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April 1, 2021

Mark D. Marini, Secretary
Department of Public Utilities
One South Station, 5th Floor
Boston, MA 02110

Re: D.P.U. 21-30 - NSTAR Electric Company d/b/a Eversource Energy 2020 Grid Modernization Annual Report

Dear Secretary Marini:

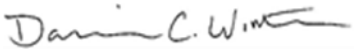
On behalf of NSTAR Electric Company d/b/a Eversource Energy ("Eversource" or the "Company"), enclosed is the Eversource 2020 Grid Modernization Annual Report. Eversource, along with Massachusetts Electric Company and Nantucket Electric Company each d/b/a National Grid and Fitchburg Gas and Electric Light Company d/b/a Unitil (collectively, the "Distribution Companies"), are in receipt of the March 11, 2021 memorandum issued by the Department of Public Utilities (the "Department") regarding revisions to the Annual Report Templates (the "Memorandum").

Regarding the revisions to Sections II.B, C and D of the template, the Distribution Companies have provided the revised information in their respective 2020 Grid Modernization Annual Reports. Regarding the revision to Section II.A of the template, the Distribution Companies have determined that additional clarification is necessary regarding this revision. Therefore, to understand the Department's directive regarding Section II.A., the Distribution Companies respectfully request that the Department schedule a virtual technical session so that the Distribution Companies may present their questions regarding this revision and receive the necessary clarification from Department Staff.

In lieu of clarification on Section II.A, the Distribution Companies' respective 2020 Grid Modernization Annual Reports utilize the methodologies for Section II.A that were included in their respective 2019 Grid Modernization Annual Reports or as adjusted as provided in response to the Department data requests referenced in the Memorandum. Following the technical session, the Distribution Companies will provide revised 2020 Grid Modernization Annual Reports, to the extent necessary and appropriate.

Thank you for your attention to this matter. Please contact me with any questions you may have.

Sincerely,



Danielle C. Winter, Esq.

Enclosures

cc: Tina Chin, Hearing Officer
Daniel Licata, Hearing Officer
Greggory Wade, Hearing Officer
D.P.U. 15-120, 15-121, and 15-122 Service Lists

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF PUBLIC UTILITIES

NSTAR Electric Company d/b/a Eversource Energy 2020 Grid Modernization Annual Report	)	D.P.U. 21-30

APPEARANCE OF COUNSEL

In the above-referenced proceeding, I hereby appear for and on behalf of NSTAR Electric Company d/b/a Eversource Energy.

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Dated: April 1, 2021

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF PUBLIC UTILITIES

NSTAR Electric Company d/b/a Eversource Energy 2020 Grid Modernization Annual Report	)	D.P.U. 21-30

APPEARANCE OF COUNSEL

In the above-referenced proceeding, I hereby appear for and on behalf of NSTAR Electric Company d/b/a Eversource Energy.

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Dated: April 1, 2021

NSTAR Electric Company
d/b/a Eversource Energy

Grid Modernization Plan
2020 Annual Report

D.P.U. 21-30

April 1, 2021

Submitted to:
Massachusetts Department of Public Utilities

I. Introduction

A. Background

In October 2012, the Department of Public Utilities (the "Department") initiated a wide-ranging and comprehensive investigation into the modernization of the Massachusetts electric grid. Modernization of the Electric Grid, D.P.U. 12-76 (2012). NSTAR Electric Company d/b/a Eversource Energy ("Eversource" or the "Company")[1] was an active and engaged partner in the Department's long-running investigation, bringing its expertise and innovation to bear on the effort. Eversource has always been, and continues to be, at the forefront of implementing technologies to further improve service to customers and lessen/mitigate the impact of outages on customers. The Department's Grid Modernization investigation enabled the Company to further expand its efforts on behalf of its customers and in making significant strides to achieve critical Massachusetts energy and environmental policies.

Over the course of several orders incorporating Eversource and other stakeholder input, the Department set out a Grid Modernization framework for Eversource, along with Massachusetts Electric Company and Nantucket Electric Company, each d/b/a National Grid ("National Grid") and Fitchburg Gas and Electric Light Company d/b/a Unitil ("Unitil")(collectively, the "Distribution Companies"), to develop and invest in an innovative and comprehensive Distribution Company-specific Grid Modernization Plans ("GMPs") designed to advance achievement in four grid modernization objectives, specifically to: (1) reduce the effect of outages; (2) optimize demand, including reducing system and customer costs; (3) integrate distributed resources; and (4) improve workforce and asset management.[2]

Consistent with the directives set out in the Department's various D.P.U. 12-76 orders, on August 19, 2015, Eversource filed its first GMP. The Department conducted a lengthy and thorough investigation of the Company's GMP. On May 10, 2018, the Department issued an order approving in part and modifying in part the Company's GMP. NSTAR Electric Company d/b/a Eversource Energy d/b/a Eversource Energy, D.P.U. 15-122 (2018) ("D.P.U. 15-122"). In its order, the Department approved the Company's proposed grid-facing grid modernization investments, as well as a three-year (2018-2020) budget of $133 million to undertake the approved investments. D.P.U. 15-122, at 172-173, 186-187. The Department also determined that it was appropriate for Eversource to recover the costs of its energy storage demonstration projects and its

[1] On December 31, 2017, Western Massachusetts Electric Company ("WMECO") was merged with and into NSTAR Electric Company ("NSTAR Electric"), with NSTAR Electric as the surviving entity pursuant to the Department's approval in D.P.U. 17-05 under G.L. c. 164, § 96. D.P.U. 17-05, at 36-44. Beginning January 1, 2018, the legal name of Eversource Energy's electric distribution company in Massachusetts is NSTAR Electric Company d/b/a Eversource Energy.

[2] The Department refined the grid modernization objectives in its order on the Distribution Companies' 2018-2020 GMPs, with the following established as the final 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.

electric vehicle ("EV") infrastructure program, approved in the Company's 2017 base distribution rate case, D.P.U. 17-05, through its targeted grid modernization cost recovery mechanism ("Grid Modernization Factor" or "GMF").

As part of its ongoing review of Eversource's 2018-2020 and future GMPs, the Department required the Company to file annual GMP progress reports detailing its performance under the GMP during the relevant year ("Grid Modernization Annual Report" or "Report"). D.P.U. 15-122, at 112. The Company is required to report on its performance under the statewide and Eversource-specific infrastructure and performance metrics. The Department stamp approved the Company's performance metrics on July 25, 2019.

On May 12, 2020, the Department issued a decision extending the 2018-2020 GMP through December 31, 2021 to provide the Distribution Companies with the flexibility to adjust their respective GMPs through 2020 and reschedule any planned deployments that were delayed through 2021 due to COVID-19, or other factors. Petition of NSTAR Electric Company and Western Massachusetts Electric Company, each d/b/a Eversource Energy for Approval by the Department of Public Utilities of their Grid Modernization Plan, D.P.U. 15-122-D, at 4 (2020)("D.P.U. 15-122-D"). In its decision, the Department stated that, if the Distribution Companies experienced budget constraints related to authorized GMP investments as a result of the extension, they were authorized to petition the Department for an expansion of the Department-approved 2018-2020 GMP budget. D.P.U. 15-122-D at 7. Additionally, the Department required the Distribution Companies to file (1) an annual grid modernization report for calendar year 2020 on or before April 1, 2021; and (2) a grid modernization term report for calendar years 2018 through 2021 on or before April 1, 2022. Id. at 4, fn. 3.

On July 1, 2020, Eversource petitioned the Department requesting authorization for a budget extension of $56 million for the 2018-2021 GMP term, apportioned within the five investment categories previously authorized by the Department for Advanced Sensing, Automated Feeder Reconfiguration, Urban Underground Automation, Distribution System Network Operator and Communications. NSTAR Electric Company d/b/a Eversource Energy, D.P.U. 20-74, 2020 Grid Modernization Program Extension and Funding Report at 6. In support of its petition, the Company noted that it expected to successfully complete its authorized 2018–2020 GMP by the end of 2020, having met or exceeded most targets and demonstrated progress relative to many of the ongoing metrics of grid modernization value and performance (id. at 5). The Company also requested approval of a budget authorization of $10 million to support and continue the approved EV Infrastructure Program through the end of 2021, as well as $3 million to continue the Energy Storage Program with engineering of incremental projects focused on the integration of distributed energy resources ("DER") in southeastern Massachusetts (id. at 6).

Following its investigation, the Department approved, with certain modifications, the Company's petition. D.P.U. 20-74, at 41-42.

Consistent with the provisions of D.P.U. 15-122-DD, as well as the Department order in D.P.U. 20-74, the Company is filing its 2020 annual grid modernization report and will file its 2018-2021 Grid Modernization Term Report on April 1, 2022.

After the May 10, 2018 issuance of the D.P.U. 15-122 order, the Department conducted a sub-proceeding designed to formalize the contents and form of the Grid Modernization Annual Reports, including the development of templates to comprehensively and clearly provide data demonstrating the Company's annual progress under its GMP. When the Company submitted its 2018 Annual Report, the Grid Modernization Annual Report Templates had not yet been finalized. Accordingly, the Department directed Eversource and the other Distribution Companies to file, by May 1, 2019, a narrative detailing their performance under their respective 2018 GMPs. D.P.U. 15-122, March 29, 2019 Memorandum, at 2. The Company filed this narrative on May 1, 2019.

On December 6, 2019, following a stakeholder comment period and a comprehensive technical conference to discuss the form and content of the Grid Modernization Annual Reports, the Department issued its order on the templates and the information required for the Annual Reports. NSTAR Electric Company d/b/a Eversource Energy, D.P.U. 15-122-C (2019) ("D.P.U. 15-122-C"). Consistent with the Department's directives in the D.P.U. 15-122-C order, the Company submitted a supplemental 2018 Annual Report on January 31, 2020 to conform to the Annual Report template contemplated in the order. Further, on March 11, 2021, the Department issued a memorandum regarding additional revisions to the Grid Modernization Annual Report templates to ensure consistent reporting of information and data among the Distribution Companies. D.P.U. 21-30, March 11, 2021, Memorandum, at 2. Consistent with the Department's directives in D.P.U. 15-122-C and D.P.U. 15-122-D, as well as the Department's recent memorandum, Eversource hereby files its 2020 Grid Modernization Annual Report.

B. 2020 Progress Toward Grid Modernization Objectives

1. 2020 Overview

At the beginning of 2020, the Company initiated execution of a work plan for the year designed to cost-effectively meet or exceed its GMP targets, while ensuring completion of its traditional capital plan. Guided by a Grid Modernization Executive Steering Committee and supported by a small team dedicated to tracking and risk management of program scope, schedule and budget, the Company established an aggressive 2020 schedule designed to bring the benefits of grid modernization to customers as soon as possible. Leveraging the processes, controls and program management structure established in 2019, the Company was able to effectively continue with its scaled-up operations and in 2020 achieved the following statistics, which are detailed and explained later in this report. It is important to note that the Company's 2020 plan was to achieve or exceed the commitments made to the Department as part of the original 3-year term. Therefore, the summary descriptions below are not simply for the 2020 plan year, but are also related to the Company's three-year commitment:

- Monitoring and Control: For 2020, the Company maintained an equally ambitious actual unit-completion (244 units) as compared to 2019 actual-unit completion (247 units). The Company exceeded its overall 2020 goals for Monitoring and Control. The following are summary unit statistics:
    - 13 units, short of the Microprocessor Relay plan
    - 1 unit, short of the 4kV Circuit Breaker SCADA plan, exceeded three-year term commitment
    - 22 units, exceeded the Recloser SCADA plan
    - 3 units, short of Padmount SCADA plan, due to exhausting all possible field locations
    - Met the Network Protector SCADA plan
- Distribution Automation: For 2020, the Company took a more moderate approach to unit-completion (127 units) in comparison to the 2019 execution (299 units) The Company exceeded its overall 2020 goals for Distribution Automation, with the exception to the 4kV Auto-Restoration Loop investment category. The following are summary unit statistics:
    - 23 units, exceeded the Overhead Distribution Automation plan
    - 8 units, exceeded the Overhead Distribution Automation, with Ties plan
    - 32 units, exceeded the 4kV Oil Switch Replacement plan
    - 60 units, short of the 4kV Auto-Restoration Loop plan
- Volt-Var Optimization (VVO): For 2020, the Company's goal was to place their VVO system online. The Company exceeded its overall 2020 goals for VVO. The following are summary unit statistics:
    - Met the VVO – Regulator plan
    - Met the VVO – Capacitor Bank plan
    - Met the VVO – I.T. plan
    - 99 units, exceeded the original plan by adding this new category - Microcapacitors
    - 111 units, exceeded the original plan by adding this new category – Grid Monitoring Line Sensors

- Advanced Distribution Management System (ADMS): For 2020, the Company's goal was to place their Advanced Load Flow tool online. The Company exceeded its overall 2020 goals for ADMS. The following are summary unit statistics:
    - Met the ALF tool plan
    - Exceeded the original GIS Verification plan by completing work in the Company's western territory
- Communications: For 2020, the Company's goal was to continue to deploy master communications nodes onto the system. The following are summary unit statistics:
    - 2 units, short of the Nodes plan
    - All-Dielectric Self-Supporting (ADSS) fiber optic program was removed mid-way through the three-year term due to cost constraints.

In many respects, the Company exceeded expectations through establishing efficient work practices that enabled more work to be completed relative to targets, often at or below budgeted unit costs. In other cases, lower than expected unit cost enabled more work to be completed such that the Company was able to exceed target quantities by the end of 2020, the original three-year plan term. For all but a few programs, as of the end of 2020, the Company has completed its work for the original 2018-2020 GMP term. With respect to electric vehicle ("EV") make ready infrastructure, the Company continued to support the Commonwealth's goal of decarbonization of the transportation sector by energizing 181 new EV charging station sites with 864 ports. Of the 181 sites, 31 sites are in Environmental Justice Communities ("EJC"). The EV program was fully subscribed as of October 2020.

Additional milestones were achieved in 2020 related to investments that are not tracked on a unit basis. Please see Section VII. for an update on the Company's energy storage program projects. However, the COVID-19 pandemic presented a variety of challenges due first with the uncertainty of the extent/impact of the situation in late Q1, 2020 and then after understanding the severity, quickly pivoting to new work method protocols to ensure employee and customer protections. In addition to the pandemic, in 2020, the Company experienced an unprecedented number of inclement weather events. Though not all these events occurred within the Company's Massachusetts territory, the same operational teams that execute the MA GMP, often deployed to the Company's other state franchise to provide emergency response support. With respect to substation construction projects, the Company was challenged to execute its plan within established schedules and/or budgets due largely to the limitations put in place from the pandemic, and intermittency of work progress due to emergency response. These challenges strained the internal and contracted work force schedule and resulted in lengthened project durations and delays in construction sequencing which ended up delaying project completion into Q1, 2021. The level of complexity associated with the substation projects, including the need for planned outages requested in advance of construction, proved difficult to manage. Over the course of 2020, the

Company established new work practices to accommodate COVID-19 restrictions and also aimed at scaling up capacity for engineering, design, construction and commissioning of these projects. Despite the COVID-19 pandemic and the implementation of these new practices, the Company fell just short of the GMP targets for substation projects for the GMP term.

As a part of the engineering and cost estimating process for all GMP investments, the Company maintains oversight and review of investment cost-effectiveness and value proposition for customers. Using its established capital project approval process described below, all projects are reviewed to confirm the project need, justification, scope, comparison to alternatives and budget.

Throughout the implementation of the GMP, the Company continuously reviewed and assessed projects to understand the lessons-learned and to identify opportunities to increase efficiency and improve operations going forward. The following is a summary of selected key findings. More specific lessons learned are detailed in Section III.

- Following disciplined planning and scheduling processes is essential to managing scope, schedule and budget. Ensuring engineering and procurement of long-lead materials well in advance of construction allows for optimal project execution. Good communication in departmental hand-offs for complex tasks such as commissioning supports more efficient deployments. Having defined and definitive completion milestones during project development is key to optimizing scheduling of internal and contracted field.

- Deployment of new technologies will inevitably involve unforeseen challenges that will stress schedule and budget. Setting detailed requirements and statements of work up-front with technology vendors enables more rapid issue resolution as concerns arise. Additionally, the ability for the project team of new technology deployments to change their paradigm from a "design, then build" philosophy to an "iterative design, then build" process, allows for creative resolutions.

- Complexities associated with information technology / operational technology ("IT/OT") projects require sufficient, and often extensive, lead time and planning. Implementation of real-time systems used by System Operations are particularly challenging and have far-reaching consequences outside the control room.

Efforts to stand up and then continuously improve the GMP portfolio implementation capability reinforced the Company's ongoing efforts to build the workforce of the future required to continue to transition the distribution grid into a platform that enables higher penetration of DER. A grid characterized by widespread sensing, monitoring and control technology requires specialized and highly trained resources in electrical and telecommunications engineering, field communications, field engineering, system operations, project management and information technology. Approval of the Company's GMP has further emphasized the importance of identifying near and long-term opportunities to build skills, attract talent and grow the execution efficiency of the Company's workforce. Many of the successes and lessons learned described in this Report demonstrate the power of a motivated and well-organized workforce to scale up operations and identify creative

solutions to technical challenges as well as the opportunities to augment technical capabilities required to build the grid of the future.

As the Company continued to implement its GMP in 2020, it has continued to experience increasing levels of DER penetration on the distribution system. In 2020, the Company interconnected over 4,900 additional solar generation facilities, for a total of 50,000 solar generation facilities interconnected to the system. These solar generation facilities represent over 130 MW of incremental capacity. Further, the number of facilities waiting to interconnect to the system increased from about 1,600 MW in 2019 to over 1,700 MW in 2020. As described in Section V, many of the new solar projects are incorporating energy storage, increasing the complexity of the interconnection study process. High saturation of solar and energy storage in certain areas of the Company's system have resulted in increased need for substation upgrades and Independent System Operator ("ISO") studies. These factors support the fundamental need for grid modernization efforts that aid in the transparent, cost-effective and efficient planning and deployment of DER on the system.

2. Implementation Strategy

Following the Department's approval of the GMP, the Company initiated a GMP implementation strategy based on the following key principles:

- **Leverage proven, established processes to the extent possible.** As described above, the Company's ability to execute its 2020 GMP work plan was largely attributable to its ability to leverage existing processes and organizational capabilities. These efforts commenced in 2018 and continued through 2020. Using its existing project approval processes, the Company ensured consistency with its overall policies for capital budget spending authorization. In 2020, the Company continued to leverage its existing work management systems and processes to create dedicated work orders for grid modernization projects; order standardized materials based on the Company's established competitive procurement policies; support planning and scheduling of work and enable robust and accurate tracking of GMP investments. With respect to planning and scheduling, the Company created an integrated schedule for both 2020 GMP and base capital projects to ensure maximum execution efficiency and completion of the Company's full scope of work.

- **Dedicate effort to maximize cost-effectiveness of implementation.** Many of the decisions made in the first and second year of GMP implementation drove cost-effectiveness in achieving plan objectives in the third year of the plan. In 2019, the Company efficiently and effectively installed grid modernization investments based on the prioritized equipment locations identified in 2018. In 2020, the Company continued to utilize these prioritized locations to install additional GMP investments throughout the year in line with its then-effective 2018-2020 GMP. By prioritizing equipment location in 2018, and installing equipment in 2019, the Company was able to maximize the value for the GMP deployment in 2020 by learning from the equipment locations in 2019 and utilizing these locations to install additional investments in certain areas, or re-evaluate the

locations, in 2020. With the locations prioritized and ranked, and then tested in 2019, in 2020, the Company was able to continue to efficiently and effectively install more grid modernization investments as planned. Having this prioritization step completed in 2018, and investments installed in 2019, helped to maximize customer benefits and minimize cost.

- **Establish a dedicated team for portfolio management and financial tracking.** The Company recognizes the critical importance of transparency and visibility in implementing its GMP portfolio. Ensuring accurate, timely tracking and reporting is a principal component required to ensure actions are taken to manage scope, schedule and budget. Focus on tracking and reporting will also support robust performance reporting and active engagement in the measurement and verification ("M&V") process. For the 2018-2021 GMP program, the Company established three positions dedicated solely to GMP program and financial management responsible for developing and executing the integration plan for the GMP portfolio. These key employees were hired in 2018 and continued to support the GMP in 2020.

- **Engage senior Operations leadership to provide implementation guidance and support.** The Company's senior Operations leadership has demonstrated a strong commitment to supporting implementation of GMP objectives. Leaders recognize the direct customer benefit and importance in enabling the continued transition to the grid of the future. Periodic meetings to review progress were held in 2020, and leadership feedback continued to provide critical guidance on the implementation of the 2020 GMP.

Develop an effective approach to implementation of new grid modernization technologies and capabilities. Many of the programs included in the Company's GMP support deployment of existing monitoring and control, communication and automation technologies. These types of programs are relatively more amenable to leveraging existing processes and capabilities. Investments in VVO and Advanced Distribution Management System ("ADMS") investment categories require more of an innovative approach. In order to implement these new programs, the Company established, beginning in 2018, organizational structures and assessed workforce needs. Additional work was also required relative to competitive procurement of new technologies. The Company utilized this structure and workforce and leveraged its existing competitive procurement processes for the 2018-2021 GMP and these processes continued to provide significant support in the deployment of grid modernization technologies in 2020. Through this process, the Company was able to competitively procure the resources needed to construct and implement the Advanced Load Flow "ALF", Volt-Var Optimization "VVO" and Western Massachusetts GIS Verification projects.

The process framework described above provided the Company with concrete methods to undertake the necessary preparatory work prior to initiating investments under the 2018 GMP. The groundwork also provided a solid implementation framework for the 2020 GMP. First, using the established prioritization methodologies, the Company utilized investment deployment locations in 2019 to maximize the investment's value to customers. The Company was able to learn from these deployment locations to identify further locations for the 2020 GMP. For

example, the Company deployed additional Overhead Distribution Automation inclusive of tie-points (i.e. new recloser locations), Recloser SCADA (i.e upgrade of existing recloser locations), and 4kV Oil Switch Replacements. Additionally, the Company utilized its knowledge of the electric power system, their recent technology deployments, particularly VVO, and cost savings from other investment categories/types, to implement two new investment types: "Microcapacitors" and "Grid Monitoring Line Sensors". Deployment of these investment types will help with the effectiveness of the VVO program, and provide valuable system data, respectively. Both of which are also precursor investments to the Distribution Management System.

In addition, Engineering teams continued to utilize multiple technology selection efforts to implement the 2020 GMP.

Similar to its practice under the 2018 and 2019 GMPs, the Engineering teams drafted Project Approval Forms ("PAFs") for each investment category in accordance with the Company's Capital Authorization Policy in order to ensure that all 2020 GMP investments had the requisite spending authorization. The PAFs describe the project need, justification, scope, budget and alternatives considered. The PAFs were approved through the Company's delegation of authority consistent with the process used to authorize all capital expenditures.

Following the practice established under the 2018 GMP, the Planning and Scheduling team conducted an analysis to estimate the number of labor hours required to engineer, construct and commission the 2020 GMP work plan. This analysis supported the development of a labor resource strategy designed to maximize the efficiency of GMP execution by leveraging incremental internal resources where possible, particularly for highly technical tasks related to field engineering and communication. This strategy also supported a competitive procurement process to obtain external engineering and construction resources to complete the 2020 GMP work plan.

Under the 2020 GMP, the Eversource Investment Planning team again utilized specific and dedicated cost control processes to isolate and monitor all costs associated with the GMP. The Company relied on an accounting process to specifically track GMP costs and expenditures, which includes the continued use of a work order process to track grid modernization investments separately from other capital projects undertaken by the Company. All grid modernization work orders for the 2018, 2019 and 2020 GMPs link to a specific grid modernization project, which in turn links to a specific line of business. This process will be discussed in more detail in the Company's May 15, 2021 cost recovery filing detailing the 2020 grid modernization investment costs through the GMF.

Consistent with its experience under the 2019 GMP, the foundational steps and the implementation described above enabled the Company to implement its 2020 GMP in an efficient and cost-effective manner. Additionally, this framework allowed the Company to proactively look forward through the portfolio to understand and plan for areas of opportunity to accelerate the deployment schedule to the maximum extent possible over the remainder of the 2018-2021 GMP.

C. Summary of 2020 GMP Investment Deployment (Actual vs. Planned)

Drawing upon the implementation strategy described above, the Company continued to implement its GMP in 2020. Planning efforts for the 2020 GMP focused on achieving the milestone targets established in the Company's August 15, 2018 *Grid Modernization Plan Statewide and Eversource-Specific Infrastructure Metrics Baselines and Targets* filing ("Baseline and Targets Filing")(see Table 2.4.7). The Company's planning efforts were also informed by the grid modernization infrastructure and performance metrics approved by the Department on July 25, 2019.

The 2020 GMP unit targets from the Baseline and Targets filing is reproduced below *Table 1: 2020 Units Status"*. In Table 1, the Company has reflected its progress relative to 2020 targets in the columns "2020 Actual" and "2020 Plan". The "Variance (Units) column provides the units to be installed in the 2021 GMP year.

Table 1: 2020 Units Status

	Commissioned Units			
Investment Areas and Preauthorized Device Types	**2020 Actual**	**2020 Plan**	**Variance (Units)**	**Percent (%)**
Monitoring & Control (SCADA)	**244**	**239**	**5**	**102%**
Microprocessor Relay	83	96	(13)	86%
4kV Circuit Breaker SCADA	38	39	(1)	97%
Recloser SCADA	25	3	22	833%
Padmount Switch SCADA	15	18	(3)	83%
Network Protector SCADA	83	83	-	100%
Power Quality Monitors	-	-	-	N/A
Distribution Automation	**127**	**124**	**3**	**102%**
OH DA	70	47	23	149%
OH DA w/Ties	8	-	8	N/A
4kV Oil Switch Replacement	48	16	32	300%
4kV AR Loop	1	61	(60)	2%
Volt-Var Optimization	**240**	**30**	**210**	**800%**
VVO - Regulators	27	27	-	100%
VVO - Capacitor Banks	3	3	-	100%
VVO - LTC Controls	-	-	-	N/A
VVO - Line Sensors	-	-	-	N/A
VVO - IT Work	N/A	N/A	N/A	N/A
Microcapacitors	99	-	99	N/A
Grid Monitoring Line Sensors	111	-	111	N/A
Advanced Distribution Management System (ADMS)	**N/A**	**N/A**	**N/A**	**N/A**
Communications	**4**	**6**	**(2)**	**67%**
Numbers of Nodes	4	6	(2)	67%
Miles of Fiber	-	-	-	N/A
Electric Vehicles	**N/A**	**N/A**	**N/A**	**N/A**
Energy Storage	**N/A**	**N/A**	**N/A**	**N/A**
Totals	**615**	**399**	**216**	**154%**

In order to appropriately assess the Company's performance under its 2020 GMP, understanding the way the Company tracks progress under its GMP work orders is important. The Company utilizes two classifications when categorizing the status of an investment:

- **Construction Complete**: the Company classifies a GMP unit as "Construction Complete" when a device is placed in-service, meaning that it is used and useful. Due to the nature of the Company's GMP investment categories, it is often the case, particularly in regard to line-equipment devices, that a piece of equipment is installed and electrically placed into service, but has not yet gone through its commissioning process, which, when complete, places that piece of equipment into the Company's monitoring and control systems (i.e., SCADA).

- **Commissioned**: once a device is commissioned, the piece of equipment is electrically connected to the system, classified as in-service, and has been connected into the Company's monitoring and control systems, typically SCADA, which allows authorized personnel control and/or visibility of that device. The Company refers to the completion of the commissioning step as communicating and functioning consistent with the specifications set out in the GMP.

In terms of reporting its progress on the GMP in the Annual Report, the Company is reporting on both the Construction Complete and Commissioned statuses in order to provide a complete, accurate and transparent view of progress. As shown in *Table 2: 2020 Capital and In-Service Spend Summary*, any grid modernization device or system that has been categorized as Construction Complete is reflected in the Plant In-Service columns.[3] While a GMP investment is classified as in-service when it falls in the "Construction Complete" category, the Company does not consider it to be operating and providing benefits consistent with the GMP in such a manner that it helps to advance the Department's grid modernization goals, until the investment is "Commissioned". When an investment is "Commissioned", it is complete within the GMP process.

Cost recovery under the GMP is initiated when an investment is "Construction Complete," which is in-service, and used and useful in accordance with the Department's cost recovery standard and precedent. It is at this point that the Company reviews the work orders associated with that investment to ensure the costs charged to-date were appropriately charged to the GMP work order and recoverable through the GMF. Costs will continue to accrue on a work order until the work order is "Commissioned." After the work order is "Commissioned," the Company will undertake the same review of the additional costs incurred to move the investment into the "Commissioned" category.

[3] The Company will also provide a similar summary of grid modernization devices and systems categorization in its May 15, 2020 cost recovery filing.

For the investments that were classified as Construction Complete in 2020, the Company will include the costs associated with the investment in its 2020 cost recovery filing to be submitted on May 15, 2021.

As can be seen in *Table 1: 2020 Unit Status* above, the Company undertook an ambitious approach to implementing the 2020 GMP and made significant strides in implementing the GMP and due to this approach and the discussion points above, the Company was able to successfully complete their original 2018-2020 GMP Department-commitments in all but three investment types. Those three investment types are; Microprocessor Relays, 4kV AR Loops and Communications Nodes. The primary driver of missed targets was an aggressive incremental workload driving an implementation schedule that did not provide for extra time to address unforeseen field conditions. Further, the Company endeavored to work around the COVID-19 construction protocols, which was particularly impactful to craft workers who were collocated in confined substation work areas, whom were required to stagger work efforts. COVID-19 restrictions also included a period where construction was suspended at the pandemic onset. This situation was particularly significant in the case of the more complex substation projects that involved closely sequenced system outages planned well in advance of construction. In order to provide transparency in the process, the Company differentiated "carry-over" work in the 2021 work plan and established an internal target to complete all 2020 carry-over work in the first quarter of 2021. Therefore, as of April 1, 2021, carry-over work from the 2020 GMP associated with Microprocessor Relays, 4kV Circuit Breaker SCADA and Communications Nodes have been constructed and commissioned.

VVO regulators, VVO capacitor banks, VVO LTC Controls and Padmount SCADA may be showing as fewer than the Department-commitment and/or shown as behind on the Company's 2020 plan. However, the VVO program achieved operations in its entirety in 2020 and the reduction in devices, relative to Department-commitment was due to final engineering and design analysis. This is a similar scenario for the Padmount SCADA except that the Company is indicating completion below the Department-commitment because all feasible locations on the system had been upgraded.

Unfortunately, the Company was not able to overcome all of the challenges associated with the newly deployed technology for the 4kV AR Loops. The system has been built out since Q4, 2020 but the communications protocols and logic have not been fully resolved to the point of being a reliability asset to the Company's customers served by those circuits. Additionally, and as described above, the Company suspended the communications fiber program due to cost considerations.

In addition to the progress relative to GMP device targets, the Company achieved milestones associated with GMP programs for which unit targets are not appropriate. For instance, the Company made substantial progress on its ALF project. The Company completed a competitive procurement process for load flow software, selecting the DNV-GL product Synergi. The Company also defined the data structures and functional requirements, established IT and security protocols, built the model forge process and provided training to engineers. These efforts enabled

the Company to achieve its first implementation milestone such that engineers can now use the Synergi tool to build and analyze models for all non-network feeders in Massachusetts.

D. Summary of Spending (Actual v. Planned)

In *"Table 2: 2020 Capital and In-Service Spend Summary"* provided below, the Company has broken out the "Total Capital Spend" and "Plant In-Service" to correspond to the work order progress, as explained in the "*Summary of Grid Modernization Deployment (Actual v. Planned)*" table above. The Company has provided specific, detailed narratives in this Report on the details of each GMP investment category and device type.

Table 2: 2020 Capital and In-Service Spend Summary

Investment Areas and Preauthorized Device Types	Capital Spend (in thousands $)				Plant In-service (in thousands $)			
	2020 Actual	2020 Budget	Variance ($)	Percent (%)	2020 Actual	2020 Budget	Variance ($)	Percent (%)
Monitoring & Control (SCADA)	**26,095**	**23,822**	**2,272**	**110%**	**28,332**	**34,828**	**(6,496)**	**81%**
Microprocessor Relay	11,737	14,762	(3,025)	80%	14,477	23,423	(8,945)	62%
4kV Circuit Breaker SCADA	11,763	6,983	4,780	168%	12,494	8,502	3,992	147%
Recloser SCADA	1,534	675	859	227%	578	1,218	(640)	47%
Padmount Switch SCADA	286	270	16	106%	361	361	1	100%
Network Protector SCADA	560	1,132	(572)	49%	421	1,324	(903)	32%
Power Quality Monitors	215	-	215	N/A	-	-	-	N/A
Distribution Automation	**14,053**	**15,804**	**(1,751)**	**89%**	**12,538**	**19,330**	**(6,792)**	**65%**
OH DA	3,839	4,185	(347)	92%	3,339	5,057	(1,718)	66%
OH DA w/Ties	455	1,720	(1,265)	26%	328	1,932	(1,604)	17%
4kV Oil Switch Replacement	9,190	6,500	2,690	141%	8,710	8,267	442	105%
4kV AR Loop	569	3,399	(2,830)	17%	161	4,074	(3,913)	4%
Volt-Var Optimization	**4,749**	**4,165**	**584**	**114%**	**5,079**	**5,955**	**(876)**	**85%**
VVO - Regulators	1,632	620	1,012	263%	1,581	1,031	550	153%
VVO - Capacitor Banks	311	-	311	N/A	(280)	-	(280)	N/A
VVO - LTC Controls	30	-	30	N/A	29	219	(191)	13%
VVO - Line Sensors	556	-	556	N/A	502	-	502	N/A
VVO - IT Work	1,469	3,545	(2,076)	41%	2,629	4,705	(2,076)	56%
Microcapacitors	751	-	751	N/A	618	-	618	N/A
Grid Monitoring Line Sensors	-	-	-	N/A	-	-	-	N/A
Advanced Distribution Management System (ADMS)	**6,033**	**9,107**	**(3,074)**	**66%**	**8,809**	**11,883**	**(3,074)**	**74%**
Advanced Load Flow	6,033	9,102	(3,069)	66%	8,809	11,878	(3,069)	74%
GIS Verification (Expense)	-	-	-	N/A	-	-	-	N/A
Dist. Management System	-	5	(5)	0%	-	5	(5)	0%
Forecasting Tool	-	-	-	N/A	-	-	-	N/A
Synergi Upgrades	-	-	-	N/A	-	-	-	N/A
PI Asset Framework	-	-	-	N/A	-	-	-	N/A
Communications	**1,362**	**1,435**	**(74)**	**95%**	**649**	**1,852**	**(1,203)**	**35%**
Numbers of Nodes	1,106	1,435	(330)	77%	359	1,542	(1,183)	23%
Miles of Fiber	256	-	256	N/A	290	310	(20)	94%
Electric Vehicles	**18,076**	**18,981**	**(906)**	**95%**	**15,667**	**23,093**	**(7,426)**	**68%**
Energy Storage	**16,308**	**44,427**	**(28,119)**	**37%**	**-**	**49,036**	**(49,036)**	**0%**
Martha's Vineyard	946	11,945	(10,999)	8%	-	14,207	(14,207)	0%
Provincetown	15,362	32,482	(17,120)	47%	-	34,830	(34,830)	0%
Total	**86,674**	**117,742**	**(31,068)**	**74%**	**71,074**	**145,978**	**(74,904)**	**49%**
Estimated O&M Expense	**3,067**	**2,128**	**939**	**144%**				
Total Capital & O&M	**89,741**	**119,871**	**(30,130)**	**75%**				

The "Capital Spend" dollars represent the Company's budget and should be considered for any budget variance analysis. Below are several aspects of the 2020 GMP implementation that impact the financial performance under the 2020 GMP, as related to the capital spend:

- Microprocessor Relays: Though the unit costs are higher than expected, the program was short of its unit and budget goals for the year. Work continued uninterrupted into 2021 when the remaining capital expense and plant in-service funds will be expended in Q1. The budget for this investment type was under the planned amount due to the shift in units from Microprocessor Relays, to 4kV Circuit Breaker SCADA

- 4kV Circuit Breaker SCADA: The budget for this investment type was over the planned amount due to the shift in units from Microprocessor Relays, to 4kV Circuit Breaker SCADA. Additionally, unit costs were found to be higher than expected for this investment, which drove the overage in 2020.

- Padmount Switch SCADA: Though only three units below the Department-commitment, this program was virtually on target for the planned costs.

- Network Protector SCADA: The planned three-year team units for this investment were met in Q1 of 2020. Due to efficiencies and underruns in other investment types, and the efficient rollout and momentum of this program, the Company planned to execute network protector SCADA upgrades at two additional locations, and the Company budgeted for those two new locations (above and beyond the Department-commitment). Work was substantially completed at one of the sites, but a communications issue prevented the units from being placed online in 2020 and therefore were not credited in the "GMP Qualified unit counts". The minor remaining work and costs will be completed in Q1, 2021. The other site that the Company intended to install, ended up failing an engineering screening evaluation due to other upgrades at the corresponding substation that needed to occur at a date later than the GMP timeline.

- OH DA w/o Ties: Unit costs were consistently below the budgeted amounts and even in lieu of completing additional units, this investment was under budget for 2020.

- OH DA with Ties: Unit costs were consistently below the budgeted amounts and even in lieu of completing additional units, this investment was under budget for 2020.

- 4kV Oil Switch Replacements: The unit costs for this investment are averaging on budget but there were some significant standard deviations in work order costs. The reason for the overage in 2020 was due in part to the increased units completed above the original Department-commitment but also because of the accelerated deployment that the Company implemented to make up for local city COVID-19 restrictions that precluded installation for over six weeks.

- VVO Devices: As a combined category, VVO regulators, VVO capacitor banks and line sensors were over the planned budget namely due to a redesign of platform-mounted regulators that was required mid-installation.

- VVO IT: After final design and vendor selection, the costs to implement this investment were substantially lower than expected and budgeted.

- ALF: Similar to the VVO IT investment, after selecting a vendor and implementing the program, costs were lower than expected and budgeted.

- DMS: Even though budgeted for 2020, the Company deferred the DMS budget to 2021 in order to better analyze the overall IT/OT investments and ensure that the selection of DMS projects complemented the long-term vision.

- Miles of Fiber: As is elaborated upon in Section III of this Report, following a thorough analysis, the Company determined that there was not a cost-effective solution that would benefit customers under the Miles of Fiber program. This investment was limited to minor work in support of another GMP investment.

- EV: The Company made a concerted effort to accelerate this program through 2020 in order to complete the originally designed five-year program in three and a half years. The Company budgeted this accelerated effort in the 2020 work plan but came in just under expectations.

- Energy Storage: The deviation in the energy storage spend is primarily due to the shift in the execution of the major contracts with the battery vendor, NEC.

The Company closely monitors the current and expected spend for the various investments and has made, and will continue to make, adjustments and shifts between authorized investments to ensure that the most appropriate, cost-effective, and customer-beneficial devices and technology are deployed within the authorized GMP timeframe.

Table 2 above also includes preliminary expense spending associated with the 2020 GMP. The Company spent an additional $3 million in expense in the 2020 plan year. The expense spending was primarily driven by the EV, ADMS, and general administrative and regulatory expense. Expense within the EV investment category was driven by marketing, evaluation work undertaken by Akimeka, and EV charger rebates in environmental justice communities. Expense within AMDS was driven by the Western Massachusetts GIS Verification project. General administrative and regulatory expense reflects expense associated with the evaluation work undertaken by Guidehouse (formerly Navigant Consulting, Inc.) on behalf of Eversource and the other Distribution Companies as required by the Department in D.P.U. 15-122 and internal GMP labor. The internal GMP labor is the labor that was validated through the GMP testing process for recovery. Expense spending will be finalized at the time of the Company's Grid Modernization Factor ("GMF") filing due to be filed by May 15th, 2021.

II. Program Implementation Overview

A. Organizational Changes Designed to Support Program Implementation

In order 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. Administratively, the portfolio of GMP programs is managed by a group of three dedicated employees, the Grid Modernization Portfolio Manager, Program Analyst and Financial Analyst shown in Figure 1 below. These personnel were charged with developing and constructing the execution platform, and reporting, closing and dispositioning each of the GMP programs. The remaining personnel identified in Figure 1 depict existing employees who are supporting the implementation of the GMP efforts.

Administratively, to support the integration, the team developed a process framework to evaluate, analyze, align and mange cross-functional responsibilities. Though a robust system from the outset, the Company made several enhancements during 2019, to its repository and tracking process. Under this process framework, the Company has undertaken the following steps in order to successfully implement and manage the GMP through 2020.

- **Evaluate/Inventory:** The team continued to study the strategic and end-state goals of the GMP program, identified the internal and external stakeholders who will/can influence program completion and success, and mapped the data repositories with relevant information, such as STORMs and Passport, the Company's work management systems, PowerPlan, the Company's financial repository system, the Company's Geographical Information System ("GIS"), the Outage Management System, the Primavera P6 scheduling systems, and various other data sources. This data was aggregated into a centrally housed database to enable report generation and analysis that will be used over the course of the GMP to track investments and the Company's overall progress under the GMP.

- **Analyze:** The GMP analyst further refined the data into the GMP Portfolio Tracker allowing for internal monitoring and reporting for quality assurance/quality control ("QA/QC") checks. This step is critical to successful GMP execution as it allows for visibility into the GMP implementation, which enables the Company to identify potential issues as early as possible during a given investment and develop and apply a resolution before program impact. The Company has also implemented granular tracking of the various elements of individual work orders in 2019 and added a more robust set of data to the recurring data downloads from the various Company systems. During 2020, tracking was further enhanced with the implementation of an automated dashboard that enables quick analysis of spend activity from the line of business level down to the specific work order, cost element, and account level. Because the later mentioned GMP Cost Tracking Process using Planning Analytics only allows for analysis at the project level, this new tool became very useful. Prior to implementing the dashboard, the team did analyze this level of detail, however, it was previously very time consuming.

- **Align:** The GMP represents incremental work that was overlaid onto and integrated with Eversource's existing controls and processes. Therefore, the core 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, Information Technology, and various administrative functions. This provides inter-departmental visibility into the various GMP program types and enables more effective and efficient planning of work and resources. In 2019, the Company added several enhanced reporting elements, including: 1) the addition of "Workdown Curves" that graphically communicate how the plan has been executed to date, and the remaining planned trajectory through the year end; and 2) monthly financial review meetings with key team members that allow for immediate and decisive review, understanding and communication of the portfolio financials to ensure alignment across the Company's organization. In 2020, the team, shown in Figure 1, below, continued to develop more enhanced reporting elements to assist in the monitoring of and communication regarding the portfolio. For example, the creation of the automated dashboard mentioned above streamlined what was previously a very data intensive and time-consuming process. The team also made enhancements and refinements to processes based on information requests received from the Department and time spent working with Guidehouse on the measurement and verification process.

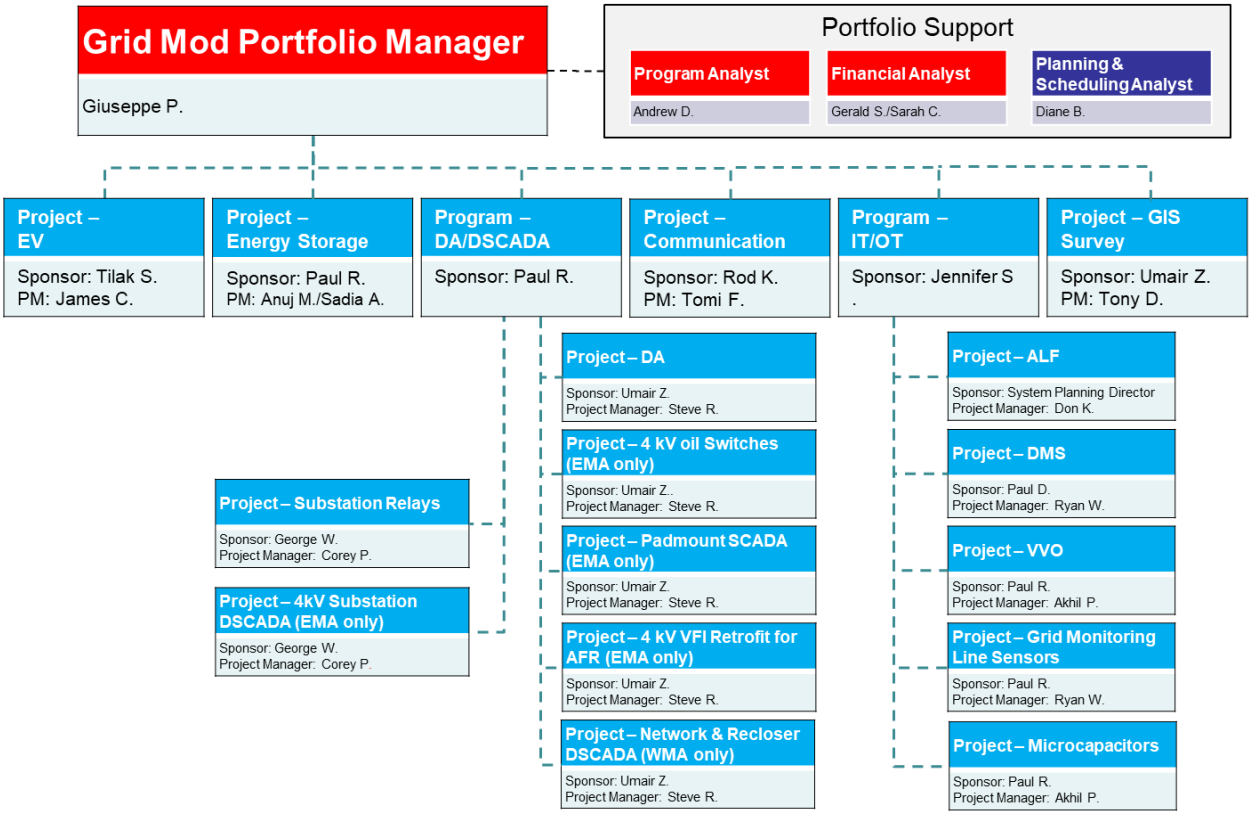
Figure 1 Grid Modernization Team

Core Grid Mod Team	
Name	**Title**
Jennifer Schilling	Vice President - Grid Mod
Anuj Mathur	Manager - Technology Projects
Ben Byboth	Director - Grid Mod
Steve Casey	Senior Project Manager
Emilio Cepeda	Engineer
Ryan West	Manager - Grid Mod
Don Kane	Lead Engineer
Aadith Kannan	Engineer
John Kreso	Engineer
Austin DeFrancesco	Associate Engineer
Akhil Punnoose	Lead Engineer
Kelsey McGlashan	Engineer
Syed Dawood Ali	Engineer
Tony Lasa	Lead Engineer
Daria Mayfield	Senior Analyst - Marketing
Alex Wilson	Associate Engineer
Hicham Khireddine	Associate Engineer
Waseem Aldabagh	Program Manager
Giuseppe Perniciaro	Portfolio Manager - MA
Andrew DelGaudio	Program Analyst - MA
Sarah Carey	Financial Analyst - MA
Gerald Smith III	Financial Analyst - MA

- **Manage:** Through the use of cross-functional GMP project managers, recurring status and coordination meetings, and recurring reporting, the core GMP team utilizes an execution platform to oversee and guide the implementation of the GMP program to ensure Eversource deploys the GMP investments in an efficient and effective manner designed to advance the achievement of the Department's identified grid modernization objectives. Enhancements to 2020 include: 1) the continued integration of the incremental GMP programs and projects, into the existing Company processes and procedures, in an effort to identify and resolve any work flow challenges; 2) additional, dedicated meetings with senior leadership, both one-on-one and critical group conversations, in an effort to keep decision makers informed and to allow for timely review of project challenges and development of corrective plans; and 3) a refreshed process of costing and budgeting activity review, to allow for quicker identification of project anomalies and a more refined cost forecast.

