NSTAR Electric Company
Western Massachusetts Electric Company
each d/b/a Eversource Energy
D.P.U. 17-05
Exhibit ES-GMBC-1
January 17, 2017
H.O. _____

COMMONWEALTH OF MASSACHUSETTS

DEPARTMENT OF PUBLIC UTILITIES

Petition of NSTAR Electric Company and Western Massachusetts Electric Company each d/b/a Eversource Energy for Approval of an Increase in Base Distribution Rates for Electric Service Pursuant to G.L. c. 164, § 94 and 220 C.M.R. § 5.00	)	D.P.U. 17-05

DIRECT TESTIMONY OF

Craig A. Hallstrom
Penelope M. Conner
Paul R. Renaud
Jennifer A. Schilling
Samuel G. Eaton

Grid Modernization Base Commitment

On behalf of

NSTAR Electric Company and
Western Massachusetts Electric Company
each d/b/a Eversource Energy

January 17, 2017

DIRECT TESTIMONY OF
CRAIG A. HALLSTROM, PENELOPE M. CONNER, PAUL R. RENAUD
JENNIFER A. SCHILLING & SAMUEL G. EATON

TABLE OF CONTENTS

COMMONWEALTH OF MASSACHUSETTS

DEPARTMENT OF PUBLIC UTILITIES

DIRECT TESTIMONY OF

CRAIG A. HALLSTROM, PENELOPE M. CONNER, PAUL R. RENAUD

JENNIFER A. SCHILLING & SAMUEL G. EATON

I. INTRODUCTION

Craig A. Hallstrom

Q. Please state your name, position and business address.

A. My name is Craig A. Hallstrom. I am President, Regional Electric Operations for Massachusetts and Connecticut for Eversource Energy. My business address is 247 Station Ave, Westwood, Massachusetts 02090.

Q. What are your principal responsibilities in this position?

A. As President, Regional Electric Operations, I am responsible for providing safe and reliable electric service to Eversource customers in both Massachusetts and Connecticut. I have oversight for electric field operations and electric system operations for NSTAR Electric Company ("NSTAR Electric") and Western Massachusetts Electric Company ("WMECO") in Massachusetts, and for Connecticut Light and Power Company ("CL&P") in Connecticut. I lead a team of approximately 2,270 employees and manage an annual budget of nearly $1 billion for operations and maintenance and capital work on the transmission and distribution systems. In this proceeding, I am testifying on behalf of NSTAR Electric and WMECO each d/b/a Eversource Energy (together "Eversource" or the "Company").

Q. Please summarize your professional and educational background.

A. In 1981, I received an Associate degree in Electric Engineering Technology from Wentworth Institute of Technology. In 1985, I graduated from Merrimack College with a Bachelor of Science degree. In 1991, I received a Master of Business Administration degree from Northeastern University. I began my career at Massachusetts Electric Company in 1981 and joined NSTAR Electric (Boston Edison Company) in 1989. Since that time, I have served in several managerial and supervisory roles with successive responsibility, including Senior Supervising Engineer; Manager, Splicing Division/Northeast Division/Trouble & Maintenance Department; Director Electric Operations; and Vice President of Electric Operations. I was named President of NSTAR Electric and WMECO in 2013, and in June 2016, I was named to my current position.

Q. Have you previously testified before the Department or other regulatory agencies?

A. Yes. I have previously testified before the Department of Public Utilities (the "Department") in relation to the Department's investigation of the Company's storm performance in NSTAR Electric Company, D.P.U. 11-86-B/11-119-B (2012) and the Company's storm-cost recovery in NSTAR Electric Company, D.P.U. 13-52 (2013), as well in several generic proceedings involving electric operations and service quality among other matters.

Penelope M. Conner

Q. Please state your name, position and business address.

A. My name is Penelope M. Conner. I am the Senior Vice President and Chief Customer Officer for Eversource Energy Service Company ("Eversource Service Company" or "ESC"). My business address is 247 Station Ave, Westwood, Massachusetts 02090.

Q. What are your principal responsibilities in this position?

A. As Senior Vice President and Chief Customer Officer, I am responsible for overseeing all aspects of the Eversource Energy customer services, including the customer-contact center, billing, field services, credit and collections and strategic account management. In additon, I am responsible for delivering a cost-effective portfolio of energy-efficiency programs to customers on behalf of the Eversource gas and electric companies. I lead a team of 1,400 employees and manage a budget of $120 million annually. In this proceeding, I am testifying on behalf of NSTAR Electric and WMECO.