These steps represent critical foundational steps that were developed and deployed in order to ensure that all GMP investments were undertaken in a deliberate and efficient manner. This framework was utilized in the execution of the 2020 GMP and will be used for future GMPs.

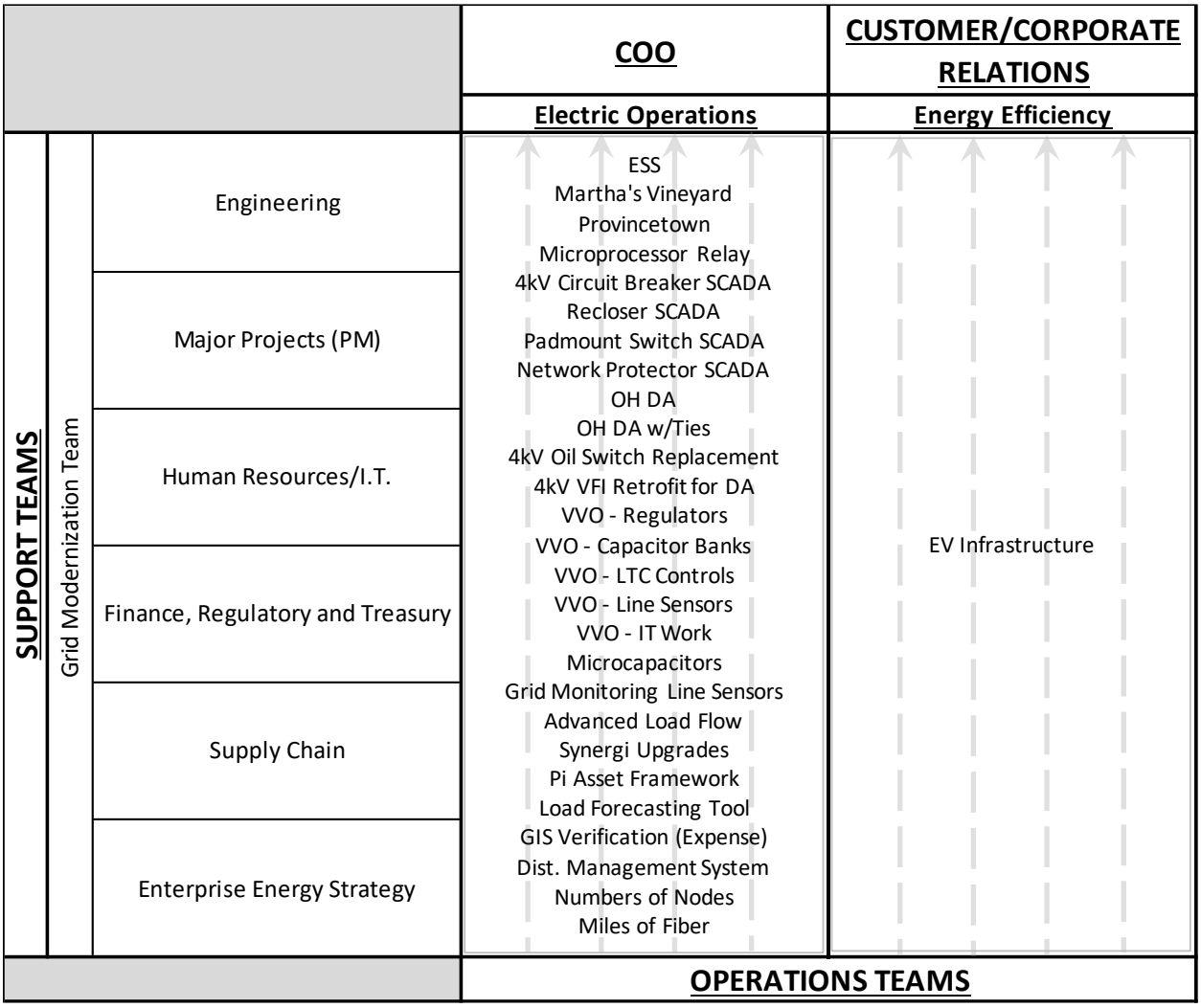
Figure 2 Grid Modernization Organization



Operationally, the GMP is being implemented by a combination of internal and contracted operational personnel, such as line workers, electricians, technicians, IT developers, and commissioning agents. Eversource uses a matrix organizational structure, as can be seen in Figure 3 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 3 Eversource Organizational Structure



B. Cost and Performance Tracking Measures

GMP Accounting Process

The Company developed a distinct accounting structure to ensure that GMP costs were isolated from all other capital project costs and were incremental to existing or business as usual investments. The GMP accounting structure started with the creation of new cost control centers for both Eastern Massachusetts and Western Massachusetts. Although the GMP was designed and will be 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 for each investment type to track GMP projects and work orders separately from any base capital work. The separate lines of business are listed below:

- Electric Vehicle – 12165
- Energy Storage – 12160
- Advanced Sensing Technology – 12190
- Automated Feeder Reconfiguration – 12170
- Urban Underground System Automation – 12175
- Communications – 12180
- Distribution System Network Operator – 12185.

The Company also created a mechanism for properly tracking all GMP Labor charges. Originally a specific work order, GMPLBR21, was established to track these labor charges, but a new specific work order (GMPLBR00) was created to track all new external hires whose work is dedicated 100 percent to the GMP, i.e., these new hires do not perform any work on other Eversource programs or initiatives. The change in work orders was completed so that costs associated with the external hires would be completely segregated and independent of costs associated with the pre-authorized investments. All charges from the old work order were migrated to the new work order to retain all historic entries. 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 spread across all work orders consistent with Eversource accounting practice for all capital work. For existing employees, i.e., those individuals employed prior to March 15, 2018, all of their labor expense and productive and non-productive time will remain as an expense in the employee's home cost center and is not recoverable under the current GMF. All outside services procured to design/implement/construct grid modernization capital units of property will charge the GMP capital work orders and be recoverable through the GMF.

GMP Cost Tracking Process

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 that required 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, that contains only GMP projects and lines of 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 that 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 historical performance and Actuals from the prior month.

As Actuals accrue for each project, the Projections are manually entered into Planning Analytics by the Budgeting group, who receive updated figures from Project Managers. 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 report results to various groups internally. Analysis of Planning Analytics Actuals is also performed to further ensure that the Planning Analytics data is the same as the PowerPlan data.

Total Plant in Service

The Company has created a cost tracking process to track total plant in service dollars for the entire GMP portfolio. Total dollars placed in service cannot be tracked in the same manner as total capital spending because Planning Analytics does not contain the necessary FERC account information used to classify a work order/project as being in service. This information is extracted from PowerPlan, Eversource's Fixed Asset 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 Plant in Service. Similar to the total capital spending Planning Analytics process, the PowerPlan extract is performed by the Grid Modernization Financial Analyst on or around Business Day 4 of each month's accounting close process.

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 carefully scrutinizes and assesses the reported data. A mechanism was 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. Operational work order details are formally tracked using this reporting. Work order detail, including but not limited to, work order description, service center, costs and work order status are pulled into the reports from various Eversource systems. The Grid Modernization Program Analyst refreshes the data weekly. Eversource's work management systems (Passport and STORMS) are queried

weekly to pull GMP work orders that have been created. The population of work orders is cross checked to the Company's financial reporting tool, PowerPlan. Data is organized by project and by the GMP-specific lines of business discussed above in the GMP Accounting Process section. 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 cancel and rewrite the work order to the correct GMP project and line of business.

As a further review of the data, weekly meetings are held with diverse groups of Eversource personnel. The summarized GMP data, as well as detailed data from the tracking mechanism, is shared and analyzed during this meeting. In addition, the Grid Modernization Portfolio Manager shares additional information related to the program, such as program risks, issues, and progress towards internally established targets. The Grid Modernization Project Managers also report on progress made for their respective areas of responsibility. The weekly meetings provide a recurring opportunity and platform to discuss any issues related to or potentially impacting the GMP.

Informal processes also exist outside of the formal tracking reports and weekly 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. Stakeholders within these various department also maintain their own tracking mechanisms, which are cross checked periodically to the formal GMP source document maintained by the Grid Modernization Program Analyst.

Grid Modernization Unit Tracking Process

GMP-qualified units are manually tracked by the Grid Modernization Program Analyst in the GMP portfolio tracking reports. As discussed above, all GMP work orders are reviewed and analyzed on a weekly basis, 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 Project 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 are comprehensively addressed. The Company's procedures allow for detailed analysis to support GMP investments and, eventually, cost recovery. Over the course of the 2018-2021 (and future) GMPs, the Company will continuously assess its tracking and reporting processes and, as appropriate, modify those processes and adopt best practices.

C. Project Approval Process

Consistent with the Company's Capital Authorization Policy and procedures, all GMP projects that were placed in service in 2020 have received the requisite spending authorization (adhering to the APS 1 Project Authorization Policy). All GMP projects link to one of the 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. For GMP projects where the total costs are below $100,000, the authorization has been granted via the annual program blanket approval that occurs as part of the capital plan book review by the Company's Board of Directors. For GMP projects where the total cost exceeds $100,000, a specific project identification number is assigned, and a Project Approval Form ("PAF") is written and approved through the PowerPlan system following the delegation of authority process set out in the Capital Authorization Policy. If a GMP project is expected to exceed the original authorized dollar amount, then a supplemental project authorization form is required when the direct costs of the project exceed or are expected to exceed the original authorized amount by the following levels:

- For projects <= $250K - An increase in direct costs >= $25K or;
- For projects >$250K - An increase in direct costs >10%

III. Implementation by Investment Category

III.A.1. Monitoring and Control

(Microprocessor Relays, 4kV Circuit Breaker SCADA, Recloser SCADA, Padmount SCADA, Network Protector SCADA)

A. Description of Work Completed

MICROPROCESSOR RELAYS: Under the 2020 GMP, the Company continued to replace the Electromechanical feeder overcurrent, reclosing, and under-frequency relaying schemes with a Primary 351S relay and a Backup 751 relay and associated test devices. The primary relay will include pushbutton controls for the breaker(s), primary overcurrent protection, Hot Line Tag, reclosing, breaker failure, and under-frequency load-shedding schemes. The backup relay will serve as the SCADA interface and will include backup overcurrent protection and breaker timing logic.

4KV CIRCUIT BREAKER SCADA: Under the 2020 GMP, the Company continued construction on several projects to upgrade circuit breakers to have DSCADA capabilities (control, indications, and analogs) at 4kV underground substations in Eastern Massachusetts ("EMA"). The work includes replacing distribution feeder electro-mechanical relays with modern microprocessor relay protection schemes and installing new, or upgrading existing, station remote terminal units ("RTUs") or adding real-time automation control ("RTACs") to add control, indication, and analog functionality at all feeder breakers, tie-breakers, and secondary transformer breakers where they currently do not exist.

RECLOSER SCADA: Under the 2020 GMP, the Company completed its planned deployment of overhead recloser devices utilizing the same plan as was described in the 2019 Annual Report, where, instead of simply adding a communications package, the Company replaced oil-filled recloser locations with new reclosers, which included the communications equipment necessary so that the device can be centrally monitored and controlled by the Company's System Operations Center ("SOC").

PADMOUNT SWITCH SCADA: Under the 2020 GMP, the Company continued with program deployment to the point where all existing motor operated Padmount switch devices in the field that were both compatible and did not currently have communications capability were exhausted. These devices can now be centrally monitored and controlled by the Company's SOC.

NETWORK PROTECTOR SCADA: Under the 2020 GMP, the Company continued to install the Digital Grid network monitoring system. The system includes: (1) enhancing relays at various field locations; and (2) at the substation, the installation of communications couplers on each of the affected circuits, tying back to a control panel, which will ultimately to be tied into the Company's communications infrastructure. The work that was started in 2019, for the network system in the Springfield, Massachusetts area, was commissioned in Q1 of 2020. In addition to

the Digital Grid Network upgrades in Springfield, Massachusetts, the Company continued this successful program by installing the field device relays and accompanying substation equipment at the Pittsfield, MA network location. The Pittsfield work was on schedule to be fully commissioned in 2020 but a last-minute challenge to the communication structure prevented this from occurring. Further details are outlined in the following sections of this report. The system includes: (1) enhancing relays at various field locations; and (2) at the substation, the installation of communications couplers on each of the affected circuits, tying back to a control panel, which will ultimately to be tied into the Company's communications infrastructure. At this time, the field devices will not be built into the Company's existing SCADA system in order to allow the Company to continue to build and implement its new enterprise-wide SCADA system, which has been in progress. The new enterprise-wide SCADA system has been successfully cutover in Massachusetts. Because the Company took a holistic approach to the Digital Grid platform, which is used in various configurations at other locations within the Company's franchise, the Company will wait until the new enterprise-wide SCADA system is fully deployed before integrating the Digital Grid system directly into the new SCADA platform. It is important to note that through the holistic view of the system, the Company has accommodated the current Digital Grid deployments in Springfield and Pittsfield, Massachusetts to be ready to integrate into the Company's new SCADA system, when ready. Until the transition to SCADA, the Digital Grid relays and station devices will be monitored and controlled via the Digital Grid software platform, which provides monitoring capability for the status of the network protectors, in addition to the several additional data points that were added at each location. These new data points include but are not limited to information such as voltage, current, fault current, hot line tagging status, power factor, reactive power, under-frequency status and hardware information. The system will be centrally monitored and controlled by the Company's SOC.

B. Lessons-Learned/Challenges and Successes

The Company utilized a programmatic framework when implementing the GMP. 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. Several of the following Lessons-Learned/Challenges and Successes are program-agnostic and apply to the GMP as a whole:

- The Company continued the process of communicating the GMP investments and status which accommodated recurring and as needed, ad-hoc meetings, with all levels of the leadership, so that issues could be quickly raised, and resolution action plans enacted.

- The significant deployment efforts in 2019 positioned the Company to develop an equally aggressive schedule for 2020, but with the ability to better manage program-to-program variances or changes, while still meeting or exceeding Department commitments in most preauthorized deployments.

- The unpredictable onset of the COVID-19 pandemic originally caused the Company's execution efforts to contract, while the impact assessment was being made. This had an

immediate and downstream negative affect on project plans, some of which could not be overcome.

  - However, after a relatively short delay, the Company took action and implemented definitive and conservative measures and protocols, that both protected Eversource employees and allowed work plans to recommence.

  - The new Company policies and procedures, used to manage the COVID-19 pandemic, did have an impact on production, particularly in closed-in areas like substations, but the Company's personnel quickly pivoted and integrated these new policies and procedures into their day-to-day work.

- 2020 had an unprecedented number of weather-related emergency response events for the Company, both within Massachusetts and in the other Eversource Energy service territories, i.e., Connecticut and New Hampshire. Though the Company effectively manages emergency response events, the immediate re-deployment of personnel from project work, like the high-paced GMP program, caused delays that were often longer than the day-for-day absence of those employees. Delays were often the result of missing/re-scheduling a planned outage. Cost pressures were often due to accelerating efforts to catch up, or the idling of project-specific contracted resources during Company personnel redeployment periods.

- Due to the project management consistency that was retained among the various GMP programs, project managers, based on their earlier GMP experience, capitalized on enhancing efficiencies and worked to eliminate issues and challenges. Additionally, at the onset of many of the GMP programs, new vendor/contractor resources were sourced, which required an onboarding and acclimation timeframe before full efficiency could be achieved. The continuation of working with these same vendors in 2020 allowed the GMP teams to better interact with various people/groups/departments and gain momentum in execution.

  - Once contracted and scheduled, the onboarding of new, external employees to an existing workforce will always provide challenges until both teams learn each other's cultures, habits and work styles, and become fully integrated. The timeframe for this integration can vary greatly. However, once the teams worked through these initial interactions and processes, production and efficiency continued to increase. The Company worked hard to limit any demobilization of a contracted resource once they had been onboarded to avoid the inherent slow-down of the integration process.

MICROPROCESSOR RELAYS:

  - Substation work was a challenge in 2020. Work completed within a substation typically requires significant coordination between Company's departments. Due to the fast-paced nature of each of the substation projects, ensuring tight coordination still presented challenges. Obtaining the right mix of internal and external resources also provided some challenges, mostly during the solicitation

and onboarding process. As an example, 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 mobilization/demobilization in between.

  - Due to the fast pace of the program and external obstacles, such as the on-going COVID-19 pandemic, there were still many challenges with planning and execution of the interdependencies among internal departments and between contracted resources. However, the pre-planning efforts of the 2019 lessons-learned allowed the team to solicit external vendors further in advance while obtaining buy-in from internal departments. These improvements, which are difficult to quantify, allowed for more work to be completed in 2020 than otherwise would have been completed without the lessons from 2019.

- Substation work is often complex and comprehensive. It has been the Company's experience with previous, non-GMP substation projects, that during the execution of the initially scheduled project, it is possible to identify unforeseen conditions and/or additional conditions or equipment that are appropriate and prudent to repair/replace in concurrence with the original work scope. This approach is logical, common in the industry and cost-efficient. The Company is following this same operational approach for any substation work being constructed under the GMP, while ensuring that all costs associated with any work completed that is not due to or related to GMP investments are segregated from the GMP and accounted for separately. The Company has successfully balanced funding, completing all prudent ancillary substation work and maintaining a strict segregation between GMP and non-GMP costs. Similar to its experience under the 2019 GMP, the Company in 2020 continued to leverage economies of scale by concurrently completing multiple projects within the same substation.

- Leveraging the lessons-learned from 2019, the Company utilized the 2018-2020 GMP project plan to secure external resources earlier in the process, than had occurred in the past. This allowed the teams to secure highly skilled, niche resources in an efficient and effective manner.

- The Company had originally intended to explore the possibility of utilizing third-party packager/kitting firms to assist with aggregating and coordinating materials (often from third-party vendors), so that the correct material is delivered when needed. Investments such as the Microprocessor Relay and 4kV Circuit Breaker programs do not require overly complex materials. However, there are many common parts and pieces that need to be coordinated to ensure they are on site at the correct times. Additionally, the volume of these projects is significant. Since the procurement process requires multiple

Company departments to be involved in the specification, procurement ordering, delivery and receipt of material, the advantage of using a firm such as a third-party packager is the ability to free up these internal Company resources to focus on more pressing and complex issues as opposed to these fairly standard and recurring projects. After consideration, the Company deemed that it was not practical to implement this process as a mid-stream change to the GMP. The efforts of a third-party vendor to assist in pre-packaged materials will be explored for the 2022-2024 GMP.

- As is typical with most construction projects, particularly renovation projects, pre-construction evaluations, which are referred to as "walk-downs," are critical to minimize unforeseen conditions and ensure that initial designs are adequate. The Company launched additional efforts in 2020 to complete these walk-downs. However, the ability to fully analyze existing conditions was not always possible due to energized components that may require an outage to inspect. Unforeseen conditions still occurred on the 2020 projects, and the Company will make more concerted efforts to observe and record existing conditions, prior to engineering and design efforts.

4KV CIRCUIT BREAKER SCADA:

- The 4kV circuit breaker SCADA work is very similar to the Microprocessor Relay program and has similar feedback on the lessons learned. There is one lessons-learned that was specific to the 4kV SCADA program due to its initial deployment in 2020:
    - Due to the newness of this program, certain assumptions needed to be made at initial engineering and design phases. Some of these assumptions needed to be modified during the construction phase, partly due to unforeseen field conditions and partly due to refining the original scope of work to ensure conformance with the GMP.
    - As the project teams have iterated through the processes of this program, they have continuously worked to refine the scope of work and execution methods, based on prior program experience.

RECLOSER SCADA:

- This program has been instituted in the Company's Western Region ("WMA") where the Company identified significant opportunities to enhance SCADA sectionalizing capabilities, particularly on long feeders. In 2019, the Company exhausted all locations that would allow for a simple communications package to be added to existing, older recloser locations. As an alternative, the Company pivoted to a "replace, in-place" process which fully replaced older, oil-filled recloser locations that did not have full SCADA capabilities with new SCADA-enabled, vacuum reclosers. This program was very successful and due to the

efficiency in the installation process, the Company deployed equipment to more locations than was set out in the 2018-2020 GMP.

- In addition to the significant efforts in 2020, the Company ensured that all personnel in the work stream were aware of the 2020 GMP commitments. An area of emphasis for this program in 2020 was ensuring that the Commissioning resources, who the Company relies on for their specialized skill set, maintained an increased focus on the GMP commitments. The Company identified this as an area of opportunity in 2019 and in 2020 placed a greater emphasis on planning and monitoring of the Commissioning team to achieve an aggressive but executable plan to complete the work.

PADMOUNT SWITCH SCADA:

- Consistent with the discussion in the 2019 GMP Annual Report, the Company anticipated that its experience with Padmount Switch SCADA would be similar to its experience with the Recloser SCADA program, including the potential to exhaust the list of those locations where simply adding a communications package to an existing Padmount switch was feasible. This proved to be accurate in 2020 as the Company exhausted all such locations in its service territory. Given these location restraints, the Company was three units short of the original 2018-2020 GMP target. Because of the significantly increased costs associated with the equipment and installation of a replace, in-place Padmounted switch, the Company elected not modify this investment category and instead simply met the originally planned goal.

NETWORK PROTECTOR SCADA:

- The following lesson was discussed in the 2019 GMP Annual Report and continues to apply to the GMP. The most significant lesson learned for this program was that the Company should have segregated the field work, which was presented to the Department on a unit-basis, from the substation work, which comprised the more significant work effort and is not attributable to a "unit." The completion of the substation work was required prior to any field relay devices being able to be commissioned into the new system. This bifurcation of field devices and substation devices is a typical project breakdown and would have allowed for simplified tracking and reporting. Moving forward, for all proposed work The Company will include a sufficiently granular breakdown of the project components, not just for the Network Protractor SCADA investments, but for any investments needing that clarification.

- The Company leveraged the lessons-learned regarding the long material lead times for this project and, for the additional investment in this category in 2020, the project team placed an emphasis on project logistics and planning. This

logistical planning emphasis was beneficial and allowed the Company substantially completed all work on this additional project.

- Though the Company substantially completed the additional project, an unforeseen communications issue required the relocation of the substation communications cabinet, which caused the project to slip into 2021. The lesson in this instance was related to the design of the powerline carrier ("PLC") signal process, and its limitations.

C. Actual vs. Planned Implementation and Spending

Refer to Tables 3 and 4 below for the Company's 2020 implementation unit and spending summaries for the Monitoring and Control GMP Investments. Spending was broken down into "Total Capital Spend" and "Plant In-Service." As indicated in section I. Introduction, Plant In-Service is initiated by a device being "Construction Complete" and therefore cost recoverable.

Table 3: 2020 Implementation Unit Summary

	Commissioned Units			
Investment Areas and Preauthorized Device Types	**2020 Actual**	**2020 Plan**	**Variance (Units)**	**Percent (%)**
Monitoring & Control (SCADA)	**244**	**239**	**5**	**102%**
Microprocessor Relay	83	96	(13)	86%
4kV Circuit Breaker SCADA	38	39	(1)	97%
Recloser SCADA	25	3	22	833%
Padmount Switch SCADA	15	18	(3)	83%
Network Protector SCADA	83	83	-	100%
Power Quality Monitors	-	-	-	N/A

Table 4: 2020 Implementation Cost Summary

	Capital Spend (in thousands $)				Plant In-service (in thousands $)			
Investment Areas and Preauthorized Device Types	**2020 Actual**	**2020 Budget**	**Variance ($)**	**Percent (%)**	**2020 Actual**	**2020 Budget**	**Variance ($)**	**Percent (%)**
Monitoring & Control (SCADA)	**26,095**	**23,822**	**2,272**	**110%**	**28,332**	**34,828**	**(6,496)**	**81%**
Microprocessor Relay	11,737	14,762	(3,025)	80%	14,477	23,423	(8,945)	62%
4kV Circuit Breaker SCADA	11,763	6,983	4,780	168%	12,494	8,502	3,992	147%
Recloser SCADA	1,534	675	859	227%	578	1,218	(640)	47%
Padmount Switch SCADA	286	270	16	106%	361	361	1	100%
Network Protector SCADA	560	1,132	(572)	49%	421	1,324	(903)	32%
Power Quality Monitors	215	-	215	N/A	-	-	-	N/A

MICROPROCESSOR RELAYS:

The Company's implementation of the microprocessor relays was short of its originally planned 96-unit target by 13 units in 2020. However, as engineering

and design was fully developed, the Company internally increased its goal from 96 to 105 units. After experiencing a similar workload for this investment in 2019, the Company knew that they had set another aggressive goal for 2020. Achievement of the 2020 investment was further exacerbated by the COVID-19 pandemic and the impacts of the Company's response to significant and repeated storm events, which led to delay in GMP investments as Company personnel fulfilled their Emergency Response Plan ("ERP") duties.

Similar to 2019, projects in this investment category were concurrently executed throughout the Company's entire Massachusetts region. Significant effort was taken to build a team, validate locations, and execute the 2020 plan to install the microprocessors simultaneously at multiple locations. To leverage experience, the Company utilized the same teams that were undertaking the 4kV Circuit Breaker SCADA program. Although the Company fell short of its 2020 goal, this significant coordination and concerted effort represents a level of commitment at the Company and demonstrates the Company's ability to leverage internal and external expertise to continue the successful implementation of the GMP.

Due mainly to COVID-19 and limited outage work allowed over the summer months, the outage sequencing associated with these investments again resulted in a very busy second half of 2020. Most of the projects ended up on the critical path, with no leeway for schedule changes without affecting the project end-date, which then caused unplanned project overlap and resource constraints. The cascading resource constraints in the EMA region and a challenging underground conductor fault from a foreign feeder in WMA ultimately pushed three projects into 2021, despite significant recovery efforts. Some of these efforts included:

- interdepartmental coordination at the senior levels of the organization to ensure timely decisions and real-time updates;
- shifting resources in order to accelerate the schedule, working towards completing two feeder relays per week;
- increased reporting to all levels to ensure timely information exchange; and
- contracting more of the work, throughout the year.

As of March 31, 2021, all 2020 carry-over relays, including those in the Company's stretch goal, have been completed and commissioned.

- As was experienced in 2018 and 2019, the Total Capital Spend of the unit-costs for this program were estimated to average higher than originally budgeted unit costs. Economies of scale in some locations were realized again during 2020 when Microprocessor Relay projects were completed in parallel with other

projects within the same substation. The Company reviews all GMP project costs in real-time and made adjustments/decisions where needed at the project level to analyze and reallocate funds across GMP programs as appropriate. Because the Company was expecting to see similar unit costs as in 2019, it had already reallocated budgets from other investments, without impacting those investments,[4] to address the increased costs. Originally, the Company expected that, following the initial program startup costs and compressed duration contracted work that was experienced in 2018, actual unit-costs in 2019 and 2020 would come further in alignment with budgeted unit costs. However, even after continued operations throughout 2019 and 2020, which included a competitive procurement process, that did not prove to be the case. This is principally due to the use of specialty contracted resources and the overtime required to perform this incremental work internally.

- In analyzing the cost increases from budget to actual, the Company has identified several drivers of the increases, as discussed below, many of which are similar to 2019:

    a. Each substation addressed in the Microprocessor Relay program had some commonality, but also a level of uniqueness that required various levels of effort, and money, to address. It was the unique nature of the substations, coupled with the corresponding resource/skill set(s), that resulted in the variations in implementing Microprocessor Relays at the substations, including the unit costs.

    b. Due to the incremental nature of the GMP work, it is often necessary to engage vendor resources to augment the Company's internal staff. Many of these resources have limited availability, such as Lead Commissioning Engineers ("LCEs") and Substation Test Engineers, both of which perform work for many aspects of the Company, in addition to the GMP. The Company's solicitations are typically distributed to approximately four technically qualified companies. Due to their significant experience, two of the four firms are highly sought after. These resource limitations in the market have led to increased negotiated rates over the last several years. This trend is expected to continue as more and more of the Company's, and the electric distribution sector in general, devices become more complex and interconnected.

    c. Additionally, labor hours, particularly by contracted resources that cannot easily be redeployed, encountered an increase in actual costs relative to estimated costs due to COVID-19 restrictions and project

[4] Note that the Company made the definitive decision in 2019 to significantly reduce the All Dielectric Self-Supporting ("ADSS") fiber program.

delays experienced while Company personnel fulfilled their ERP duties during storm response.

4KV CIRCUIT BREAKER SCADA:

- The Company's implementation of the 4kV Circuit Breaker SCADA relays was short of its 38-unit target by one unit in 2020. The singular unit that is identified as a missed target was intentionally removed from the GMP due to a circuit reconfiguration in 2020, which eliminated this feeder position and the corresponding relay unit. Therefore, it is important to note that, although Table 3 indicates this investment is one unit short of the 2020 goal, the Company did reach its target. Similar to the Microprocessor Relay discussion above, it was apparent during the engineering stages of these projects that took place earlier in 2020 that achieving 38 units in 2020 was going to prove very challenging. Ultimately, through close coordination and several workplan revisions and accommodations, the team was able to successfully complete all 4kV Circuit Breaker SCADA work for the entire 2018-2020 GMP term.

  The 4kV Circuit Breaker SCADA program experienced identical challenges the Microprocessor Relay program. Through the development of new project teams, engineering and design of the projects, and limited outage work allowed over the summer months, the outage sequencing ended up with a very busy last half of the year. However, the Company was able to successfully compete the 2020 work plan.

- Total Capital Spend for this program was anticipated to average higher than original budgeted unit costs. The Company reviews project costs in real-time and makes adjustments/decision where needed at the project level and analyzes and reallocates funds across GMP programs as appropriate consistent with the Department's order in D.P.U. 15-122. In this case, unused funds from other GMP investment categories were utilized to account for higher budgeted costs. The Company had revised its original budget upward based on the results of 2019 and expected deployments in 2020. This was done both for the added unit cost, and for the increase in actual units planned (see Section H of the 2020 GMP Annual Report). The increase in unit costs was principally due to the use of specialty contracted resources and the overtime required to perform this incremental work internally. Based on the Company's experience in 2019 and the revised term-end cost projections as they relate to the overall GMP portfolio, provided for increased budgetary and projections accuracy in 2020.

RECLOSER SCADA:

- The recloser SCADA program continued to be implemented in a very efficient and cost-effective manner over the course of 2020. The Eversource GMP team is familiar with completing this type of work and was able to leverage existing processes to implement this incremental investment on the Company's system.

Due to its efficient and effective processes and planning, the Company was able to exceed both its 2020 goal of three units and its three-year term goal of 37 units by 22 units.

- As discussed in the "Lessons Learned" section of the 2019 GMP Annual Report, the Company had shifted this program into a 'replace, in-place' program as an efficient way to continue to deploy SCADA communications to existing field locations. The "replace, in-place" strategy continued throughout the 2020 plan year.

- The Total Capital Spend for this program is still below budgeted unit costs, even after modifying the implementation of this GMP program to a "replace, in place." The Company was able to maintain this program under the originally budgeted unit costs.

PADMOUNT SWITCH SCADA:

- The Company's implementation of the Padmount Switch SCADA program was short of its 18-unit target by three units in 2020. However, it is important to note that the shortage in meeting the 18-unit goal was not due to execution, but instead was a result of the Company exhausting all possible locations where the addition of a communications package only, to the existing Padmount switch, was possible. Within the 2019 GMP Annual Report, the Company discussed the possibility that it would exhaust sufficient locations to reach the original 62-unit 2018-2020 GMP goal. Even though the Company had identified sufficient locations for Padmount switch upgrades during the engineering stages, when full designs were completed, several prospective sites were removed from the execution list due to lack of upgrade compatibility. Similar to the condition experienced in the Recloser SCADA program, the Company analyzed implementing a "replace, in-place" strategy for the Padmount switch equipment but rejected this change due to a disproportionate installation cost.

- The Total Capital Spend for this program indicates that the average unit costs are slightly higher than budgeted. Based on the Company's analysis into the cost increases, it determined that much of the increase was associated with the time and effort to analyze and validate the chosen locations for these devices, as well as the additional work that was sometimes required to allow the existing device to operate with the installed communications package. Following the completion of the 2019 implementation and the review of costs, the overall budget for this GMP program was increased. The increase was marginal, and funds were redeployed from other GMP programs.

NETWORK PROTECTOR SCADA:

- Under the Network Protector SCADA program, which encompassed the integration of the Digital Grid solution, and as discussed in the 2019 GMP

Annual Report, the Company was able to successfully commission all of its 83-unit target of devices, including substation upgrades for the originally planned project in West Springfield, Massachusetts. Additionally, the Company added another substation, which included eight network relays, into the plan. This additional work was completed in Pittsfield, Massachusetts and was in addition to the original 2018-2020 investment commitment. The team successfully installed all eight relays and all accompanying substation equipment in 2020. Unfortunately, during the commissioning process, there was an unforeseen issue within the PLC infrastructure that would not allow the field devices to communicate with high fidelity to the substation. The team pivoted quickly to develop a new solution to solve the problem but were not able to finalize the specific equipment relocation and commissioning efforts in 2020. As of March 31, 2021, all of the additional work has been completed and commissioned.

- The total Capital Spend for this program is significantly below budgeted costs. Digital Grid was the vendor selected for the project as their products are consistent with the Company's Standards. In addition, the Digital Grid system is used in various forms in by other Eversource Energy operating companies. At the time of the original GMP filing in D.P.U. 15-122, the exact system configuration was not known. However, after final design and the efficiencies in work execution, it was evident that there would be significantly more budget to allocate. The Company employed the Digital Grid system at an additional network within the Western Massachusetts territory and will re-deploy the remaining portion of the budget to other GMP programs consistent with the Department's order in D.P.U. 15-122.

D. Performance on Implementation/Deployment

Refer to Appendix 1 for the year-to-year and overall portfolio implementation/deployment data.

E. Description of Benefits Realized as the Result of Implementation

There are immediate benefits to the Company and ultimately its customers by having visibility and control of additional devices in the field, such as insight into emergent conditions, remote switching, and acquisition of load data. Additionally, the increase of the investment types identified in this section will influence several of metrics identified in Sections IV and VI of the 2020 Grid Modernization Annual Report and Appendix 1. Refer to "Massachusetts Grid Modernization Program Year 2020 Evaluation – Monitoring and Control" provided by Guidehouse (formerly Navigant Consulting) for further analysis.

F. Description of Capability Improvement by Capability/Status Category

METHODOLOGY

Microprocessor Relays: The specific relays selected for this program were based on a list of feeders and their characteristics. One characteristic was an indication if SCADA was available. Selecting

non-SCADA feeders was the first pass analysis. Next, substations for which there was major (non-GMP) work scheduled but not anticipated to be completed prior to 2020 were eliminated from consideration. Next, all substations that utilized overhead reclosers serving as feeder breakers were removed from consideration. Finally, all substations with scheduled retirements were removed from consideration. What followed from this analysis was the list of substations and feeders that were good candidates for the microprocessor relay upgrades.

SCADA Switches (Recloser, Padmount, Network): Prioritization for reclosers, secondary network protectors and Padmount switches was based on the same zone size and reliability ranking methodology as described in the Distribution Automation section of the 2018 Grid Modernization Annual Report (Section III.A.2). These criteria included: number of customers impacted by the device (higher); and the circuit reliability (lower). Padmount switches had an additional criterion: motorized switches were prioritized and were a requirement for investment.

EXPECTED CAPABILITY IMPROVEMENT:

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 Distribution Management System ("DMS"). Additionally, and even prior to full circuit automation and integration with the GMP-driven IT systems, these new/upgraded devices will provide an enhanced level of visibility and control to the system operators.

Enabling monitoring and control of motor-operated Padmount switches will have significant reliability benefits by enabling a scheme in which switches will indicate the fault location, enabling dispatch to remotely isolate the faulted cable section and restore power to all customers on the loop.

G. Key Milestones

The Company maintains an execution plan and schedule of all its GMP investment categories. This schedule, which encompasses all three years of the GMP, was developed and is administered with the requisite flexibility that enables the Company to adjust its investment schedule and timing over the course of the GMP in the event that external factors, such as third-party resource availability, material availability, outage authorization, or unforeseen conditions impact the GMP and the relevant investment schedule. However, a sampling of the key 2020 milestones follows:

- 85% completion of the original three-year term goal of Microprocessor Relays
    - Planned units that were not able to be completed in 2020 have been completed in Q1 of 2021.
    - Delta in Microprocessor Relay underrun was accounted for in additional 4kV Circuit Breaker SCADA – this was noted in the 2019 GMP Annual Report, Section III.A.1.H.

- 130% completion of the original 2018-2020 GMP goal of 4kV Circuit Breaker SCADA.

- 160% completion of the original 2018-2020 GMP goal of Recloser SCADA.

- 97% completion of the original 2018-2020 GMP goal of Padmount Switch SCADA.

    - Obtaining 100% was not possible due to exhausting all available locations capable of upgrade.

- 100% completion of the original 2018-2020 GMP goal of Network Protector SCADA

    - As of Q1 2021, 110% of the 2018-2020 GMP goal has been completed.

- Specific selection has been completed for all Microprocessor Relay and 4kV SCADA investments authorized for 2021 deployment in D.P.U. 20-74.

H. Updated Projections for Remainder of the Four-Year Term

On August 15, 2018, the Company submitted its Baseline and Targets Filing, which included the 2018-2020 GMP base line (Baseline and Targets Filing at 15, Table 2.4.7). On May 12, 2020, the Department issued an order (1) extending current three-year GMP investment term; and (2) establishing a revised filing date for subsequent GMPs, which extended the MA GMP through calendar year 2021. NSTAR Electric Company d/b/a Eversource Energy, D.P.U. 15-122-D at 7 (May 12, 2020). *Table 5: Four Year Term Projections* provided below provides the projections for 2021 which accounts for the Company's additional deployments, authorized in D.P.U. 20-74. The Company immediately moved forward with the development of the projects upon receipt of D.P.U. 20-74 but recognizes that there is a lengthy inception-to-completion process particularly for the substation projects, which typically extends beyond one year. Additionally, throughout 2021, the Company will continue its analysis on the GMP portfolio and will make the necessary adjustments to effectively utilize the total $169 million (D.P.U. 12-122: $133 million authorized and D.P.U. 20-74: $66 million authorized) 2018-2021 GMP budget.

Table 5: Four-Year Term Projections

Investment Areas and Preauthorized Device Types	Capital Spend (in thousands $)			Units		
	2018-2020 Actual	2021 Plan	2018-2021 Projection	2018-2020 Actual	2021 Plan	2018-2021 Projection
Monitoring & Control (SCADA)	**52,063**	**16,932**	**68,995**	**435**	**125**	**560**
Microprocessor Relay	30,091	11,260	41,351	180	57	237
4kV Circuit Breaker SCADA	15,932	4,000	19,932	54	13	67
Recloser SCADA	3,386	-	3,386	59	-	59
Padmount Switch SCADA	1,007	-	1,007	59	-	59
Network Protector SCADA	1,431	717	2,148	83	21	104
Power Quality Monitors	215	956	1,171	-	34	34

III.A.2. Distribution Automation

(OH DA, OH DA w/Ties, 4kV Oil Switch, 4kV AR Loop)

A. Description of Work Completed

Overhead Distribution Automation ("OH DA"): Under the 2020 GMP, the Company completed the three-year plan for installation of new OH Reclosers (typically Nova Form 6) with full SCADA capability to coordinate with the existing devices/equipment in the field and further reduce the number of customers affected during an outage. This was as very successful program and has aided in reducing the average customer zone size and increasing visibility to the grid.

Overhead Distribution Automation with Ties ("OH DA w/Ties"): Under the 2020 GMP, the Company completed the three-year plan for installation of recloser technology in order to tie circuits together. The majority of these locations were areas originally consisting of manual tie points, which were automated into existing loop schemes in addition to being remotely viewed and operated via the System Operations Center.

4kV Oil Switches: Under the 2020 GMP, the Company completed its three-year plan to replaced existing oil-filled underground switches with new G&W Vacuum Fault Interrupter ("VFI") switches with full SCADA capability. Under the 2018-2020 GMP, where possible, switches were installed in strategic locations to support the 4kV Auto-Restoration ("AR") Loop program when it comes online.

4kV AR Loops: Under the 2019 GMP, the Company decided to move from the purely "4kV VFI Retrofit" investment and into a system that will allow for a decentralized automated loop restoration solution. This solution allows for a controller to be placed at the substation to have peer-to-peer communication with all the other field switching devices on a particular circuit (and adjacent circuit). In the event of a cable failure, the circuit(s) will be able to quickly and autonomously reconfigure themselves, thereby restoring the maximum number of customers in the shortest time. The Company selected a substation and its respective circuits, which were not planned for voltage conversion upgrades. The Company designed and developed these circuits into an automated loop system utilizing a Schweitzer Engineering Laboratories ("SEL") application and equipment. This included installing the communications and distribution automation controller ("DAC") infrastructure in the substation and upgrading field devices, which were overlapped with "4kv Oil Switch" replacements, to ensure remote operability. This GMP investment represents a significant step forward into an area of 4kV automation that the Company has not previously included on its distribution system. Most of the construction work had been completed within the 2019 timeframe. During 2020, the Company focused on integrating this new technology into its infrastructure. Unfortunately, the challenges on this project have prevented final system commissioning. Further details are provided below.

B. Lessons-Learned/Challenges and Successes

OH DA:

- The OH DA program contains typical device installation that is consistent with the Company's experience in installing devices on its system. Given that the Company had processes and procedures in place to address these types of installation, it was efficient in leveraging those processes to set up and undertake these incremental GMP investments.

- The Company identified commissioning resources as an area of opportunity going forward. The emphasis that that Company placed on planning and monitoring of the Commissioning team for 2020 enabled it to develop and implement an achievable yet aggressive plan. Continuous communication and situational awareness were the key factors in achieving the Company's objectives under the OH DA program.

OH DA w/Ties:

- This Company's experience with this program in 2020 was very similar to its experience with the OH DA program discussed above and the Recloser SCADA program discussed in Section III.A.1.

- One of the lessons learned from the program onset was the need to closely coordinate OH DA, OH DA with Ties and Recloser SCADA work undertaken by the Company's Protection and Control engineering teams. Such close coordination is necessary because any changes in automated, switchable devices in a circuit will affect the coordination aspects for all remaining devices on that circuit. Therefore, if each of the aforementioned investment types had been completed independently of each other, there would have been constant and inefficient engineering rework to achieve the necessary coordination between these investments. The holistic approach that the Company implemented and the rigor that was placed on program oversight and communication prevented this potential inefficiency.

4kV AR Loop:

- In the 2019 GMP Annual Report, lessons learned were geared toward the challenges of finding the right location for which to implement this AR loop program, without the need for major system upgrades. In 2020, the lessons learned are geared exclusively toward the iterative process that is needed, when deploying new technology, and the need to provide better assessments at project onset. Specifically, the Company's current planning and execution structure is set up to build consistent with design specifications. In a new technology deployment situation, such as the AR loops, it is important that relevant personnel understand that a project of this nature will not have a fully executable design and that the process will involve trial and error, with

some/many challenges along the way. It is also critical that Company personnel have the necessary resources to aid them in the build and refinement process. Another lesson learned is the level of effort and design that was needed based on using different types of communicators structures. This program would have benefited from a fully deployed fiber optic communications infrastructure. The Company, however, is not built out with that type of high-speed access in this area. Therefore, the Company's plan included the use of a radio/cellular network. The use of these technologies is practical but also comes with inherent and unforeseen conditions. The Company is using these two major lessons as it conducts pre-planning of the next 4kV AR loop deployment.

4kV OIL SWITCHES:

- The replacement of the underground oil switches is a complex process. The challenge is due in part to the high customer density and the electrical outage boundaries that need to be established in order to perform the work. The volume of switch replacements in 2020 was significant, but fewer replacements were conducted in 2020 than in 2019. Fortunately, the Company's aggressive 2019 execution plan allowed for fewer installations in 2020 while still allowing it to meet the three-year term commitment. Having fewer units to install allowed the team a buffer, to first understand, and then accommodate the challenges and restrictions of the COVID-19 pandemic. In spite of that unforeseen challenge, the Company was able to exceed the three-year term commitment chiefly for the following reasons:

  - The teams responsible for these replacements continued to closely coordinate, so that the work could be planned and executed as efficiently as possible to limit the extent and duration of the planned outage. The teams accomplished this balance by planning as much maintenance and/or non-GMP work as possible to be undertaken during the outage. The teams ensured that GMP work was maintained separately (administrative/financially) from the other work. The specific GMP work and cost tracking processes developed to implement the GMP consistent with the Department's directives and internal processes were followed in order to maintain this strict separation.

  - In order to avoid having to schedule a second planned outage, the teams identified all of the GMP switch locations in advance so that, were an emergency outage to occur that happened to overlap the GMP location, the installation team could work to install the GMP device at the same time as undertaking the work to address the initial emergency outage. The decision to complete GMP work in this manner was and will continue to be evaluated on a case-by-case basis to determine the merits of extending the existing outage to install the GMP device versus requiring a second, separate outage to install the device.

- When an emergency outage occurred in the 4kV underground system, if an oil switch was identified as being within the electrical outage boundaries and could be efficiently replaced without extending the existing outage, crews would react quickly to replace the oil switch. The crew's supervisor and management teams carefully reviewed field work charging to ensure that costs were maintained separately from the outage event, and correspondingly, that outage event costs were not included in the oil switch replacement. This was a very effective process and prevented customers from experiencing a future planned outage to remove the oil switch.

C. Actual vs. Planned Implementation and Spending

Tables 6 and 7 below show the implementation unit and spending summaries for the Distribution Automation work undertaken in 2020. Spending was broken down into "Total Capital Spend" and "Plant In-Service." As indicated in Section I. Introduction, Plant In-Service is triggered by a device being "Construction Complete" and therefore cost recoverable.