Q. Please summarize your professional and educational background.

A. I hold a Bachelor of Science degree in industrial engineering from North Carolina State University and I am a registered Professional Engineer. From 1986 through 1998, I worked for Duke Power Company in Charlotte, North Carolina. I served in a

variety of roles starting in engineering, to managing dispatch and customer service functions, to serving as the assistant to Duke Power's President and culminating in a position as General Manager for Process Integration. From 1998 through 2002, I worked for Tampa Electric Company in Tampa, FL, as a Director of Customer Service. I directed the customer service team of 350 employees with a budget of $21 million. In the four years that I was with Tampa Electric Company, I improved customer satisfaction while reducing overall customer service costs, increasing the company's J.D. Power ranking in the years 1998 through 2001 for billing and payment from 11th to 5th in the nation; and for customer service from 20th to 1st nationally, while reducing bad-debt writeoffs by 20 percent. In 2002, I was hired by NSTAR as Vice President of Customer Care, where I ensured quality customer service for NSTAR's 1.3 million electric and gas customers. This included meter reading, billing, call center, credit and collections, energy efficiency, commercial and industrial account management and cash remittance. I was named Senior Vice President and Chief Customer Officer in 2012 following the NSTAR/Northeast Utilities merger.

For over seven years, I have been the featured customer-service columnist for Electric Power and Light Magazine. I am the author of two books, Customer Service: Utility Style and Energy Efficiency: Principles and Practices. I am a member of the Edison Electric Institute Retail Services Committee; Chair of the Customer Service

Week Board of Directors; and President of the American Council for an Energy Efficient Economy. I also serve on the Customer Advisory Council for the Fraunhofer Center for Sustainable Energy Systems and the City of Boston's Green Ribbon Commission.

Q. Have you previously testified before the Department or other regulatory agencies?

A. Yes. I have previously testified before the Department in several proceedings, including the following: NSTAR Electric Company, D.P.U. 07-64 (2007) (NSTAR Green petition); Investigation regarding Low Income Consumer Protection and Assistance, D.P.U. 08-4 (2008) (on behalf of NSTAR Electric Company); Three Year Energy Efficiency Plans, D.P.U. 09-120 (2010) (on behalf of NSTAR Electric Company); NSTAR Electric Company, D.P.U. 10-06 (2010) (revised energy efficiency surcharge tariffs); NSTAR Electric Company, D.P.U. 11-85-B/11-119-B (2012) (storm investigation); Electric Grid Modernization, D.P.U. 12-76 (2014) (technical session); Service Quality Guidelines, D.P.U. 12-120 (2012) (on behalf of NSTAR Electric Company and Western Massachusetts Electric Company each d/b/a Eversource Energy); and NSTAR Electric Company and Western Massachusetts Electric Company each d/b/a Eversource Energy, D.P.U. 15-122/15-123 (Grid Modernization Plan).

Paul R. Renaud

Q. By whom are you employed and in what capacity?

A. I am the Vice President of Engineering, Massachusetts Eversource Service Company. My business address is 247 Station Ave, Westwood, Massachusetts 02090.

Q. What are your principal responsibilities in this position?

A. I am responsible for Distribution System Planning, Substation & Distribution Engineering and NERC compliance activities on behalf of Eversource Energy's operating utility subsidiaries in Massachusetts, including NSTAR Electric and WMECO. In this proceeding, I am testifying on behalf of NSTAR Electric and WMECO.

Q. Please describe your educational and professional background.

A. In 1988, I graduated from the University of Bridgeport in Bridgeport, Connecticut with a Bachelor of Science degree in Electrical Engineering. In 1997, I subsequently earned a Master of Science, Electrical Engineering, Power Systems degree from Northeastern University in Boston, Massachusetts. From 2000 through 2011, I worked for National Grid in Waltham, Massachusetts, where I started as a Lead Senior Engineer for Transmission Market Development. In 2002, I was promoted to Principal Engineer for Transmission Regulation and Policy and, in 2005, I was further promoted to Manager for Transmission Asset Strategy. In 2008 through 2011,

I held the position of Vice President of Transmission Asset Management, managing transmission assets in New York and New England. Beginning in 2011, I worked for Vermont Electric Power Company, where I served as Director of System Planning, Engineering and Telecommunication. I provided strategic and day-to-day direction on all engineering and planning activities related to Vermont's high-voltage transmission system. In March 2014, I was hired by Eversource as Vice President of Engineering, Massachusetts. I am also a registered Professional Engineer in the Commonwealth of Massachusetts.