Table 6: 2020 Implementation Unit Summary

	Commissioned Units			
Investment Areas and Preauthorized Device Types	**2020 Actual**	**2020 Plan**	**Variance (Units)**	**Percent (%)**
Distribution Automation	**127**	**124**	**3**	**102%**
OH DA	70	47	23	149%
OH DA w/Ties	8	-	8	N/A
4kV Oil Switch Replacement	48	16	32	300%
4kV AR Loop	1	61	(60)	2%

Table 7: 2020 Implementation Cost Summary

	Capital Spend (in thousands $)				Plant In-service (in thousands $)			
Investment Areas and Preauthorized Device Types	**2020 Actual**	**2020 Budget**	**Variance ($)**	**Percent (%)**	**2020 Actual**	**2020 Budget**	**Variance ($)**	**Percent (%)**
Distribution Automation	**14,053**	**15,804**	**(1,751)**	**89%**	**12,538**	**19,330**	**(6,792)**	**65%**
OH DA	3,839	4,185	(347)	92%	3,339	5,057	(1,718)	66%
OH DA w/Ties	455	1,720	(1,265)	26%	328	1,932	(1,604)	17%
4kV Oil Switch Replacement	9,190	6,500	2,690	141%	8,710	8,267	442	105%
4kV AR Loop	569	3,399	(2,830)	17%	161	4,074	(3,913)	4%

OH DA:

- The Company exceeded the 47-unit target for 2020 by 23 units. As of year-end 2020, the Company has successfully completed the OH DA program. The total number of installed units for this program is 243, which exceeds the original commitment by 47 units. As was discussed in prior annual reports, the OH DA program is a core capability of the Company and the efficient deployment of these devices allowed for a faster field deployment, which immediately impacts both visibility into the grid and reliability. The

deployment of these devices continues to positively impact the Customer Outage and System Automation Saturation metrics.

- The Total Capital Spend for this program continued to be below budgeted unit costs. Because the Company essentially completed all remaining units for the three-year term in 2019, there was a significant underrun in this investment budget. The Company utilized this budget capacity to continue to deploy OH DA devices, above and beyond the original 2018-2020 GMP plan.

OH DA w/Ties:

- In 2019, the Company exceeded both its yearly target and the overall 2018-2020 GMP investment target. In 2020, due to efficient deployment and budget capacity, the Company continued with this important program to create and/or automate circuit ties, by installing eight additional units, which brought the total deployed quantity to 53 units. This program has exceeded the original 2018-2020 GMP investment target of 38 units by 15 units. These ties were generally simple circuit ties in which a manual switch was replaced with a tie-recloser. In some instances, additional reclosers were added on either side of the tie to either reduce customer counts between load or to facilitate recloser coordination.

  The Total Capital Spend for this program was below budgeted unit costs. Because the Company chose a higher-volume, lower-costs deployment of simple circuit ties (i.e., no line extensions, reconductoring or other circuit modifications), there was a significant budget underrun. This underrun was used to fund the additional units installed above original targets. The remaining budget capacity was redeployed to other investments within the GMP.

4kV AR Loop:

- As discussed in the 2019 GMP Annual Report and the response to Department Information Request DPU-AR-4-7, this program was changed from an exclusively VFI retrofit program to an automated restoration loop program, and the use of "units" in the sense of field units was no longer appropriate. A more appropriate unit of measure is "loops created." This is primarily due to the diversity of work required in the field to obtain remote visibility and control. For instance, in some cases a communications package was the only requirement, while in other instances an entire switch replacement was necessary. Given this, the Company has worked to dovetail the "4kV Oil Switch" replacement program into the loops, where possible, which is also discussed in the response to Information Request DPU-AR-4-7 .

  As discussed in Section A, above, the Company has selected an SEL system to administer the loop logic. In 2019, the Company completed field device and installation of the SEL distribution automation controller cabinet. Additionally, the Company established radio and cellular communication nodes so that field devices could communicate to the SEL Distribution Automation Controller ("DAC").

Essentially, all construction for this project was completed in 2019 but time expired before the final communications commissioning could occur between the SEL DAC and the Company's front-end SCADA processors. Consequently, this also meant that the site acceptance testing ("SAT") and final system configuration could not occur in 2019.

The Company's plan for 2020 was to:

1) complete the existing project, which included establishing the communications path from the SEL DAC to the new SCADA front-end processors; obtain direct/consistent communications from the field devices to the newly installed SEL DAC; commission the entire system into operations; and

2) begin the build out and ultimate commissioning of another substation and accompanying loops, with expectations that the lessons learned from the first project would dramatically reduce installation time.

Unfortunately, the Company was not able to successfully commission the current project into service in 2020. The new SCADA system was brought online in late Q2 2020 and the communication paths between the SEL DAC and the SCADA front-end processors were commissioned into service. However, the challenges remained in establishing the direct and consistent communications from the field devices to the SEL DAC. The Company continues to implement issue identification and resolution. As of March 31, 2021, this process is on-going with additional work necessary in order to place this system online.

The Company recognizes the importance of these automated loops in the 4kV underground system and will continue to drive to a solution in a cost-effective manner. However, these efforts must be balanced with the need to ensure that the new system will provide for increased reliability. For 2021, the Company has solicited third-party support to provide a holistic review of the system components and efforts to-date to help identify a plan for final commissioning.

- The Total Capital Spend for this program is averaging higher than expected due to the onsite challenges that continue to be reviewed and resolved. Additionally, and as discussed in the 2019 GMP Annual Report, the budget is not reflective of the original deployment strategy, due to the change in program function. This is also discussed to in the response to Information Request DPU-AR-4-7. The Company is planning for additional substations to develop 4kV AR loops but, due to the challenges discussed above, it is possible that the entire budget will not be expended on these investments. The Company will continue to evaluate the progress of the program and expend or redeploy funds to other investments, as appropriate.

4kV OIL SWITCHES:

- The Company exceeded its 16-unit goal for 2020 by 32 units. As of year-end 2020, the Company has successfully completed the 4kV Oil Switch Replacement program. The total number of installed units for this program is 137, which exceeds the original 2018-2020 GMP investment target by 32 units. This was a significant undertaking and the lessons learned from both 2018 and 2019 were fully employed in order to make the 2020 execution successful. The immediate deployment of devices in 2018 and the aggressive workplan in 2019 allowed the Company to quickly mature its execution of this program, which resulted in additional units being deployed and enabled the Company to respond to the COVID-19 restrictions that heavily impacted this program, most specifically in Boston.

- The Total Capital Spend for this program is higher than originally budgeted for two reasons. The Company executed a stretch goal plan and commissioned significantly more switches than originally projected and the overall program costs were approximately 15 percent higher than original budgets established at initial GMP filing. As discussed in various areas of this Report, the ability to effectively coordinate across various Company departments was instrumental in executing an aggressive GMP. This is particularly true with the execution complexity of working within the 4kV underground system. These situations led to significant variations between individual devices installation and therefore a high standard deviation of costs. To aid this process, the Company continued to provide specific points of contact in the form of a task-force for execution. Once the 2020 unit goal was met, the Company maintained the execution momentum and continued to install and commission devices.

D. Performance on Implementation/Deployment

Refer to Appendix 1 for the year to year and overall portfolio implementation/deployment data.

E. Description of Benefits Realized as the Result of Implementation

There are immediate benefits to the Company of having visibility and control of additional devices in the field, such as insight into emergent conditions, remote switching and acquisition of load data. Additionally, the increase of the investment types identified in this section will have an effect on several of metrics identified in section IV and VI of this 2020 Grid Modernization Annual Report and Appendix 1. Refer to "Massachusetts Grid Modernization Program Year 2020 Evaluation Report – Advanced Distribution Automation" provided by Guidehouse for further analysis.

F. Description of Capability Improvement by Capability/Status Category

METHODOLOGY:

To prioritize circuit investment, each circuit was analyzed to identify existing isolation segments or zones. Zone sizes were determined by the number of customers impacted in each zone. The

Company prioritized zones with customers greater than 500 for WMA (former WMECO service territory) and 1,000 for EMA (NSTAR Electric service territory). The Company also considered circuit reliability based on historical System Average Interruption Duration Index ("SAIDI") and System Average Interruption Frequency Index ("SAIFI") from 2016, 2017 and 2018 when selecting circuits for investment. The poorer the reliability of the circuit, the higher priority the circuit and its associated zones received. The Company applied a weight of 60 percent to zone size and 40 percent for the reliability score and then normalized on a 1 to 100 scale, with 100 being the highest priority for investment. Zones were ranked separately between EMA and WMA. For feeders that lack alternate supply sources, infrastructure was built where cost-effective to tie radial circuits and deliver the benefits of automation. Existing circuit ties were bolstered to increase their back-up capability where it was cost-effective.

The Company selected OH DA with Circuit Tie locations using a list of radial zones with existing manual three phase tie equipment installed. Circuit reliability performance and number of customers within the zone were then used as factors to prioritize each zone for the addition of DSCADA enabled, automatic sectionalizing equipment. Radial zones without a manual alternate source were not considered as viable options for this project.

In siting the investments for automating and upgrading the existing 4kV switching, sectionalization and SCADA infrastructure, the Company focused on the Greater Boston and Cambridge areas. The current existing 4 kV sectionalization, which is a critical component of the system serving high-density residential and commercial areas, was installed in the period of 1920-1940, making it the least modernized portion of the Company's distribution system. The investment consists of replacing existing switches with the latest technology and SCADA, so these devices have similar functionality as their overhead counterparts.

The Company prioritized GMP investments in 4kV switches using the same zone size and reliability ranking methodology as described above for the overhead circuit.

The selection criteria for the 4kV AR Loop program was based on the related substation having a long-range plan of staying at the 4kV operating voltage in addition to having sufficient space for the new DAC and telecommunications equipment and compatible RTU's/RTAC's and relays. In addition to the substation criteria, the team looked for areas: 1) with a high density of exiting field switches that could be used as-is, replaced, or upgraded; 2) where there are underground switches that are difficult to access (since the AR Loops will help prevent manual entries); and 3) with high customer impact such as large customer concentrations or important infrastructure.

EXPECTED CAPABILITY IMPROVEMENT:

DA technology will allow the grid to sense the existence of a fault, automatically isolate it to the smallest possible segment and then restore service to all customers outside the faulted zone with supply from alternate sources. By decreasing the number of customers in each segment between sectionalizing automated devices, the Company can reduce the impact of outages. With this added sectionalization and tie capability, the grid will dramatically increase its ability to reconfigure itself

based on systems conditions. In the case of outages during major events, e.g., storms, these DA investments will reduce the duration and extent of the storm events and can result in meaningful benefit to customers.

In addition to these benefits, the automated devices in the field will reduce the amount of day- to-day manual switching operations which occur as a normal part of maintaining the electric system and adding new customers. From a system planning perspective, the enhanced flexibility to shift load based on prevailing conditions has the potential to defer capital upgrades.

Upgrading existing 4kV switches with automation technology will bring the benefits of DA to the Greater Boston and Cambridge areas, as described above. Automated feeder reconfiguration will work by configuring a subset of field vacuum interrupt switches to communicate back to their local station via a decentralized Real-time Automation Controller ("RTAC"). Visibility and control of the device in the field will be accomplished by linking the substation RTAC to the Company SCADA system. The RTAC will act as both the consolidation point for all field devices to integrate into the SCADA system, and will contain the logic and algorithms that will have autonomous control over these same devices, such to enable automated restoration, down to the fewest possible customers, after and outage event occurs.

G. Key Milestones:

The Company maintains an execution plan and schedule of all its GMP investment categories. This schedule, which encompasses all four years of the GMP, was developed and is administered with the requisite flexibility that enables the Company to adjust its investment schedule and timing over the course of the GMP to respond to external factors, such as third-party resource availability, commissioning resources, and material availability. However, a sampling of the key milestones from 2020 follows:

- 124% completion of the original three-year term goal for OH DA.
- 139% completion of the original three-year term goal for OH DA with Ties.
- 130% completion of the original three-year term goal for 4kV Oil Switch Replacements.
- 4kV AR Loop:
    - Communications path and protocol was proven out between new SEL DAC and the Company's new SCADA system.
    - Significant troubleshooting, which narrowed current challenges to a communications issue between the field devices and the SEL DAC.
    - Location selection and preliminary engineering was completed for the next anticipated installation location.
- All preliminary engineering/location selection completed for OH DA and 4kv Oil Switch Replacements.

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

On August 15, 2018, the Company submitted its Baseline and Targets Filing, which included the 2018-2020 GMP baseline (Baseline and Targets Filing at 15, Table 2.4.7). On May 12, 2020, the Department issued an order (1) extending the current Three-Year GMP investment term; and (2) establishing a revised filing date for subsequent GMPs, which extended the MA GMP through calendar year 2021. D.P.U. 15-122-D at 7. Table 8: Four Year Term Projections provides the projections for 2021 which accounts for the Company's additionally authorized deployments consistent with the Department's February 5, 2021 order in in D.P.U. 20-74 . Additionally, throughout 2021, the Company will continue its analysis on the GMP portfolio and will make the necessary adjustments to effectively utilize the total $169 million (D.P.U. 12-122: $133 million authorized and D.P.U. 20-74: $66 million authorized) 2018-2021 GMP budget.

Table 8: Four-Year Term Projections

	Capital Spend (in thousands $)			Units		
Investment Areas and Preauthorized Device Types	**2018-2020 Actual**	**2021 Plan**	**2018-2021 Projection**	**2018-2020 Actual**	**2021 Plan**	**2018-2021 Projection**
Distribution Automation	**46,893**	**14,000**	**60,893**	**451**	**151**	**602**
OH DA	18,176	8,000	26,176	243	100	343
OH DA w/Ties	3,253	-	3,253	53	-	53
4kV Oil Switch Replacement	24,003	5,000	29,003	137	35	172
4kV AR Loop	1,461	1,000	2,461	18	16	34

III.A.3. Volt-Var Optimization

(Regulators, Capacitors, Line Sensors, LTC's, IT, Grid Monitoring Line Sensors & Microcapacitors)

A. Description of Work Completed

REGULATORS:

Under the 2020 GMP, the Company completed all voltage regulators installations on feeders from select substations to support the Volt-Var Optimization ("VVO") program. The regulators are generally similar to those the Company typically installs on its system, with the exception being that communications equipment is added to the control in order to enable remote control and monitoring by system operators and the central VVO software. Additionally, the largest VVO regulator types, 540-amp size, are larger than existing, non-VVO type regulators.

CAPACITORS:

Under the 2020 GMP, the Company completed all capacitor bank installation on feeders from select substations to support the VVO program. The capacitor banks are generally similar to those the Company typically installs on its system, with the exception being that communications equipment is added to the control in order to enable remote control and monitoring by system operators and the central VVO software.

LINE SENSORS:

The Company did not install any further VVO line sensors during the 2020 GMP because all deployments for this investment had been completed under the 2019 GMP

LOAD TAP CHANGERS:

The Company did not install any further VVO load tap changers during the 2020 GMP because all deployments for this investment had been completed under the 2019 GMP.

VVO IT:

The Company had previously completed procurement and installation of the VVO software and hardware. The software component includes Eaton's Yukon Integrated Volt-Var Control ("IVVC") program paired with Eaton's Visual T&D ("V-T&D") program. IVVC is the VVO control algorithm, while V-T&D provides the visual system one-line overlay through which the system operators will control and monitor the VVO deployment. In order to support efficient and secure implementation, the hardware was configured in three separate components (development, pre-production and production).

In 2020, the Company completed the system one-line modeling of the VVO feeders, configuration of operating parameters and alarms, and training for the Control Room Operators. Following

completion of testing and commissioning of all VVO devices into the IVVC software, the IT component of the VVO system was placed into service and is currently operational.

MICROCAPACITORS:

Due to efficient deployments and budget capacity within the VVO suite of investments, the Company also implemented a new investment type, "Microcapacitors," in order to help augment the existing VVO system. The Microcapacitors were commissioned in late 2020 and are used to better accommodate and react to voltage fluctuations. The Company selected the Varentec, Edge of Network Grid Optimization ("ENGO") microcapacitors, which were installed at strategic locations on the Company's secondary distribution system.

GRID MONITORING LINE SENSORS:

Due to efficient deployments and budget capacity within the VVO suite of investments, the Company also implemented a new investment type, "Grid Monitoring Line Sensors," in order to gain a higher penetration of visibility into their circuits. The deployment of the "Grid Monitoring Line Sensors" was best suited to be added into the VVO portion of the GMP. Increased visibility and insight into the system will allow for a better understanding of the circuit's response to autonomous changes initiated by the VVO platform as well as better understanding of circuit conditions for future integration into VVO. The Grid Monitoring Line Sensors were limited to the Aclara monitoring sensor, which is currently used by the Company to measure current and voltage across its distribution system. The Company chose installation location at points along the distribution system in which remote visibility was advantageous, such as large step-down transformers, distributed generation resources that did not already have remote visibility, and large side-tap circuits.

B. Lessons-Learned/Challenges and Successes

REGULATORS:

Since the VVO program is a new initiative for the Company, it took additional engineering time to locate and design the specific field components. The Company completed the engineering for all regulator locations in late 2018. For all but the largest-sized regulators, installations were quick and efficient. However, for the larger 548A platform regulators, the Company experienced two challenges. First, due to the physical size of these devices, any new locations were required to be sited through the respective town's planning department consistent with the town's requirements, including a public hearing. For many locations, this process was conducted on a normal schedule, but in several locations, the planning and permitting process was very lengthy. Second, prior to construction, the Company identified the need to revisit the design standard for large, platform-mounted voltage regulators to increase resiliency. As a part of this process, the Company performed a full review of the installation process, which caused delays in installation. A revised design standard was published in Q1 2020 and the Company completed construction and commissioning for all remaining GMP voltage regulators based on the new requirements in

2020. The Company will endeavor, in future GMPs, to utilize different equipment/technology that will enable the regulator function but at a significantly smaller and less obtrusive size.

As a part of the quality assurance review process, the Company identified, in a limited number of circumstances, factory-caused communication and wiring discrepancies that needed to be addressed prior to commissioning into the central VVO software. This is often the consequence of utilizing a device new to the Company, and each took time to review and correct.

CAPACITORS:

The capacitor banks were relatively straightforward pieces of equipment to install and there were limited challenges except, as with the regulators, when field commissioning several devices. As with the regulators, the Company discovered several factory-caused communications and wiring discrepancies when field testing the devices. This is often the consequence of utilizing a new system/device, and each took time to review and correct. All the VVO capacitor installations and commissioning were completed in 2020.

LINE SENSORS:

Though there was no deployment in the 2020 GMP plan year, the lessons learned were that the selection of the feeder-head monitoring sensor was straightforward, and the Company's process for procurement, installation and commissioning of the devices was performed very efficiently.

The design, selection and procurement of the end-of-line/grid-edge sensors was challenging. This was primarily due to the lack of industry standardization on this nascent technology that the Company could utilize to guide the selection process. As a result, the procurement process was iterative and time consuming. However, even with the unforeseen delays, the installation of the end-of-line/grid-edge sensors was straight-forward, and the work was completed on schedule within the 2019 GMP plan year.

LOAD TAP CHANGERS:

Though there were no deployments in the 2020 GMP plan year, the lessons learned with the LTC program were similar to that of the microprocessor relay program, specifically in requiring close coordination between Company departments undertaking these GMP investments. Please see Section III.B. for further discussion around the lessons learned.

The Company took the lessons learned from the 2018 GMP investment year and applied them to the remaining units in 2019. The Company focused specifically on ensuring that it had sufficient time to plan and allocate the correct resources. This program was successful in 2019 and the Company completed all of the originally planned investments in 2019, ahead of schedule.

VVO IT:

During the procurement process, which took started in 2018 and completed in Q1 2020, the project team found the live demonstrations and reference calls to be quite valuable. The team held detailed

reference calls with other utility customers that had procured similar IT platforms and implemented VVO pilots and was able to ask questions about their experience and lessons-learned from their respective VVO pilots and deployments. The Eversource team incorporated that insight into its deployment strategy, both for the field devices and in the contract for the VVO software package.

During the IT system deployment, which took place 2019 and 2020, the project team faced challenges in implementing the VVO system architecture. One challenge involved having to provide access to the engineering and analytical teams outside of the control room while still meeting the stringent IT security requirements that apply to electric operations infrastructure. This necessitated a significant collaboration between multiple Company departments and a series of architectural modifications, which resulted in a creative solution that successfully balanced the competing requirements. These challenges were further exacerbated in 2020 when, due to the on-going COVID 19 pandemic, the project team (including Company employees as well as contractors and vendors) was restricted to working remotely or in small, socially distanced cohorts. The project team had to re-tool the training, which was intended to be live and in-person, to be recorded and delivered remotely. Additionally, a moratorium on new technology deployments in the control room delayed the training delivery scheduled for Q1 2020 to Q3 2020. Despite the unexpected challenges and delays, the IT implementation was completed and placed in-service and operational in December 2020.

Lastly, in a holistic approach to system operations, the project team was able to cross-coordinate with the Company's solar operations team to obtain actual weather data at a solar site in the vicinity of the VVO circuits, which enabled the team to correlate electrical measurements with coincident weather conditions and have better insight into some anomalies observed in the VVO data. This type of collaboration further refines an integrated electric distribution system and increases capabilities and understanding.

MICROCAPACITORS:

The Varentec microcapacitors are a new piece of equipment on the Company's distribution system. They were chosen as a cost-effective, straight-forward and generally non-obtrusive device that will provide localized voltage support on the secondary distribution system.

The Varentec devices utilize a separate operational platform, via the vendor's web portal (GEMS). The web platform is used to commission and visualize the deployment of the microcapacitors and enables data acquisition, remote settings changes, and system performance monitoring. Though this system is meant to help augment the Company's newly commissioned VVO system, the Varentec system was deployed as stand-alone with potential for future integration as the vendors continue to develop their interoperability with new technology.

Currently, the Varentec system is operating as intended. As the measurement and verification process continues, the Company will be able to ascertain the direct benefits that the Varentec system has on the VVO operations.

GRID MONITORING LINE SENSORS:

The Company utilized its prior knowledge and experience of installation of the Aclara line sensors when installing the devices (Aclara) for this new investment. The device procurement and field installation are simple and the addition of these devices to the vendor's web portal is a known process. This was a successful investment with no notable lessons learned.

C. Actual vs. Planned Implementation and Spending

Refer to Tables 9 and 10 below for the Company's 2020 implementation unit and spending summaries for the VVO GMP investments, inclusive of the newly added "Microcapacitors" and "Grid Monitoring Line Sensors." Spending was broken down into "Total Capital Spend" and "Plant In-Service." As indicated in the Introduction of the 2020 GMP Annual Report, Plant In-Service is triggered by a device being "Construction Complete" and therefore cost recoverable.

Table 9: 2020 Implementation Unit Summary

	Commissioned Units			
Investment Areas and Preauthorized Device Types	**2020 Actual**	**2020 Plan**	**Variance (Units)**	**Percent (%)**
Volt-Var Optimization	**240**	**30**	**210**	**800%**
VVO - Regulators	27	27	-	100%
VVO - Capacitor Banks	3	3	-	100%
VVO - LTC Controls	-	-	-	N/A
VVO - Line Sensors	-	-	-	N/A
VVO - IT Work	N/A	N/A	N/A	N/A
Microcapacitors	99	-	99	N/A
Grid Monitoring Line Sensors	111	-	111	N/A

Table 10: 2020 Implementation Cost Summary

	Capital Spend (in thousands $)				Plant In-service (in thousands $)			
Investment Areas and Preauthorized Device Types	**2020 Actual**	**2020 Budget**	**Variance ($)**	**Percent (%)**	**2020 Actual**	**2020 Budget**	**Variance ($)**	**Percent (%)**
Volt-Var Optimization	**4,749**	**4,165**	**584**	**114%**	**5,079**	**5,955**	**(876)**	**85%**
VVO - Regulators	1,632	620	1,012	263%	1,581	1,031	550	153%
VVO - Capacitor Banks	311	-	311	N/A	(280)	-	(280)	N/A
VVO - LTC Controls	30	-	30	N/A	29	219	(191)	13%
VVO - Line Sensors	556	-	556	N/A	502	-	502	N/A
VVO - IT Work	1,469	3,545	(2,076)	41%	2,629	4,705	(2,076)	56%
Microcapacitors	751	-	751	N/A	618	-	618	N/A
Grid Monitoring Line Sensors	-	-	-	N/A	-	-	-	N/A

REGULATORS:

- As noted in section III.A.3.B of this report, there were challenges with the last regulator installations due to design and field constraints that needed to be evaluated and resolved in real-time. Despite this setback the Company completed all remaining 27 Regulators in 2020. The Company treated each individual regulator as a unit. In some instances, a location would have one unit (for single

phase), and in other instances a location may have three units (for three-phase). Engineering and design were completed in 2018 for the VVO regulators.

- As discussed in the 2019 GMP Annual Report, during the engineering process, the Company determined the original three-year total number of voltage regulators needed to achieve full VVO functionality on the program feeders was 96 units, a decrease relative to the original estimate of 105 units. All VVO regulators were installed and commissioned in 2020, along with the entirety of the VVO platform.

- The Total Capital Spend for this investment is above budgeted unit costs. As discussed in the 2019 GMP Annual Report, due to additional work required to install the remaining larger 548A platform regulators, the Company anticipated that the average unit installation costs would increase. Increased unit costs are also a result of a greater number of unanticipated field site visits during final commissioning efforts.

CAPACITORS:

- Relative to its goal of installing 76 units, the Company installed 71 units in 2019. As a result, the Company was short of its 76-unit target by five units in 2019. Two of the five locations were constructed in the field but were not commissioned due to damaged parts that needed to be replaced by the vendor. One location was not completed due to an unexpected and lengthy permitting process with the local municipality. These delays were ultimately resolved, and these three units were commissioned in 2020. Following detailed engineering, the Company determined that the two remaining units are not necessary to achieve full VVO functionality on the program feeders. The Company has installed a total of 74 capacitor banks to date.

- The Total Capital Spend for this investment is above budgeted unit costs. Increased unit costs are a result of unanticipated work due to both a greater number of field site visits during final commissioning efforts, and a firmware reconfiguration at each site that resulted from a change to the vendor's product after the Company had performed installations.

LINE SENSORS:

- The Company did not install any line sensors for the VVO program in 2020 because they were completed in 2019.

LOAD TAP CHANGERS:

- The Company did not install any load tap changer for the VVO program in 2020 because they were completed in 2019.

VVO - IT

- The Company has completed procurement, installation and commissioning of the VVO software and hardware components (described above) in three physical environments (Development, Pre-Production, and Production). The completed IT work also includes system configuration, database builds, and testing.

- As discussed in the 2018 and 2019 GMP Annual Reports, the Company did expect to have the VVO IT system completed and commissioned earlier in 2020. However, consistent with the implementation of new technologies, challenges were experienced during 2020, which extended the go-live date late into 2020, as described above.

- The Total Capital Spend for this investment was lower than expected. The primary drivers of the budget underrun were lower than expected software costs and implementation of a more efficient work plan for the model build process. The Company evaluated the costs and progress in real-time and redeployed under-run funds to other IT/OT programs, such as the "Microcapacitors" and "Grid Monitoring Line Sensors."

MICROCAPACITORS:

- The Company did not have an investment goal for microcapacitors in its original 2018-2020 GMP because the investment type was added into the plan for 2020. For 2020, the Company installed 99 units, reaching 100% of the goal.

- There was no pre-determined unit cost that was included as part of the original plan, but unit costs were in line with Company expectations, inclusive of the one-time web portal equipment and communications set up.

GRID MONITORING LINE SENSORS:

- The Company did not have an investment goal for these sensors in its original 2018-2020 GMP because the investment type was added into the plan for 2020. For 2020, the Company installed 111 units, reaching 100% of the goal.

- There was no pre-determined unit cost that was included as part of the original plan, but unit costs were in line with Company expectations.

D. Performance on Implementation/Deployment

Refer to Appendix 1 for the year to year and overall portfolio implementation/deployment data.

E. Description of Benefits Realized as the Result of Implementation

There are immediate benefits to the Company in having visibility and control of additional devices in the field, such as increased voltage regulation, as part of the fully commissioned VVO system and the new microcapacitor deployment. However, because the VVO system was only fully commissioned in late 2020, measurable benefits will not be realized until sufficient substation and circuit level reporting is acquired or the several months, and ultimately years, in accordance with the proposed performance metrics. Additionally, the increase of the investment types identified in this section has a positive effect on the system automation saturation metric identified in section IV of this 2020 Grid Modernization Annual Report. Refer to "Massachusetts Grid Modernization Program Year 2020 Evaluation Report – VVO" provided by Guidehouse for further analysis.

F. Description of Capability Improvement by Capability/Status Category

METHODOLOGY:

Eversource targeted the deployment of VVO in a limited geographic region (WMA) that consisted of substations and circuits under the jurisdiction of a single control room. The circuits in the target region offered a diverse mix of load and distributed generation ("DG") penetration, which is expected to provide a comprehensive understanding of the impact of VVO across a broad range of circuit types. Within the target region, Eversource picked locations for the pole-top devices based on a combination of load flow analyses, engineering judgment, wireless communication coverage, and any local siting concerns.

The strategy for deployment was focused on maximizing the Company's ability to understand and quantify the benefits from VVO while minimizing the number disruptions to control room and field personnel impacted by the deployment.

IT:

In tandem with the deployment of the VVO field devices described above, Eversource deployed a VVO monitoring and control software package in the control room that normally supervises and operates the VVO target region. During the competitive and rigorous procurement process, which started with six qualified vendors, a cross-functional project team thoroughly reviewed all submitted proposals and further vetted a shortlist of vendors through live product demonstrations and reference calls. Eversource selected a software solution from the proposals that best met the scope and requirements of this deployment, as well as compliance with Eversource IT/OT standards. Software delivery, installation, and testing was completed in Q4 2020.

EXPECTED CAPABILITY IMPROVEMENT:

VVO is expected to lower peak demand, reduce line losses, lower energy supply costs, and reduced greenhouse gas ("GHG") emissions. The Company also expects that customers in the VVO area potentially could see a reduction in their bills, without any adverse impact to their power quality or change in their normal electric use.

IT:

The Company anticipates that the metering capabilities of the field devices at the feeder heads and the end of the line, which will be timestamped and archived by the VVO control software, will deliver 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 expects that this data will also provide valuable insight into energy use patterns, DG and weather impacts, undetected power quality issues, etc.

G. Key Milestones

The Company maintains an execution plan and schedule of all its GMP investment categories. However, the VVO program is an entirely new system to the Company's distribution infrastructure. Significant work had been placed on developing milestones and schedules, but as with any new system, it was necessary to amend these milestones as the program progresses. A current sampling of the key milestones follows:

VVO – Line Devices:

- Developed and implemented a revised design standard for the largest of three types of regulators – implementation of the regulators under the new standard is 100% complete for the original VVO plan (2018-2020 GMP).
- Performed initial evaluations and engineering for circuits and substations in preparation for an additional GMP deployment authorization (D.P.U. 20-74).

VVO – IT

- Fully commissioned the original VVO plan (2018-2020 GMP) in late 2020.
- Evaluated and confirmed that very limited resources would be needed for a potential additional GMP deployment authorization (D.P.U. 20-74) when adding additional substations and circuits into the recently commissioned VVO system.

ADDITIONAL INVESTMENT ADDITIONS

- Successfully added and executed a microcapacitor program in 2020.
- Successfully added and executed a grid monitoring line sensor program in 2020.
- Performed initial evaluations and engineering for circuits in preparation for an additional GMP deployment authorization, consistent with the Department's directives in D.P.U. 20-74, for both microcapacitors and grid monitoring line sensors.

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

On August 15, 2018, the Company submitted its Baseline and Targets Filing, which included the 2018-2020 GMP baseline (Baseline and Targets Filing at 15, Table 2.4.7). On May 12, 2020, the Department issued an order (1) extending the current Three-Year GMP investment term; and (2) establishing a revised filing date for subsequent GMPs", which extended the MA GMP through calendar year 2021. D.P.U. 15-122-D at 7. *Table 11: Four Year Term Projections* provides the projections for 2021 for all remaining investment categories.

Additionally, throughout 2021, the Company will continue its analysis on the GMP portfolio and will make the necessary adjustments to effectively utilize the total $199 million (D.P.U. 15-122: $133 million authorized and D.P.U. 20-74: $66 million authorized) 2018-2021 GMP budget.

Table 11: Four-Year Term Projections

	Capital Spend (in thousands $)			Units		
Investment Areas and Preauthorized Device Types	**2018-2020 Actual**	**2021 Plan**	**2018-2021 Projection**	**2018-2020 Actual**	**2021 Plan**	**2018-2021 Projection**
Volt-Var Optimization	**12,933**	**6,000**	**18,933**	**577**	**624**	**1,201**
VVO - Regulators	4,007	1,150	5,157	96	48	144
VVO - Capacitor Banks	2,860	950	3,810	74	32	106
VVO - LTC Controls	1,452	720	2,172	8	4	12
VVO - Line Sensors	1,235	180	1,415	189	40	229
VVO - IT Work	2,629	-	2,629	N/A	-	N/A
Microcapacitors	751	1,500	2,251	99	200	299
Grid Monitoring Line Sensors	-	1,500	1,500	111	300	411

III.A.4. Advanced Distribution Management System ("ADMS")

(GIS Verification, Advanced Load Flow)

A. Description of Work Completed

Advanced Load Flow: This GMP program includes the implementation of Advanced Load Flow ("ALF") software to create detailed computer models of the Company's distribution system. In parallel, the data sources critical to the accuracy of the models will be assessed and enhanced as necessary to leverage the advanced functionality of the software. This enhancement of model data sources will also be critical to the operation of other functions, including VVO and the Advanced Distribution Management System ("ADMS"). During the 2020 GMP investment year, the Company:

- Completed implementation of a consolidated Central Engineering Database ("CED") to assemble and manage non-GIS data required for accurate models.
- Completed implementation of the automated process for building Synergi models from the separate GIS environments for EMA and WMA, along with automated integration to the CED.
- Refined and implemented a new algorithm for automatic estimates of transformer loads, based on customer billing/usage data, and applying a correction factor to account for customer DG impact on usage.
- Performed significant data cleanup in GIS for major distribution equipment and conductors. Priority was placed on those elements most impactful to model performance.
- Established an automated process for building the Boston underground secondary mesh network from GIS.
- Provided basic and advanced training to impacted engineering groups to enable end-user acceptance.

B. Lessons-Learned/Challenges and Successes

ALF: In 2020, the Company was focused on completing the implementation of the ALF system, which includes the Synergi software tool rollout, the automated Synergi model build process, and a CED tool which provides certain detailed engineering data for the models. The implementation process involved multiple iterations of model builds in a test environment. The synchronizing of "snapshots" of multiple live databases in this test environment proved very challenging, as the Company detected a number of model errors due to "stale" data in one snapshot or another.

Data cleanup (beyond the overhead GIS verification work completed in 2019) also proved to be more significant and time consuming than planned. The vast majority of work was completed

with desktop analysis, using Company maps along with tools like Google or Bing Streetview. A number of locations will still need to be examined in greater detail, and possibly require field verification as the Company continues to refine the models. At this stage, models typically require some manual adjustments and corrections prior to running any automated processes.

C. Actual vs. Planned Implementation and Spending

Refer to Table 12 below for the Company's 2020 spending for the ADMS GMP investments.

Table 12: Advanced Distribution Management System 2020 Implementation Cost Summary

	Capital Spend (in thousands $)			Plant In-service (in thousands $)		
Investment Areas and Preauthorized Device Types	**2020 Actual**	**2020 Budget**	**Variance**	**2020 Actual**	**2020 Budget**	**Variance**
Advanced Distribution Management System (ADMS)	**6,033**	**9,107**	**(3,074)**	**8,809**	**11,883**	**(3,074)**
Advanced Load Flow	6,033	9,102	(3,069)	8,809	11,878	(3,069)
GIS Verification (Expense)	-	-	-	-	-	-
Dist. Management System	-	5	(5)	-	5	(5)
Forecasting Tool	-	-	-	-	-	-
Hosting Capacity Maps	-	-	-	-	-	-
PI Asset Framework	-	-	-	-	-	-

The GIS Verification investment, as originally planned in the Company's 2018-2020 GMP approved in D.P.U. 15-122, included work in the Company's EMA region only. This work was completed in 2019 as an expense-only project with no related Plant In-Service. After multiple years of work, the Company placed the ALF software in-service in late 2020. As a result of the fact that neither GIS Verrification nor ALF are tracked on a unitized basis, anthe Company has not provided an "mplementation Unit Summary" table. The GIS verification is tracked based on percent of survey and data transfer complete. Survey data collected by the vendor is subject to a quality assurance and quality control review by the Company that must be satisfied prior to considering the survey completed. The ALF project is tracked based on milestone completion.

In addtion to the above, in 2020, the Company added additional scope in the GIS Verification invstment type, by commencing the process for field review and data collection for the WMA region. AsGiven that this is an expense-only project, there will not be any costs shown in Table 12, which is indicative of capital spending. The Company will further detail therequested cost recovery of this investment type in their 2020 Grid Modernization Factor ("GMF") filing. For reference, the Company's 2020 preliminary expense costs for the WMA GIS Verification project is $283,449.

D. Performance on Implementation/Deployment

Regarding the ALF program, please refer to Appendix 1 for the year-to-year and overall portfolio implementation/deployment data.

E. Description of Benefits Realized as the Result of Implementation

Benefits of GIS Verification:

- The verification of data will directly contribute to the various existing and new electric distribution system GMP platforms.
- Improved accuracy of the as-constructed distribution model.
- Greater accuracy in customer outage communications.

- Benefits of ALF:
  - Improved ability to optimize capital asset deployment and system reconfiguration.
  - Better contingency scenario planning, including within the secondary network.
  - Increased accuracy of GIS and other related data, lowering the cost and timeline to achieve the level of data accuracy required to support a DMS load flow.
  - Reduced cost and time to perform impact studies for customers applying to interconnect DER to the Company's distribution system.
  - Platform to perform more advanced analysis with automated logic, including automated hosting capacity analysis.
  - Faster and more accurate analysis of new customer connections to the network, including spot network configuration analysis.
  - Root cause analysis of failures.

Refer to "Massachusetts Grid Modernization Program Year 2020 Evaluation – Advanced Distribution Management System/ Advanced Load Flow (ADMS/ALF)" provided by Guidehouse (formerly Navigant Consulting, Inc.) for further analysis.

F. Description of Capability Improvement by Capability/Status Category

With the completed work in 2020, the Company has significantly improved its distribution modeling capability. An automated model build process from the most recent GIS configuration, as well as other up to date, active data sources, improves the Company's ability to perform system planning studies across the entire distribution system, including the downtown Boston underground secondary network. Engineers will spend less time assembling the models and more time assessing results from future changes and additions. This model build process will also be a key enabler of future automated analyses involving large numbers of circuits.

G. Key Milestones

ALF: The ALF program represents a major improvement from prior load flow capability for Eversource, including new automation of model builds and a new software product for the EMA portion of the Company's service territory. The following milestones have all been completed in the indicated timeframes:

- Phase 1:
  - Mobilization and Design Complete (Q3-2019)
  - Build Complete (Q4-2019)
  - Testing Complete (Q4-2019)
  - Phase 1 Commissioning (Q4-2019)

- Phase 2:
  - ALF Automation design Complete (Q2-2020)
  - ALF Automation build Complete (Q4-2020)
  - Testing Complete (Q4-2020)
  - Phase 2 Commissioning (Q4-2020)

H. Updated Projections for Remainder of the Four-Year Term

The Company successfully achieved all of the projections for the ADMS investment category included in its 2018-2020 GMP, as approved in D.P.U. 15-122., This section describes the activity that will occur in 2021 and as was authorized by the Department's approval of the Company's proposed supplemental budget. NSTAR Electric Company d/b/a Eversource Energy, D.P.U. 20-74, at 40-41.

GIS Verification:

The Company intends to continue the GIS Verification work it began in 2020, in the WMA region. This project will enhance the GIS data currently in place and will improve the performance of the enterprise Outage Management System ("OMS"). In order to gain greater accuracy for an OMS and Distribution Management System ("DMS"), the Company needs to accurately identify infrastructure geospatial positioning, connectivity including phasing, and the properties fed by each overhead transformer. Customer to transformer connectivity will be verified for each of the Company's overhead transformers and will include phasing, GPS locations for the transformer, and the transformer size if stamped. In addition, the Company will field survey the "Secondary Path," including the GPS of all secondary and service poles and the capture of the secondary and service path from transformer to customer.

ALF Tool:

- Eversource will continue to add functionality to the ALF system that will enable the automatic build of advanced hosting capacity maps. The work includes creating automated processes within Synergi that will produce power flow results which can be used to improve the customer facing hosting capacity maps for Massachusetts circuits.

- Eversource will implement a new tool capable of consuming DER adoption rate data and historic loading to better forecast DER adoption and distribution system capacity needs over the ten-year planning horizon. These forecasts will be utilized by the ALF system for engineering analysis and will enable robust probabilistic planning under multiple future scenarios.

- Lastly, Eversource will build historic data framework that will enable improved data analytics capabilities to provide actionable information on changes in system conditions over time.

DMS:

The following work is planned for 2021 in support of an operational DMS:

- Formalize the project plan, further refine system requirements and initialize both internal and external resources to begin work;

- Begin designing the system architecture and model build; and

- Start building the IT development environment and initially deploy software.

Ultimately, the Company's goal is to establish models in the development environment for a portion of their service territory within the EMA region.

III.A.5. Communications

(Miles of Fiber, Nodes)

A. Description of Work Completed

Communications investments are defined by two categories, Nodes and Fiber Optics - All Dielectric Self Supporting ("ADSS"). The Company continued to execute the Nodes program in 2020, which included work that was carried over from the 2019 work plan. The objective of the Nodes program is to improve the capacity of the Company's communications network to transmit signals between field devices and the Company's system operations centers. In total, four nodes projects were completed in 2020, increasing the capacity of existing radio infrastructure in eastern Massachusetts.

As described in Section B, with respect to the Fiber program, the Company made the decision in 2019 to discontinue work originally planned to build out fiber optics to the Company's distribution substations. The Company did extend a nominal amount of fiber to Station 60, Station 52 and Station 23 in eastern Massachusetts as a part of the 4kV Circuit Breaker SCADA program. Additionally, work was started in efforts to bring fiber optic communications to Station 318 in support of the next iteration of 4kV Auto-Restoration Loops.

B. Lessons-Learned/Challenges and Successes

ADSS MILES OF FIBER:

- The following is unchanged from the information provided in the 2019 GMP Annual Report. After completion of detailed engineering, the project review process determined that the Fiber project did not demonstrate a reasonable benefit relative to the cost to customers. In its GMP filing in D.P.U. 15-122 regarding communications investments, the Company had originally planned to build out 250 miles of fiber to connect distribution substations across Massachusetts into the Company's existing fiber network. Based on the results of its engineering analysis, the Company determined the per mile cost of deploying fiber averaged approximately four times the original estimate, chiefly due to the identified and designed make-ready work. The needs assessment determined that although this fiber build out would augment and reinforce the Company's communications infrastructure for future grid modernization investments, the additional fiber was not required to deliver any of the benefits associated with the 2018-2020 GMP. The decision not to move forward with the fiber program was reviewed and approved by the Company's Grid Modernization Executive Steering Committee.

NODES:

- Knowing that augmenting wireless communications infrastructure is a cost-effective option to ensure increased throughput of data transmission, the Company continued with this program as originally anticipated, i.e., by utilizing

the 900MHz licensed and unlicensed spectrum. However, the Company also seized the opportunity to develop, design and install several nodes on the 450MHz spectrum. Though the 450MHz spectrum has a lower bandwidth, the lower frequency system, coupled with higher-powered radios, will allow for greater wireless communications penetration. This will allow for better fidelity to devices that had communication challenges on the 900MHz frequency.

- An additional lesson that was observed during the execution of the Nodes program was the underestimation of the required field resources required, particularly with the deployment of the new radio frequency.

C. Actual vs. Planned Implementation and Spending

Refer to Tables 13 and 14 below for the Company's 2020 implementation unit and spending summaries for the Communications Investments. Spending was broken down into "Total Capital Spend" and "Plant In-Service." As indicated in Section I. Introduction, Plant In-Service is triggered by a device being "Construction Complete" and therefore cost recoverable.

Table 13: 2020 Implementation Unit Summary

	Commissioned Units			
Investment Areas and Preauthorized Device Types	**2020 Actual**	**2020 Plan**	**Variance (Units)**	**Percent (%)**
Communications	**4**	**6**	**(2)**	**67%**
Numbers of Nodes	4	6	(2)	67%
Miles of Fiber	-	-	-	N/A

Table 14: 2020 Implementation Cost Summary

	Capital Spend (in thousands $)				Plant In-service (in thousands $)			
Investment Areas and Preauthorized Device Types	**2020 Actual**	**2020 Budget**	**Variance ($)**	**Percent (%)**	**2020 Actual**	**2020 Budget**	**Variance ($)**	**Percent (%)**
Communications	**1,362**	**1,435**	**(74)**	**95%**	**649**	**1,852**	**(1,203)**	**35%**
Numbers of Nodes	1,106	1,435	(330)	77%	359	1,542	(1,183)	23%
Miles of Fiber	256	-	256	N/A	290	310	(20)	94%

MILES OF FIBER: As discussed in above, except for a very small subset of installation, specifically in support of other GMP investments, the ADSS Miles of Fiber program was eliminated from the 2018-2020 GMP due to significant unit cost increases that the Company did not consider prudent to expend and funds were redeployed to other investments.

NODES: The Company's implementation of the node program was short of its 6-unit goal by two units. This is primarily due to the additional work that was required to implement the new 450MHz radio master nodes. This additional work placed impacted the planned work of the field communications and commissioning teams, which could not be overcome in 2020. As of March

31, 2021, one Node associated with the original 2018-2020 GMP investment plan is left to be completed. This last node is under construction and has experienced several unforeseen challenges, due chiefly with finding the correct new equipment that could integrate with other older equipment, which was out of support. This last node is scheduled to be completed in April 2021 consistent with the terms of as authorized on February 5, 2021 by the Department in D.P.U. 20-74.

As part of the 2020 GMP work plan, the installation of the new 4RF (450MHz) in Pelham and the CalAmp (450MHz) in Pocumtuck will allow for extended radio coverage which will reach new devices that were previously not covered. Additionally, this system will add more capacity to allow for current cellular and Tait radio system devices to be transferred into the Company's packet data radio system.

The Tait System is currently at the end of its useful life and any devices attached to this system must be transferred to another means of communication. This will allow for the Tait system to be replaced in the Company's WMA region.

Other benefits to the newly installed 450MHz nodes in Pelham and Pocumtuck include:

1) The addition of several of the new volt-var optimization ("VVO") and recloser devices into the Company's communication infrastructure with higher fidelity.
2) The ability to move cellular connected devices to the new radio locations where connectivity was marginal, thus both increasing communications quality and lowering recurring cell connectivity costs.

Refer to Figures 4 and 5 below for a general coverage map associated with the commissioning of the nodes at Pelham and Pocumtuck in the Company's western Massachusetts region.