Q. Have you previously testified before the Department or other regulatory agencies?

A. Yes. I have previously testified before the Department in NSTAR Electric Company and Western Massachusetts Electric Company each d/b/a Eversource Energy, D.P.U. 15-122/15-123 (Grid Modernization Plan).

Jennifer A. Schilling

Q. Please state your name, position and business address.

A. My name is Jennifer A. Schilling. I am the Director of Strategy and Performance for Eversource Service Company. My business address is 247 Station Ave, Westwood, Massachusetts 02090.

Q. What are your principal responsibilities in this position?

A. As Director of Strategy and Performance, I am responsible for developing asset management strategies to support optimization of the Eversource Energy portfolio of electric transmission and distribution capital investments. I am also responsible for transmission and distribution standandards and telecommunications strategy. In this proceeding, I am testifying on behalf of NSTAR Electric and WMECO.

Q. Please summarize your professional and educational background.

A. I graduated with a Bachlor of Arts degree in environmental science and political science from Barnard College, Columbia University in 1995. In 2001, I earned a Master of Business Administration from Duke University. From 2001 to 2008, I held a number of positions at Reliant Energy in Houston Texas, ending my tenure in the position of Director, Corporate Strategy. In 2008, I joined the Northeast Utilities System as the Director of Business Planning for WMECO. I subsequently accepted the role of Director, Asset Management for WMECO and then Director, Distribution Engineering for the Company, prior to assuming my current role.

Q. Have you previously testified before the Department or other regulatory agencies?

A. Yes. I have previously testified before the Department in Western Massachusetts Electric Company, D.P.U. 09-34 (WMECO's Smart Grid Pilot Plan).

Samuel G. Eaton

Q. Please state your name, position and business address.

A. My name is Samuel G. Eaton. I am Project Director, Electric Vehicle Charging and Energy Storage Development for Eversource Service Company. My business address is 247 Station Ave, Westwood, Massachusetts 02090.

Q. What are your principal responsibilities in this position?

A. As Project Director, I am responsible for managing the Company's electric vehicle and energy storage development strategies including the development of specific electric vehicle charging and energy storage development programs across Eversource. In this proceeding, I am testifying on behalf of NSTAR Electric and WMECO.

Q. Please summarize your professional and educational background.

A. I graduated from Brandeis University in 2005 with a Bachelor of Arts degree in Economics and Business. In 2005, I began my consulting career by providing management, regulatory policy and strategy related services to investor owned utilities and investors in the regulated utility industry. My experience in consulting includes evaluating and supporting regulatory policy; and major utility procurement initiatives, auditing internal and project controls, evaluating management strategy and advising on corporate and asset acquisitions and divestitures. In 2016, I left my

position as Director of ScottMadden, Inc. to join Eversource as Project Director, Electric Vehicle Charging and Energy Storage Development.

Q. Have you previously testified before the Department or other regulatory agencies?

A. Yes. I have previously testified before the Department in NSTAR Electric Company and Western Massachusetts Electric Company each d/b/a Eversource Energy, D.P.U. 15-181 [Withdrawn], relating to the requested approval of Firm Gas Transportation and Storage Agreements with Algonquin Gas Transmission Company, LLC, pursuant to G.L. c. 164, § 94A.

Q. What is the purpose of this joint testimony?

A. The purpose of this joint testimony is to present the Company's Grid Modernization Base Commitment ("GMBC"), as one of two interrelated elements of the Eversource Grid-Wise Performance Plan. Within the Eversource Grid-Wise Performance Plan, the GMBC will work in conjunction with a proposed performance-based ratemaking mechanism ("PBRM"). Through the GMBC, the Company will commit to $400 million in incremental investment over the next five years, without a separate cost-recovery mechanism. With the Department's approval of the PBRM, Eversource would initiate the GMBC as of January 1, 2018, to enable clean-energy initiatives, including the development of electric-vehicle infrastructure and electric-storage

capabilities, as well as the implementation of technologies, such as remote sensing and switching that will assist in integrating distributed energy resources ("DER") and maintaining top-tier service reliability. The Eversource GMBC Investment Plan provides the details of the Company's planned investments through the GMBC, accompanying this testimony as Exhibit ES-GMBC-2. Exhibit ES-GMBC-2 delineates the Company's five-year investment plan for the GMBC.