Figure 4: Pelham – New Radio Master Installation Coverage

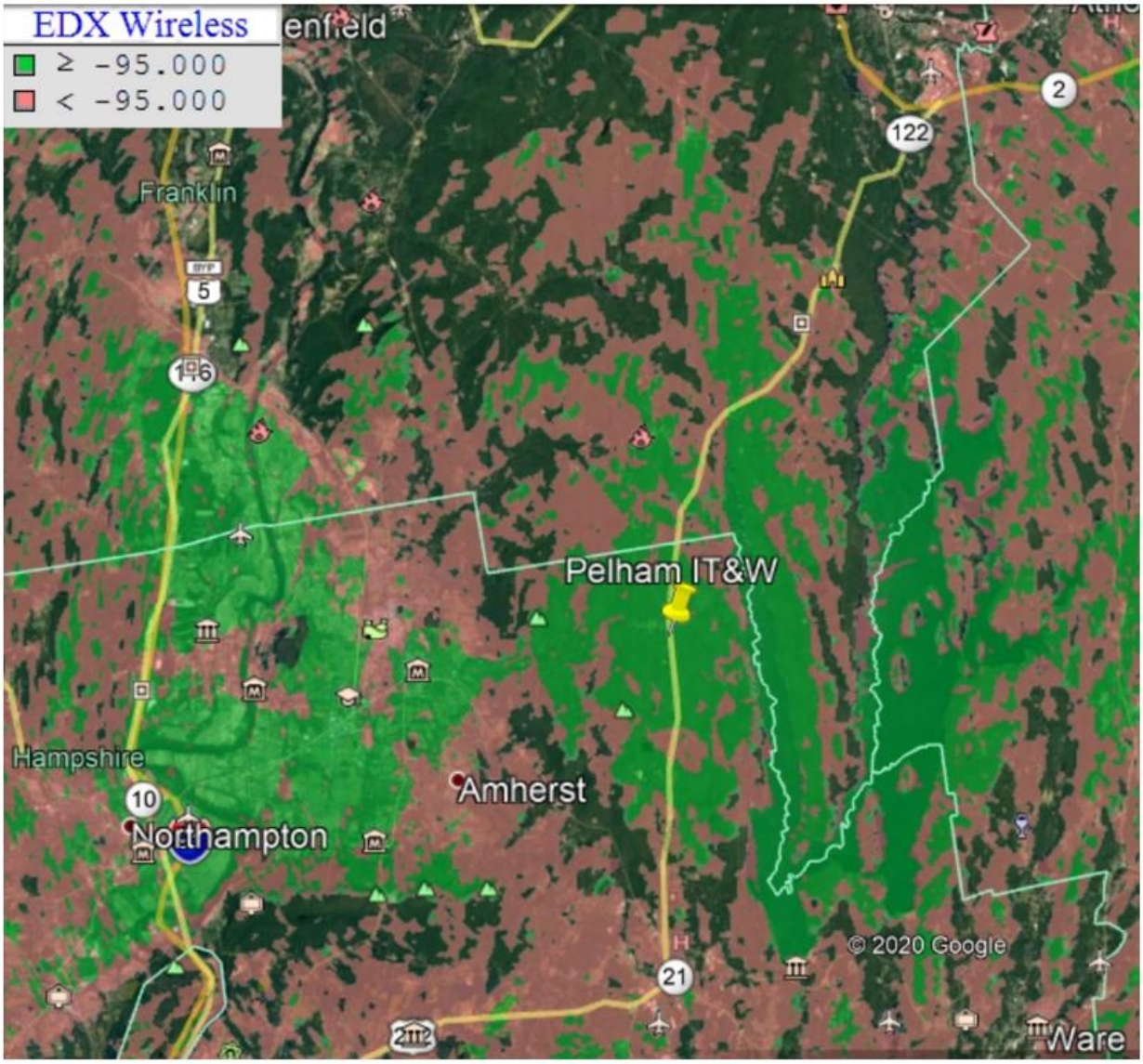
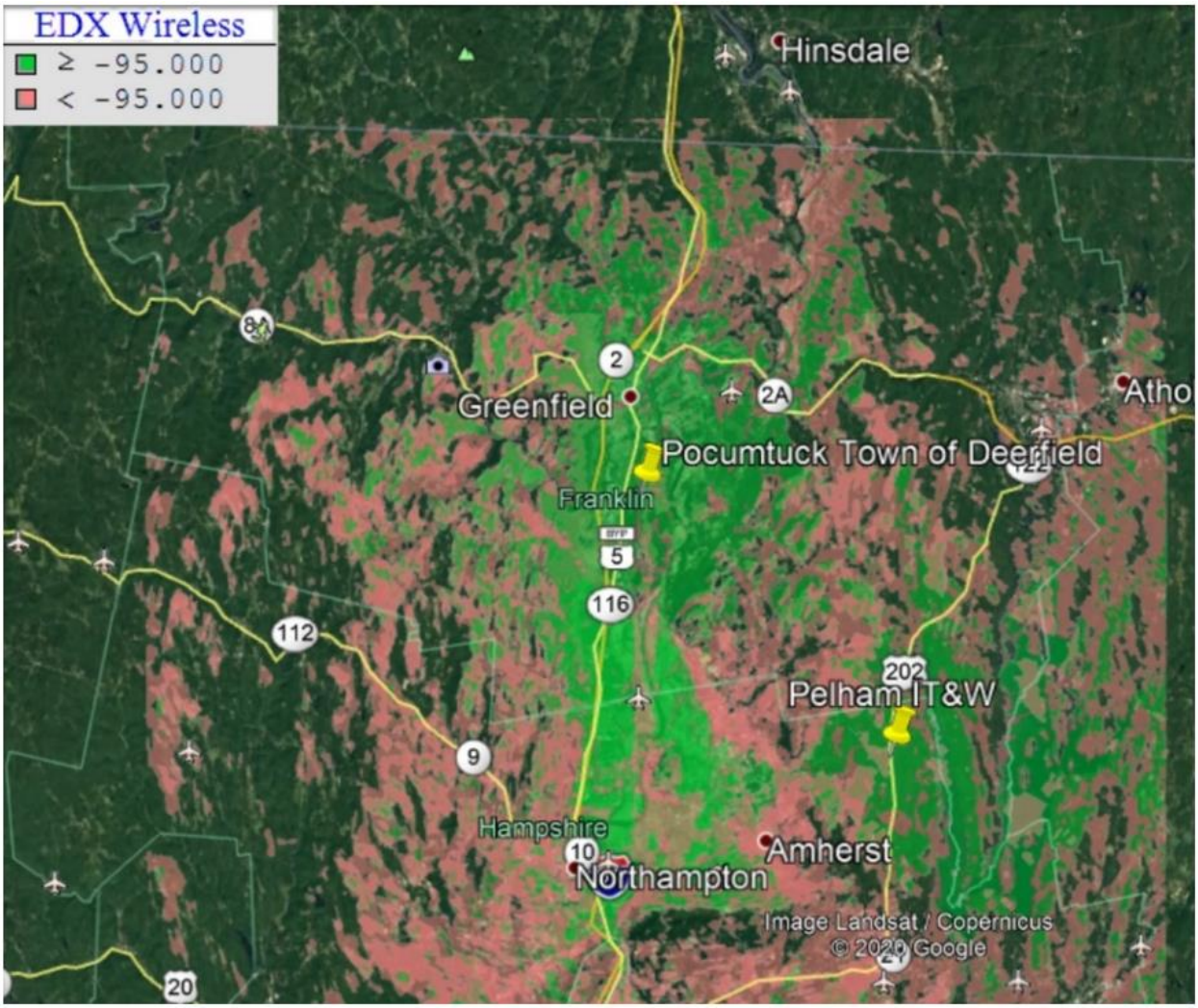


Figure 5: Pocumtuck – New Radio Master Installation Coverage



For the Total Capital Spend, work was delayed in some locations as described above. This caused an underrun in budget capacity for the 2020 GMP work plan. As of March 31, 2021, one remaining node, discussed above, is still underway and expected to be completed in April 2021. The Company is continuing forward with the 2021 GMP work plans consistent with the Department order in D.P.U. 20-74.

D. Performance on Implementation/Deployment

It is not possible to quantify the performance increases experiences with broader coverage and increased throughput of data, other than to note that communication failure rates will decrease, with fewer field locations that will fail a communications check. This allows remote devices to operate in new areas on the system. See Section C above for a sampling of coverage maps.

E. Description of Benefits Realized as the Result of Implementation

The immediate benefits from this program are namely the increased coverage areas with the upgraded radio node locations and the ability to process significantly more communication traffic via the upgraded front-end processors of the SCADA system, which occurred prior to the 2020 work plan year. Additionally, the Company expects that the deployment of the 450MHz radio master nodes will provide even deeper and more comprehensive coverage and penetration into areas of challenge. Refer to Appendix 1 for the year-to-year and overall portfolio implementation/deployment data. Refer to "Massachusetts Grid Modernization Program Year 2020 Evaluation – Communications" provided by Guidehouse (formerly Navigant Consulting, Inc.) for further analysis.

F. Description of Capability Improvement by Capability/Status Category

The capability improvements associated with the upgrade or addition of radio nodes within the territory provide for an expanded coverage area which will allow locations 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.

As discussed in the 2019 GMP Annual report, the Company elected not to move forward with the fiber optic installations due to significant cost increases that outweighed the benefits associated with that investment. However, the Company recognizes that a successful GMP must have a robust and efficient communications network. To that end, the Company pivoted its node deployments to include a new 450MHz system. This 450MHz system will work in conjunction with the 900MHz system but allow for some increased penetration capabilities, particularly in dense areas. A sampling of the projects that the Company has underway as part of the 2021 GMP work plan, as authorized in D.P.U. 20-74, are shown below.

Figure 6: Shoot flying Hill and EMA Southern Region – New Radio Master Installation Coverage (450MHz and 900MHz)

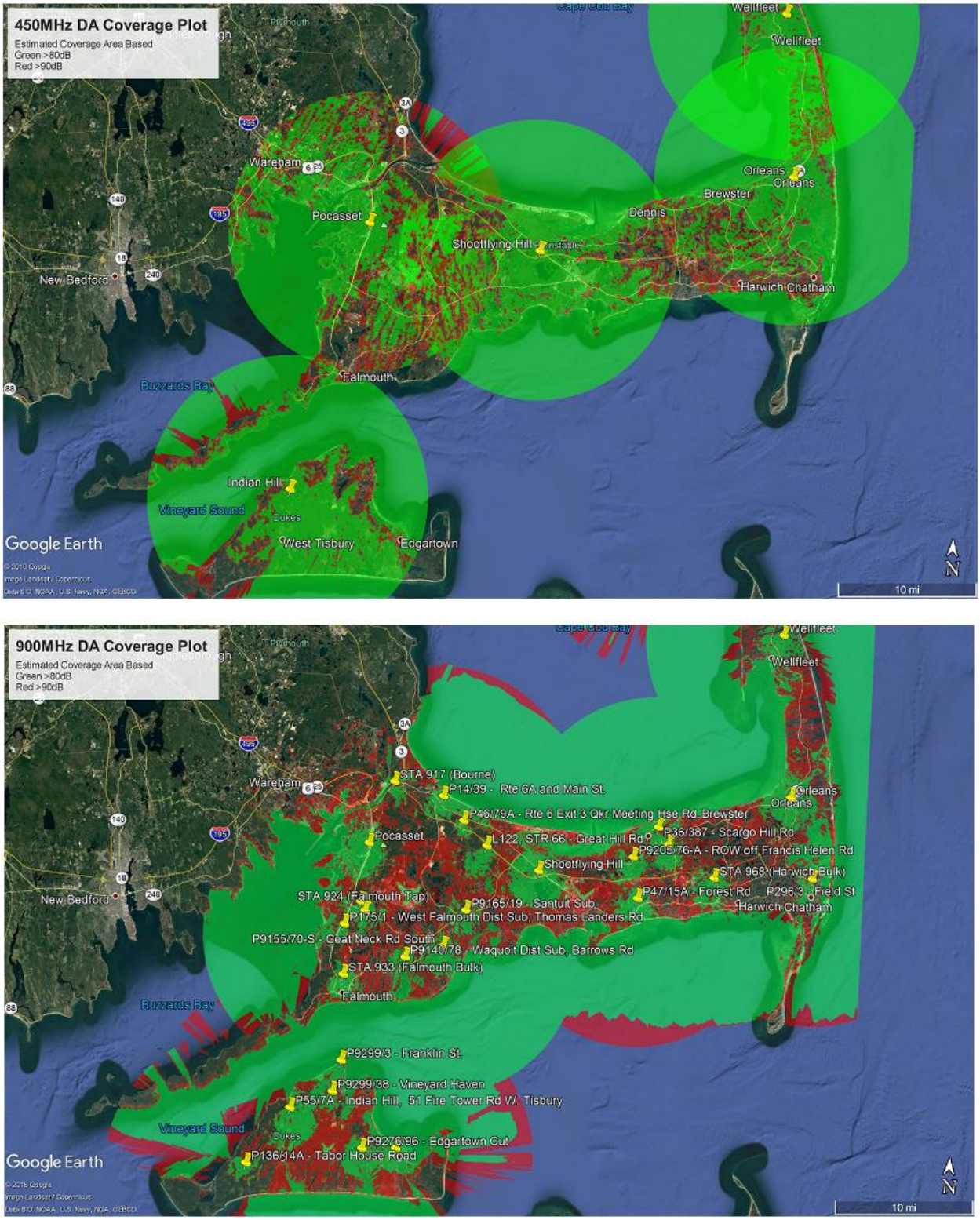
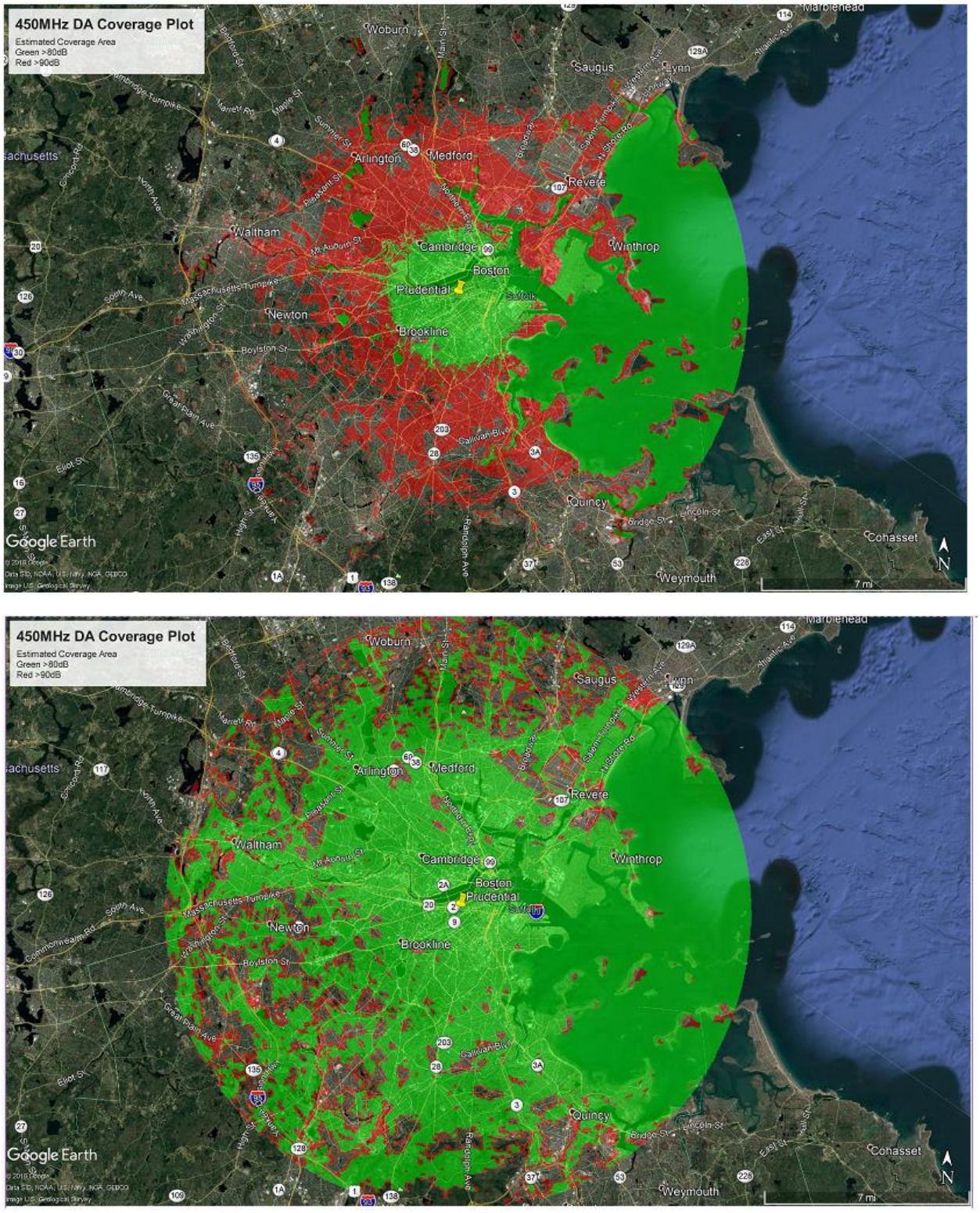


Figure 7: Prudential Center – New Radio Master Installation Coverage (450MHz before and after)



G. Key Milestones

The Company retains an execution plan and schedule of all its investment categories. This schedule, which encompasses all four years of the GMP, was developed and is administered with the requisite flexibility that enables the Company to adjust its investment schedule and timing over the course of the GMP in the event that external factors, such as third-party resource availability, material availability, etc., impact the work plan. However, a sampling of the key 2020 milestones follows:

- Four out of six nodes were added or upgraded to radio masters in 2019.
- Construction had commenced work on the last two nodes, which were originally scheduled for 2020 completion, but were shifted into Q1, 2021. As of March 31, 2021, these nodes have been completed, consistent with the investment plan included in the 2018-2020 GMP.
- Engineering, design and, in some instances, construction was commenced on new 450MHz sites in the Company's EMA region – this work will continue in 2021.
- ADSS fiber work for several other GMP devices was engineered, designed and entered portions of construction in 2020. However, permitting delays pushed these projects into 2021.

H. Updated Projections for Remainder of the Four-Year Term

On August 15, 2018, the Company submitted its Baseline and Targets Filing, which included the 2018-2020 GMP baseline (Baseline and Targets Filing at 15, Table 2.4.7). On May 12, 2020, the Department issued an order: (1) extending Current Three-Year Grid Modernization Plan Investment Term; and (2) establishing a Revised Filing Date for Subsequent Grid Modernization Plans, which extended the GMP through calendar year 2021. Table 15: Four Year Term Projections provided below provides the projections for 2021 which accounts for the Company's additionally authorized deployments, authorized in D.P.U. 20-74. Additionally, throughout 2021, the Company will continue its analysis on the GMP portfolio and will make the necessary adjustments to effectively utilize the total $169 million (D.P.U. 12-122: $133 million authorized and D.P.U. 20-74: $66 million authorized) 2018-2021 GMP budget.

Table 15: Four-Year Term Projections

	Capital Spend (in thousands $)			Units		
Investment Areas and Preauthorized Device Types	**2018-2020 Actual**	**2021 Plan**	**2018-2021 Projection**	**2018-2020 Actual**	**2021 Plan**	**2018-2021 Projection**
Communications	**2,194**	**5,106**	**7,300**	**8**	**6**	**14**
Numbers of Nodes	1,628	4,106	5,735	8	6	14
Miles of Fiber	566	1,000	1,566	-	-	-

III.B. Feeder Level Implementation by Investment Category

A. Monitoring and Control:

1. Highlights of Feeder Level Implementation

Refer to Section III.A of this report for further information related to specific planning and deployment for each of the respective investment categories.

The Monitoring and Control program is specifically designed to increase remote visibility and control of existing devices already located on the Company's system. For 2020, the Company continued to install microprocessor relays, including relays and remote terminal units ("RTUs") at the 4kV substation. Eversource also implemented network monitoring and control, utilizing the Digital Grid system and converted, or replaced, existing padmounted and overhead switches to be SCADA-capable. Although already part of the system, these devices will now allow for:

- Increased visibility and remote operability by the system operators.
- Provision of valuable data related to load conditions and switch position (open/closed).
- The ability for the system operators to remotely apply protection schemes to the devices, when crews need to work within the device boundaries.
- In terms of the overhead, the reclosers can be built into existing loop schemes, allowing for autonomous system healing.
- In terms of the underground (4kV), the switches will be available for future loop scheme build out.

2. Feeder Level Lessons Learned/Challenges and Successes

Due to the volume and incremental nature of technical programs such as Microprocessor Relay and 4kV Circuit Breaker SCADA, securing the correct blend of internal and external resources was challenging. The Company had determined it needed to start the solicitation of these outsourced resources earlier than its typical process and did so by engaging contracted resource in late 2019 for 2020 work. In addition to resource availability, there were times when all site conditions of a new project cannot be fully reviewed ahead of time, i.e., there may be the need to schedule an electrical outage to observe the condition of energized parts to better understand how to proceed with design work. Because of the compressed nature of this work, it was not typically feasible/practical to schedule these additional up-front outages to verify site conditions. Therefore, the Company continued to make a calculated assessment when moving forward, with the understanding that unforeseen conditions would most likely arise. Unforeseen conditions did occasionally arise during the 2020 GMP, and the Company's experience with the 2018 and 2019 projects positioned it to better respond to each unique situation. The Company has and will continue to evaluate its end-to-end processes in order to better streamline future deployments. Though the units for each of the Microprocessor Relay and 4kV Circuit Breaker SCADA programs

were adjusted down and up, respectively, the net unit deployment of these two investment categories is directly in line with the GMP the Department approved in D.P.U. 15-122.

The Recloser SCADA program was successful in its design and construction, and, leveraging the lessons learned from 2018 and 2019, the Company developed an execution plan for 2020 that was efficient and did not overly stress resources, originally identified to be a potential constraint on GMP progress. As discussed in the 2018 and 2019 Grid Modernization Annual Reports, the Company continued with the modified Recloser SCADA program to encompass a "replace in-place" alternative that enabled continued successful implementation of the program while keeping the per-unit installation costs within original budgeted costs. This investment category has exceeded the original investment commitment made in the 2018-2020 GMP approved by the Department in D.P.U. 15-122.

The Padmount SCADA program originally presented challenges from the standpoint of coordinating the correct type of existing field equipment with a location suitable for communications. During 2018 and 2019, a significant amount of time was spent first coordinating these requirements and locating suitable locations to fulfill the entire 2018-2020 GMP commitment. An additional challenge related to the equipment installations based on the respective year's plan. After a thorough review of the eligible and available locations, the Company confirmed that it had exhausted the locations which would only require a communications package. All possible remaining locations were completed in the 2020 work plan. Therefore, even though the three-year unit deployment for this investment category is slightly lower than the original scenario included in the 2018-2020 GMP, because there were no other available locations to upgrade, and a "replace, in-place" scenario was not cost-effective, the Company has met the intent of this program within the original three-year timeline.

The Network Protector SCADA program was also a success. The Company originally intended to deploy the Digital Grid system at only one substation. However, due to an efficient installation process and budget capacity, the Company was able to identify, design, construct and commission a second network within its western Massachusetts ("WMA") territory. Prior to 2020, the Company had not deployed these assets in this specific configuration in WMA. However, due to cross-coordination of efforts with other Company departments, the Grid Modernization team was successful in bringing this high-impact project online, which will allow the system operators to have visibility into these networked systems that had not previously been available.

There were two specific challenges, both of which were overcome, with this investment category. The first was in the Springfield, Massachusetts network, relating to the ordering a piece of equipment that was necessary to allow field components to communicate with the substation equipment. The Company's feeder head configuration was slightly different than the typical installations associated with the Digital Grid system and this resulted in the need to acquire an atypical piece of equipment that required a longer timeframe for delivery. The second issue, at the Company's Pittsfield, Massachusetts network, was the assumption that the communications path, using a powerline carrier ("PLC"), between the field devices and the substation equipment was acceptable, even though there was a three-span section of overhead conductor within the system

that represented an atypical communications path. Based on further analysis, the Company determined that this assumption was not correct, and the team had to relocate some equipment out of the substation and into one of the underground vaults, within the system. The ordering time and the equipment relocation extended the commissioning timeline into March 2021. The Company has met its investment commitment in this category within the 2018-2020 GMP. Given its success in this investment category under the 2018-2020 GMP, the Company has begun to move forward with the additional Microprocessor Relay and 4kV Circuit Breaker SCADA programs, as authorized by the Department in D.P.U. 20-74.

B. Distribution Automation

1. Highlights of Feeder Level Implementation

Refer to Section III of this report for further information related to specific planning and deployment for each of the respective investment categories.

Any time a device is placed on the system which will provide real-time information, allow for increased fault location precision, and/or have the ability to further minimize the effects of that fault, the system's capabilities will inherently improve. The overhead reclosers (new locations, replace in-place, and field ties) and 4kV underground switches (oil switch replacement and Vacuum Fault Interrupter ("VFI") upgrades for auto-restoration loops) installations in 2020 contributed to these areas of improvement. In addition, these devices allow for:

- Increased visibility and remote operability by the system operators.
- Provision of valuable data, as related to load conditions and switch position (open/closed).
- The ability for the system operators to remotely apply protection schemes to the devices when crews need to work within the device boundaries.
- In terms of the overhead system, the reclosers can be built into existing loop schemes, allowing for autonomous system healing.
- In terms of the underground (4kV) system, the switches will be available for future loop scheme build out.

Except for the 4kV AR Loop investment, the Company exceeded its 2018-2020 GMP investment commitments for all other investment types within this category within the three-year period. The 4kV AR Loop investment has been substantially completed since late 2019 but the Company continues to prove out the project concept with this new technology. The Company has begun to move forward with the additional OH DA and 4kV Oil Switch Replacement programs, as authorized by the Department in D.P.U. 20-74. The 4kV AR Loop program will proceed upon issue resolution from the Company's original project.

2. Feeder Level Lessons Learned/Challenges and Successes

As discussed in the 2018 and 2019 annual reports, it was important for the Company to establish a holistic approach, across its overhead investment types in WMA[5] regarding the location selection and design for these investments. Additionally, WMA does not utilize a centralized real-time automation controller ("RTAC") similar to EMA, which makes device-specific controller settings a field requirement. The holistic approach was an efficient approach which allowed centralized and bulk device settings design and field deployment without the need to redesign device settings, because all planned up/down stream devices were known. The DA deployments in the Company's overhead system were very successful, due to their speed of installation, limited unforeseen conditions, and immediate and increased visibility and control of the electric power grid..

Implementing GMP programs on the 4kV underground systems, which are often located in densely populated city environments, is affected by numerous factors, such as the coordination of vehicle removal, police details, city permits and manhole/vault cleaning in order to first inspect the site and equipment to ensure compatibility with the program's intent. These factors were again present during the 2020 investment year and further compounded by COVID-19 restrictions. By leveraging the coordination lessons learned from 2018 and 2019, including the implementation of a task-force approach that identified owners and key points of contact within the process, the Company was able to continue to successfully deploy devices well in excess of its original goal. The Company attributes its 2020 success, amidst the pandemic, to its aggressive approach and deployment in 2019, which drove that momentum into 2020.

For 2020, the Company carried forward the significant lesson lessons learned from the 2018 and 2019 GMP implementation: the need for careful and upfront planning to ensure that all necessary tasks were undertaken and accomplished in the necessary order. This planning enabled the Company to identify situations (emergent or planned) that existed in areas adjacent to the GMP work area in question, allowing the Company to leverage those ancillary projects and obtain data while other work was progressing. For instance, if there was a circuit outage evolution for a non-GMP project in the vicinity of a future GMP device installation, the Company utilized that outage to collect data and/or perform pre-work on the GMP device location. These efforts required close coordination between GMP and non-GMP projects, with the requisite separation and tracking of costs.

C. Volt-Var Optimization

1. Highlights of Feeder Level Implementation

Refer to Section III.A of this report for further information related to specific planning and deployment for each of the respective investment categories.

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5 WMA is the only region of the Company that has these multiple overhead device deployment types.

As discussed in the previous Annual Reports, the Company completed the VVO analysis, selected substations and circuits, identified the specific field device locations and selected the software platform in 2018. The Company had targeted 2019 as the year to install all VVO field components to have them ready for final commissioning when the IT portion of the program was completed in 2020. The Company's execution plan was well designed, and all load tap changer ("LTC") controls and line sensors were installed and commissioned with communications in 2019 as planned. Capacitor banks and regulators were carried over into the 2020 GMP as described in the 2019 Annual Report and these investments were successfully installed and commissioned in 2020.

The VVO system was placed in-service and was operational in December 2020, when the day ON/OFF testing schedule commenced. Day ON/OFF testing is the scenario that will be utilized to observe differences and deviations from the measured and recorded circuit information between when the VVO system is operational (On) and when the system is non-operational (Off). This scenario was coordained with Guidehouse as the measurement and verification entity and the other EDC's.

2. Feeder Level Lessons Learned/Challenges and Successes

As discussed in previous Annual Reports, the regulator field devices come in three different sizes. The largest of these devices requires a significant amount of pole/platform infrastructure to enable its installation. As a preliminary step to installation at new locations, the Company (or Verizon for their pole-set areas) must petition the local municipal siting authority for permission to install. The petition process can take a significant amount of time and these petitions can be denied by the siting authority. Given that only a certain select number of feeders have been identified for inclusion in this program, there are limited opportunities for the Company to adjust the installation locations. Back up locations, in the event that a primary location is not feasible, that stay consistent with the overall VVO plan can sometimes be identified. For instance, siting locations can sometimes be shifted along the pole line. However, because of the specific function of the VVO field devices, the opportunity for deviation from the designed location is typically quite small. Even with proactively managed communications with the municipalities, there ultimately ended up being siting challenges for the largest of the regulator units. Additionally, because the VVO design encompasses all feeders for a specifically selected substation, it is not feasible to simply select another feeder that is not part of the planned substation.

The permitting constraints, coupled with identified stability issues discussed earlier in this Report, significantly extended the 2019 installation timeframes into 2020. The installation teams successfully completed all remaining installations according to the revised design standard in 2020. This program also included revisiting existing installations that were applicable to and impacted by the new design requirements.

In addition to the challenges with the regulators, the end of line sensors were a challenge to design and source. This is a nascent technology, and the Company needed to work with a vendor to develop and prove out the specification before being able to take delivery of the equipment for

installation. The installations were successfully completed in 2020 but took much longer than anticipated.

For all types of devices, the visibility afforded by the VVO monitoring system identified issues and damage to field devices due to equipment failure/deterioration or damage sustained during storms that would have been imperceptible from a visual patrol alone.

D. Advanced Distribution Management System

1. Highlights of Feeder Level Implementation

Refer to Section III.A of this report for further information related to specific planning and deployment for each of the respective investment categories.

The ADMS program was not administered on a feeder basis. For 2020, the Company met its commitment for the Advanced Load Flow ("ALF") investment for all of the Company's circuits. Additionally, the GIS Survey investment was completed for all overhead circuits in the EMA region of the service territory and a project to assist in the GIS model builds was started in the WMA region. The WMA project will continue into 2021 consistent with the Department's order in D.P.U. 20-74.

2. Feeder Level Lessons Learned/Challenges and Successes

Much like what occurred in 2019, the implementation process for the ALF project involved multiple iterations of model builds in a test environment. The synchronizing of "snapshots" of multiple live databases in this test environment proved very challenging, as a number of model errors simply due to "stale" data in one snapshot or another were detected. Therefore, the project team had to establish a well-orchestrated process to bring together data that ensured the snapshot was consistent across multiple data sets.

Also, data cleanup (beyond the overhead GIS verification work completed in 2019) also proved to be more significant and time consuming than planned. This challenge was overcome by implementing a desktop analysis, using Company maps along with tools like Google or Bing Streetview.

E. Communications

1. Highlights of Feeder Level Implementation

The Communications program is not being implemented on a "Feeder Level." Please see Section III of this Report for a further discussion of the Communications program.

2. Feeder Level Lessons Learned/Challenges and Successes

The Communications program is not being implemented on a "Feeder Level." Please see Section III of this Report for a further discussion of the Communications program.

IV. Description and Report on Each Infrastructure Metric

As part of its approval of the Company's GMP, the Department approved the proposed statewide and company-specific infrastructure metrics. Regarding statewide infrastructure metrics, the Department required the Distribution Companies to report on the following: (1) system automation saturation; (2) number/percentage of sensors installed versus planned; (3) percentage of circuits with installed sensors; and (4) total number of grid-connected DG facilities, nameplate capacity and estimate output of each unit and type of customer-owned or operated units. D.P.U. 15-122, at 198-199. As for the Eversource-specific infrastructure metrics, the Company is required to report on the following for each category of preauthorized grid-facing investment: (1) the number of devices or other technologies deployed; (2) the associated cost for deployment; (3) reasons for deviation between actual and planned deployment for the GMP investment year; and (4) projected deployment for the remainder of the GMP term. Id. at 200-201. To assist in the development of these baselines, the Department directed each of the Distribution Companies to develop and maintain information on its system design, operational characteristics (e.g., voltage, loading, line losses), and ratings prior to any deployment of preauthorized grid-facing technologies. Id. at 203. Additionally, the Department directed the Distribution Companies, when developing their proposed baselines to use, to the extent possible, information reported in the annual service quality filings, as well as other publicly available information. Id.

While the purpose of these infrastructure metrics is to determine how performance can be changed because of grid modernization investments, there are outside factors, over which the Company has no control, that can and will impact performance. Weather, customer behavior, economic conditions and other factors will have a significant influence on the parameters being measured under these metrics.

The statewide infrastructure metrics use the following common definitions across the Distribution Companies.

Grid Modernization Device - any device that meets the requirements of either a fully automated or a partially automated device.

Fully Automated Device – a device that meets all the following requirements:

- reacts to system conditions to isolate or restore portions of the electric system;
- communicates system quantities (e.g., voltage, trip counts) to a central location, such as SCADA; and
- the state of the device can be remotely controlled by dispatch.

Partially Automated Device – a device that meets at least one of following requirements:

- Reacts to system conditions to isolate or restore portions of the electric system;

• Communicates system quantities (e.g., voltage, trip counts) to a central location, such as SCADA;

• The state of the device can be remotely controlled by dispatch; or

• Be capable of upgrade to a fully automated device without full replacement.

Sensor – Equipment that sends or records information of the electric system that can be used to improve the efficiency or effectiveness of workforce or asset management (e.g., Fault locators that would help pinpoint a problem for more efficient crew deployment).

Statewide Infrastructure Metrics

1.1 Grid Connected Distribution Generation Facilities

The data used in the calculation of this metric consider units that have an executed Interconnection Service Agreement ("ISA") and are in service and connected to the distribution system.[6]

The Company has tracked the following data on a substation and circuit basis:

a. Total number by technology or fuel type – count of units by technology or fuel type

b. Nameplate capacity by technology or fuel type – sum total of nameplate capacity

c. Estimated output by technology or fuel type – sum of nameplate capacity * capacity factor * 8760 hours

d. Type of customer-owned or operated units by technology and fuel type – (i.e., count of Photo Voltaic ("PV"), wind, Combined Heat and Power ("CHP"), Fuel Cell, etc.)

e. Nameplate as a Percent of Peak Load – calculated as total nameplate capacity (MW) / peak load (MW)

The baseline for this metric has been quantified and calculated based upon units in service by December 31, 2017. Please refer to the Company's Baselines and Targets Filing for the detailed baseline quantities.

The 2020 results for this metric are summarized in the table below. The 50,442 facilities represent an increase of 15,329 facilities over the baseline amount of 35,113. The increase was primarily driven by PV facilities. The supporting details can be found in Attachment SI-1.

[6] It is important to note that DER developers' decisions regarding DER interconnection may be influenced by tax incentives, subsidies, and costs and availability of the technology, which, in turn, will influence these metrics.

Table SI-1

Grid Connected Distribution Generation Facilities
2020

Technology Type	Number of Facilities
Gas Turbine	15
Hydro Electric Turbine	23
Internal Combustion Engine	234
Micro Turbine	6
PV	49,573
PV & Battery	460
Steam Turbine	4
Wind Turbine	117
Fuel Cell	9
Battery	1
Grand Total	50,442

1.2 System Automation Saturation

This metric measures the automation saturation by customer served by fully automated or partially automated device. The terms "fully automated" and "partially automated" refer to feeders for which Eversource has attained optimal or partial, respectively, levels of visibility, command and control, and self-healing capability through the use of automation.

The baseline saturation rate has been calculated based on what existed on the Eversource system as of the date the baseline was first calculated on August 1, 2018. Customers that can benefit from multiple devices will be counted as one for purposes of calculating the baseline. The installations will not be limited to the main line infrastructure and will include no-load lines and distribution system supply lines.

The following matrix has been provided as guidance to determine which type of equipment would be considered partially automated, fully automated or included as a sensor.

Device Type	Not Included	Partial Automation	Full Automation	Included as a Sensor
Feeder Breakers (No SCADA)		X		
Feeder Breakers (SCADA)			X	X
Reclosers (including sectionalizers, single phase reclosers, intellirupters, ASU) (No		X		
Reclosers (including sectionalizers, single phase reclosers, intellirupters, ASU)			X	X
Padmount Switchgear (No SCADA)		X		
Padmount Switchgear (SCADA)			X	X
Network Transformer/Protector with full SCADA			X	X
Network Transformer/Protectors with monitoring, no control		X		X
Network Transformer/Protector with no SCADA	X			
Feeder Meter (e.g., ION, with comms)				X
Capacitor and Regulator with SCADA		X		X
Capacitor and Regulator no SCADA	X			
Line Sensor (with comms)				X
Fault Indicator (with comms)				X
Other Fault Indicators (no comms)	X			
Other Voltage Sensing (with comms)			X	X
Sectionalizer (no SCADA)		X		
Sectionalizer (SCADA)			X	
Customer Meter	X			
Distribution /step down Transformer	X			
Other Substation Breakers	X			
Fuse	X			

As more automation is installed on the Company's system, both under the GMP and pursuant to other system investment outside of the GMP, the results of this metric will be reduced.

Metric Calculation:

Customers Served

_____

Fully Automated Device + 0.5*(Partially Automated Device)

The baseline for this metric has been quantified and calculated based upon equipment in service as of August 1, 2018. Eversource's baseline is 247.1. Please see the Company's Baselines and Targets Compliance Filing for circuit level detail.

The calculated score at the end of 2020 was 170.8. This is an improvement of 76.3 over the baseline amount of 247.1. Please see Attachment SI-2 and Attachment SI-3 for circuit level detail.

1.3 Number/Percentage of Circuits with Installed Sensors

This metric measures the total number of electric distribution circuits with installed sensors[7] which will provide information useful for proactive planning and intervention. The installation of sensors provides the means to enable proactive planning and measure several grid modernization initiatives such as VVO and asset management. A sensor analytics development program is an essential part of grid modernization and provides the visibility into network operations needed to move toward an effective grid modernization program.

The baseline for this metric consists of all sensor installations on Eversource's distribution circuits and substations, including existing installations.

The baseline for this metric has been quantified and calculated based upon equipment in service as of August 1, 2018. Eversource's baseline has been calculated as 82.3 percent. Please see the Company's Baselines and Targets Filing for the circuit detail used to develop the baseline.

For 2020, Eversource's number and percentage of circuits with installed sensors has increased to 85.1 percent. Please see the Table SI-3 below for further details.

Table SI-3

**Number/
Percentage of Circuits with Installed Sensors
2020**

Sensor	Number of Feeders	Percent
Y	1,800	85.1%
N	315	14.9%

[7] Please see the previous matrix for devices that have been defined as "sensor" for the purpose of determining whether a circuit has a sensor.

Eversource-Specific Infrastructure Metrics

2.1 Number of devices or other technologies deployed

Under this metric, Eversource has tracked the following information per GMP investment at the substation and circuit level where appropriate:

a. Number of devices or other technologies deployed

b. Total number of devices planned

c. Percent – Number of devices installed / total number of devices planned

This metric is strictly a GMP deployment metric: accordingly, the baseline for this metric necessarily starts at zero to ensure that pre-GMP investments are not captured in the baseline.

Please refer to Table **S2-1** below for the Company's GMP investment deployment through 2020.

Table S2-1

Grid Modernization - Total Deployment Plan (Units)

Investment Areas and Preauthorized Device Types	Commissioned Units			
	2018-2020 Actual	2018-2020 Plan	2018-2020 Variance (Units)	2018-2020 Percent (%)
Monitoring & Control (SCADA)	**435**	**430**	**5**	**101%**
Microprocessor Relay	180	193	(13)	93%
4kV Circuit Breaker SCADA	54	55	(1)	98%
Recloser SCADA	59	37	22	159%
Padmount Switch SCADA	59	62	(3)	95%
Network Protector SCADA	83	83	-	100%
Power Quality Monitors	-	-	-	N/A
Distribution Automation	**451**	**448**	**3**	**101%**
OH DA	243	220	23	110%
OH DA w/Ties	53	45	8	118%
4kV Oil Switch Replacement	137	105	32	130%
4kV AR Loop	18	78	(60)	23%
Volt-Var Optimization	**577**	**367**	**210**	**157%**
VVO - Regulators	96	96	-	100%
VVO - Capacitor Banks	74	74	-	100%
VVO - LTC Controls	8	8	-	100%
VVO - Line Sensors	189	189	-	100%
VVO - IT Work	N/A	N/A	N/A	N/A
Microcapacitors	99	-	99	N/A
Grid Monitoring Line Sensors	111	-	111	N/A
Advanced Distribution Management System (ADMS)	**N/A**	**N/A**	**N/A**	**N/A**
Communications	**8**	**10**	**(2)**	**80%**
Numbers of Nodes	8	10	(2)	80%
Miles of Fiber	-	-	-	N/A
Electric Vehicles	**N/A**	**N/A**	**N/A**	**N/A**
Energy Storage	**N/A**	**N/A**	**N/A**	**N/A**
Total Units	**1,471**	**1,255**	**216**	**117%**

2.2 Associated cost for deployment

Under this metric, the Company has tracked the following information per investment type at the substation and circuit level where appropriate:

a. Cost of devices or other technologies deployed

b. Total cost of devices planned

c. Percent – Cost of devices installed / total cost of devices planned

Please refer to Table S2-2 below for the Company's associated cost for deployment through 2020.

Table S2-2
Grid Modernization - Total Deployment Plan (Cost)

Investment Areas and Preauthorized Device Types	Capital Spend (in thousands $)			
	2018-2020 Actual	2018-2020 Plan	2018-2020 Variance ($)	2018-2020 Percent (%)
Monitoring & Control (SCADA)	**52,063**	**49,790**	**2,272**	**105%**
Microprocessor Relay	30,091	33,116	(3,025)	91%
4kV Circuit Breaker SCADA	15,932	11,152	4,780	143%
Recloser SCADA	3,386	2,527	859	134%
Padmount Switch SCADA	1,007	991	16	102%
Network Protector SCADA	1,431	2,003	(572)	71%
Power Quality Monitors	215	-	215	N/A
Distribution Automation	**46,893**	**48,644**	**(1,751)**	**96%**
OH DA	18,176	18,522	(347)	98%
OH DA w/Ties	3,253	4,518	(1,265)	72%
4kV Oil Switch Replacement	24,003	21,313	2,690	113%
4kV AR Loop	1,461	4,291	(2,830)	34%
Volt-Var Optimization	**12,933**	**12,350**	**584**	**105%**
VVO - Regulators	4,007	2,995	1,012	134%
VVO - Capacitor Banks	2,860	2,549	311	112%
VVO - LTC Controls	1,452	1,422	30	102%
VVO - Line Sensors	1,235	679	556	182%
VVO - IT Work	2,629	4,705	(2,076)	56%
Microcapacitors	751	-	751	N/A
Grid Monitoring Line Sensors	-	-	-	N/A
Advanced Distribution Management System (ADMS)	**8,809**	**11,883**	**(3,074)**	**74%**
Advanced Load Flow	8,809	11,878	(3,069)	74%
GIS Verification (Expense)	-	-	-	N/A
Dist. Management System	-	5	(5)	0%
Forecasting Tool	-	-	-	N/A
Synergi Upgrades	-	-	-	N/A
PI Asset Framework	-	-	-	N/A
Communications	**2,194**	**2,268**	**(74)**	**97%**
Numbers of Nodes	1,628	1,958	(330)	83%
Miles of Fiber	566	310	256	182%
Electric Vehicles	**31,915**	**32,820**	**(906)**	**97%**
Energy Storage	**20,917**	**49,036**	**(28,119)**	**43%**
Martha's Vineyard	3,208	14,207	(10,999)	23%
Provincetown	17,710	34,830	(17,120)	51%
Total Capital Spend	**175,723**	**206,792**	**(31,068)**	**85%**
Estimated O&M Expense	**11,522**	**10,583**	**939**	**109%**
Total Capital & O&M	**187,245**	**217,375**	**(30,130)**	**86%**

2.3 Reasons for deviation between actual and planned deployment for the plan year

Under this metric, the Company tracked the following information per investment at the substation and circuit level where appropriate:

a. Number of devices or technology installed versus plan for a given year

b. Cost of devices or technologies installed versus plan for a given year

c. Reason for discrepancies

Please refer to Table S2-3 below for the Company's reasons for deviation between actual and planned deployment for the plan year.

Table S2-3
Grid Modernization - 2020 Unit vs. Cost Deployment

Investment Areas and Preauthorized Device Types	Capital Spend (in thousands $)				Commissioned Units			
	2020 Actual	2020 Budget	Variance ($)	Percent (%)	2020 Actual	2020 Plan	Variance (Units)	Percent (%)
Monitoring & Control (SCADA)	**26,095**	**23,822**	**2,272**	**110%**	**244**	**239**	**5**	**102%**
Microprocessor Relay	11,737	14,762	(3,025)	80%	83	96	(13)	86%
4kV Circuit Breaker SCADA	11,763	6,983	4,780	168%	38	39	(1)	97%
Recloser SCADA	1,534	675	859	227%	25	3	22	833%
Padmount Switch SCADA	286	270	16	106%	15	18	(3)	83%
Network Protector SCADA	560	1,132	(572)	49%	83	83	-	100%
Power Quality Monitors	215	-	215	N/A	-	-	-	N/A
Distribution Automation	**14,053**	**15,804**	**(1,751)**	**89%**	**127**	**124**	**3**	**102%**
OH DA	3,839	4,185	(347)	92%	70	47	23	149%
OH DA w/Ties	455	1,720	(1,265)	26%	8	-	8	N/A
4kV Oil Switch Replacement	9,190	6,500	2,690	141%	48	16	32	300%
4kV AR Loop	569	3,399	(2,830)	17%	1	61	(60)	2%
Volt-Var Optimization	**4,749**	**4,165**	**584**	**114%**	**240**	**30**	**210**	**800%**
VVO - Regulators	1,632	620	1,012	263%	27	27	-	100%
VVO - Capacitor Banks	311	-	311	N/A	3	3	-	100%
VVO - LTC Controls	30	-	30	N/A	-	-	-	N/A
VVO - Line Sensors	556	-	556	N/A	-	-	-	N/A
VVO - IT Work	1,469	3,545	(2,076)	41%	N/A	N/A	N/A	N/A
Microcapacitors	751	-	751	N/A	99	-	99	N/A
Grid Monitoring Line Sensors	-	-	-	N/A	111	-	111	N/A
Advanced Distribution Management System (ADMS)	**6,033**	**9,107**	**(3,074)**	**66%**	**N/A**	**N/A**	**N/A**	**N/A**
Advanced Load Flow	6,033	9,102	(3,069)	66%	N/A	N/A	N/A	N/A
GIS Verification (Expense)	-	-	-	N/A	N/A	N/A	N/A	N/A
Dist. Management System	-	5	(5)	0%	N/A	N/A	N/A	N/A
Forecasting Tool	-	-	-	N/A	N/A	N/A	N/A	N/A
Synergi Upgrades	-	-	-	N/A	N/A	N/A	N/A	N/A
PI Asset Framework	-	-	-	N/A	N/A	N/A	N/A	N/A
Communications	**1,362**	**1,435**	**(74)**	**95%**	**4**	**6**	**(2)**	**67%**
Numbers of Nodes	1,106	1,435	(330)	77%	4	6	(2)	67%
Miles of Fiber	256	-	256	N/A	-	-	-	N/A
Electric Vehicles	**18,076**	**18,981**	**(906)**	**95%**	**N/A**	**N/A**	**N/A**	**N/A**
Energy Storage	**16,308**	**44,427**	**(28,119)**	**37%**	**N/A**	**N/A**	**N/A**	**N/A**
Martha's Vineyard	946	11,945	(10,999)	8%	N/A	N/A	N/A	N/A
Provincetown	15,362	32,482	(17,120)	47%	N/A	N/A	N/A	N/A
Total	**86,674**	**117,742**	**(31,068)**	**74%**	**615**	**399**	**216**	**154%**
Estimated O&M Expense	**3,067**	**2,128**	**939**	**144%**				
Total Capital & O&M	**89,741**	**119,871**	**(30,130)**	**75%**				

As is further discussed in Section III.A of this Report, the COVID-19 pandemic and an unprecedented number of emergency response events had the most impact on precluding the Company from commissioning all the units planned for calendar year 2020. Except for the 4kV auto-restoration loop project and one telecommunication node, all the work not completed in 2020 was placed in-service and commissioned as of April 1, 2021.

2.4 Projected deployment for the remainder of the four-year GMP term

The metric compares the revised projected deployment with the original targeted deployment as the Company implements its GMP. The year-by-year investment plan is subject to change based upon the quantity of work completed, the availability of the technology, material lead times, contractor availability, etc. Each year's revised investment plan will be used as the basis of comparison for the following year's GMP work.

Under this metric, the Company has tracked the following information per investment at the substation and circuit level where appropriate:

a. Number of devices or technology to be installed the following year

b. Cost of devices or technologies installed the following year

The metric will be used as the baseline and target for the following year's work and will be reported on an annual basis. Please refer to Table S2-4 below for the Company's projected GMP investment deployment for 2021.

Table S2-4
Grid Modernization - Total Deployment Projection (Cost & Units)

Investment Areas and Preauthorized Device Types	Capital Spend (in thousands $)			Units		
	2018-2020 Actual	2021 Plan	2018-2021 Projection	2018-2020 Actual	2021 Plan	2018-2021 Projection
Monitoring & Control (SCADA)	**52,063**	**16,932**	**68,995**	**435**	**125**	**560**
Microprocessor Relay	30,091	11,260	41,351	180	57	237
4kV Circuit Breaker SCADA	15,932	4,000	19,932	54	13	67
Recloser SCADA	3,386	-	3,386	59	-	59
Padmount Switch SCADA	1,007	-	1,007	59	-	59
Network Protector SCADA	1,431	717	2,148	83	21	104
Power Quality Monitors	215	956	1,171	-	34	34
Distribution Automation	**46,893**	**14,000**	**60,893**	**451**	**151**	**602**
OH DA	18,176	8,000	26,176	243	100	343
OH DA w/Ties	3,253	-	3,253	53	-	53
4kV Oil Switch Replacement	24,003	5,000	29,003	137	35	172
4kV AR Loop	1,461	1,000	2,461	18	16	34
Volt-Var Optimization	**12,933**	**6,000**	**18,933**	**577**	**624**	**1,201**
VVO - Regulators	4,007	1,150	5,157	96	48	144
VVO - Capacitor Banks	2,860	950	3,810	74	32	106
VVO - LTC Controls	1,452	720	2,172	8	4	12
VVO - Line Sensors	1,235	180	1,415	189	40	229
VVO - IT Work	2,629	-	2,629	N/A	-	N/A
Microcapacitors	751	1,500	2,251	99	200	299
Grid Monitoring Line Sensors	-	1,500	1,500	111	300	411
Advanced Distribution Management System (ADMS)	**8,809**	**13,000**	**21,808**	**N/A**	**N/A**	**N/A**
Advanced Load Flow	8,809	-	8,809	N/A	N/A	N/A
GIS Verification (Expense)	-	-	-	N/A	N/A	N/A
Dist. Management System	-	8,000	8,000	N/A	N/A	N/A
Forecasting Tool	-	3,246	3,246	N/A	N/A	N/A
Synergi Upgrades	-	767	767	N/A	N/A	N/A
PI Asset Framework	-	986	986	N/A	N/A	N/A
Communications	**2,194**	**5,106**	**7,300**	**8**	**6**	**14**
Numbers of Nodes	1,628	4,106	5,735	8	6	14
Miles of Fiber	566	1,000	1,566	-	-	-
Electric Vehicles	**31,915**	**19,002**	**50,917**	**N/A**	**N/A**	**N/A**
Energy Storage	**20,917**	**28,678**	**49,595**	**N/A**	**N/A**	**N/A**
Martha's Vineyard	3,208	391	3,599	N/A	N/A	N/A
Provincetown	17,710	28,287	45,997	N/A	N/A	N/A
Total	**175,723**	**102,718**	**278,441**	**1,471**	**906**	**2,377**
Estimated O&M Expense	**11,522**	**1,062**	**12,584**			
Total Capital & O&M	**187,245**	**103,780**	**291,026**			

The Company submitted its Baseline and Targets Filing in the Compliance Filing on August 15, 2018, which included the 2018-2020 GMP baseline (Baseline and Targets Filing at 15, Table 2.4.7). As discussed in Section I.B of this Report, the Company has continuously sought opportunities to accelerate the preauthorized device type unit deployments in an efficient and cost-effective manner. Due to the framework put in place for the portfolio at the outset, and by leveraging real-time lessons learned, the Company was able to virtually complete 2018-2020 GMP on schedule and within preauthorized costs. The statuses, including deployment schedules, for each respective investment category and type are discussed in Section III of this Report. Please

also refer to the Company's Attachment ES-1, which provides the Excel versions of the Eversource-specific tables included in Section 2.1, Section 2.2, Section 3.3, and Section 2.4.

V. Distributed Energy Resources ("DER")

Installations of DER are growing at an unprecedented rate in many parts of the United States, including in Massachusetts where state policy directives have incentivized and accelerated DER deployment in support of the Commonwealth's clean energy and climate goals. In its Massachusetts territory alone, Eversource is currently processing applications for solar distributed generation totaling about 1,730 MW, ranging from the high-volume residential roof top to large multi-MW stand-alone projects. Figure 8 below shows the number of applications for simplified (less than 15 kW) and expedited/standard (15 KW to over 5 MW) projects in 2020. These proposed projects come at a time when the Company's electric distribution infrastructure in many key areas, especially Southeastern Massachusetts (SEMA), is already saturated with DER that has been interconnected primarily over the last 10 years, incentivized in large part through the Commonwealth's previous solar incentive programs, including its Solar Renewable Energy Certificate-I and II programs, and the SMART program. This surge in DER deployment on the utility's electric power system ("EPS") is expected to continue for the foreseeable future.

Figure 8: 2020 Interconnection Applications

Territory	Status	Simplified	EXP/STD	Totals
EMA	Applications Online in 2020	3,472	282	3,754
	Applications Received in 2020	5,178	703	5,881
WMA	Applications Online in 2020	1,133	23	1,156
	Applications Received in 2020	1,591	92	1,683

The challenges associated with integrating this large amount of DER into the Company's EPS are numerous and require solutions on several levels, from technological to process-driven to policy. Eversource has enhanced its ability to study and determine the impacts of high DER penetration on the EPS and on its customers and developed innovative tools and methods to identify mitigation measures for safely and reliably connecting DER, as well as optimal solutions that address long-term system needs. Eversource has developed and invested in applications and processes to streamline the application, study and approval process for DER projects. Eversource has also worked with the Department (in D.P.U. 19-55 and D.P.U. 20-75) to address current barriers to the continued growth of DER in Massachusetts through changes that are consistent with long-term objectives for cost allocation and design of the EPS. Across this spectrum of solutions, one consistent underpinning is that upgrades to the Company's EPS are necessary (especially in highly saturated areas) to allow DER to successfully integrate and consistently generate energy when it's needed, in locations where it can be accommodated.

Based on Eversource's experience, there are new complicating factors that are now evolving in the market that require more technical review time and integrated system work to ensure the safety and reliability of the system. These factors include the emergence of:

1) Increased deployment of solar coupled with energy storage including DOER SMART program requirement for storage for all projects over 500 kW.

a. This market has added complexity to DER studies and screens as well as metering and incentive program applicability.

b. Applicants are interested in maximizing incentive programs across state and Independent System Operator ("ISO") markets which can lead to confusion on application tracks.

2) Substation upgrades

a. Due to high saturation levels in several areas of the system, (e.g., SEMA) system impact studies are determining that substation upgrades, (significant upgrades in some cases), are required to allow for project interconnection. This has the potential to make study and construction activities more complicated and time-consuming. It also requires the Company's planning teams to account for the potential for additional substation work or dedicated/express feeders due to the expected continuing DER activity. The Company must ensure that resources are utilized, and projects are executed in an efficient manner, which requires careful planning and coordination across several engineering disciplines. Also planning must take into account future DER in the queue to make appropriate long-term design decisions for the largest number of DG customers. The Company is currently executing several large group studies in Eastern and Western Massachusetts to understand these implications and develop equitable methods for allocating the costs of these necessary upgrades across multiple customers.

3) More frequent ISO transmission studies

a. ISO is requiring studies for projects less than 5 MW in areas it deems saturated. This adds time, cost and engineering effort to many projects that historically did not have this extra layer of administrative and engineering complexity. Utilities and Transmission Groups are performing more level 0/1 and level 3 transmission studies and, in some cases, doing them in groups to process them more quickly than if they were processed sequentially. ISO and Eversource work together on the study process to minimize customer impact, but Eversource is aware that these new requirements are confusing to customers. Eversource anticipates completing the first wave of these groups in 2021.

4) New metering and design configurations

a. Metering configurations that vary based on system design and/or incentive program (e.g., ISO program participation, SMART program energy storage adder).

b. Multiple service requests on single parcel and/or building (dedicated service for the DER which is separate from the existing customer).

5) Aggregation of small projects in certain areas

a. Over time the number of small projects interconnected in an area leads to significant installed capacity.

b. Simplified applications for multiple small projects in the same area require additional study and administrative and engineering burden to execute outside of the normal simplified process.

Eversource has participated in the D.P.U. 19-55 discussions with DER stakeholders to work on alignment and updates to the statewide Interconnection Tariff. Discussions have been targeted on topics such as group studies, cost allocation, metering, communications, energy storage, ASO Studies and ISO market participation.

Eversource is constantly exploring opportunities to better manage its DER grid interconnection processes in ways that can more fully leverage technology advancements (e.g., advanced inverter functionalities), enable procedural transparency, and recognize evolving technical standards.

- Eversource recognizes first that a core group of technical experts is needed to streamline the application studies and effectively adapt to the changing dynamics. Accordingly, the Company has hired and is currently hiring additional engineers, analysts, customer service representatives and program managers into the DER Planning organization. Eversource also recognizes the communications to customers and the application process could be better executed. In 2020 the Company rolled out the Power Clerk online application tool for the Simplified process and will roll out the Expedited/Standard track for application in 2021. This will provide customers a better application experience and allow customers to track their projects status in real time. Ultimately the resources and Power Clerk tool will:
  - streamline the interconnection process;
  - help customers track the progress of their projects in real time;
  - support customers application process and reduce manual errors;
  - further refine and improve the Company's interconnection processes; and
  - provide developers/customers with additional information during the application process.

Additionally, the Company has rolled out and is continually exploring initiatives associated with mapping tools, an interactive self-service application portal, and proposing select locations for storage to meet utility needs. Accurate, up-to-date maps of the distribution system can play a useful role for both the Company and potential DER interconnection applicants. For the utility, having this information can support a more rapid review of an interconnection application on a specific feeder. For applicants, having access to a more dynamic version of the map, specifically one that indicates remaining hosting capacity for new DER projects, allows them to be more selective in the types and locations of projects and their specifics (e.g., capacity, technology deployed, etc.) to pursue in a formal interconnection application. By increasing visibility into the characteristics and feasibility of individual circuits, these maps can save both customers and the Company time and money.

The Company has published updated versions of the Hosting Capacity Maps in its Western MA service territories. In March 2020, the DER team also published the Hosting Capacity Map for

Eastern Massachusetts ("EMA") and is currently working towards the monthly update on that data. These maps, which do not depend on the use of an ALF tool, expeditiously provide key preliminary information to developers. The Company continues to work to incorporate feedback and data requests from the Department of Energy Resources ("DOER") and DER developers into the maps.

VI. Performance Metrics

A. Description and Report on Each Performance Metric

In D.P.U. 12-76-B, the Department directed Eversource, National Grid and Until (collectively, the "Distribution Companies" or "Companies" and individually, a "Distribution Company" or "Company") to include in their respective GMPs performance metrics that measure progress towards the objectives of grid modernization. D.P.U. 12-76-B, at 30. Eversource filed proposed performance metrics with its GMP in D.P.U. 15-122, as did National Grid and Unitil in each of their respective GMP dockets. The Department determined that additional work was needed to develop performance metrics that appropriately track the quantitative benefits associated with pre-authorized grid-facing investments, and progress toward the grid modernization objectives. D.P.U. 15-122, at 95-106. The Department ordered the Distribution Companies to file revised proposed performance metrics designed to address the preauthorized grid-facing investments and noted that it would convene a stakeholder process to facilitate review of the revised performance metrics. Id. at 202.

On August 15, 2018, the Distribution Companies filed revised proposed performance metrics. Following that filing, the Department, the Department of Energy Resources ("DOER") and the Cape Light Compact ("Compact") issued information requests to the Distribution Companies regarding the revised proposed performance metrics. On February 13, 2019, the Department held a technical conference to aid its review of the Distribution Companies' revised proposed performance metrics. Following the technical conference, the Department issued a Memorandum on March 19, 2019, ordering the Distribution Companies to file further revised performance metrics consistent with the directives set out in the Memorandum. March 19, 2019 Memorandum at 2-5. The Companies submitted final revised proposed performance metrics on April 9, 2019.

On July 25, 2019, the Department stamp approved the Companies' proposed performance metrics dated April 9, 2019. This section of the Grid Modernization Annual Report describes the statewide, as well as company-specific, performance metrics that Eversource is using to evaluate progress towards the grid modernization objectives. Please note that, as the statewide metrics apply to Eversource, National Grid and Unitil, this section of Eversource's 2020 Annual Grid Modernization Report will refer to all three Distribution Companies when describing the statewide metrics. For each performance metric, this section will identify the type, objective, assumptions, calculation approach, organization of results, and baselines.

The Department also ordered the Distribution Companies to develop a formal evaluation process, including an evaluation plan and evaluation studies, to review the Distribution Companies' preauthorized GMP investments and their progress toward meeting the Department's grid modernization objectives. D.P.U. 15-122, at 204-205. Guidehouse (formerly Navigant Consulting, Inc.) is completing the evaluation to ensure a uniform statewide approach and to facilitate coordination and comparability across the Distribution Companies.

The data supporting the performance metrics have been provided to the Guidehouse evaluation team by the Company. Results of the Monitoring and Control ("M&C"), Distribution Automation ("DA"), Communications, and Advanced Distribution Management System ("ADMS") investment areas are expected to be shared by Guidehouse in June 2021, as stated in the response to DPU-EP-1-1. The performance metrics are based on statistical analyses and case studies for the M&C and DA investment categories, performed by the evaluation team using data provided by each Distribution Company and will be evaluated in 2021 to allow adequate data collection to be completed.

The underlying data that supports several of the performance metrics can also be found in the 2020 Annual Report Appendix 1.

The next section provides the accompanying details behind the performance metrics. As noted above, the results of these metrics and supporting analysis will be provided by Guidehouse in the Evaluation Reports to be filed in June 2021. It is important to note that as part of Information Request D.P.U. EP-1-1, filed on February 6, 2020, and the revised "GMP Stage 3 Eval Plan (Revised 12-1-20)" filed on December 1, 2020, Guidehouse provided some updates, modifications and enhancements to their evaluation plan, as it relates to the approved performance metrics. The following matrix has been provided to summarize the relationship between each performance metric and its associated investment category.

	Investment Category					
Metric	**M&C**	**DA**	**VVO**	**ADMS**	**Comms**	**ALF**
Volt Var Optimization (VVO) Baseline			X			
VVO Energy Savings			X			
VVO Peak Load Impact			X			
VVO Distribution Losses w/o AMF (Baseline)			X			
VVO Power Factor			X			
VVO – Energy and GHG Impact			X			
VVO Related Voltage Complaints Performance Metric and Baseline			X			
Increase in Substations with DMS Power Flow and Control Capabilities				X		
Control Functions Implemented by Circuit (VVO, Auto Reconfiguration)				X		
Numbers of Customers that benefit from GMP funded Distribution Automation Devices		X				
Reliability-Focused Grid Modernization Investments' Effect on Outage Durations	X	X				
Reliability-Focused Grid Modernization Investments' Effect on Outage Frequency	X	X				
Advanced Load Flow - Percent Milestone Completion						X
Eversource Customer Outage Metric (Average Zone Size)		X				

1.1 VOLT VAR OPTIMIZATION AND CONSERVATION VOLTAGE REDUCTION BASELINE

Volt VAR Optimization and Conservation Voltage Reduction ("VVO/CVR") is a solution that reduces energy consumption and demand without the need for customer interaction or participation. The core principle behind VVO/CVR is that load is more optimally utilized at lower voltages. The primary focus of VVO/CVR is to reduce circuit demand and energy consumption by flattening and lowering voltage profile on the circuit while maintaining customer service voltage standards. In addition, VVO/CVR systems allow for more gradual and responsive control of reactive power devices, such as capacitors, which will help improve the overall system power factor and reduce system losses. VVO/CVR allows customers to realize lower consumption without experiencing a reduction on the level of comfort and service.

Quantifying the exact impact of VVO/CVR is difficult to achieve given the Companies' current level of visibility into their systems. In a VVO/CVR system, the Companies will not have visibility into exactly what customer loads are being impacted, nor will they be able to identify the impact of the VVO/CVR system at any specific point in time. In order to have this level of visibility, the Companies would need to have interval metering at each residential customer's premises. At this time, none of the Companies have this level of residential metering. The metrics discussed below are all based on a measurement and verification ("M&V") process, which uses a statistical process to quantify the impact the VVO/CVR system has on the customers it serves.

1.1.1 Type of Metric

Statewide Performance Metric

1.1.2 Objective

Establish a baseline impact factor for each VVO enabled circuit which will be used to quantify the peak load, energy savings and greenhouse gas ("GHG") impact measures.

1.1.3 Assumptions

VVO dynamically controls and coordinates multiple devices to manage both voltage and reactive power. System-wide efficiency is achieved by simultaneously coordinating operations using continuous measurements from multiple sensors distributed across the circuit.

Once a circuit has VVO enabled, a M&V process will be performed through operating VVO using a predetermined time period and series. Based on the results of this M&V process, a circuit level VVO impact and baseline will be created.

1.1.4 Calculation Approach

The following data will be tracked and reported on a substation and circuit basis:

a. Determine circuit loads through measurements during on/off periods.
b. Apply temperature corrections.
c. Develop load profiles.

As part of the baseline data capture, each VVO circuit will capture hourly circuit data for real and reactive power.

Time	P (kW)	Q (kVAR)
1:00 AM	4298	1949
2:00 AM	4061	1542
3:00 AM	3284	1574
4:00 AM	3408	1277
5:00 AM	2896	1519
6:00 AM	2900	1200
7:00 AM	3185	1388
8:00 AM	3103	1476
9:00 AM	4006	1868
10:00 AM	3817	1884
11:00 AM	4351	1997
12:00 PM	4635	2323
1:00 PM	5129	2390
2:00 PM	5213	2673
3:00 PM	5517	2677
4:00 PM	5378	2478
5:00 PM	5400	2855
6:00 PM	5658	2986
7:00 PM	5720	2638
8:00 PM	5643	2922
9:00 PM	5290	2664
10:00 PM	5346	2628
11:00 PM	5019	2496
12:00 AM	4801	2667

1.1.5 Organization of Results

This information will be provided for each VVO enabled circuit and serve as the baseline variable for calculating demand reductions or serve as variables for other calculations, such as reductions in GHG emissions. This calculation will be performed once and will support both circuit and system level impacts.

1.1.6 Baseline

The baseline will be calculated through M&V after each circuit and/or substation is placed into service. The Distribution Companies recommend that each VVO/CVR circuit undergo a three to six-month M&V process, the results of which will be used to estimate the impact the system has on system load for the next five years. At the end of five years, the M&V would be repeated to ensure that each Company is using recent and relevant results for metric reporting. Baselines will be reported during the first Annual Report following the field verification.

1.2 VVO ENERGY SAVINGS

1.2.1 Type of Metric

Statewide Performance Metric

1.2.2 Objective

Quantify the energy savings achieved by VVO using the baseline established for the circuit against the annual circuit load with the intent of optimizing system performance.

1.2.3 Assumptions

Once a circuit has VVO enabled, a M&V process will be performed through operating VVO using a predetermined time period and series. Based on the results of this M&V process, a circuit level VVO impact and baseline will be created.

1.2.4 Calculation Approach

The following data will be tracked and reported upon on a substation and circuit basis:

a. Annual energy delivered in kilowatt hours ("kWh") for 2015, 2016, and 2017.

Energy Savings will be represented by the net impact of VVO using the baseline established for the circuit against the annual circuit load.

1.2.5 Organization of Results

This information will be provided for each VVO-enabled circuit and serve as the baseline variable for calculating demand reductions or serve as variables for other calculations. This will be performed annually, and support both circuit and system level impacts.

1.2.6 Baseline

VVO-related pre-investment baseline of energy delivered in kilowatt hours ("kWh") will be provided for each feeder and substation within the service territory for the years 2015, 2016, and 2017 to the extent that historical metering data are available. For feeders where such data are currently not available, the Companies shall estimate the VVO-related pre-investment baseline of annual energy delivered in kWh and identify these feeders with estimates until the necessary metering in installed.

1.3 VVO PEAK LOAD IMPACT

1.3.1 Type of Metric

Statewide Performance Metric

1.3.2 Objective

This metric is designed to quantify the peak demand impact VVO/CVR has on the system with the intent of optimizing system demand.

1.3.3 Assumptions

For this metric, the Companies will utilize active circuit M&V peak demand reduction results from individual circuits. No M&V results older than five years will be used.

1.3.4 Calculation Approach

This metric will use the following data:

- Circuit level M&V estimated hourly demand reduction;
- Circuit level hourly on/off VVO/CVR Status;
- Circuit level hourly peak demand; and
- System Level yearly peak time.

Each Company will apply the corresponding M&V estimated hourly demand reduction on all circuits with active VVO/CVR for the appropriate peak hour. As some circuits have different peak times, using the appropriate demand estimated reduction for the correct hour is important. This will result in a single (GW) estimated demand reduction attributed to VVO/CVR for each Company. Each Company's individual demand reduction attributed to VVO/CVR will be aggregated, resulting in the statewide estimated reduction.

1.3.5 Organization of Results

Each Company will provide individual circuit VVO/CVR performance, GWs estimated demand reduction, as well as the summation of total system impact.

1.3.6 Baseline

VVO-related pre-investment baseline of annual peak load in million-volt ampere ("MVA") will be provided for each feeder and substation within the service territory for the years 2015, 2016, and 2017.

1.4 VVO – DISTRIBUTION LOSSES WITHOUT AMF (BASELINE)

1.4.1 Type of Metric

Statewide Performance Metric

1.4.2 Objective

VVO reduces circuit demand by flattening and lowering circuit voltages, primarily by using voltage regulators. At the same time, VVO actively controls capacitor banks to maintain circuit power factors near unity. This DA project will implement better voltage regulation to improve

power quality and reduce losses. This includes the coordinated operation of a voltage regulator with a transformer load-tap changer at a substation.

Electrical loss in the circuit can be investigated using the difference between power provided by the circuit regulator and the total power delivered to the consumer loads. This impact metric presents the difference between circuit load measured at the substation via the SCADA system and the metered load measured both at the substation and at line devices capable of capturing load over the necessary intervals.

1.4.3 Assumptions

There are many elements that contribute to differences between circuit load data and the hourly measurements. These factors include:
• Unmetered load, such as street lights;
• Electricity theft; and
• Circuit line losses.

1.4.4 Calculation Approach

Using hourly data for real and reactive power, one can determine hourly line losses. This represents both technical and non-technical, e.g., theft, losses.

1.4.5 Organization of Results

This information will be provided on an annual basis for VVO-enabled circuits. Results will be based upon the results at the end of each calendar year.

1.4.6 Baseline

The baseline for line losses will need to be developed once the circuit is enabled and the data is captured. The baseline for this metric will be reported in the first annual report after the M&V is completed.

1.5 VVO POWER FACTOR

1.5.1 Type of Metric

Statewide Performance Metric

1.5.2 Objective

VVO reduces circuit demand by flattening and lowering circuit voltages, primarily by using voltage regulators. Simultaneously, VVO actively controls capacitor banks to maintain circuit power factors near unity. Power factor is an indication of how efficiently the distribution system is delivering power. A distribution system operating at unity power factor delivers real power more efficiently than one operating at either a leading or lagging power factor. This performance metric seeks to quantify the improvement that VVO/CVR is providing. However,

power factor alone is not sufficient to accurately describe the impact VVO/CVR has on the system. At low demand levels, a poor power factor is not as significant than at high demand levels. Therefore, some qualifications must be made to accurately track power factor.

1.5.3 Assumptions

Performance will be based on circuit level hourly power quality measurements at the substation.

1.5.4 Calculation Approach

This metric will use the following data:

- Circuit level hourly Power Factor;
- Circuit level hourly on/off VVO/CVR Status; and
- Circuit level hourly peak demand.

For this performance metric, only power factors corresponding to greater than 75 percent of a circuit's peak annual demand will be used. This qualified data will then be averaged to provide a circuit by circuit power factor performance metric. These averages will then be used to generate a system power factor performance, weighted by the peak demand of each respective circuit.

1.5.5 Organization of Result

The results of this metric will be reported in a tabular format on a circuit by circuit basis and a total system tally. Power factor is a dimensionless metric.

1.5.6 Baseline

The baseline will be measured with VVO disabled and then again with VVO enabled to develop a baseline. The baseline for this metric will be reported in the first Annual Grid Modernization Report after the M&V is completed.

1.6 VVO ESTIMATED VVO/CVR ENERGY AND GHG IMPACT

1.6.1 Type of Metric

Statewide Performance Metric

1.6.2 Objective

This metric is designed to quantify the overall GHG impact VVO/CVR has on the system. A GHG reduction estimate will be derived from the circuit level energy savings.

1.6.3 Assumptions

For this metric, each Company will utilize active circuit M&V energy reduction results from individual circuits. No M&V results older than five years will be used. To calculate GHG

reductions, each Company will use GHG emissions factors consistent with those used in the 2019-2021 Three-Year Energy Efficiency Plans for displaced GHG.

1.6.4 Calculation Approach

This metric will use the following data:

- Circuit level M&V estimated Energy Reduction;
- Circuit level hourly on/off VVO/CVR Status;
- Circuit level hourly energy; and
- GHG emissions factors consistent with those used in the 2019-2021 Three-Year Energy Efficiency Plans.

Each Company will accumulate all hours with active VVO/CVR and use the respective M&V energy reduction estimate, applied against the hourly demand. This will result in a single (GWhr) estimated energy reduction attributed to VVO/CVR for each Company, and, when combined with other companies, statewide.

CO_2 avoided due to VVO/CVR will be calculated by multiplying the above energy reduction by a typical generation emissions factor based upon metric tons per MWh.

$$CO_2\ Emissions(tons) = Energy\ Savings(MWh) \times CO_2\ Emissions\ Factor\left(tons/MWh\right)$$

The calculation will use the GHG emissions factors consistent with those used in the most recent version (currently 2019-2021) Three-Year Energy Efficiency Plans.

1.6.5 Organization of Results

Each Company will provide individual circuit VVO/CVR performance, GWhrs estimated energy reduction, as well as the summation of total system impact.

1.6.6 Baseline

The baseline for this metric will be reported in the first Annual Grid Modernization Report after the M&V is completed.

1.7 INCREASE IN SUBSTATIONS WITH DISTRIBUTION MANAGEMENT SYSTEM ("DMS") POWER FLOW AND CONTROL CAPABILITIES

1.7.1 Type

Statewide Performance Metric

1.7.2 Objective

This metric will demonstrate the progress in the m ADMS investment by tracking the substations that have been equipped with power flow capabilities as well as the number of

customers benefitting from the technology on each feeder. This metric will support the objective of optimizing system performance and more specifically improve asset utilization, improve reliability and integrate distributed energy resources. ADMS gives system operators increased visibility on the real time output of generating facilities. This metric is designed to demonstrate that the model is an accurate representation of field conditions.

1.7.3 Assumptions

A substation will be assumed to have DMS power flow capability when all feeders are modeled daily with no unwarranted voltage or capacity violations over a consecutive 30-day period.

1.7.4 Calculation Approach

This metric will track and report on the following:
From the time that a substation model is available on a daily basis, for each substation, number of voltage or capacity violations for a consecutive 30-day period, with explanation of any warranted voltage or capacity violations.

In addition, the Companies will report on the number of customers on each feeder benefitting from this technology.

1.7.5 Organization of Results

This information will be provided on an annual basis. Results will be based upon the results at the end of the calendar year.

1.7.6 Baseline

The baseline for this metric will start at zero since no feeders have been equipped with this technology. A chart with the total number of feeders installed each year along with a detailed report supporting the chart will be provided to support the tracking of this metric.

1.8 CONTROL FUNCTIONS IMPLEMENTED BY CIRCUIT (VVO, AUTO RECONFIGURATION)

1.8.1 Type

Statewide Performance Metric

1.8.2 Objective

This metric will show the progress in the ADMS investment by tracking the control functions implemented at the circuit level as well as the number of customers affected by the technology on each feeder. This metric will support the objective of optimizing system performance and more specifically minimize electrical losses and improve reliability.

1.8.3 Assumptions

A control function will be defined as the ability for the DMS to automatically issue command to field devices based on real time system condition, and a circuit will be included in this metric when all devices defined as "fully automated" can be automatically controlled.

1.8.4 Calculation Approach

This metric will track and report on the following:

- Circuits with control function implemented; and
- Type of control function implemented.

In addition, the Companies will report on the number of customers on each feeder affected by this technology.

1.8.5 Organization of Results

This information will be provided on an annual basis. Results will be based upon the results at the end of the calendar year.

1.8.6 Baseline

The baseline for this metric will start at zero since the specific control functions laid out as part of the Companies' respective GMPs have never been deployed. A table outlining the details behind the control functions implemented at the circuit level will be provided to support the tracking of this metric.

1.9 NUMBERS OF CUSTOMERS THAT BENEFIT FROM GMP FUNDED DISTRIBUTION AUTOMATION DEVICES

1.9.1 Type

Statewide Performance Metric

1.9.2 Objective

This metric will show the progress in the DA investment by tracking the numbers of customers that have benefitted from the installation of DA devices. This metric will support the objective of optimizing system performance and more specifically reduce the duration and number of customers impacted by outage events. These investments will also allow for a reduction in manual switching operations, reduce operations cost and potentially defer capital upgrades with enhanced flexibility to shift load.

1.9.3 Assumptions

A customer will benefit from DA when their automated zone size is reduced.

1.9.4 Calculation Approach

This metric will track and report on the following:

Circuit number; and
Number of customers impacted.

1.9.5 Organization of Results

This information will be provided on an annual basis. Results will be based upon the results at the end of the calendar year.

1.9.6 Baseline

The baseline for this metric will start at zero since this will be tracking only the customers that benefit from GMP investments. A table with the type of device, circuit number where installed and number of customers benefitted will be provided to support the tracking of this metric.

1.10 RELIABILITY-FOCUSED GRID MODERNIZATION INVESTMENTS' EFFECT ON OUTAGE DURATIONS

1.10.1 Type

Statewide Performance Metric

1.10.2 Objective

This metric will compare the experience of customers on GMP DA-enabled circuits as compared to the prior three-year average for the same circuit. This metric will provide insight into how DA can reduce the duration of outages.

1.10.3 Assumptions

Outages and their impact are typically situational in nature. The DA solutions must be capable of performing intended actions in under the one-minute threshold set by the Department. There may be circumstances where more complex FLISR schemes may take longer than one minute, but less than five, to properly locate, isolate and restore an impacted area safely. The circuit must have three years of System Average Interruption Duration Index ("SAIDI") history to be included in the metric. Additionally, numerous factors, such as a Company's tree trimming cycle, weather and vehicular accidents, can impact system reliability, regardless of a Company's grid modernization investments.

1.10.4 Calculation Approach

This metric will track and report on the following:

- Circuit level SAIDI for circuits that have DA enabled in the GMP plan year;
- Three-year average circuit level SAIDI covering the years 2015, 2016, and 2017; and
- Compare the current year circuit SAIDI with the three-year historic average SAIDI of the circuit.

AVERAGE ('CKAIDI 2015'+' CKAIDI 2016'+' CKAIDI 2017') - 'CKAIDI Year n' = if greater than 0, positive impact.

1.10.5 Organization of Results

This information will be provided on an annual basis. Results will be based upon the results at the end of the calendar year.

1.10.6 Baseline

The pre-investment baseline of a static three-year average circuit level SAIDI in 2015, 2016, and 2017 shall be provided for each feeder within the service territory. Additionally, the baseline shall be provided with and without Excludable Major Events[8] along with a summary of the main causes of outages on each feeder. The metric will use the circuit three-year SAIDI covering the years 2015-2017 average as the baseline. It will compare the SAIDI results of the plan year to the circuit's 2015-2017 three-year historic average.

1.11 RELIABILITY-FOCUSED GRID MODERNIZATION INVESTMENTS' EFFECT ON OUTAGE FREQUENCY

1.11.1 Type

Statewide Performance Metric

1.11.2 Objective

This metric will compare the experience of customers on DA-enabled circuits as compared to the prior three-year average for the same circuit. This metric will provide insight into how DA can reduce the frequency of outages.

1.11.3 Assumptions

Outages and their impact are typically situational in nature. The DA solutions must be capable of performing intended actions in under the one-minute threshold set by the Department. There may be circumstances where more complex FLISR schemes may take longer than one minute, but less than five, to properly locate, isolate and restore an impacted area safely. The circuit must have three years of System Average Interruption Frequency Index ("SAIFI") history to be included in the metric.

1.11.4 Calculation Approach

This metric will track and report on the following:

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[8] The Department has defined an "Excludable Major Event" as a major interruption event that meets one of the three following criteria: (1) the event is caused by earthquake, fire or storm of sufficient intensity to give rise to a state of emergency proclaimed by the Governor (as provided under the Massachusetts Civil Defense Act); (2) any other event that causes an unplanned interruption of service to fifteen percent or more of an Electric Company's total customers in its entire service territory; or (3) the event was a result of the failure of another company's transmission or power supply system. D.P.U. 12-120-D, §I.B (2015). An interruption event caused by extreme temperature condition is not an Excludable Major Event. Id.

- Circuit level SAIFI for circuits that have DA enabled in the GMP plan year;
- Three-year average circuit level SAIFI covering the years 2015, 2016, and 2017; and
- Compare the current year circuit SAIFI with the three-year historic average SAIFI of that circuit.

AVERAGE ('CKAIFI 2015'+' CKAIFI 2016'+' CKAIFI 2017') - 'CKAIFI Year n' = if greater than 0, positive impact.

1.11.5 Organization of Results

This information will be provided on an annual basis. Results will be based upon the results at the end of the calendar year.

1.11.6 Baseline

The pre-investment baseline of a static three-year average circuit level SAIFI in 2015, 2016, and 2017 shall be provided for each feeder within the service territory. Additionally, the baseline shall be provided with and without Excludable Major Events along with a summary of the main causes of outages on each feeder. The metric will use the circuit three-year SAIFI average covering the years 2015-2017 as the baseline for this metric. It will compare the SAIFI results of the GMP plan year to the circuit's 2015-2017 three-year historic average.

1.11.6 VVO RELATED VOLTAGE COMPLAINTS PERFORMANCE METRIC AND BASELINE

1.11.7 Type of Metric

Statewide Performance Metric

1.11.8 Objective

The primary focus of the VVO investments is to manage circuit voltages at a lower threshold while maintaining minimum voltage service requirements for all customers on a substation and circuit. Since VVO will be actively managing voltages, there is a desire to track and report on the potential for the introduction of VVO-related voltage complaints. While VVO is not an active solution in use by the Companies today in Massachusetts, there may be historical low voltage causes that exist outside of a customer's service connection and equipment. Certain voltage issues, such as those that are ultimately determined to have been caused by customer-owned equipment, will not be mitigated by the Companies' VVO investments. The Companies will measure the change in voltage complaints following deployment of VVO technology to determine the impact relative to a pre-deployment baseline.

1.11.9 Assumptions

Prior to the requirement to track and report on whether VVO investments could potentially contribute to customer voltage complaints, there was never a need for the Companies to track

customer voltage complaints in this manner. For instance, in some cases large commercial and industrial ("C&I") customers' voltage complaints were processed through their customer account executives and were not necessarily logged in the Companies' work management systems: thus, there is no data as to the cause of the voltage issue that gave rise to the complaint. While residential customer voltage complaints were logged in the respective systems, given that VVO is a new investment the Companies cannot reasonably associate these historical complaints as being caused or impacted by VVO investments. In an effort to develop a baseline for this metric, the Companies must manually review the available records to determine the cause and remedy of the voltage issue that led to the customer complaint.

Going forward, the Companies intend to specifically track customer voltage complaints to determine if VVO investments led to the voltage condition giving rise to the customer complaint. Eversource currently has a tracking and reporting process in its Western Massachusetts ("WMA") and Eastern Massachusetts ("EMA") service territory that enables it to capture and categorize the necessary data related to these voltage complaints. Eversource expanded this process into its Eastern Massachusetts ("EMA") service territory to ensure that all relevant data related to the impact of VVO investments on customer voltage complaints is tracked and reported. Unitil currently tracks customer voltage complaints in its Customer Information System ("CIS") and plans to revise the system coding to better capture the data necessary to determine if a voltage issue was impacted by VVO investments. National Grid is currently exploring system and process improvements and enhancements to ensure it is able to track the necessary data on these customer complaints.

Given the lack of consistent and comprehensive data as to whether a customer's voltage complaint was influenced by VVO investments, the Companies propose to utilize all customer voltage complaints received in 2015, 2016 and 2017 to develop the baseline for this performance metric. Additionally, since the compilation of the voltage complaints is a significant manual process, the Companies propose, for the 2018-2020 GMPs, to utilize the following circuits to establish the initial baseline for this performance metric.

Eversource – In its 2018-2020 GMP, Eversource will deploy VVO on circuits in WMA. As previously mentioned, there was a voltage complaint tracking system in WMA so Eversource will establish a baseline based on the information included in the WMA tracking system and report on the WMA performance. There are no VVO investments planned in EMA during 2018-2020. Eversource will incorporate EMA in its baseline, tracking and reporting process in 2021 for the next three-year GMP (2022-2024).

Unitil – Under its approved GMP, Unitil intends to install VVO investments on all of the circuits in its service territory. For this performance metric, Unitil proposes to utilize all of its circuits in establishing the baseline.

National Grid – National Grid proposes, as an initial baseline, to use the 16 feeders on which it intends to install VVO investments under its 2018-2021 GMP. National Grid is targeting larger circuits in its service territory, that serve approximately 1000 customers or more. National Grid will, following its development and implementation of system and process improvements and enhancements to track these customer complaints and the relevant data, incorporate the remainder of the circuits in its service territory into the baseline for this performance metric for the 2021-2023 GMP.

Eversource and National Grid propose to update the baseline for this metric with respect to the 2022-2024 GMPs to include all circuits within their respective service territories.

1.11.10 Calculation Approach

This metric will track and report on the following:

- Quantity of voltage complaints for the current year that are deemed caused by VVO voltage management by circuit for circuits that will have VVO installed.
- Three-year average of all voltage complaints by circuit covering the years 2015, 2016, and 2017.
- Compare the current year quantity of voltage complaints with the three-year historic average.

AVERAGE ('Voltage Complaints 2015'+ 'Voltage Complaints 2016' + 'Voltage Complaints 2017') = Voltage Complaint Baseline

1.11.11 Organization of Result

The baseline voltage complaints and the annual VVO-related voltage complaints (once VVO investments are active and enabled) will be provided on an annual basis for each circuit. Results will be based upon the results at the end of the calendar year. This will provide the Department an opportunity to assess the effectiveness of the VVO investments while minimizing the introduction of new customer impact.

1.11.12 Baseline

Utilizing the assumptions discussed above, the Companies will calculate the 2015 through 2017 baseline to use to measure process under this metric. Given the manual and time-consuming nature of the process to review and compile the customer complaint data, the Companies have determined that this process can be undertaken and completed by June 28, 2019 for incorporation into the Companies' respective 2018 Annual Grid Modernization Reports.

1.11.13 EVERSOURCE ADVANCED LOAD FLOW – PERCENT MILESTONE COMPLETION

1.11.14 Type of Metric

Eversource-specific Performance Metric

1.11.15 Objective

The metric is designed to demonstrate progress towards the final completion of a fully automated modelling tool. The metric will measure percent completion relative to a final deliverable of a fully automated load flow tool used by Eversource engineers and system operators to perform multi-circuit analysis for all non-network circuits.

1.11.16 Assumptions

Demonstration of progress will be measured by assessment of achieved functionality. Models and capabilities will continue to improve in functionality and accuracy with further refinements in a process of continuous improvement of modeling tools.

1.11.17 Calculation Approach

Under this metric, the percent completion will be determined based on the demonstrated progress with respect to the following milestone targets:

Static Analysis: Ability to analyze results at an individual circuit level - for new load, for Distributed Generation ("DG") pre-application screening, fault analysis, high/low voltage complaint investigations.

Semi-Automatic 1: Ability to run basic analysis in an automated process at an individual circuit level – for new load, DG pre-application screening, fault analysis, high/low voltage complaint investigations.

Semi-Automatic 2: Added capability to automatically run processes on groups of circuits – advanced DG impact studies, including contingencies and alternate source analysis.

Fully Automated: Capability to automatically run processes on all circuits, storing results in a database that can be used by engineering and operations, as well as for customer facing information tools like hosting capacity maps.

1.11.18 Organization of Results

Results will be organized by percent of feeders meeting each milestone target.

1.11.19 Baseline

The baseline is estimated at 40 percent of circuits meeting the Static Automation milestone and 10 percent of feeders meeting the Semi-Automatic 1 metric. Baseline for Static Automation 2 and Fully Automated are each 0 percent.

1.12 EVERSOURCE CUSTOMER OUTAGE METRIC

1.12.1 Objective

This metric is intended to measure progress in sectionalizing circuits into protective zones designed to limit outages to customers located within the zone. This metric will measure progress in achieving the grid modernization objective of reducing the impact of outages.

1.12.2 Assumptions

A protective zone is defined as the portion of a circuit or circuits that would be isolated by automated backbone devices that will operate automatically to minimize the number of customers affected in the event of an outage.

1.12.3 Calculation Approach

For each circuit and for the sum of circuits in EMA and WMA, the metric will track and report on the average zone size in terms of number of customers interconnected in each protective zone.

1.12.4 Organization of Results

This information will be provided on an annual basis. Results will be based upon the results at the end of the calendar year.

1.12.5 Baseline

The Company will provide the average zone size by circuit as of the end of 2017 as the baseline for this metric.

B. Lessons Learned/Challenges and Successes

Given that the reported performance metrics data is in the early stages, comparative analysis is not yet available to make a determination as to the efficacy of the GMP investments toward their objectives.

C. Hosting Capacity Analysis Update

The Advanced Load Flow ("ALF") component of the Eversource GMP, which is a key enabler of future detailed Hosting Capacity ("HC") maps, is proceeding on schedule, improving the automation capability to produce detailed distribution circuit models. This effort will enable

the creation of the HC maps as part of the Eversource 2021 GMP effort.[9] Creating those maps will involve some additional model improvement (to approach full automation capability), as well as the coding and automation within the load flow software and associated results database to produce the customer-facing maps.

In the meantime, Eversource has produced initial HC Maps, available via the Eversource website, providing a circuit level capacity value. This first step has not only provided some basic information to the public but has also given the Company some experience in HC map presentation options. Feedback from this tool will provide valuable input to the more detailed and robust maps to be developed in the next GMP.

[9] In D.P.U. 20-74, Eversource, given that it had met or exceeded most targets contained in its 2018-2020 GMP utilizing the budget authorization set out by the Department in D.P.U. 15-122, requested authorization for a budget extension of $56 million for the 2018-2021 GMP term. The Department approved this request, with modification, on February 4, 2021.

VII. Research, Design and Development

In D.P.U. 12-76-B, the Department directed the Distribution Companies, as part of their GMPs, to propose research, design and development ("RD&D") projects that focus on the testing, piloting, and deployment of new and emerging technologies to meet their grid modernization objectives. D.P.U. 12-76-B at 27-30. As part of its GMP, Eversource filed an RD&D proposal to undertake projects in the following areas: (1) sensing and monitoring; (2) advanced analytics; (3) real-time flexible action and dynamic integration of distributed energy resources; (4) impact of grid modernization technologies on low income customers; (5) pricing options; (6) customer engagement and behavioral response; and (7) microgrids. D.P.U. 15-122, at 44.

Ultimately, the Department did not approve the Company's proposed RD&D projects, nor did it approve the proposals filed by National Grid and Unitil. Id. at 185. The Department indicated that any future RD&D proposals incorporated into future GMPs would be reviewed consistent with the standards developed by the Department in light of RD&D proposals made in other contexts. Id. at 185, citing D.P.U. 17-05, at 457-460; NSTAR Electric Company and Western Massachusetts Electric Company, D.P.U. 16-178, at 26, 29-30 (2017); Fitchburg Gas and Electric Light Company, D.P.U. 16-184, at 11 (2017). In reaching its decision, the Department emphasized that any future RD&D proposals contained in future GMPs should be the result of collaboration between the Distribution Companies and other stakeholders. Id.

Consistent with the Department's decision in D.P.U. 15-122, the Company is not undertaking any RD&D efforts as part of its 2018-2021 GMP. The Company will, in developing any future RD&D proposals, collaborate with National Grid and Unitil, as well as relevant stakeholders, prior to filing any proposal with the Department for its review and approval.

VIII. Energy Storage

This Section discusses activity to date on Eversource's two battery energy storage ("BES") projects following the Department's final decision in the Company's rate case, DPU. 17-05.

A. Outer Cape BESS

1. Overview

The Outer Cape BES project will be constructed as a 24.9 MW / 38 MWh lithium-ion battery system, located on approximately 1.4 acres at the Provincetown transfer station on land leased from the Town of Provincetown.

The Outer Cape BES project's primary purpose is to provide backup power during outages on Line 96, a single, three-phase distribution line that serves as many as 11,000 customers from the Towns Wellfleet, Truro, North Truro, and Provincetown.