As part of the *Eversource Grid-Wise Performance Plan*, the Company is proposing a set of 14 metrics within six GMBC investment categories that will allow the Department and other stakeholders to gauge the Company's progress on its GMBC commitments. The metrics are also designed to produce gains in knowledge and experience that will inform future development of the modernized electric grid. Performance on these metrics will be the basis for discussions with stakeholders over the investment horizon of the GMBC. Apart from the GMBC (and under the PBRM), the Company will remain subject to the Department's rigorous service-quality guidelines, which were recently updated in D.P.U. 12-120-D (2015), requiring improved performance by electric utilities in the area of electric reliability. The performance metrics developed by the Company to apply to the specific commitments contained within the GMBC are set forth in Exhibit ES-GMBC-3, accompanying this testimony. The same metrics are also replicated in Exhibit ES-GMBC-2, as part of the Eversource GMBC Investment Plan.

The GMBC is designed to enable technologies that would further the objectives of the Green Communities Act ("GCA") and the Global Warming Solutions Act ("GWSA"),[1] as most recently expressed in the Baker Administration's Executive Order No. 569, Establishing an Integrated Climate Change Strategy for the Commonwealth (September 16, 2016) ("Executive Order No. 569"), including the reduction of greenhouse gases and preparation for the impacts of climate change. Executive Order No. 569 is provided as Exhibit ES-GMBC-4, accompanying this testimony.

Together, the GCA and GWSA put in place a comprehensive policy framework designed to result in marked reductions to greenhouse gas emissions on a designated time line. In the eight years that have passed since the enactment of the GCA and GWSA, the operating environment for electric distribution companies has experienced a profound transformation, evolving into a highly dynamic setting characterized by declining electric consumption on a per-customer basis, coupled with intensifying pressure for more reliable electric service, unbounded digital access and the widespread accommodation of DER, among other factors. Consequently, electric utilities are at a crossroads where the ability to extract revenue from the system to cover necessary operating costs and capital investment is declining, while

[1] Chapter 169 of the Acts of 2008, An Act Relative To Green Communities ("Green Communities Act") and An Act Establishing the Global Warming Solutions Act, St. 2008 c. 298, § 7.

the obligations and demands for performance to meet a range of stakeholder interests is rapidly expanding.

The *Eversource Grid-Wise Performance Plan*, encompassing the PBRM and GMBC, represents the Company's proposal for getting started on the next generation distribution utility.

Q. Would you please describe the overall structure of the GMBC?

A. As we will discuss below, the GMBC encompasses two overarching categories of grid-modernization initiatives, which are Distribution Network System Operations and Customer Engagement and Enablement. The investments identified within these two broad categories will deliver tangible benefits to customers with respect to (1) system resiliency and carbon-emissions reduction; (2) integration of DER and visibility into the performance and impact of DER on the Company's system in real-time; and (3) facilitation of DER customer engagement. Improved system resiliency and reliability remains more critical than ever in the context of needing to accomodate DER integration and the associated two-way power flows on the system, while also meeting the challenge of climate-change impacts. Investments within these two overarching categories represent the foundational steps that are necessary to implement other aspects of grid modernization for the electric grid and for

customers consistent with the objectives identified by the Department in Electric Grid Modernization, D.P.U. 12-76-B (2013).

The specific investments that Eversource has included in the GMBC represent critical "enabling" investments that are necessary to support a broad spectrum of grid-modernization efforts envisioned for the next generation electric-distribution utility. A complete modernization of the grid will require extensive, long-term change. The Company has an imperative to manage this change in a way that maintains the distribution system's capability to provide customers with safe and reliable service in a model where power is both generated and consumed by customers and new resource types provide alternatives to traditional distribution investments.

At the same time, the extent and nature of the coming change is not entirely certain and will depend on technology changes, business economics and other factors outside the Company's control. As a result, it is important that initiating investments are made in a manner that will accommodate a range of future scenarios and that incorporate experience gained along the way. The GMBC plan accomplishes these objectives.

As described in detail below, the GMBC encompasses certain components of the Eversource Grid Modernization Plan ("GMP") and Short Term Investment Plan ("STIP") under review by the Department in D.P.U. 15-122/15-123 (the "2015

GMP"). However, the GMBC also incorporates initiatives not previously presented to the Department, such as a significantly expanded proposal for automation of the Company's 4kV system; electric vehicle make-ready infrastructure and an energy storage pilot program. These details are covered in Exhibit ES-GMBC-2, which presents the details of the Company's proposed GMBC Investment Plan and five-year investment schedule.