Line 96 starts at the Wellfleet substation and extends along Route 6, going east to Provincetown. Due to its proximity to harsh Atlantic winds and weather conditions, Line 96 has poor reliability statistics, making it an appropriate candidate for the BES project and the reliability improvements it is anticipated to provide to customers. Customers on Line 96 and all tapped circuits and low voltage stations in Wellfleet, Truro, and Provincetown have experienced over 137,756 customer outage hours over the last five years and an average of 27,551 per year from 2015-2019. Since the beginning of 2019, there have been two events on Line 96 for which the BES would have avoided a total of 14,600 sustained customer outages.

One solution to improve this significant reliability issue for the Company's customers on Line 96 would be to build a 13-mile redundant distribution line. This line would require construction through a substantial portion of the Cape Cod National Seashore, which would generate potential environmental impacts.

The Eversource engineering team identified this area as the target for a BES project and was confirmed by Eversource's expert consultant, Doosan, in its preliminary feasibility analysis. The Department approved the Company's BES project proposal in DPU. 17-05, with a projected cost of $40 million.

2. Design, Site Selection, and Outreach Activity

Based on the preliminary feasibility analysis, Eversource expected to construct the BES project in Wellfleet, Massachusetts. However, Eversource and its experts confirmed as part of the final feasibility analysis that siting the BES project as close to the tip of Provincetown as possible would be the optimal solution to maximize potential benefits for customers on the Outer Cape.

Eversource now estimates that, during times when loading is at lower levels (particularly in the non-summer months), the BES project could provide backup power for up to 10 hours. This duration would cover most outages. Eversource further estimates that, during summer peak loads,

the BES project will provide between 1.5 to 3 hours of backup power depending on the outage's precise location.

In late 2019, the Town of Provincetown (the "Town") select-board approved the Energy Services Agreement between Eversource and the Town of Provincetown, which outlined the agreement to lease 1.4 acres of Town-owned land at the Transfer Station and construct the BES.

In January 2020, Eversource continued to work closely with the Town to draft a Memorandum of Understanding (the "MOU"), a requirement of the Energy Services Agreement. The MOU outlines commitments Eversource made to the Town and requirements for the construction and operation of the BES. The MOU was executed in February 2020.

The Town continues to be a strong partner. In March 2020, Eversource notified the Town of plans to start construction and held a virtual pre-construction meeting with Town officials. Once construction began, Eversource continued extensive outreach with Town leadership and members of its various departments. The COVID-19 pandemic prohibited face-to-face meetings in the early part of the year; however, Eversource and municipal officials began meeting virtually every week to discuss the ongoing construction activities, coordination, and any concerns brought forward.

Outreach to abutting property owners was conducted throughout the year through regular project mailings, door-to-door outreach, email updates, and representatives available on-site during major construction activities to mitigate any issues that arose from work quickly.

3. Permitting

The Outer Cape BES project permitting process is substantially complete. Local permits were secured from the Provincetown Planning Board, Zoning Board, Select Board, and Conservation Commission. Permits or approvals were also secured from the Massachusetts Department of Transportation and the Massachusetts Department of Fisheries and Wildlife Natural Heritage & Endangered Species Program. Eversource has also secured a Landfill Post-Closure Minor Modification Permit from the Massachusetts Department of Environmental Protection.

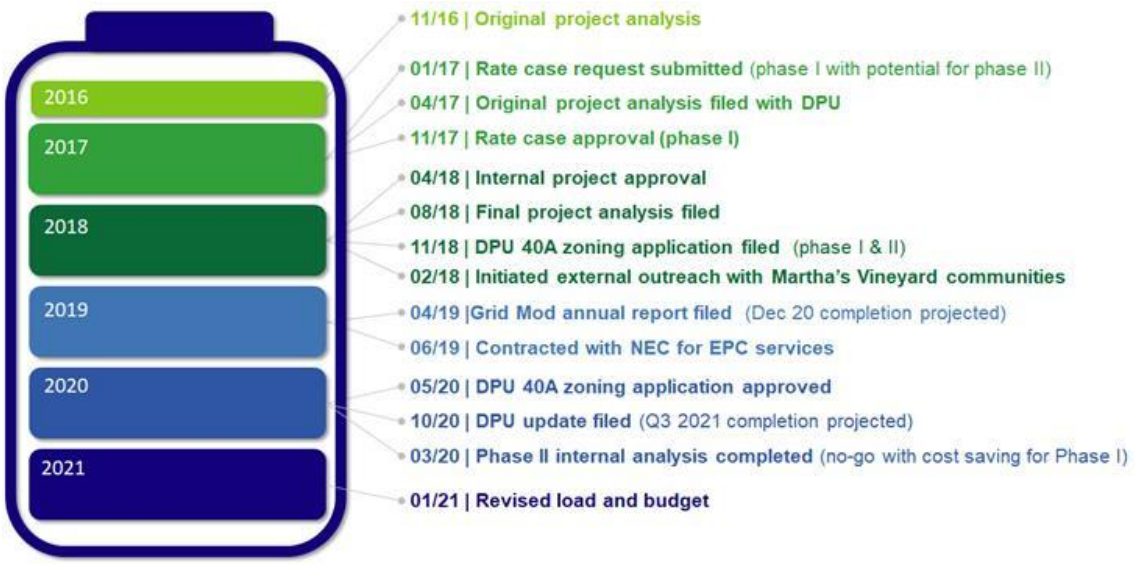
B. Martha's Vineyard BES (2018-2021)

1. Overview

On November 30, 2017, the Department authorized NSTAR Electric to undertake Phase 1 of the Martha's Vineyard BES project ("Phase 1" or "Project") consisting of a 4.9MW/20MWh Battery Energy Storage ("BES") system on Eversource-owned land at the Oak Bluffs Service Center located on Martha's Vineyard. Martha's Vineyard BES project's primary purpose was to significantly reduce reliance on five diesel-fired peaking generators on Martha's Vineyard that are used to supply power to the Island during high load conditions.

The Martha's Vineyard Phase 1 Project conceptual grade estimate was $15M. This estimate was based on a per-MWh cost projection prepared by a consulting company with experience on BES projects. At the time, the Company presented its case in DPU. 17-05, the $15M cost estimate represented the best approximation of the project cost available to Eversource (the Company). The project was presented to the Department as a demonstration project.

A high-level view of the project timeline is shown below.



Martha's Vineyard is served by four undersea cables that connect to the mainland at Falmouth. The year-round population on the Island is around 15,000 but increases to approximately 125,000 residents in the summer. Electric consumption surges on the Island in the summer, and the undersea cables become strained. When this happens, Eversource relies on five diesel-fired peaking units, providing approximately 12.5 MW of supplemental power. These units were constructed in the 1950s.

Eversource engineers identified Martha's Vineyard as a potential BES location to significantly reduce reliance on the diesel-fired peaking generators, as well as to enable the interconnection of additional solar photovoltaics ("PV") on the Island (see DPU 15-122, Eversource Response to DPU-ES-2-1). This recommendation was confirmed by Eversource's expert consultant, Doosan, through its preliminary feasibility analysis. The Department approved the Company's BES project proposal in DPU. 17-05, with a projected cost of $15 million.

Eversource contemplated the Martha's Vineyard BES project as having two phases. The first phase would reduce reliance on two of the five peaking units. The second phase of the BES project (constructing additional battery capacity) would be evaluated to reduce the reliance on all five peaking generators.

2. Design, Site Selection, and Outreach Activity

Following the issuance of the Department's final decision in DPU. 17-05 on November 30, 2017, Eversource and Doosan completed a final feasibility study for the project. This study confirmed that, in addition to the project's original goals, the BES project would help reduce the impact during an N-1 contingency condition on the Island, potentially deferring the construction of an additional undersea cable. The Eversource team also subsequently confirmed that the BES project could be used to shave yearly and monthly peaks when not needed to reduce reliance on the

peaking units, resulting in additional capacity and transmission Regional Network Savings ("RNS") savings.

In January 2018, Eversource commenced outreach to the Town of Oak Bluffs (the "Town") about the project, and specific work with the Town began in April 2018. Eversource advised its intent to construct the BES project on Company-owned land behind its Area Work Center in Oak Bluffs. This location met the Eversource siting criteria by (1) minimizing the visibility of the BES project for aesthetic purposes; (2) involving minimal sound impacts to surrounding properties from the BES project; (3) offering approximately one acre of space with limited or no environmental impact (i.e., no wetlands, rare species habitat); and (4) enabling an optimal electrical connection to the distribution system. The Town indicated the BES project would need to be constructed and housed in a building rather than a container solution to meet the Town's aesthetic requirements.

Eversource worked closely with the Town, meeting multiple times in person with Town select-board members, the Town Manager, the Fire Chief, Building Inspector, and the Planning Board. The Town provided feedback on the BES facility's height, roof pitch, fire safety, and other design details that Eversource could incorporate into an updated design of the BES project. Using this feedback, in late summer 2018, Eversource performed a permitting-level design for the BES (i.e., 30 percent engineering).

In 2020, Eversource continued to work collaboratively with the Town and held meetings with municipal officials and fire chiefs in Oak Bluffs, Tisbury, and Edgartown to discuss fire safety further and respond to questions about the BES design. As part of the permitting process, Eversource regularly communicated with and responded to several requests for information ("RFI") from the Martha's Vineyard Commission ("MVC") relative to fire safety design, environmental design, and anticipated operational practices. The Company anticipated continuing work to collaborate and communicate with local and regional officials and anticipated receiving all Town and local approvals for the project in early 2021.

3. Permitting

Eversource filed a Chapter 40A land-use permit with the Department in late November 2018. Before the filing, Eversource met multiple times with the Oak Bluffs Fire Chief and Building Inspector and incorporated their input into fire safety and other design aspects. Eversource also conducted abutter outreach and participated in a public hearing in Oak Bluffs.

Eversource and the Town continued to work together during the initial siting process. In May 2019, Eversource executed a Memorandum of Understanding ("MOU") with the Town where the Town will work collaboratively with Eversource to facilitate the progress of the BES project, and Eversource will make certain public health and safety, and environmental commitments to assist the Town.

In 2019, the Company was referred by the Oak Bluffs Planning Board to the Martha's Vineyard Commission ("MVC") as the BES project was defined as a Development of Regional Impact (DRI). An application was filed with the MVC in 2019, and an initial presentation was conducted in July 2019. Subsequently, further research was completed, and additional material was submitted to the MVC as part of that application.

In 2020, the Company continued to communicate and work with the MVC and public safety officials. This effort included multiple virtual meetings, extensive responses to requests for information from the MVC, incorporation of feedback from local public safety officials on all fire safety documents, as well as coordination with the MVC, its fire safety consultant, the Town of Oak Bluffs, the Oak Bluffs Water District and the local fire chiefs.

In April 2020, the Company received approval from the Department for its Chapter 40A petition filed in 2018. Final approval of the BES project by the MVC was anticipated in early 2021. In 2021, an emergency evacuation plan, environmental emergency response was submitted in October 2020 to support Eversource's DRI application (DRI 691), emergency evacuation, and environmental emergency response plans. Eversource addressed concerns from the Town of Oak Bluffs relative to the previously completed groundwater analysis and agreed to incorporate additional safety measures into the facility design, including (but not limited to) conducting additional geotechnical borings to collect additional data to inform a revised groundwater analysis, commitment to install a groundwater monitoring well, and incorporation of secondary containment for the power transformers located outside of the ESS building.

C. Competitive Procurement

In June 2020, Eversource received notification from NEC Energy Solutions, the EPC company, that they were exiting the energy storage business. Eversource, together with NEC, worked diligently to develop and execute a viable plan to ensure the Energy Storage Projects are successfully built and energized. The parties continue to meet regularly to keep communication lines open and ensure proper execution of the plan.

Since the last filing, the project team issued various miscellaneous engineering and equipment contracts to support both locations' ongoing work. This work was awarded to Suppliers based on a competitive bid that supports the entire Eversource service territory or a BES project-specific bid.

D. Lessons Learned/Challenges and Successes

Eversource is immersed in developing the BES projects and has developed a strong cross-functional team to develop these projects. Lessons learned to date include the following:

1. Safety

- Review the latest NFPA standards to ensure compliance and conduct a hazard analysis to establish the appropriate fire safety and other associated systems needed for the projects, continuously monitor for updates as implementation progresses.

The NFPA 855 fire code, a new standard for the Installation of Energy Storage Systems, was initially published on July 26, 2019, and a Tentative Interim Amendment was issued effective on April 21, 2020, that addressed the minimum water flow density and the requirements for UL9540A Installation level tests. This has been issued since the approval of these projects in DPU. 17-05, and the Company has had to incur additional costs to construct the BESS projects in compliance

with the new code requirements. Eversource has consulted with NEC Energy Solutions and industry experts to ensure the BESS projects will immediately disconnect from the grid in the event of any trouble warning and will be equipped with the leading BESS fire suppression equipment, including chemical suppression, water suppression, and ventilation systems. Engage local fire departments and first responders early to understand their information needs and desire for design review.

Eversource obtained information on a BESS fire at an Arizona Public Service (APS) facility on April 19, 2019. Eversource requested that its vendor give a complete fire safety analysis of the BESS design for both projects, incorporate lessons learned from Arizona and best practices more generally, and make any further adjustments needed.

Eversource did not receive a complete fire safety analysis of the BESS design for either project. However, the APS report states: "The ERP for the McMicken BESS did not have an extinguishing, ventilation, and entry procedure in the event of cascading thermal runaway that would produce significant flammable gases." The lessons learned from the APS incident include the following:

- Ultimately, there was a lack of information concerning the potentially explosive gas hazard created from unmitigated cascading thermal runaway through an entire battery rack throughout the commissioning process.

- This is demonstrated by the deficiencies in the Emergency Response Plan (ERP), which lacked procedures for extinguishing, ventilation, and entry of the BESS in the event of a cascading thermal runaway.

Eversource has planned for this in the following ways:

- **Becoming knowledgeable and informed:**

Eversource contracted with NEC Energy Solutions. A BESS supplier with an extensive array of BESS worldwide and in use on a variety of applications. NEC has a Battery Fire safety Specialist on staff. Eversource personnel has reviewed the latest NFPA standards for the Installation of Energy Storage Systems.

Eversource reached out to Duke Energy, a utility with extensive BESS within their system, for information on their best management practices for BESS planning, construction, and operation. Eversource personnel have thoroughly reviewed the final report from the APS incident – McMicken Battery Energy Storage System Event Technical Analysis and Recommendations; Issue: A, Status: Final Date: July 18, 2020 – for the express purpose of implementing the lessons learned from this incident.

- **Extinguishing:**

The batteries are controlled by AEROS, which monitors the health and activity of the batteries. If a fire or thermal runaway is detected, the system shuts down and disconnects from the grid. The batteries are wrapped in epoxy Novec sheets for fire prevention. A clean agent system is installed to prevent thermal runaway. A water spray system is installed to cool the batteries in the event of a thermal runaway

- **Ventilation:**

A ventilation system is installed to prevent the accumulation of explosive gases that result from battery decomposition from heat, H2, and CO from reaching 25% of their lower explosive limit, thus preventing explosions.

Note that NFPA855 requires BESS to have either an NFPA68 system or an NFPA69 system. The NFPA68 system includes deflagration vents. This system anticipates that there will be an explosion and deflects the force of the explosion up from whatever houses the batteries in a safe direction. The NFPA69 system monitors the atmosphere surrounding the batteries for explosive gases and activates the ventilation system at 25% of the Lower Explosive Limit. This is done to prevent an explosion. This is the system that Eversource selected for the Provincetown & MV BESS, as it prevents rather than controls explosions.

- **Entry Procedure:**

In the event of a fire, Eversource has determined the following:

a) There will be no attempted entry into the battery building or fire fighting attempts.

b) The installed systems will be allowed to react to the fire.

c) If the installed systems do not stop the fire, then the battery fire will burn itself out.

d) Fire Departments and other First Responders will be trained to **not** attempt any fire suppression activities.

e) Fire Departments and other First Responders will be trained to control the perimeter and protect any people or structures around the BESS. That will be their only responsibility.

Lastly, changing the battery manufacturer has implications for reviewing and approving fire safety standard operating procedures and can impact projects' timing. If possible, determine specific batteries used in the projects and don't change unless required for a specific purpose.

2. Municipal Support

Municipal support is a critical aspect of developing BES projects encompassing a variety of stakeholders. Municipal coordination is an iterative process that requires careful attention to inputs. The Company has worked diligently to balance stakeholder input with the core obligation to provide safe and reliable service through the BES projects. BES projects have to be situated at precise locations to have the beneficial impacts associated with installation. This means that the Company will need to have a flexibility level to make accommodations and adapt the conceptual design to incorporate requests by the hosting municipalities. Without this flexibility to work with, and incorporate input from, the municipalities, these projects will be difficult and challenging to install, rather than becoming easier to site. Detailed engineering and cost estimation can only be completed once there is an agreement with a municipality on location and facility for housing them, among other details.

3. Permitting

There are unique challenges to permitting and site development for new technology projects, particularly in Martha's Vineyard and Provincetown, where construction of large utility-scale projects on land adjacent to community land is not typical. Although the BES projects were welcomed in these communities, challenges regarding land use, adjacency to residents, natural resource constraints (such as a sole-source aquifer and rare species habitat) had to be surmounted to progress forward due to the relatively remote locations and geographical attributes.

4. Engineering & New Technologies

Eversource has identified that implementation of new technologies, including BES projects, must take into account requirements for complex engineering and design of new solutions such as islanding and advanced distribution automation schemes that require specialized technical input in areas such as protection and control and communications engineering, which will occur through the bid selection process for an engineering, design and construction vendor.

The Company has learned a great deal about sound issues connected to BES. With respect to sound, the batteries require HVAC systems that have some sound impact. To ensure the batteries will not be audible to the human ear from any surrounding residences or businesses, the Company has now developed plans to include sound walls and shrouds and to house some equipment within the battery building.

- Look at the down-grid impact of the BES on substations and other grid facilities to ensure the project's full scope and costs are captured, and there are no hidden impacts on the system for the BES to be implemented and operated successfully.

- If storage for a spare part is on-site, ensure adequate roadways for delivery vehicles, turnaround space, offloading space, and a means to offload and install (unless that equipment comes with the delivery vehicle). Ensure adequate roadways, turnaround area, and offloading space to deliver equipment and material for construction and maintenance—review site plan with logistics in mind.

There is a substantial cost differential associated with constructing an enclosed battery building facility versus a containerized solution. When specifying the system, select batteries in containers and not in buildings if possible. If needed, use dense and tall shrubs to hide the containers and other outdoor equipment.

- Start a model of interdependent systems and processes as early in engineering/design to avoid rework designs to avoid conflicts and inconsistencies later in the implementation process.

- Consider having the battery system provider coordinate the function of any and all fire protection systems upfront to maintain clear responsibility for the overall fire safety design in relation to the project.

5. Training & Development

Training for ES personnel (and external parties) should occur as soon as practical within the project schedule as possible. Numerous ES (and external parties) departments will receive training specific to their function and information needs. Training will include online as well as hands-on training on-site.

6. Procurement Strategy

Conduct analysis for contracting strategy full EPC including building and BES versus separate contracts for site preparation, battery facility (container or building), and the energy storage system. This can limit the contractors that have subcontractors on-site and improve site coordination.

7. Construction Management

Schedule logistics meetings on-site to review the delivery of major equipment or construction events.

When there are multiple contractors on-site, schedule weekly contractor meetings on Monday mornings to review the work going on, the subcontractors doing the work, any work hazards, the work's location, and power requirements needed.

E. Project Costs

Through December 31, 2020, the Company has expended approximately $3.2 million for the Martha's Vineyard BES project and approximately $17.7 million for the Outer Cape BES project. Additional details can be found in Appendix 1.

F. Performance on Implementation/Deployment

Please see sections (A) and (B) above.

G. Description of Benefits Realized from Implementation

Please see sections (A) and (B) above.

H. Key Milestones

Key milestones through commissioning are listed below. The Company anticipates that all construction milestone dates are at risk due to restrictions associated with the COVID-19 pandemic. Delivery dates for the battery system are also at risk given that NEC has issued multiple force majeure warnings regarding implication to contract execution due to the pandemic. As currently estimated, upcoming milestones are:

- Outer Cape permits are substantially complete as of March 2020 (updating the landfill operations and maintenance plan is a condition of the PCUP permit and is required to be submitted to DEP approximately 30 days prior to placing the facility in service).

- Construction on the Outer Cape Project began in March 2020.
- Complete civil and building construction, including battery installation of the Outer Cape BES project by June 2021.
- Commence operations of the Outer Cape BES project by September 2021.

I. Updated Projections for Remainder of 2021-2022 GMP

Project costs for the Outer Cape project are currently estimated at approximately $46 million relative to the initial, conceptual-level cost estimate of $40 million presented in DPU. 17-05. Upgrades necessitated the increase to the fire safety and explosion prevention requirements resulting from the siting and permitting process.

The Company is continuing to work through the challenges associated with the Martha's Vineyard project and is completing the Phase III feasibility assessment described in DPU. 17-05; the Company committed to a detailed, phased, technical and financial analysis of each project based on the costs and benefits of each project (Exhs. AG 32-2; DPU 57-7; Tr. 1, at 175-180; Tr. 10, at 3180-3183). Costs for the Martha's Vineyard project are currently estimated at $23.5 million compared to the conceptual-level cost estimate of $15 million, with the differential necessitated by permitting requirements and revised construction costs determined through the competitive bid process for the civil and building portion of the project.

IX. Massachusetts EV Make Ready Program

Introduction

As part of Eversource's proposed Electric Vehicle ("EV") Make Ready program (the "Make Ready Program" or "Program") that was approved by the Department of Public Utilities (the "Department") in D.P.U. 17-05, the Company developed a robust two-part evaluation plan. The first phase, to be completed after the first two years of program implementation, focuses on site host recruitment and operational lessons learned that could be incorporated into the program going forward. Phase 2 will be focused on the analysis of all data captured as a result of these deployments. The Company intends to include a thorough and inclusive analysis of charging station data as part of its Phase 2 evaluation efforts. In preparation for this work, Eversource has engaged with a data analytics vendor to begin aggregating, analyzing, synthesizing, and reporting on this data. Quarterly, data and analyses are being prepared, reviewed and improved on in an iterative process to ensure that a quality final analysis will be available for all stakeholders once the program has been fully deployed. A preliminary data report is explained in Section E and provided as Exhibit 2.

This document includes the following sections:

1) Program overview and summary of the work completed to-date;
2) Implementation metrics & site cost analysis;
3) Successes, challenges and lessons learned; and
4) Interim charging data analysis and findings.

A. Description of Work Completed

1. Background

On November 30, 2017, the Department approved the Company's proposal to spend up to $45 million over five years on the EV Program. D.P.U. 17-05, at 475-478, 501.

Consistent with the Department's findings and directives in D.P.U. 15-122 and D.P.U. 17-05, the Company is providing this report on the Make Ready Program's status and achievements, as well as the lessons learned from the Program in 2019. This Program update contains operational information including: the number of EV charging stations and sites deployed; site host enrollment; number of EV supply equipment tools installed; costs; and deployment in or adjacent to disadvantaged communities. The Company's progress report also provides information and ideas gathered from the Company's targeted outreach with various stakeholders and work with environmental justice ("EJ") communities and stakeholders.

As part of its proposal in D.P.U. 17-05, the Company proposed to track and report on six proposed performance metrics to evaluate the implementation and customer benefits of the Make Ready Program. D.P.U. 17-05, at 474. In D.P.U. 15-122, the Department noted that it would develop performance metrics for the Program through a separate EV metrics stakeholder process. D.P.U. 15-122, at 187. In the interest of providing the Department and stakeholders with a robust review of the Company's 2020 progress under the Make Ready Program, the Company is providing its

progress under the six proposed performance metrics first introduced in D.P.U. 17-05. The specific performance metrics include:

(1) total number of "make ready" sites developed;

(2) ten percent capital invested in direct charging ("DC") fast charging sites;

(3) ten percent capital invested in EJ communities;[10]

(4) utilization of EV charging stations separately for Level II chargers and DC fast chargers (measured in annual kWh per port);

(5) the percentage of Eversource residential customers within the range of an Eversource "make ready" site constructed as part of the EV program (i.e., percentage within 20-mile range and within 40-mile range); and

(6) available data on plug-in EV adoption and CO_2 emissions reductions.

2. Program Overview

Launched in 2018, the Make-Ready Program seeks to help accelerate EV charging infrastructure development within its service territory, encourage EV purchases, and contribute to greenhouse gas ("GHG") emissions reduction in the Commonwealth. The Program is designed to help meet the Commonwealth's goal contained in the Global Warming Solutions Act ("GWSA") and support the campaign of the EEA to encourage zero emissions vehicles ("ZEVs") via a commitment for 300,000 ZEVs registered in Massachusetts by 2025.

The Make-Ready Program's primary component is increased investment in long dwell-time EV charging make-ready infrastructure in public and workplace settings and at multi-unit dwellings ("MUDs"). Under the Program, Eversource invests in infrastructure beyond the meter up to the charging station, specifically for the service panel and the associated conduit and conductor necessary to connect each piece of equipment.

The Make-Ready Program was originally designed to run in two phases: Phase I extended from January 1, 2018 through December 31, 2019; and Phase II will extend from January 1, 2020 through December 31, 2022. Over the course of the program, Eversource planned to support the deployment of up to 72 DC fast charging ports at 36 charging sites, and up to 3,500 Level II charging ports at 400 charging sites, throughout its service territory in Massachusetts. Based on

[10] Generally, EJ communities are defined in terms of demographic and socioeconomic characteristics, with certain environmental policy implementation practices aimed at these communities because of race/ethnicity/class-based environmental inequities. The Department directed the Company to select EJ communities that meet two of the following three criteria established by the Massachusetts Executive Office of Energy and Environmental Affairs ("EEA") in Eastern Massachusetts and one of the following in Western Massachusetts: (1) 25 percent or more of the population in the communities must earn 65 percent or less than the Massachusetts median household income; (2) 25 percent of more of the population in the communities must identify as a race other than white; and (3) 25 percent of households lack a person over the age of 14 who speaks only English or speaks English very well.

customer demand for the Program, in 2019 Eversource accelerated implementation of the Make-Ready Program.

Eversource will support the deployment of EV charging ports by installing electrical equipment and components necessary to connect EV chargers to its distribution system. Eversource will install the "Eversource-side Infrastructure," and contract with third-party electrical contractors to install behind the meter "Participant-side Infrastructure." Specifically, the EV infrastructure that Eversource is proposing to install and own includes the following: (1) distribution primary lateral service feed; (2) necessary transformer and transformer pad; (3) new service meter; (4) new service panel; and (5) associated conduit and conductor necessary to connect each piece of equipment.

3. Vendor Prequalification

In the Spring of 2018, Eversource issued a Request for Information / Proposal to begin the process to pre-qualify vendors to participate in the Make-Ready program. This process was undertaken to give EV charging station manufacturers, network integrators, and installers the opportunity to have their equipment and services pre-authorized for inclusion in the Program. Recognizing that new technologies and new vendors may emerge over the duration of the program, Eversource issued a subsequent Request for Proposal in April 2019, to further deepen its bench of partners. A complete listing of these vendors can be found on the program website: https://www.eversource.com/content/ema-c/residential/save-money-energy/explore-alternatives/electric-vehicles/charging-stations/preferred-vendor-list

Being selected indicates that Eversource has reviewed and approved the equipment and services and verified that they meet its specifications and standards, and that the vendors have signed Eversource qualification agreement terms and conditions. Site hosts are welcome to use equipment, installers, or network integrators not selected by Eversource for pre-approval, if those vendors agree to Eversource qualification agreement terms and conditions.

4. Contractor Qualification

Under the program, Eversource uses third-party electrical contractors for the installation of the "behind the meter" infrastructure. This infrastructure primarily includes the new service panel and enclosure and associated conduit and conductor necessary to connect each piece of equipment.

Eversource chose to use electrical contractors with proven track records already approved by the Company to work on Eversource Energy Efficiency programs. Those contractors include (but are not necessarily limited to):

- Maverick Construction Corporation (Boston, MA)
- J.&M. Brown Company, Inc. (Jamaica Plain, MA)
- Horizon Energy (Taunton, MA)

In 2019, a fourth contractor was added through a response to a Company issued RFP:

- Volta (Boston, MA)

5. Stakeholder Outreach

Throughout the program thus far, Eversource has presented updates and solicited continual program feedback from multiple stakeholders in the Make-Ready Program. Specifically, the Company met with the Massachusetts Department of Energy Resources ("DOER"); EEA; Department of Transportation; Massachusetts Bay Transportation Authority; Massachusetts Department of Environmental Protection; Environmental Business Council of New England; Sierra Club of Massachusetts; Union of Concerned Scientists; Natural Resources Defense Council; Acadia Center; the Zero Emission Vehicle Commission; Georgetown Climate Center, Green Energy Consumers Alliance; National Grid; Electrify America; Plug-In America; Nissan; General Motors; Tesla; multiple charging station vendors; multiple towns and municipalities in Massachusetts.

In addition to meeting with the various stakeholders identified above, Eversource presented at various forums to help its sight host recruitment and general raise awareness efforts. The Company attended and spoke at quarterly meetings hosted by the Advanced Energy Group to provide regular updates on program status and recent activities, and to solicit and incorporate feedback from the public.

Finally, Eversource maintained close coordination with National Grid through quarterly meetings to share lessons learned and discuss opportunities to collaborate jointly on the deployment of the companies separate yet similar EV programs.

Common themes from stakeholders included general support for the infrastructure program, a need for general market awareness, confirmation of the barriers to DC fast charging implementation, and suggestions regarding the application and legal agreements.

B. Implementation Metrics

1. Program Metrics

The following tables provide information on EV Make-Ready charging station projects as of December 31, 2020:

a. Station Profiles

	Level 2			DC Fast Charger			Total		
	2018	2019	2020	2018	2019	2020	2018	2019	2020
Charging Ports Installed	62	386	866	0	0	0	62	386	866
Charging ports Enabled	85	893	1,624	0	0	0	85	893	1,624
Avg. # Ports Installed Per Site	5	3	5	n/a	n/a	n/a	5	3	5

Public Sites	8	65	69	0	0	0	8	65	69
Workplace Sites	4	41	72	0	0	0	4	41	72
Multi-Unit Dwelling Sites	0	6	40	0	0	0	0	6	40
Environmental Justice Sites	2	23	31	0	0	0	2	23	31
Annual kWh/port*	n/a	1,976	1,624	n/a	n/a	n/a	n/a	1,976	1,624

*Annual kWh/port is a measure of the kWh consumption of all charging ports installed in the previous years, and therefore contain at least a full year of data. Charging ports installed in each respective year were not included in that year's calculation.

b. Station Locations

	Level 2			DC Fast Charger			Total		
	2018	2019	2020	2018	2019	2020	2018	2019	2020
Metro Boston	9	67	116	0	0	0	9	67	116
South Coast	1	7	7	0	0	0	1	7	7
Cape & Martha's Vineyard	0	12	18	0	0	0	0	12	18
Western MA	2	26	40	0	0	0	2	26	40
% of residential customers	100%	100%	100%	n/a	n/a	n/a	100%	100%	100%

*Please note that historical charging ports installed and charging ports enabled figures differ slightly from those included in the Company's previous annual reports. This discrepancy can be attributed to improvements in data reporting and charging station verification procedures that have been implemented over the past year.

c. Map

A map of all Electric Vehicle charging stations that have been installed through the Make Ready program as of December 31, 2020 can be found by accessing the following link:

https://www.google.com/maps/d/edit?mid=170fhDsYDOd5IEIh29T7BcJQ5NJOvn_mt&usp=sharing

d. Environmental

Operating under the assumption that each charging port installed incentivizes the adoption of six incremental electric vehicles[11], the first three years of the Make Ready Program enabled 7,884 EVs (372 in 2018, 2,316 in 2019 and 5,196 in 2020), equating to an annual CO2 reduction of 27,594 MT; 1,302 MT in 2018, 8,106 MT in 2019 and 18,186 MT in 2020.

C. Lessons Learned/Challenges and Successes:

The first three years of Make Ready Program implementation have provided numerous opportunities to learn and adjust processes to manage towards optimization. Lessons learned related to operational execution, site host recruitment and market segmentation have been gleaned and the Company has taken action to course-correct as appropriate.

1. Operational Execution

a. Timelier Legal Agreements

To participate in the program and complete installation of charging station infrastructure, a customer must execute several documents. These include a Site Host Agreement, agreeing to the terms and conditions of participation in the Program, and an Easement granting permission to Eversource for construction and maintenance of the infrastructure that leads to the charging station. These documents can be long lead time items, leading to a delay in infrastructure deployment.
Eversource has taken steps to minimize delays from execution of these legal agreements to help ensure the timely installation of infrastructure. First, the Site Host Agreement is introduced to customers as one of the first steps in the enrollment process. Second, Eversource introduced a Site License Agreement, which grants the Company permission from the Site Host to access the site and perform the work of installing the charging infrastructure until a permanent easement for the facilities at the site is granted. Both steps have helped to reduce the time it takes for legal documents to be executed and facilitated timelier infrastructure deployment.

b. Modifying Use Cases based on Costs to Scale

The Make-Ready Program was designed to help customers avoid future costs of expansion while enabling future charging expectations. As originally envisioned, Eversource offered two primary level 2 charging station deployment use cases: 1) “Up to five ports” – if customers requested two to five ports, the infrastructure would be put in place to support up to five single, or two dual and one single port stations; and 2) “Ten ports” – if customers requested six or more charging ports, the infrastructure would be put in place to support up to ten potential ports.
As Eversource examined the actual implementation costs of both use cases, the Company determined that the cost to deploy the infrastructure to support 10 ports was only marginally more expensive than the cost to support five ports. Additionally, consolidating to a single level 2 use case allows the Company to standardize electrical infrastructure equipment an enable procurement efficiencies. Going forward, Eversource, where possible, will put in place the infrastructure to

[11] Workplace Charging Challenge, U.S. Department of Energy, https://www.energy.gov/sites/prod/files/2017/01/f34/WPCC_2016%20Annual%20Progress%20Report.pdf

support 10 charging ports, with the expectation that customers will install additional charging stations as the market continues to develop.

c. Initial Ports Installed Per Site

Though Eversource has installed the infrastructure to support 10 charging ports at the majority of sites where feasible, the average number of ports installed in 2020 was 5 per site.

d. Need for Additional Electrical Contractors

Upon the program's inception in 2018, Eversource contracted with three vendors to install the behind the meter electrical infrastructure. While these contractors were instrumental in helping to get the program off the ground, it was determined that more partners will be needed to scale program implementation to the level anticipated in Phase 2. The project team issued a subsequent RFP in 2019 to establish a wider network of electrical contractors throughout the Commonwealth. On February 14th, 2019, Eversource issued an RFP to electrical contractors and EV charging network vendors. In total, 33 vendors were invited to participate in this RFP, and 22 vendors provided a formal response. Eversource ultimately contracted with 15 partners, including one electrical contractor.

e. Standardization

Owning and operating infrastructure on the customer side of the meter also provided an opportunity (and necessity) to standardize where possible the physical components, both to reduce costs through the ability to scale and to maximize deployment efficiency through the ability to order and inventory necessary equipment. Specifications were standardized for the EV Supply Cabinet (electrical panel), and Eversource contracted with Merrimac to design and construct the panels for this program.

Also, to the extent possible, site design and engineering has been standardized to provide consistent station configurations across the infrastructure that Eversource owns as part of the Make-Ready program.

f. Building Channel and Supply Chain in the Northeast

To efficiently deploy the number of charging stations demanded by the program, Eversource needed to significantly grow the EV Infrastructure vendor channel in Massachusetts. The two RFPs were used to create a pre-qualified bench of contractors, vendors, installers and manufacturers for the program. In 2019 and 2020, Eversource also conducted various vendor workshops with charging station manufacturers and electric distributors, designed to educate them on the program, Eversource standards and processes, and the local market conditions and value propositions.
Eversource has been in regular weekly conferences with charging station vendors to coordinate sales and installation support and optimize pipeline management.

g. Every Site is Unique

Understanding that every deployment is different and brings its own unique challenges has been a key learning in the first three years of program implementation. From both a scheduling and cost standpoint, site-specific characteristics can make it difficult to determine an "average" or expected timeline and budget early in the project.

Permitting processes can be very different from one site to the next. Each town or municipality has its own permitting requirements and associated timelines and waiting on the necessary approvals to begin construction work has the potential to delay a project. Additionally, Eversource must also obtain the necessary rights to do work on customer property, and the execution of these legal agreements typically takes a substantial amount of time. Both of these elements are key inputs into the development of an electrification schedule.

The high standard deviation of costs across all of the sites that have been completed to-date can be tied back to a number of factors: distance from utility electrical supply to the charging stations, topography of the land being trenched, availability of capacity at the site transformer, and potential upgrades needed to enable charger electrification all result in some sites being relatively cheap and others being rather expensive to construct. Being diligent in upfront engineering and design work is key to limiting surprises and unexpected cost adders during the construction process.

2. Site Host Recruitment

a. Site Host Marketing

The Company's site host recruitment efforts revealed that customers are in various places on their education – some being very advanced and knowledgeable about EVs and EV charging, some just hearing about it for the first time, and every place in between.

Marketing the Make-Ready program to potential site hosts is a high touch sales effort supported by tailored marketing content. Eversource created coordinated Print, Social Media, and Mailing campaigns to appropriate Commercial & Industrial ("C&I") customers, and multi-unit dwelling property owners. The Company also conducted targeted outreach to various sectors, including EJ Community site hosts.

The Company developed a customer package and roadmap to completion of sites, including the Intake application, Site Host Agreements, License / Easement agreement, and Marketing pieces targeted to the facility.

Eversource also hosted a series of ride and drive events (funded outside the Make-Ready program) at various site host locations in both 2018 and 2019.

Early in the Program it became clear that customer education and stakeholder engagement would be imperative for program success. Beginning in 2019, and thru 2020, the Company worked with Advanced Energy Boston to convene quarterly stakeholder events to solicit customer and community stakeholder feedback.

b. Equipment Incentives

Besides the ongoing operational costs, the primary cost for customers participating in the Make-Ready program is the purchase of EVSE – the charging stations themselves.

Rebates or incentives are helpful in defraying or eliminating the cost of the EVSE to the site host and eliminating barriers to participation in the program. The two primary sources of EVSE incentive have been 1) rebates on level 2 chargers to qualified site hosts in EJ Communities, and 2) level 2 charger incentives from the Mass EVIP program.

The Mass EVIP incentives have been very helpful, particularly to municipal customers, in encouraging them to apply and participate in the Make-Ready Program. The two programs are naturally complimentary. There can be timing issues, where customers wait to learn if they have been awarded Mass EVIP grants before committing to participate in the Make-Ready program. This has the potential, if not well coordinated, to slow down the deployment process of the Make Ready Program.

c. Understanding Operational Issues

Part of customer site host education is making sure customers understand the bill impacts of hosting EV charging stations. The electric bill is the largest ongoing operational cost of being an EV charging station host. Customers have looked to Eversource to help understand what to expect given various demand scenarios. Eversource has taken on a consultative role, describing different utilization scenarios and their impact. Customers have also looked to Eversource to understand the impact of what pricing levels might have on demand, and on their overall charging operations. The Company has provided guidance on strategies to increase utilization and manage demand.

d. Customer Interest Exceeded Expectations

Eversource's site host recruitment efforts to date have been very successful for Level 2 charging. In 2018 the Company received 150 applications and signed site agreements with 55 customers. In 2019 the Company received over 450 applications and signed site agreements with 219 customers.

In 2020 the Company received over 100 applications and signed site agreements with 127 customers. The significant interest from customers in hosting EV charging stations has led to a very healthy backlog, resulting in the original $45 million preauthorization becoming fully subscribed in 2020.

e. Customer Appetite for Larger Deployments

Several customers have expressed interest in hosting more than the 10 charging ports that the current program design allows. In some cases, there is an appetite for the deployment of 30 or more charging ports to be electrified at one location. While the Program was initially designed with the intention to spread customer dollars across as many sites as possible, having the flexibility to selectively choose exceptions where a greater number of chargers makes sense and helps to accelerate EV adoption is beneficial to advancing the Commonwealth's goals.

3. Market Segmentation

a. Multi-Unit Dwellings

Eversource's site host recruitment efforts have confirmed the experience of many other utilities that have implemented EV infrastructure programs – multi-unit dwellings are a challenging use case. Parking spaces in multi-unit dwellings tend to be a scarce resource and often building owners do not yet see EV charging as an amenity by which to increase property value and attract tenants. There are also logistical hurdles, such as payment, scheduling parking, and monitoring use. The Company was able to electrify 6 multi-use dwelling sites in 2019 and 40 in 2020.

b. Customer Owned Distribution Networks

One of the requirements for participation in the Program is that the charging station site must be separately metered, and therefore must be wired directly to Eversource equipment. Several customers who own their own distribution network behind the meter, including universities, airports, and other large campus customers, are not eligible for participation. Many customers who were initially flagged as good targets based on parking characteristics (large, publicly accessible, long dwell-time, highly utilized), were ineligible.

c. Low-Moderate Income (Environmental Justice) Communities

In the first three years of the program, the Company was successful in meeting its target of 10 percent of capital deployed at installations in EJ Communities. Of the 305 stations electrified in the first three years, 56 were in EJCs, accounting for approximately 20 percent of total Make Ready Program investment. Of the 56 sites installed in EJC's, 2 were deployed in 2018, 23 were installed in 2019 and the remaining 31 were electrified in 2020.

The Company actively participates in cross-jurisdictional internal groups with its affiliates and other utilities and collaborates with stakeholders representing disadvantaged and low-income communities.

It is too early to evaluate the impact on actual EV adoption in these communities, or the direct benefit of EV charging there. The Company anticipates being able to conduct this analysis by the end of the program implementation in its final report.

d. DC Fast Chargers

Eversource's site host recruitment efforts for DC fast chargers have not been successful.

Eversource did have a strategy to recruit site hosts for this type of deployment. The Company targeted locations that meet a specified set of criteria to support electrification of main travel corridors. Selection of locations included: peak traffic areas, ensuring gap coverage between service territories, a 40-mile max distance to next station, more stations in higher traffic areas and off-exit deployment to enable easy access. The Company met with MA DOT and other stakeholders to try and identify appropriate sites.

The Company concluded that there are two primary barriers to customers willing to be site hosts for DC fast chargers: 1) the high upfront cost of the hardware/software; and 2) high anticipated operating costs.

DC Fast Chargers can cost between $35,000 and $50,000 for a 50kW charger and up to $150,000 for a 150kW charger. Compared to the average $3,500 per port for Level 2 chargers, the upfront cost of purchasing a DC Fast Charger is significant. Massachusetts, through Appendix D of the Volkswagen Settlement, has allocated more than $11 million to EV charging infrastructure. This provides a good opportunity to leverage non-taxpayer, non-ratepayer funds to help advance the deployment of this much needed infrastructure. Eversource will work together with the Massachusetts Department of Environmental Protection ("DEP") to better understand plans for the remaining VW funding and explore ways to synergize between the two programs.

Operating expenses, particularly related to the bill impacts associated with powering DC fast chargers, are an additional concern for potential charging station site hosts. Demand charges for these installations can be significant, in some cases accounting for 80 percent of the monthly electric bill. The operating profile of these assets, resulting from the combination of higher power and lower utilization, has resulted in several customers that initially expressed an interest in deploying this equipment at their facilities being hesitant to move forward. Eversource continues to explore potential rate solutions that could be tailored to the unique load curve of DC fast chargers.

e. Barriers to Adoption

As part of the original proposal, Eversource identified several barriers to EV adoption including the upfront cost of EVs, lack of available charging infrastructure and EV range. Recent market studies continue to affirm the same barriers to EV adoption exist today.[12]

f. COVID-19 Impacts

The Company has collected data to analyze potential impacts of EV charging on the electric distribution grid, however this data collected to-date is not yet sufficient to perform such analysis. COVID-19 has had unforeseen impacts on consumer behavior, including electric vehicle purchasing, driving and charging behavior in 2020, which are still evolving. Nationally, the trends from large charging station network operators have shown a significant decline in utilization. In April 2020, EVgo, one of the country's largest charging networks, reported the amount of time that customers are using its stations has dropped by more than half. And Electrify America, the Volkswagen AG subsidiary that runs the nation's largest network of public chargers, reported a 60 percent decline in utilization rates. In May 2020, Tesla reported a 70 percent drop in utilization in North America. Similar trends are happening locally on the stations installed as part of the Company's Make-Ready program. Despite more stations continuing to be installed by the Company's Make Ready program throughout 2020, in October, the total average daily kWh used

[12] https://www.greencarreports.com/news/1121698_poll-suggests-more-americans-might-buy-an-ev-if-only-they-had-a-place-to-charge

across the installed chargers is still only approximately 66 percent of the average from January – March of 2020. Planning horizon for EV impacts are closer to 10 years than one. While overall public EV charging load may be reduced this year, the Company is continuing to deploy EV infrastructure in line with the Commonwealth's long-term goals. The Company does not anticipate that the trends and impacts of 2020 will be long lasting or permanent. The Company anticipates charging behavior will return to normal behavior levels at some point in 2022. Because of the current year impacts however, the data collected on charging stations in 2020 may not be useful to drawing conclusions in a business-as-usual scenario.

D. Actual v. Planned Implementation and Spending:

1. Phase 1 Milestones Achieved

January 2018: Project and Construction leads assigned to Eversource implementation team

March 2018: Presented DC Fast Charger Deployment Plan to EEA/DOER/DOT

April 2018: Request for Information / Proposals issued to qualify EV charging station vendors

April 2018: Site host recruitment efforts initiated

May 2018: Site host agreement / license forms finalized

June 2018: Pre-qualified vendors selected

June 2018: Third-party electrical contractors selected

July 2018: First site host contract executed

October 2018: First charging station site electrified

December 2018: Launched web-site: https://www.eversource.com/content/ema-c/residential/save-money-energy/explore-alternatives/electric-vehicles

April 2019: Additional charging station vendors qualified through subsequent Request for Proposal

June 2019: Finalized development of standardized panel enclosure

September 2019: Received 500th customer intake application

December 2019: Electrified 1st Multi-Unit Dwelling

December 2019: Electrified 100th customer site

July 2020: Requested additional $10 million in preauthorized funding from the Department to continue program spending through 2021. The Department approved this request in February 2021.

October 2020: 400th contract signed; program fully subscribed

December 2020: Electrified 300th customer site

The Company's actual and planned spending data can be found within Section IV.

Description and Report on Each Infrastructure Metric as well as within the 2020 Annual Report Appendix 1.

E. Performance on Implementation/Deployment:

Exhibit 1 summarizes the investments in the 305 charging station sites placed in service in the first three years of the Make Ready Program.

F. Description of Benefits Realized from Implementation:

As detailed in Section B (Implementation Metrics), the deployment of the 305 charging station sites with 1,314 installed ports in the first three years of the program supports 7,884 incremental EVs on the road, resulting in an annualized CO2e reduction of 27,594 MT.

G. Summary of Interval Charging Data:

As indicated in Eversource's Make Ready Program filing in D.P.U. 17-05, the Company intends to include a thorough and inclusive analysis of charging station data as part of its Phase 2 evaluation efforts. In preparation for this work, Eversource has engaged with a data analytics vendor to begin aggregating, analyzing, synthesizing, and reporting on this data. Quarterly, data and analyses are being prepared, reviewed and improved on in an iterative process to ensure that a quality final analysis will be available for all stakeholders once the program has been fully deployed.

Attached as Exhibit 2 is a report ("Eversource Massachusetts Electric Vehicle Infrastructure Program Charging Station Analysis Report 2020") that captures data for 807 of the 1,314 ports that have been installed through December 31, 2020. Data for the remaining 507 ports exists, however Eversource is still working on establishing the necessary protocols with charging station manufacturers to gain visibility to this information. This has been a key learning from the first three years of program implementation and the goal is to refine the process to continue to improve the efficiency and speed of data access moving forward.

Some of the preliminary conclusions include but are not limited to:

- Driving and parking behaviors as a result of COVID-19 resulted in lower station usage and made analysis of station usage data challenging for 2020.

- In general, the conclusions drawn in the Company's 2019 Annual Report and highlighted below still appear valid:

a. Stations at Business Offices experience some longer plug-in times (workday durations of 8-10 hours) than other venues, although stations a Leisure Destinations had some long durations. At all venues, most charging is completed after 4 hours.

b. A large portion of charging events at Business Offices start earlier in the day, around 7-9 am, most likely when employees arrive for work. Stations at other locations also have many charging events starting during the morning hours, but show flatter distributions, indicating charging events starting throughout the day. Charging events at Multi-unit Dwellings also appear to mostly start at the beginning of the day.

c. Weekday peak is during the late morning hours, whereas the weekend has a less defined peak with high periods around mid-day.

d. The total number of unique users at Program charging stations has consistently increased over time.

e. Each market segment appears to have unique load curves.

H. 2021 Implementation Plans

The Company expects that site electrification efforts to-date will result in utilizing the preauthorized $45 million investment by mid-2021, delivering on the customer benefits ahead of schedule. To maintain momentum that has been established to-date, and to continue to help the Commonwealth achieve its stated EV adoption and GHG emissions reduction objectives, additional preauthorized funding is necessary to avoid program interruptions. Therefore, the Company requested an additional $10 million preauthorization in July 2020, which was subsequently approved by the Department in February 2021. D.P.U. 20-74, at 40. These additional preauthorized funds will support the deployment of up to an additional 100 EV charging sites through the end of 2021.

As part of its next Grid Modernization filing in July 2021, Eversource expects to include additional investments in Transportation Electrification. This follow-on program will build on the success of current deployment activities, with some new components incorporated to leverage lessons learned and market evolution.

Table S2-1
Grid Modernization - Total Deployment Plan (Units)

Investment Areas and Preauthorized Device Types	Commissioned Units			
	2018-2020 Actual	2018-2020 Plan	2018-2020 Variance (Units)	2018-2020 Percent (%)
Monitoring & Control (SCADA)	**435**	**430**	**5**	**101%**
Microprocessor Relay	180	193	(13)	93%
4kV Circuit Breaker SCADA	54	55	(1)	98%
Recloser SCADA	59	37	22	159%
Padmount Switch SCADA	59	62	(3)	95%
Network Protector SCADA	83	83	-	100%
Power Quality Monitors	-	-	-	N/A
Distribution Automation	**451**	**448**	**3**	**101%**
OH DA	243	220	23	110%
OH DA w/Ties	53	45	8	118%
4kV Oil Switch Replacement	137	105	32	130%
4kV AR Loop	18	78	(60)	23%
Volt-Var Optimization	**577**	**367**	**210**	**157%**
VVO - Regulators	96	96	-	100%
VVO - Capacitor Banks	74	74	-	100%
VVO - LTC Controls	8	8	-	100%
VVO - Line Sensors	189	189	-	100%
VVO - IT Work	N/A	N/A	N/A	N/A
Microcapacitors	99	-	99	N/A
Grid Monitoring Line Sensors	111	-	111	N/A
Advanced Distribution Management System (ADMS)	**N/A**	**N/A**	**N/A**	**N/A**
Communications	**8**	**10**	**(2)**	**80%**
Numbers of Nodes	8	10	(2)	80%
Miles of Fiber	-	-	-	N/A
Electric Vehicles	**N/A**	**N/A**	**N/A**	**N/A**
Energy Storage	**N/A**	**N/A**	**N/A**	**N/A**
Total Units	**1,471**	**1,255**	**216**	**117%**

Table S2-2
Grid Modernization - Total Deployment Plan (Cost)

Investment Areas and Preauthorized Device Types	Capital Spend (in thousands $)			
	2018-2020 Actual	2018-2020 Plan	2018-2020 Variance ($)	2018-2020 Percent (%)
Monitoring & Control (SCADA)	**52,063**	**49,790**	**2,272**	**105%**
Microprocessor Relay	30,091	33,116	(3,025)	91%
4kV Circuit Breaker SCADA	15,932	11,152	4,780	143%
Recloser SCADA	3,386	2,527	859	134%
Padmount Switch SCADA	1,007	991	16	102%
Network Protector SCADA	1,431	2,003	(572)	71%
Power Quality Monitors	215	-	215	N/A
Distribution Automation	**46,893**	**48,644**	**(1,751)**	**96%**
OH DA	18,176	18,522	(347)	98%
OH DA w/Ties	3,253	4,518	(1,265)	72%
4kV Oil Switch Replacement	24,003	21,313	2,690	113%
4kV AR Loop	1,461	4,291	(2,830)	34%
Volt-Var Optimization	**12,933**	**12,350**	**584**	**105%**
VVO - Regulators	4,007	2,995	1,012	134%
VVO - Capacitor Banks	2,860	2,549	311	112%
VVO - LTC Controls	1,452	1,422	30	102%
VVO - Line Sensors	1,235	679	556	182%
VVO - IT Work	2,629	4,705	(2,076)	56%
Microcapacitors	751	-	751	N/A
Grid Monitoring Line Sensors	-	-	-	N/A
Advanced Distribution Management System (ADMS)	**8,809**	**11,883**	**(3,074)**	**74%**
Advanced Load Flow	8,809	11,878	(3,069)	74%
GIS Verification (Expense)	-	-	-	N/A
Dist. Management System	-	5	(5)	0%
Forecasting Tool	-	-	-	N/A
Synergi Upgrades	-	-	-	N/A
PI Asset Framework	-	-	-	N/A
Communications	**2,194**	**2,268**	**(74)**	**97%**
Numbers of Nodes	1,628	1,958	(330)	83%
Miles of Fiber	566	310	256	182%
Electric Vehicles	**31,915**	**32,820**	**(906)**	**97%**
Energy Storage	**20,917**	**49,036**	**(28,119)**	**43%**
Martha's Vineyard	3,208	14,207	(10,999)	23%
Provincetown	17,710	34,830	(17,120)	51%
Total Capital Spend	**175,723**	**206,792**	**(31,068)**	**85%**
Estimated O&M Expense*	**11,522**	**10,583**	**939**	**109%**
Total Capital & O&M	**187,245**	**217,375**	**(30,130)**	**86%**

*2020 O&M is preliminary and will be finalized at the time of the Company's Grid Modernization Factor ("GMF") filing due to be filed by May 15th, 2021.

Table S2-3
Grid Modernization - 2020 Unit vs. Cost Deployment

Investment Areas and Preauthorized Device Types	Capital Spend (in thousands $)				Commissioned Units			
	2020 Actual	2020 Budget	Variance ($)	Percent (%)	2020 Actual	2020 Plan	Variance (Units)	Percent (%)
Monitoring & Control (SCADA)	**26,095**	**23,822**	**2,272**	**110%**	**244**	**239**	**5**	**102%**
Microprocessor Relay	11,737	14,762	(3,025)	80%	83	96	(13)	86%
4kV Circuit Breaker SCADA	11,763	6,983	4,780	168%	38	39	(1)	97%
Recloser SCADA	1,534	675	859	227%	25	3	22	833%
Padmount Switch SCADA	286	270	16	106%	15	18	(3)	83%
Network Protector SCADA	560	1,132	(572)	49%	83	83	-	100%
Power Quality Monitors	215	-	215	N/A	-	-	-	N/A
Distribution Automation	**14,053**	**15,804**	**(1,751)**	**89%**	**127**	**124**	**3**	**102%**
OH DA	3,839	4,185	(347)	92%	70	47	23	149%
OH DA w/Ties	455	1,720	(1,265)	26%	8	-	8	N/A
4kV Oil Switch Replacement	9,190	6,500	2,690	141%	48	16	32	300%
4kV AR Loop	569	3,399	(2,830)	17%	1	61	(60)	2%
Volt-Var Optimization	**4,749**	**4,165**	**584**	**114%**	**240**	**30**	**210**	**800%**
VVO - Regulators	1,632	620	1,012	263%	27	27	-	100%
VVO - Capacitor Banks	311	-	311	N/A	3	3	-	100%
VVO - LTC Controls	30	-	30	N/A	-	-	-	N/A
VVO - Line Sensors	556	-	556	N/A	-	-	-	N/A
VVO - IT Work	1,469	3,545	(2,076)	41%	N/A	N/A	N/A	N/A
Microcapacitors	751	-	751	N/A	99	-	99	N/A
Grid Monitoring Line Sensors	-	-	-	N/A	111	-	111	N/A
Advanced Distribution Management System (ADMS)	**6,033**	**9,107**	**(3,074)**	**66%**	**N/A**	**N/A**	**N/A**	**N/A**
Advanced Load Flow	6,033	9,102	(3,069)	66%	N/A	N/A	N/A	N/A
GIS Verification (Expense)	-	-	-	N/A	N/A	N/A	N/A	N/A
Dist. Management System	-	5	(5)	0%	N/A	N/A	N/A	N/A
Forecasting Tool	-	-	-	N/A	N/A	N/A	N/A	N/A
Synergi Upgrades	-	-	-	N/A	N/A	N/A	N/A	N/A
PI Asset Framework	-	-	-	N/A	N/A	N/A	N/A	N/A
Communications	**1,362**	**1,435**	**(74)**	**95%**	**4**	**6**	**(2)**	**67%**
Numbers of Nodes	1,106	1,435	(330)	77%	4	6	(2)	67%
Miles of Fiber	256	-	256	N/A	-	-	-	N/A
Electric Vehicles	**18,076**	**18,981**	**(906)**	**95%**	**N/A**	**N/A**	**N/A**	**N/A**
Energy Storage	**16,308**	**44,427**	**(28,119)**	**37%**	**N/A**	**N/A**	**N/A**	**N/A**
Martha's Vineyard	946	11,945	(10,999)	8%	N/A	N/A	N/A	N/A
Provincetown	15,362	32,482	(17,120)	47%	N/A	N/A	N/A	N/A
Total	**86,674**	**117,742**	**(31,068)**	**74%**	**615**	**399**	**216**	**154%**
Estimated O&M Expense*	**3,067**	**2,128**	**939**	**144%**				
Total Capital & O&M	**89,741**	**119,871**	**(30,130)**	**75%**				

*2020 O&M is preliminary and will be finalized at the time of the Company's Grid Modernization Factor ("GMF") filing due to be filed by May 15th, 2021.

Table S2-4

Grid Modernization - Total Deployment Projection (Cost & Units)

Investment Areas and Preauthorized Device Types	Capital Spend (in thousands $)			Units		
	2018-2020 Actual	2021 Plan	2018-2021 Projection	2018-2020 Actual	2021 Plan	2018-2021 Projection
Monitoring & Control (SCADA)	**52,063**	**16,932**	**68,995**	**435**	**125**	**560**
Microprocessor Relay	30,091	11,260	41,351	180	57	237
4kV Circuit Breaker SCADA	15,932	4,000	19,932	54	13	67
Recloser SCADA	3,386	-	3,386	59	-	59
Padmount Switch SCADA	1,007	-	1,007	59	-	59
Network Protector SCADA	1,431	717	2,148	83	21	104
Power Quality Monitors	215	956	1,171	-	34	34
Distribution Automation	**46,893**	**14,000**	**60,893**	**451**	**151**	**602**
OH DA	18,176	8,000	26,176	243	100	343
OH DA w/Ties	3,253	-	3,253	53	-	53
4kV Oil Switch Replacement	24,003	5,000	29,003	137	35	172
4kV AR Loop	1,461	1,000	2,461	18	16	34
Volt-Var Optimization	**12,933**	**6,000**	**18,933**	**577**	**624**	**1,201**
VVO - Regulators	4,007	1,150	5,157	96	48	144
VVO - Capacitor Banks	2,860	950	3,810	74	32	106
VVO - LTC Controls	1,452	720	2,172	8	4	12
VVO - Line Sensors	1,235	180	1,415	189	40	229
VVO - IT Work	2,629	-	2,629	N/A	-	N/A
Microcapacitors	751	1,500	2,251	99	200	299
Grid Monitoring Line Sensors	-	1,500	1,500	111	300	411
Advanced Distribution Management System (ADMS)	**8,809**	**13,000**	**21,808**	**N/A**	**N/A**	**N/A**
Advanced Load Flow	8,809	-	8,809	N/A	N/A	N/A
GIS Verification (Expense)	-	-	-	N/A	N/A	N/A
Dist. Management System	-	8,000	8,000	N/A	N/A	N/A
Forecasting Tool	-	3,246	3,246	N/A	N/A	N/A
Synergi Upgrades	-	767	767	N/A	N/A	N/A
PI Asset Framework	-	986	986	N/A	N/A	N/A
Communications	**2,194**	**5,106**	**7,300**	**8**	**6**	**14**
Numbers of Nodes	1,628	4,106	5,735	8	6	14
Miles of Fiber	566	1,000	1,566	-	-	-
Electric Vehicles	**31,915**	**19,002**	**50,917**	**N/A**	**N/A**	**N/A**
Energy Storage	**20,917**	**28,678**	**49,595**	**N/A**	**N/A**	**N/A**
Martha's Vineyard	3,208	391	3,599	N/A	N/A	N/A
Provincetown	17,710	28,287	45,997	N/A	N/A	N/A
Total	**175,723**	**102,718**	**278,441**	**1,471**	**906**	**2,377**
Estimated O&M Expense*	**11,522**	**1,062**	**12,584**			
Total Capital & O&M	**187,245**	**103,780**	**291,026**			

*2020 O&M is preliminary and will be finalized at the time of the Company's Grid Modernization Factor ("GMF") filing due to be filed by May 15th, 2021.

EVERSOURCE

Massachusetts
Electric Vehicle Infrastructure Program

Charging Station Analysis Report
2020

Prepared by:

ENERGETICS

Electric Vehicle Infrastructure Program

On November 30, 2017, the Department of Public Utilities issued Order 17-05, approving NSTAR ELECTRIC COMPANY AND WESTERN MASSACHUSETTS ELECTRIC COMPANY d.b.a. Eversource Energy (Eversource) to spend up to $45 million over five years on an electric vehicle (EV) infrastructure program (Program).

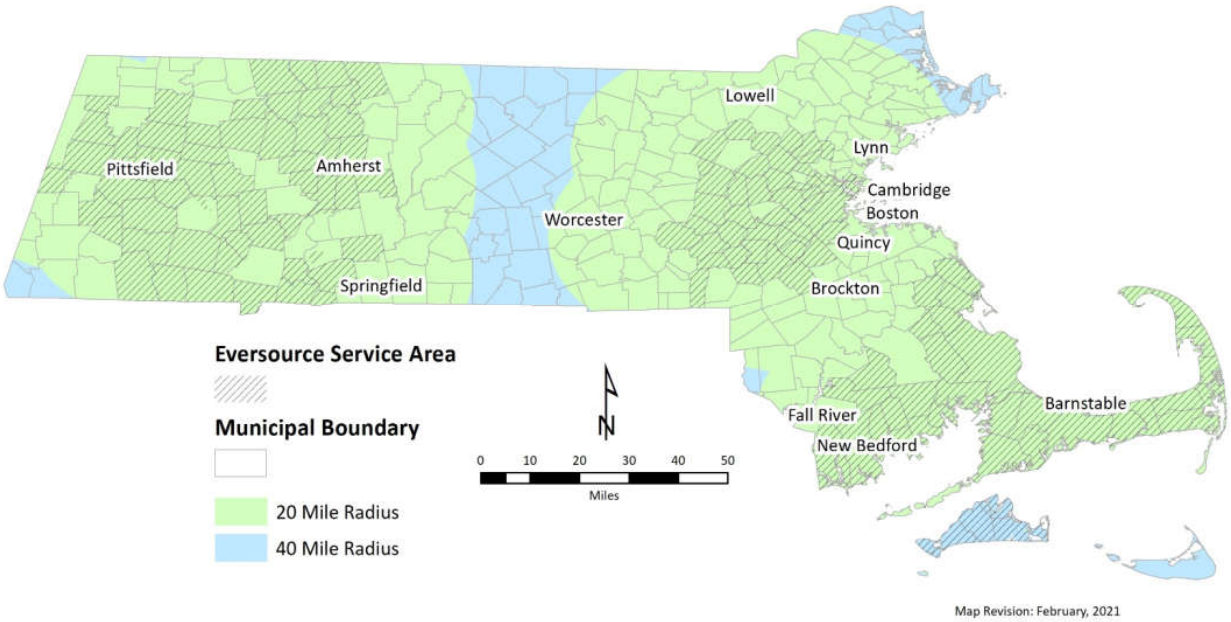
Eversource is supporting the deployment of EV charging ports by installing electrical equipment and components necessary to connect EV chargers to its distribution system. Eversource is installing the "Eversource-side Infrastructure," and contracting with third-party electrical contractors to install behind the meter "Participant-side Infrastructure." Specifically, the EV infrastructure that Eversource installs and owns includes: (1) distribution primary lateral service feed; (2) necessary transformer and transformer pad; (3) new service meter; (4) new service panel; and (5) associated conduit and conductor necessary to connect each piece of equipment.

Between 2018 and 2022, Eversource plans to support the deployment of up to 72 direct current fast charging (DCFC) ports at 36 sites, and up to 3,500 Level 2 charging ports at 450 sites, throughout its service territories in Massachusetts. Eversource hopes to accelerate implementation of the Make-Ready Program based on customer demand.

Eversource Customers Served by Program Installations

99% of Eversource customers are within 20 miles of a Program charging station *

100% of Massachusetts residents and businesses are within 40 miles of a Program charging station **



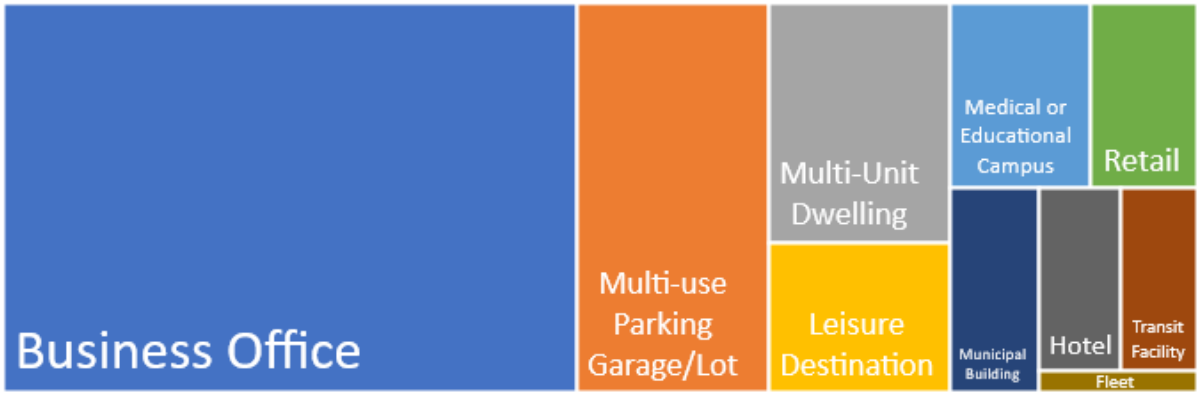
* The only portion of the Eversource Service Territory not within 20 miles of a staiton is on Martha's Vineyard.

** There are no stations on the island of Martha's Vineyard to date, so those residents would need to use the ferry to access a charging station.

Program Station Installations

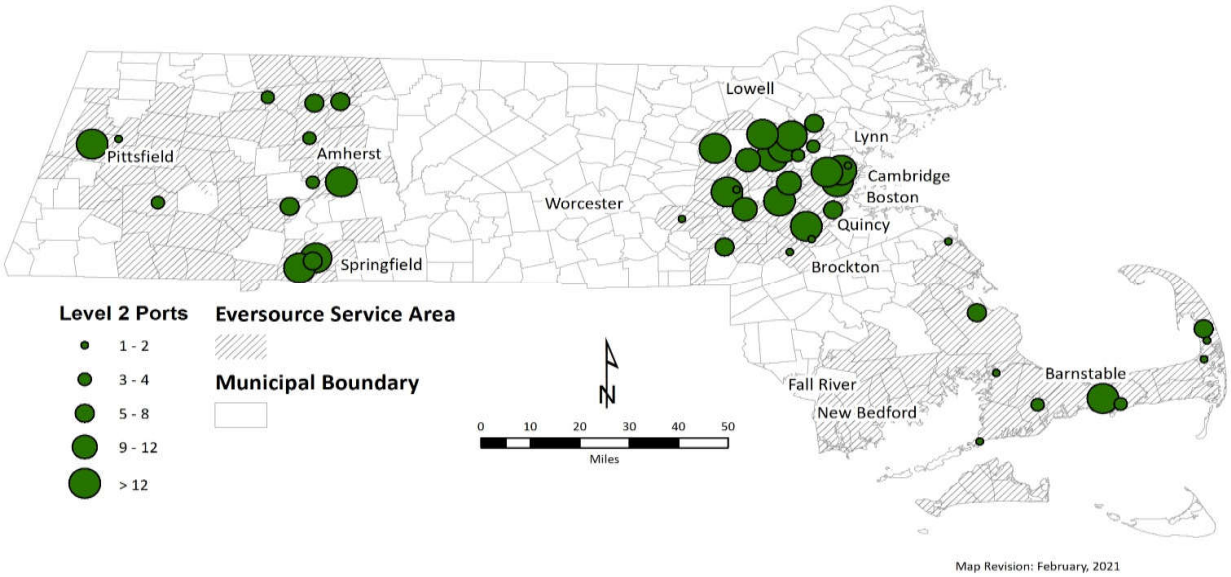
Level 2 ports provide drivers approximately 20 miles of electric driving range for each hour of charging.

807 **Level 2 Ports Installed by the Program to Date**



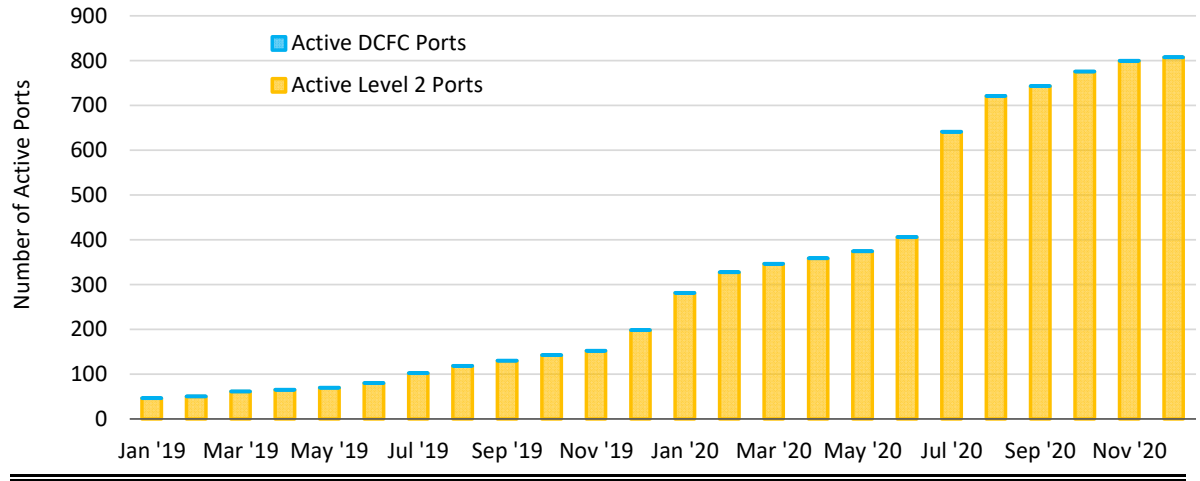
DCFC ports provide drivers 50-150 miles of electric range in 20 minutes of charging.

0 **DCFC Ports Installed by the Program to Date**

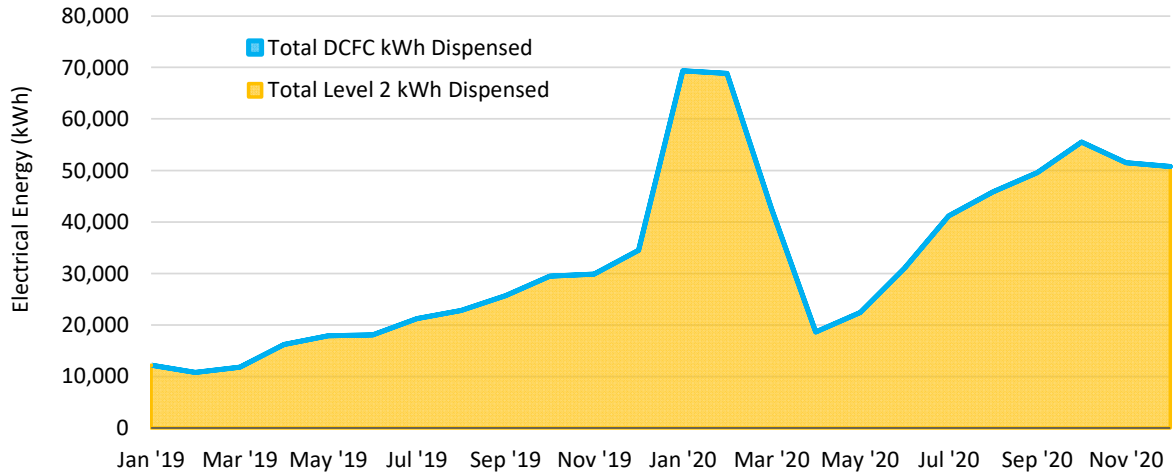


Program Station Installations

Ports are "Active" based on activation date provided by the service provider, excluding known periods when repairs were needed. The jump in July 2020 is due to a large 250 port installation at one business location.



Energy Dispensed



Environmental Impacts		2019	2020	Total Program to Date
Total Charging Events[1]	Level 2	19,988	44,123	64,111
	DCFC	0	0	0
	Total	**19,988**	**44,123**	**64,111**
Total Energy Dispensed (kWh)	Level 2	250,588	547,184	797,771
	DCFC	0	0	0
	Total	**250,588**	**547,184**	**797,771**
Gallons of Gasoline Displaced[2]		**37,457**	**81,791**	**119,248**
Tons of Carbon Dioxide Saved[3]		**264.2**	**576.9**	**841.1**

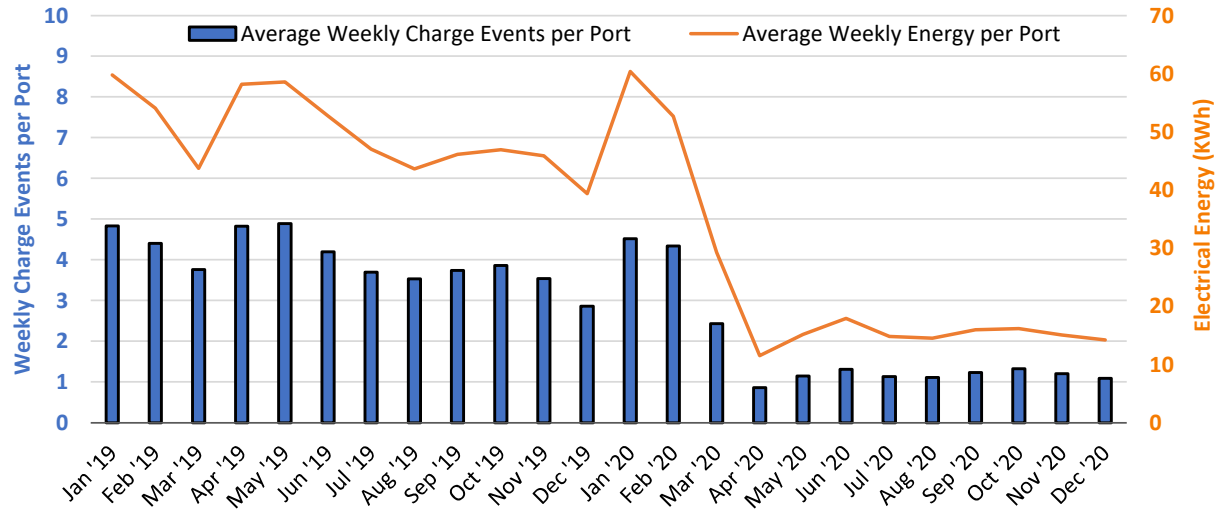
[1] *A recorded event is classified as a charging event if at least 0.2 kilowatt-hours (kWh) is dispensed.*

[2] *Average EV efficiency = 0.3 kWh/mile (Plug In America). Average U.S. light duty vehicle fuel efficiency (2017) = 22.3 mpg (USDOT)*

[3] *CO_2 emmissions/gallon = 19.6 pounds. MA output emmission rate = 821 lb/MWh (USEPA)*

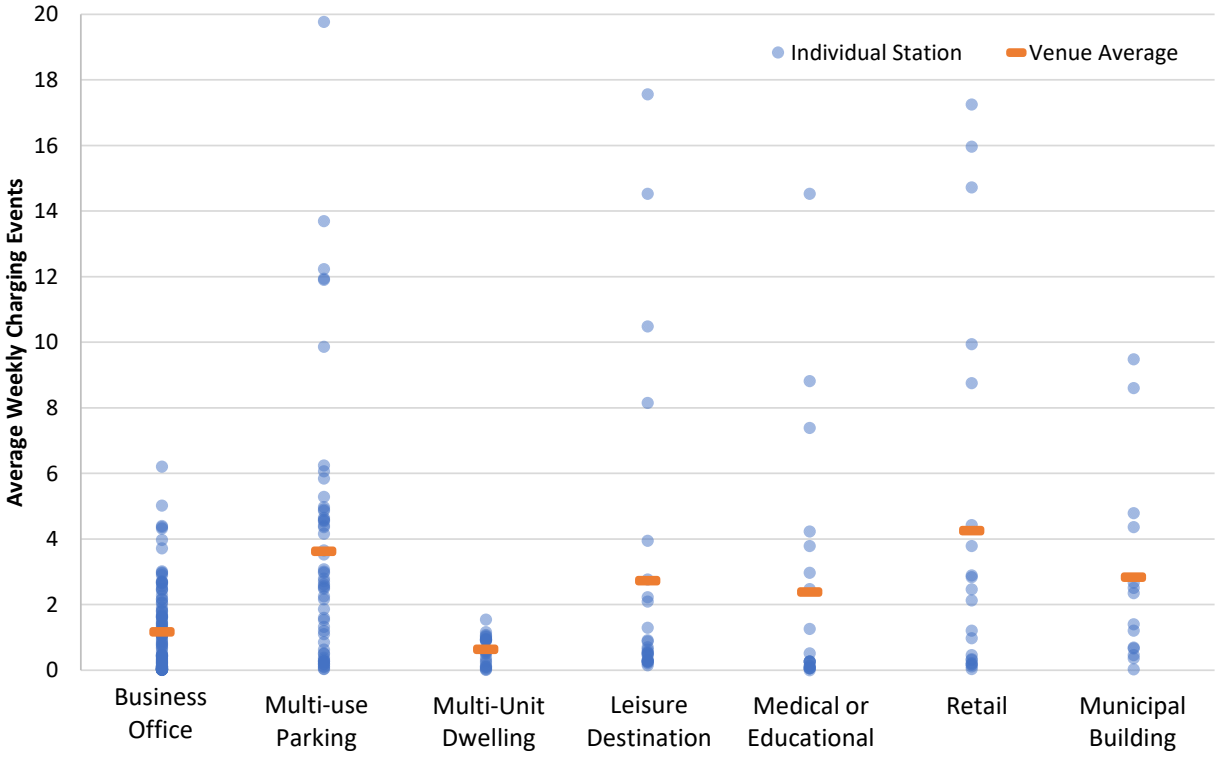
Level 2 Port Utilization

The COVID-19 pandemic significantly decreased charging activity in March and April 2020. While total energy dispensed by all chargers has recovered, the increase in installed stations has kept the average per port low.



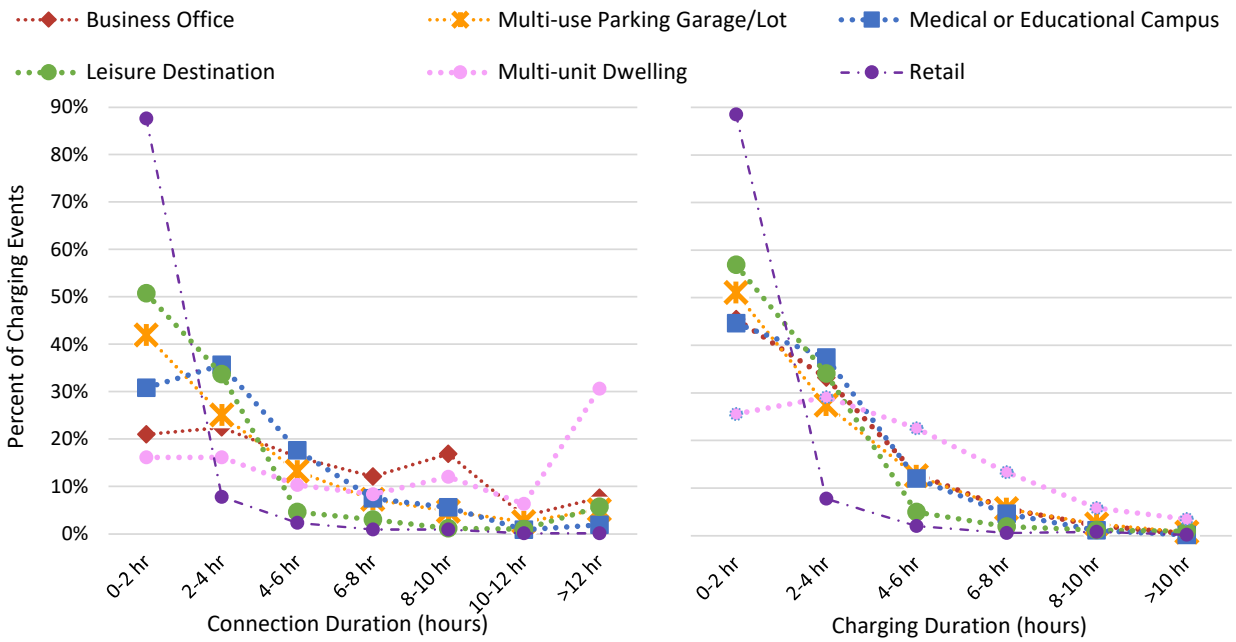
Level 2 Weekly Charging Events by Venue Type

Stations at Multi-use Parking Garages/Lots experience the broadest range of utilization, followed by Leisure Destinations, Retail locations, and Medical/Educational Campuses. Most stations at Multi-Unit Dwellings and Business Offices had very few charging event per week in 2020.



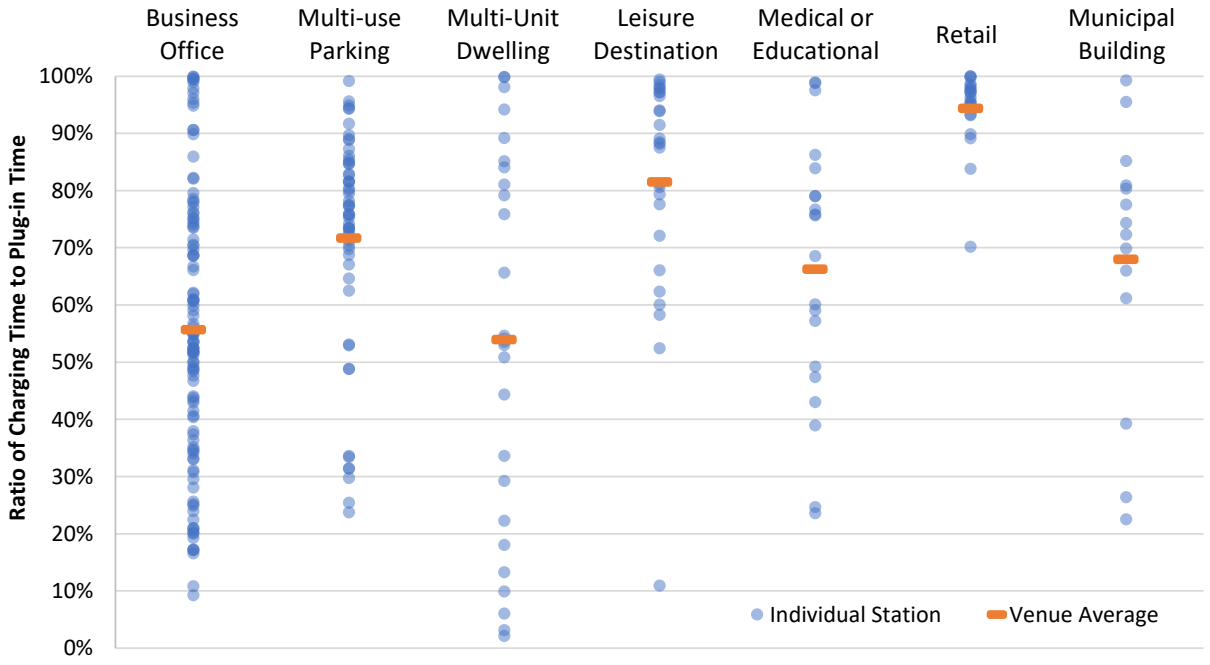
Durations for Level 2 Charging Events

Stations at Multi-Unit Dwellings experience a higher percentage of longer plug-in times (connection durations >12 hours) and have longer charging durations. At other venues, most charging is completed after four hours. Charging at Retail locations is the shortest in duration.



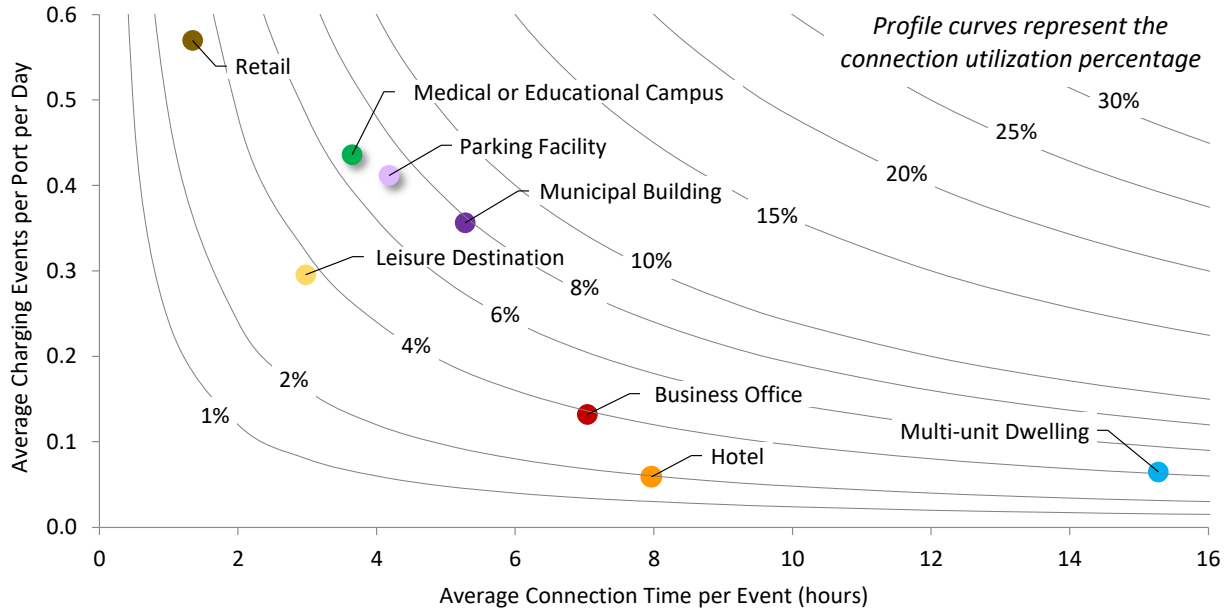
Connection Time Spent Charging for Level 2 Charging Ports

EVs often remained plugged in at Business Offices and Multi-Unit Dwellings much longer than their charging time (charging only 50-60% of the time is the average).



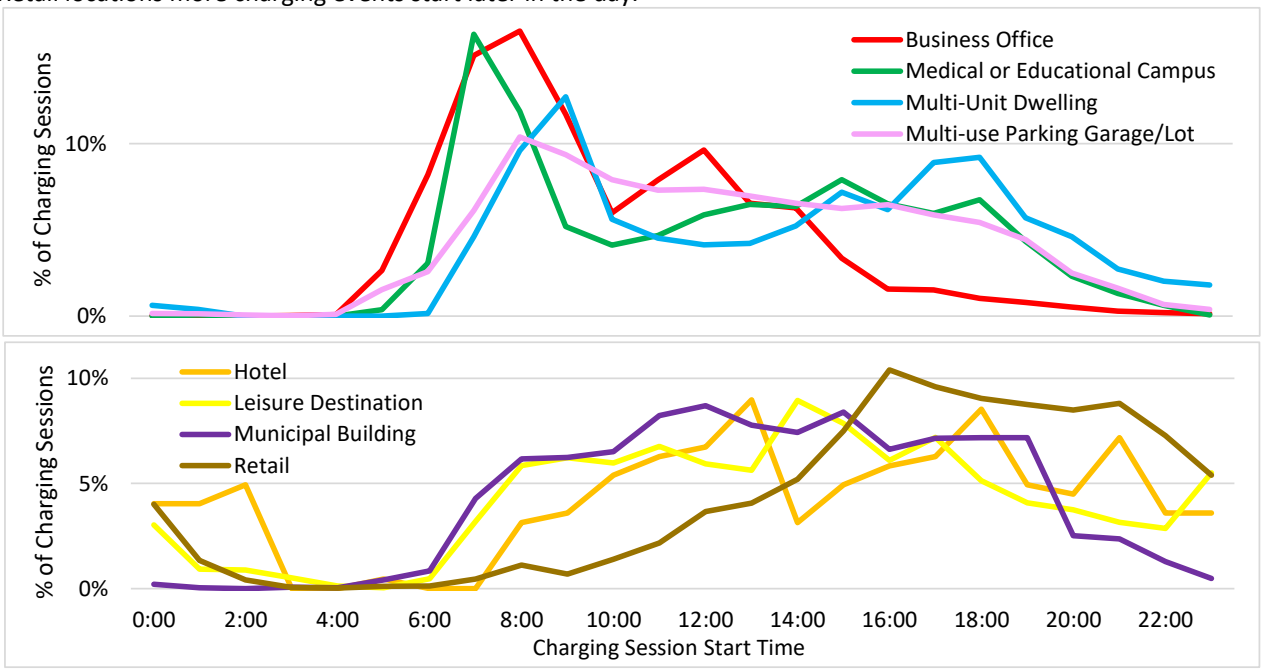
Level 2 Charging Characteristics by Venue Type

The average connection time plotted against the average number of daily charging events shows utilization characteristic differences by venue. Stations at Municipal Buildings, Multi-use Parking Facilities, and Medical/Educational Campuses had the highest utilization. Average connection time was longest for stations at Multi-Unit Dwellings and shortest at Retail locations.



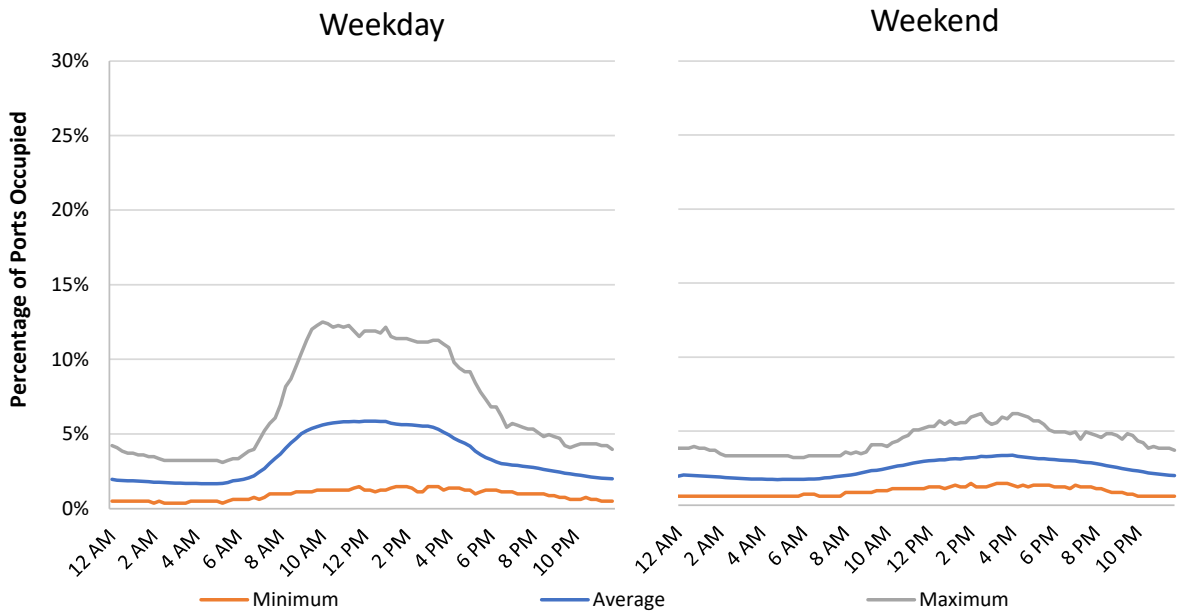
Level 2 Charging Event Start Times

Stations at Business Offices, Medical/Educational Campuses, Multi-unit Dwellings, and Multi-use Parking Facilities have more charging events start in the morning, whereas at Hotels, Leisure Destinations, Municipal Buildings, and Retail locations more charging events start later in the day.

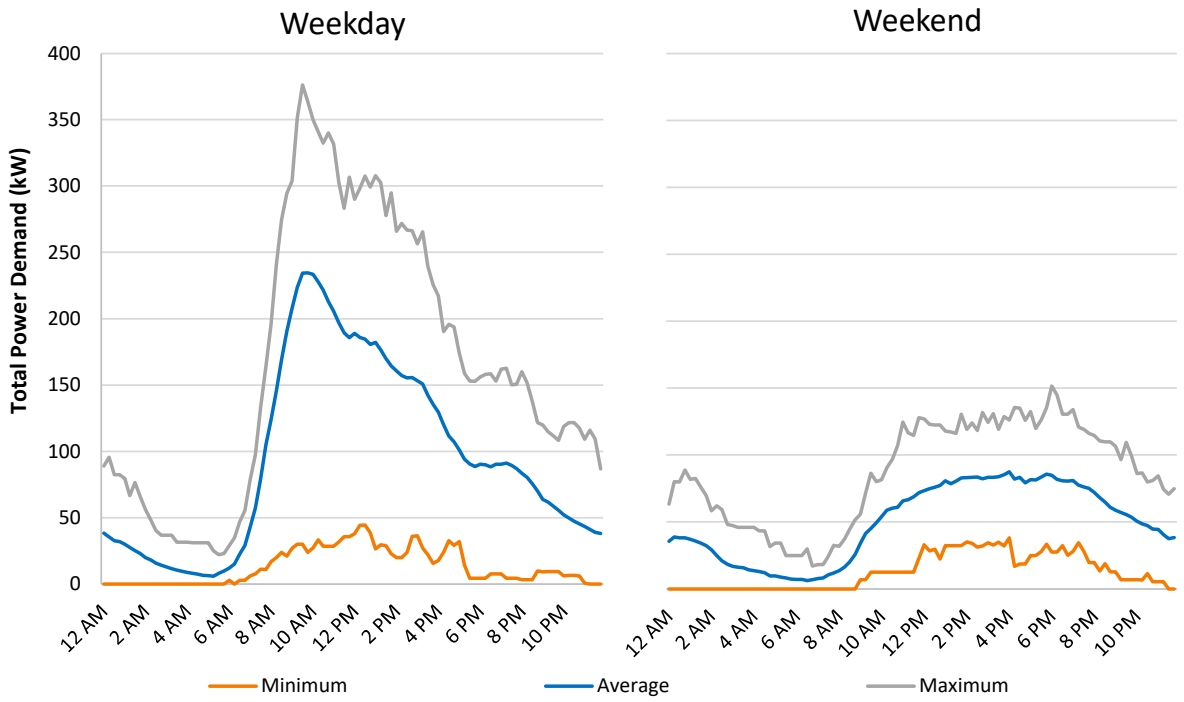


Level 2 Charging Impact on Power Grid - All Venues

Port Availability: Percentage of active charging ports in use across the time of day for weekdays and weekends. Peak occupancy is higher and earlier in the day on weekdays than on weekends.

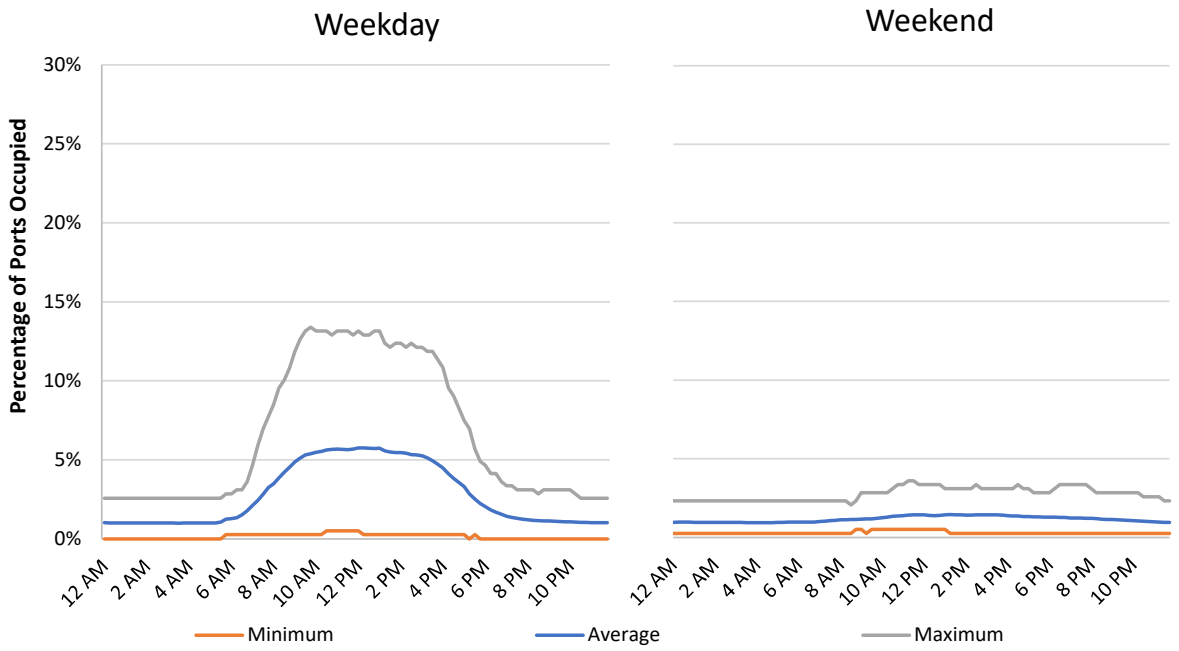


Estimated Total Charging Demand: Total power draw (calculated using average power per charging event for the charging duration) from all stations for weekdays and weekends. Peak is earlier in the day and about 2.5 times higher on weekdays than on weekends.

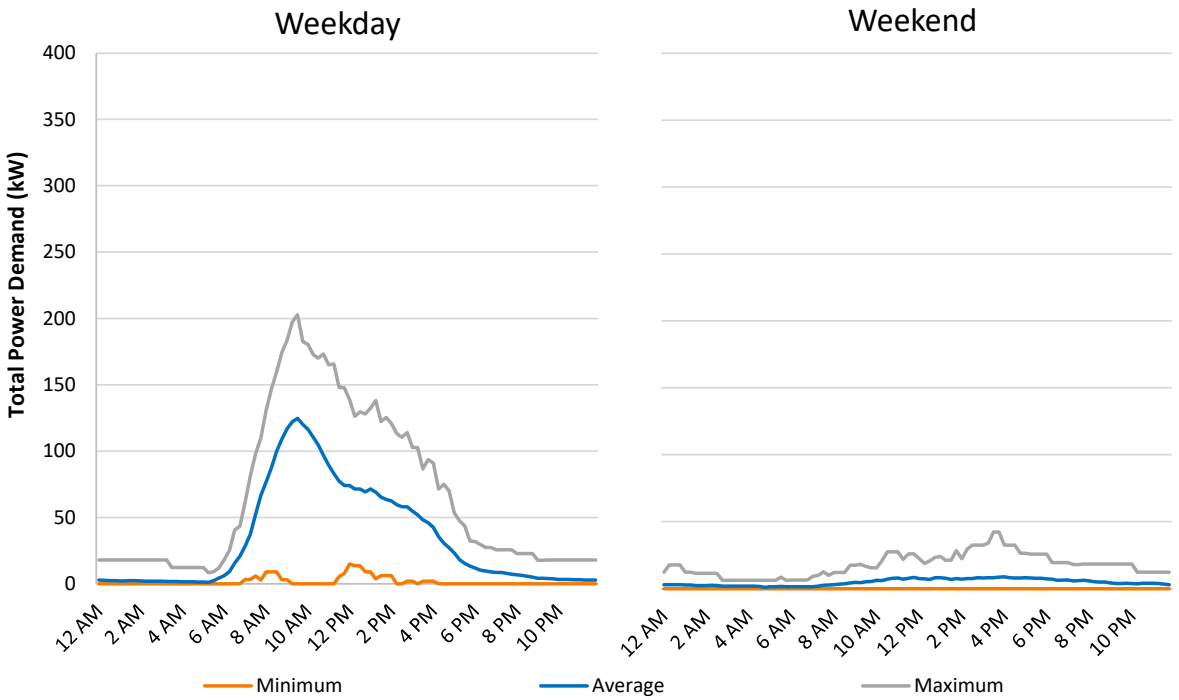


Level 2 Charging Impact on Power Grid - Business Offices

Port Availability: Percentage of active charging ports in use across the time of day for weekdays and weekends.

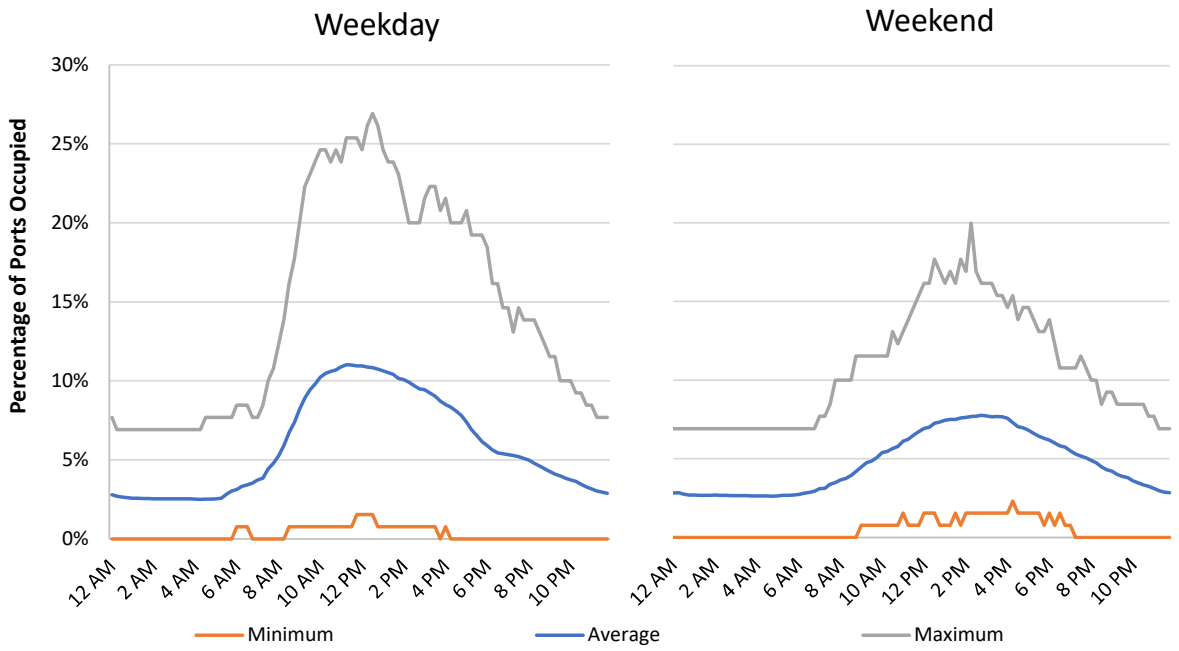


Estimated Total Charging Demand: Total power draw (calculated using average power per charging event for the charging duration) for weekdays and weekends.

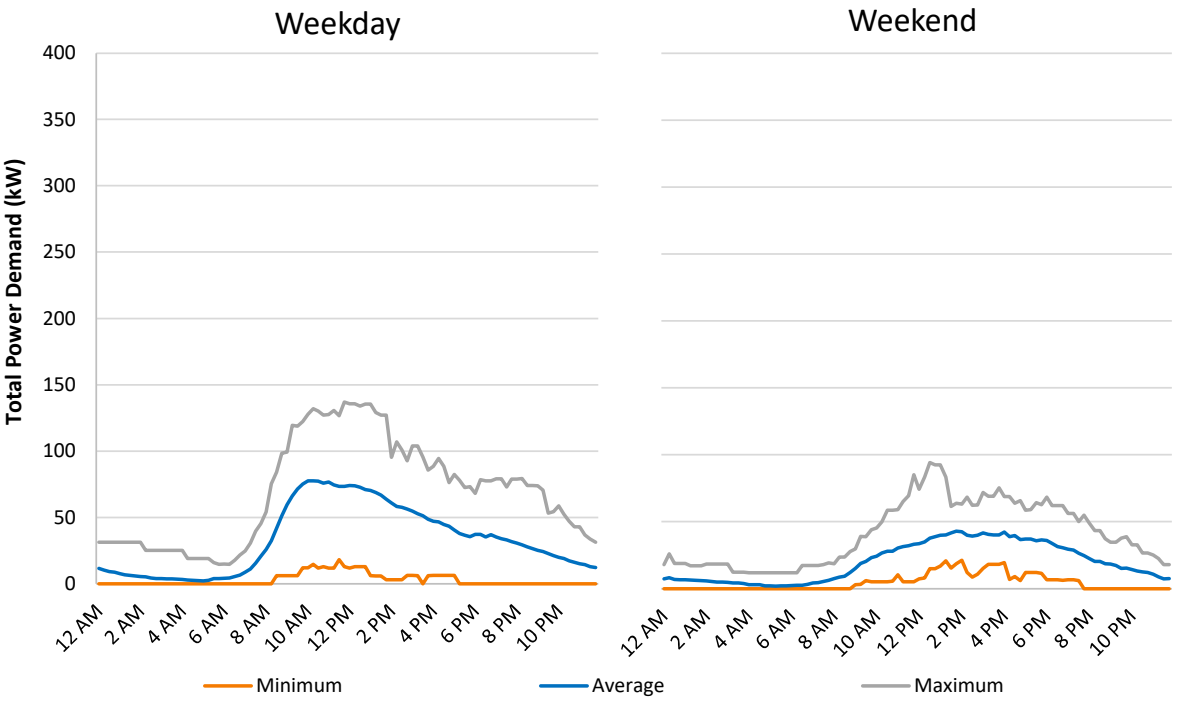


Level 2 Charging Impact on Power Grid - Multi-use Parking

Port Availability: Percentage of active charging ports in use across the time of day for weekdays and weekends.

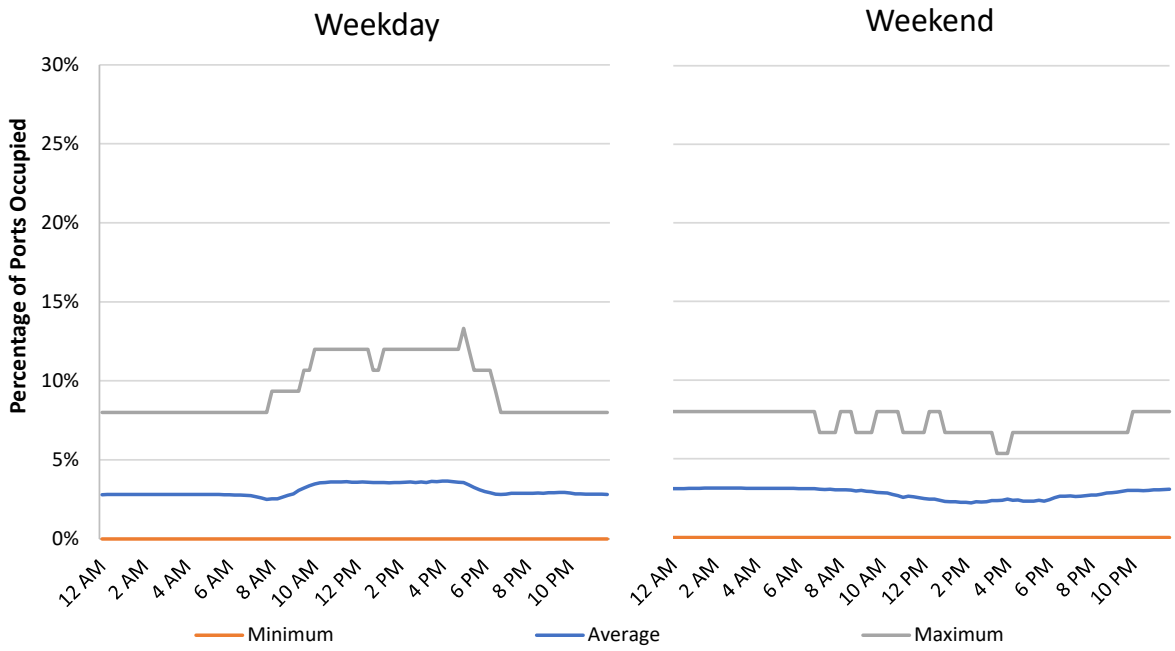


Estimated Total Charging Demand: Total power draw (calculated using average power per charging event for the charging duration) for weekdays and weekends.

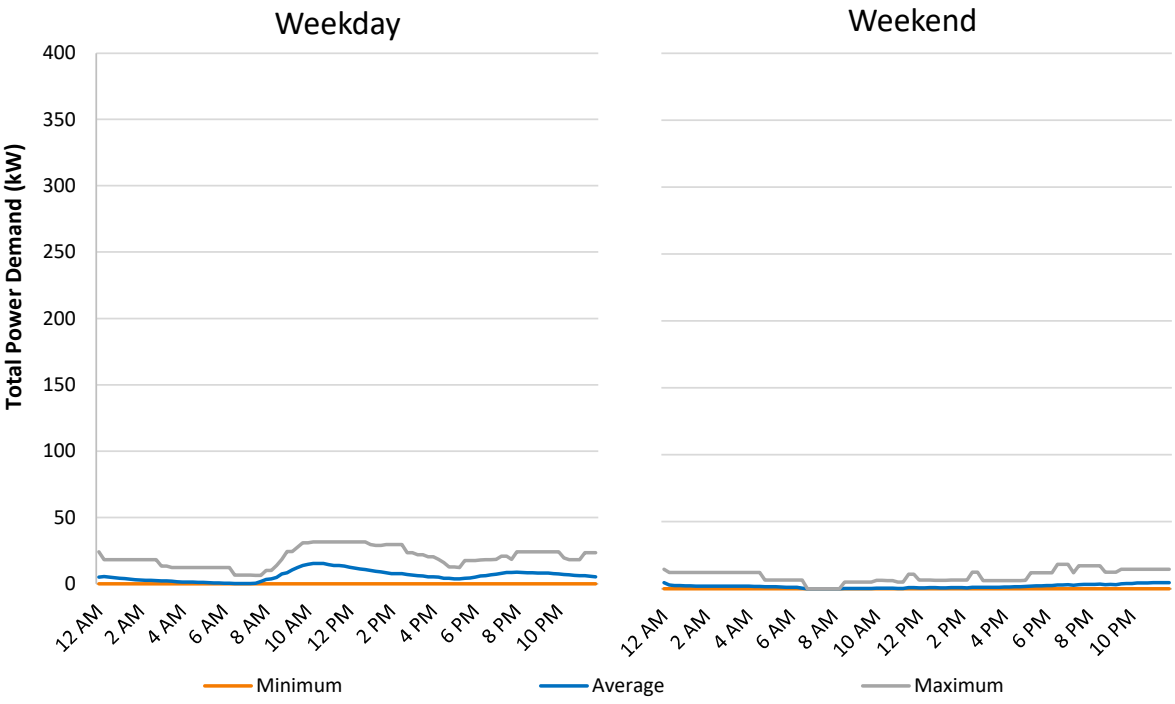


Level 2 Charging Impact on Power Grid - Multi-Unit Dwellings

Port Availability: Percentage of active charging ports in use across the time of day for weekdays and weekends.

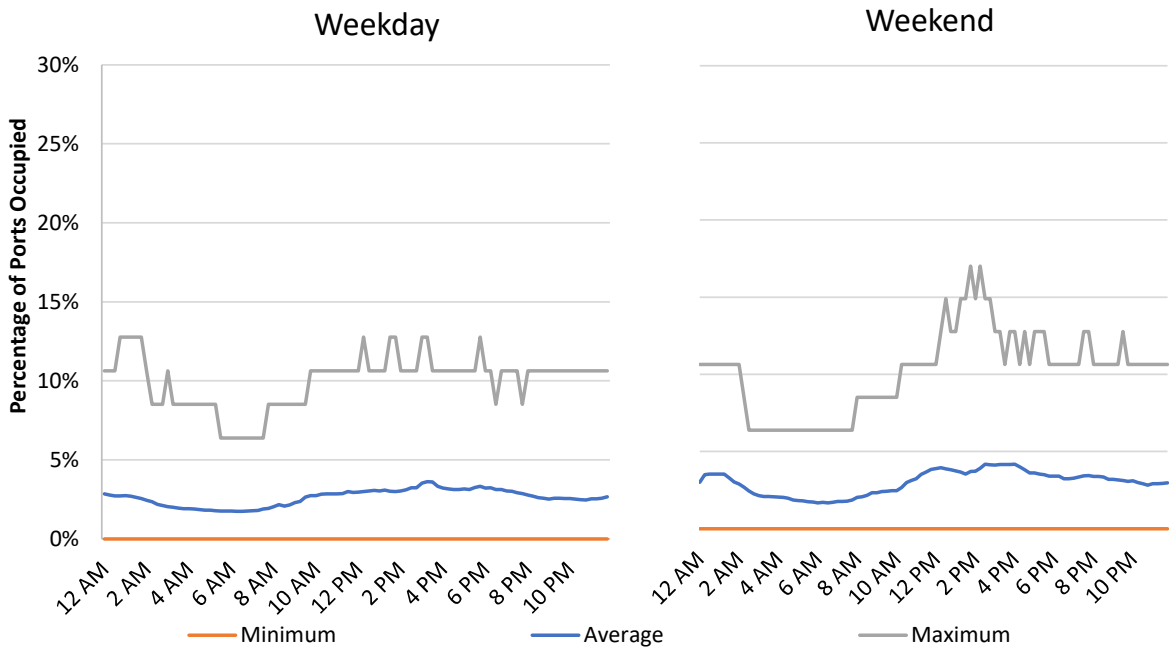


Estimated Total Charging Demand: Total power draw (calculated using average power per charging event for the charging duration) for weekdays and weekends.

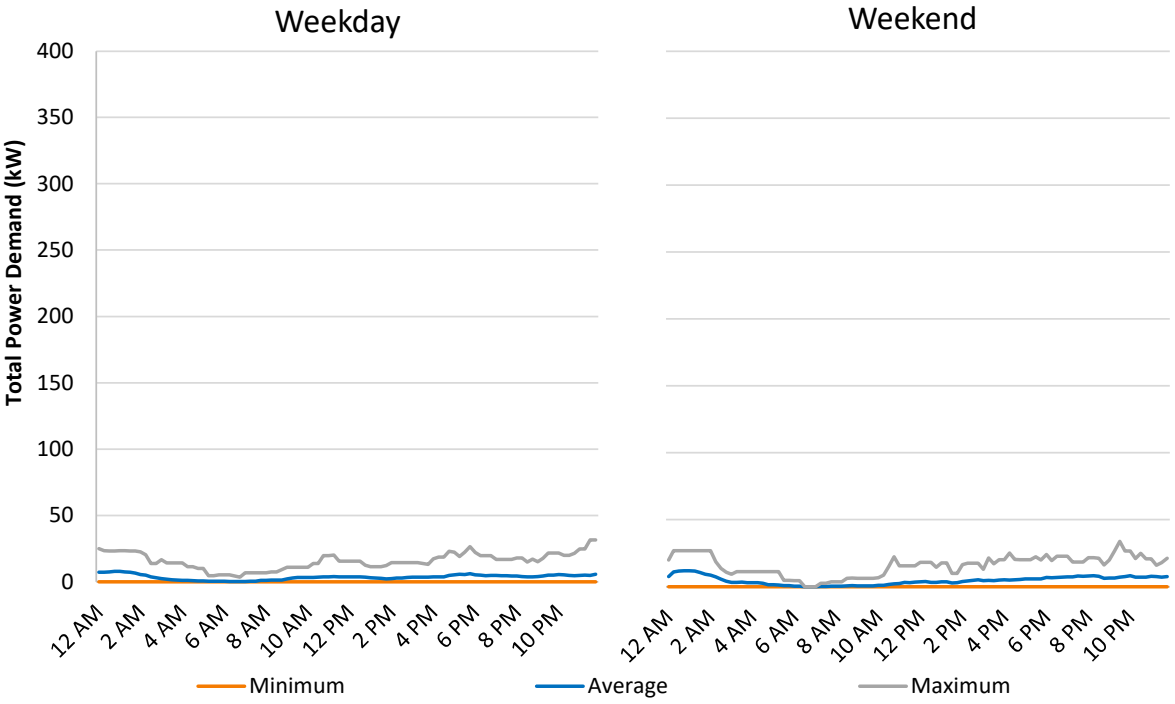


Level 2 Charging Impact on Power Grid - Leisure Destinations

Port Availability: Percentage of active charging ports in use across the time of day for weekdays and weekends.

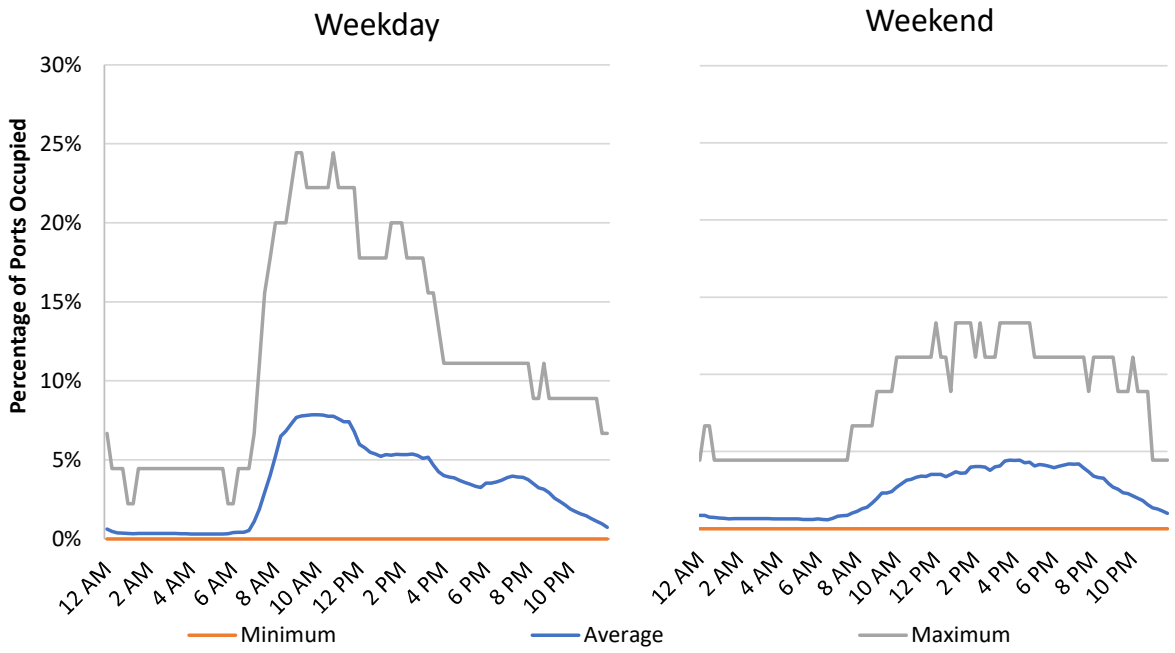


Estimated Total Charging Demand: Total power draw (calculated using average power per charging event for the charging duration) for weekdays and weekends.

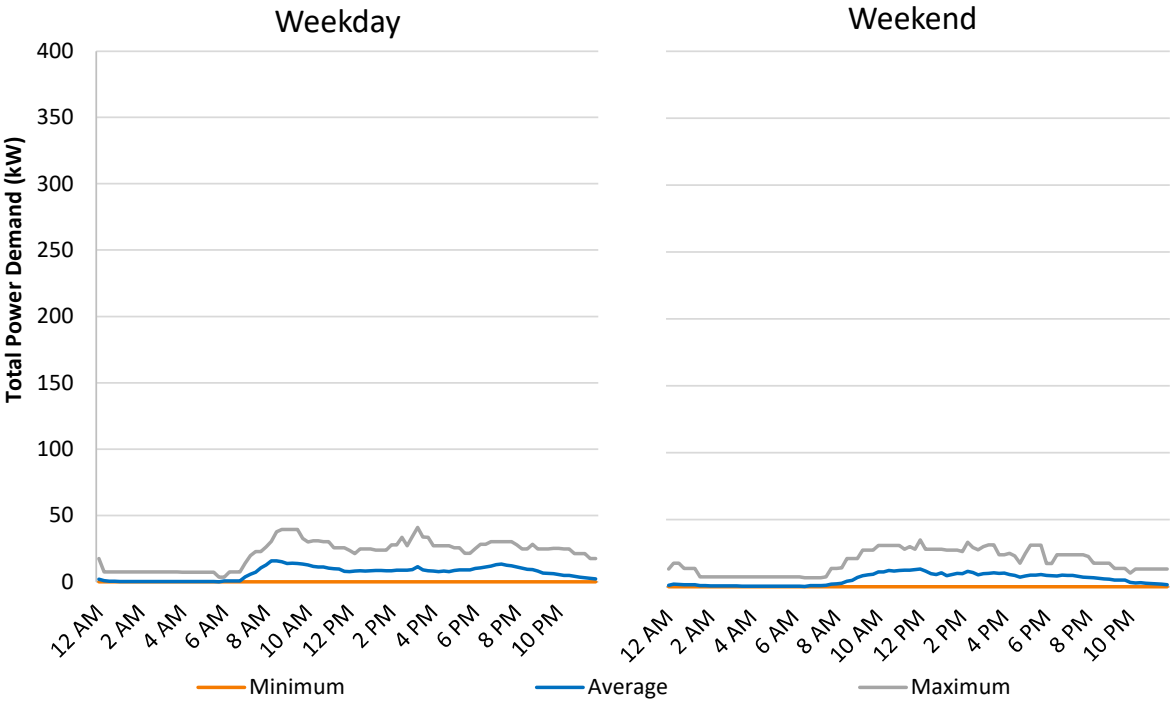


Level 2 Charging Impact on Power Grid - Medical/Educational

Port Availability: Percentage of active charging ports in use across the time of day for weekdays and weekends.

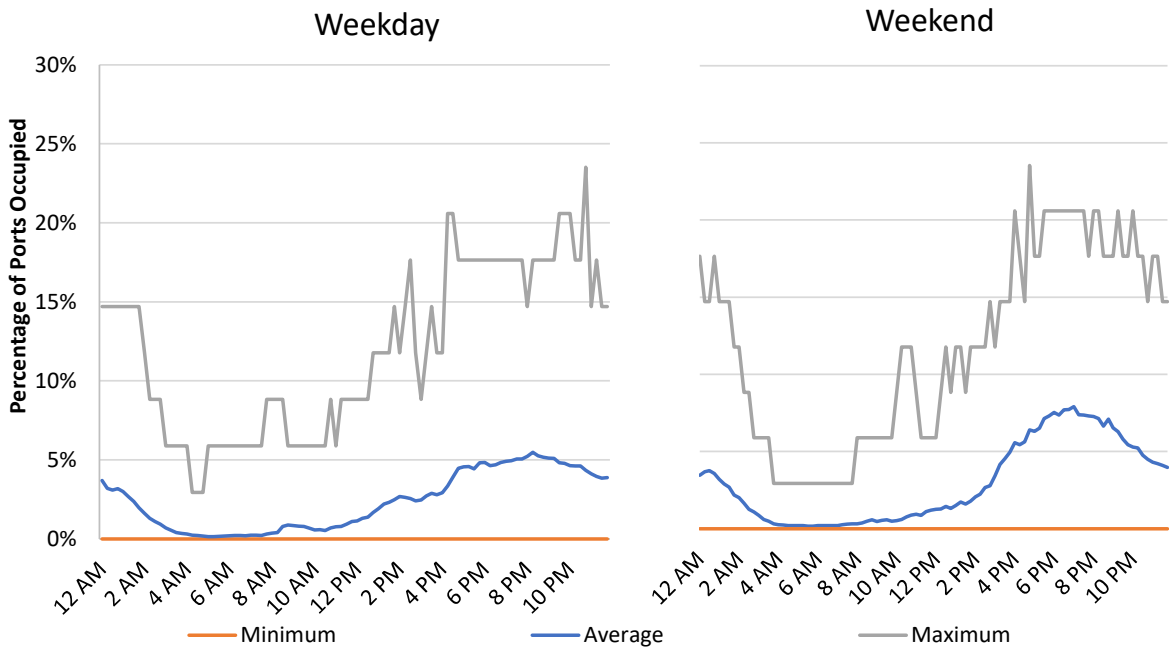


Estimated Total Charging Demand: Total power draw (calculated using average power per charging event for the charging duration) for weekdays and weekends.

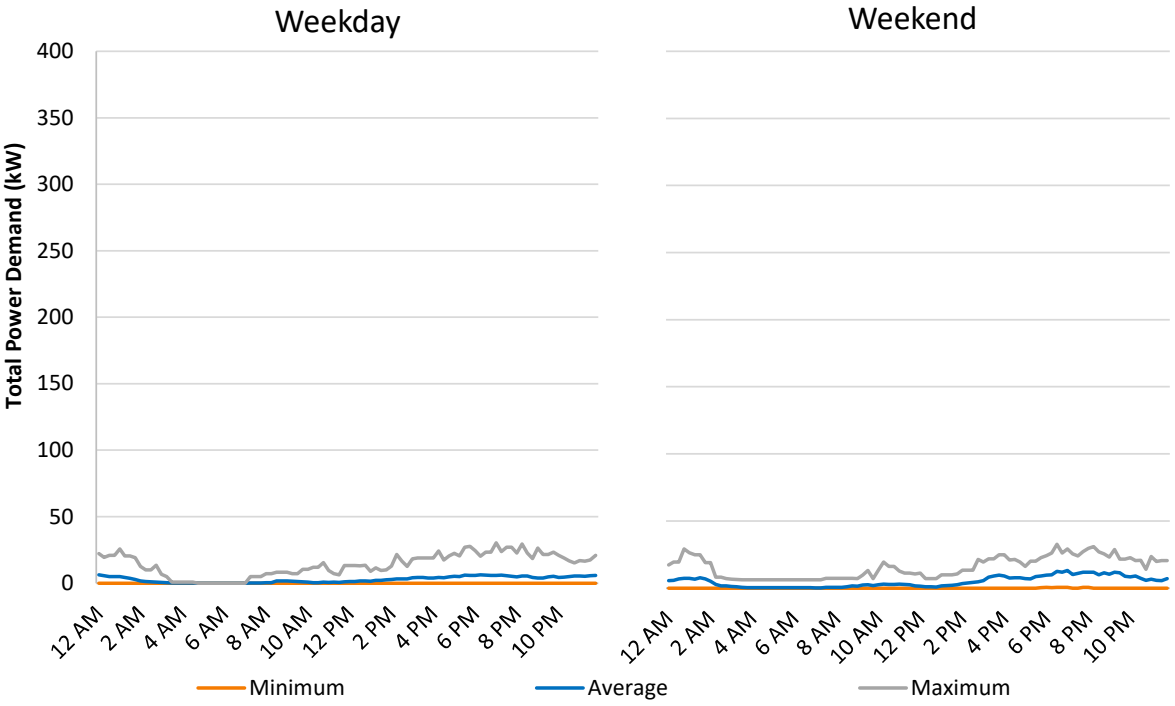


Level 2 Charging Impact on Power Grid - Retail Locations

Port Availability: Percentage of active charging ports in use across the time of day for weekdays and weekends.

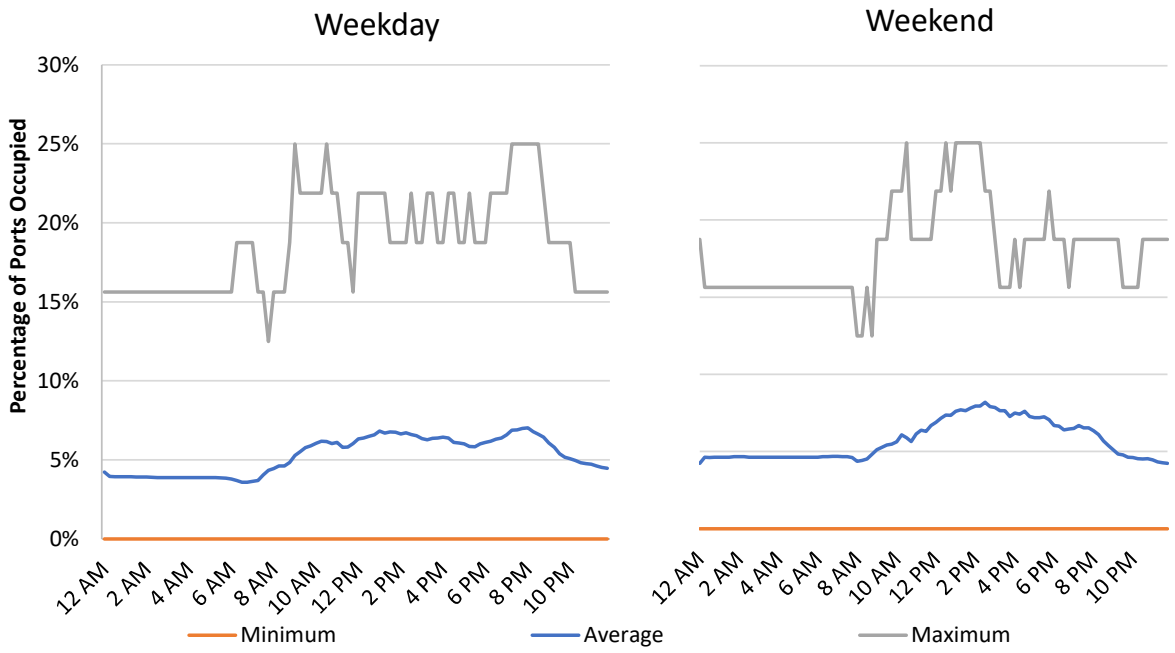


Estimated Total Charging Demand: Total power draw (calculated using average power per charging event for the charging duration) for weekdays and weekends.

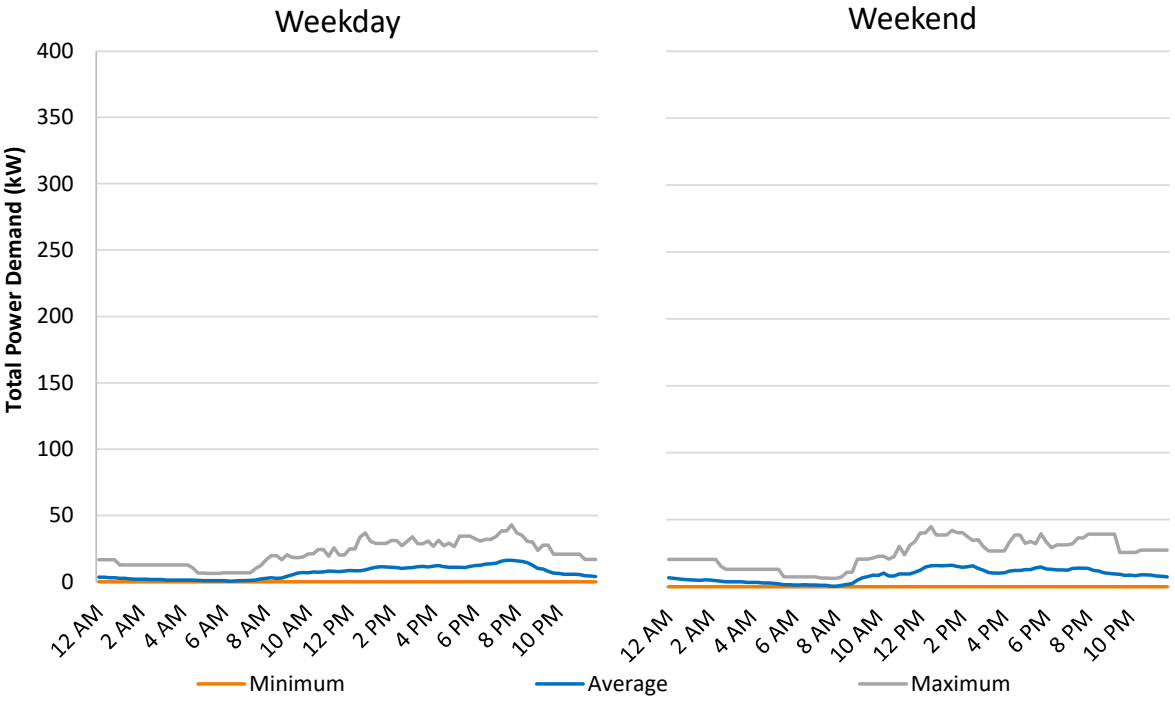


Level 2 Charging Impact on Power Grid - Municipal Buildings

Port Availability: Percentage of active charging ports in use across the time of day for weekdays and weekends.

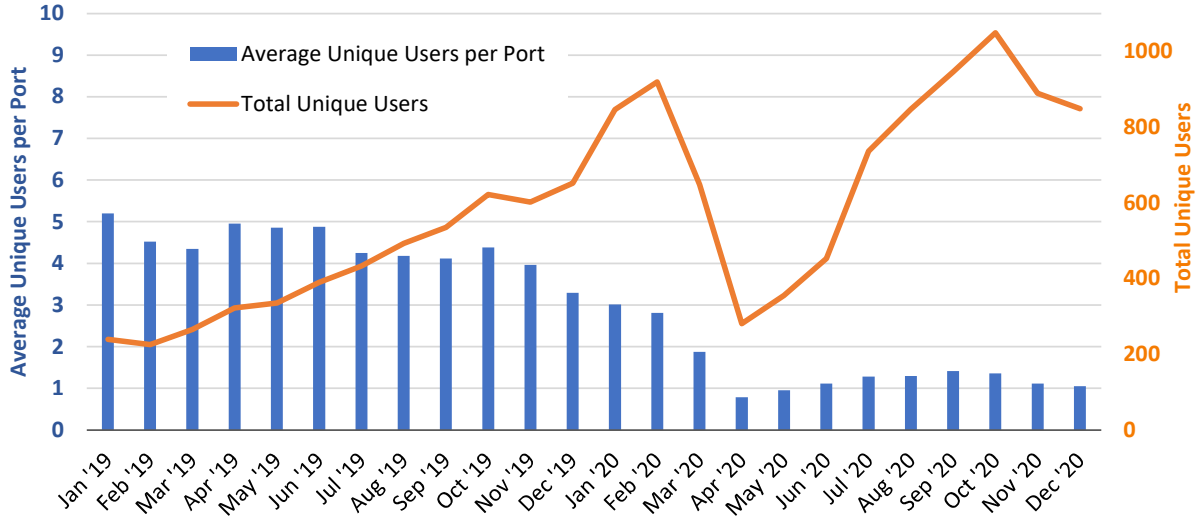


Estimated Total Charging Demand: Total power draw (calculated using average power per charging event for the charging duration) for weekdays and weekends.

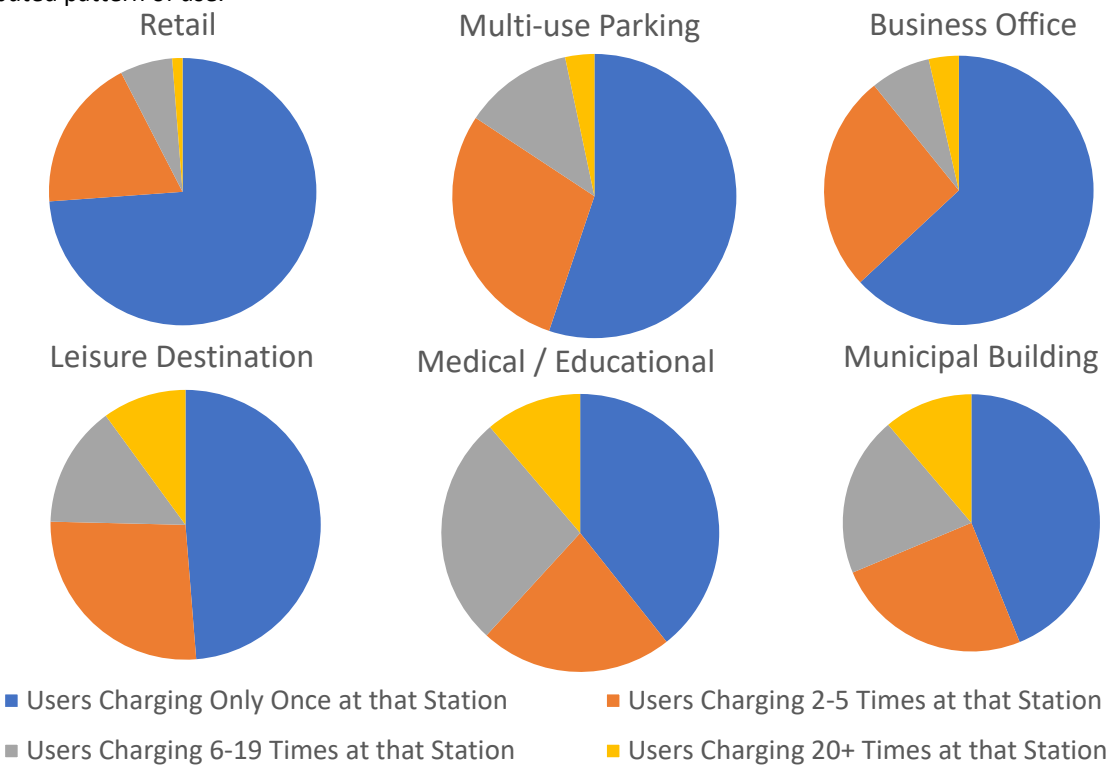


Unique EV Drivers Using the Program Charging Stations

Unique Users: The total number of unique users per month for all stations have returned to pre-pandemic levels, but the average unique users per port remains comparatively low because new ports have been installed.



Average Portion of Frequent Users: Different charging station venues will be used by a variety of different users, the majority of which might only charge there once (i.e., Retail), while other venues show a more evenly distributed pattern of use.



Detailed Level 2 Charging Station Usage Statistics

Venue Type	Ports	Total Days of Port Availability	Charging Events (CE)	Charging Events per day	Plug-in Time		Charging Time		% of Plug-in time spent charging	Total Energy (kWh)	Energy per CE (kWh)
					Hours	Hours per CE	Hours	Hours per CE			
Business Office	388	83,842	11,072	0.1	77,913	7.0	30,240	2.7	39%	147,308	13.3
Multi-use Parking Garage/Lot	130	36,852	15,179	0.4	63,411	4.2	39,275	2.6	62%	213,599	14.1
Multi-Unit Dwelling	75	19,954	1,294	0.1	19,769	15.3	5,325	4.1	27%	29,188	22.6
Leisure Destination	47	13,605	4,022	0.3	11,967	3.0	5,687	1.4	48%	23,681	5.9
Medical or Educational Campus	45	7,480	3,263	0.4	11,894	3.6	8,512	2.6	72%	46,724	14.3
Retail	34	8,954	5,102	0.6	6,856	1.3	6,365	1.2	93%	31,062	6.1
Municipal Building	32	8,064	2,873	0.4	15,157	5.3	7,170	2.5	47%	37,656	13.1
Hotel	26	2,695	159	0.1	1,266	8.0	363	2.3	29%	3,655	23.0
Transit Facility	24	7,774	126	0.0	370	2.9	265	2.1	72%	1,158	9.2
Fleet	6	1,719	961	0.6	15,329	16.0	2,686	2.8	18%	13,173	13.7

Region	Ports	Total Days of Port Availability	Charging Events (CE)	Charging Events per day	Plug-in Time		Charging Time		% of Plug-in time charging	Total Energy (kWh)	Energy per CE (kWh)
					Hours	Hours per CE	Hours	Hours per CE			
Boston Metro	620	142,727	37,666	0.3	192,631	5.1	92,573	2.5	48%	482,765	12.8
Western	126	31,123	3,818	0.1	15,781	4.1	8,148	2.1	52%	36,985	9.7
Southeast	61	17,092	2,567	0.2	15,519	6.0	5,168	2.0	33%	27,452	10.7

Land Use Type[1]	Ports	Total Days of Port Availability	Charging Events (CE)	Charging Events per day	Plug-in Time		Charging Time		% of Plug-in time charging	Total Energy (kWh)	Energy per CE (kWh)
					Hours	Hours per CE	Hours	Hours per CE			
Urban	769	177,106	38,197	0.2	211,844	5.5	96,450	2.5	46%	505,034	13.2
Rural	38	13,835	5,854	0.4	12,087	2.1	9,440	1.6	78%	41,531	7.1
Highly Rural	0	0	0	0.0	0	0.0	0	0.0	0%	0	0.0

[1] Land Use Type Definitions
- Urban Area: population density of at least 1,000 people per square mile.
- Rural Area: Any non-urban or non-highly rural area.
- Highly Rural Area: An area having less than 7 people per square mile.