Q. Is the Company requesting approval of the 2015 GMP filed in D.P.U. 15-122/15-123, in this proceeding?

A. No, the Company is not requesting approval of the 2015 GMP in this proceeding, although the Company has included several elements of the Company's 2015 GMP in the GMBC. In this proceeding, the Company is requesting that the Department approve implementation of the GMBC as part of the *Eversource Grid-Wise Performance Plan*, to encompass a *subset* of foundational elements for grid modernization. The Company's proposal in D.P.U. 15-122/15-123 remains an overarching concept designed to achieve the Department's initially stated grid modernization objectives, including its objectives related to Advanced Metering Functionality ("AMF") and Time Varying Rates ("TVR"). The Company is not proposing these two elements here and expects to continue to participate fully in the Department's proceeding in D.P.U. 15-122/15-123 in relation to these elements.

Q. Is the Company planning to adjust the 2015 GMP on file with the Department?

A. Yes. The Company is preparing a revised Eversource 2015 GMP for filing with the Department in D.P.U. 15-122/15-123. The revision will remove elements of the Eversource STIP from the 2015 GMP, which are now included in the GMBC or are no longer part of the Company's proposal. The Company's proposal for TVR and the associated technology investments will remain part of the 2015 GMP under review in D.P.U. 15-122/15-123 and the Company plans to participate fully in that docket. The Company anticipates that the modified 2015 GMP will be fully explored and litigated by the Department and other stakeholders in D.P.U. 15-122/15-123.

Q. What is the guiding principle that the Company has applied in structuring the GMBC?

A. During the Department's proceeding in Electric Grid Modernization, D.P.U. 12-76, participants (including Eversource) recognized that no definitive construct has yet emerged in the electric industry as to the exact nature and characteristics of the future, modernized grid. As a result, the Department's generic investigation into grid modernization focused on identifying "the range of capabilities that collectively define a modern distribution framework."[2] It was further acknowledged that "there is a range of potential capabilities, acitivites and enablers that may result in the desired outcomes" and that the effectiveness of "each potential capability and enabler may be

dependent upon many factors," thereby requiring consideration and evaluation over time by the Department, electric distribution companies, consumer advocates and other stakeholders.[3]

The capabilities identified in D.P.U. 12-76 as appropriate for consideration included: (1) reducing the impact of outages; (2) optimizing demand to encourage customer engagement in peak-load reduction and allow for better utilization of customer load as a resource for distribution planning and operations; (3) integrating DER; (4) improving a company's ability to monitor the location, performance and utilization of equipment and crews across the network.[4] The investments contemplated for the GMBC serve as the foundational, first-step initiatives to enable the long-term achievement of these objectives.

As these objectives imply, grid modernization is the process of transforming the operation and management of electric distribution systems from radial, one-way power delivery systems relying heavily on physical and manual processes to monitor, assess and maintain system performance, to a system that encompasses *two-way* power flows enabled by electronic, computer-based equipment that can communicate

---

[2] D.P.U. 12-76, *Massachusetts Electric Grid Modernization Stakeholder Working Group Process: Report to the Department of Public Utilities from the Steering Committee*, Final Report, July, 2 2013, at 11.

[3] Id.

[4] Id. at 11-13.

information within, across and outside of the system on a secure, safe and reliable basis. Today, electric distribution companies operate largely the way they have operated for upward of 100 years and completing this envisioned transformation will take years of hard work, substantial capital investment and collaboration among a range of constituencies. Planning and execution of this vision will involve iteration as new technologies and processes are put in place allowing for evaluation and operational learning, and subsequent adjustment as experience is gained. The Company's GMBC is designed to initiate this effort and commence the learning process with investments that are targeted at specific objectives and that can be implemented and evaluated in areas on the Eversource system where there is already a concentration of DER, such as in southeastern and western Massachusetts.

Q. In your view, what is the critical path element of the GMBC?

A. As discussed in more detail below, the foundation of this transformation will be the distribution management system or "DMS," which will serve a system-critical role similar to the role currently served by the Company's Supervisory Control and Data Acquisition ("SCADA") system and Outage Management System ("OMS"). A DMS is necessary to collect data from the distribution system and to control and optimize system resources, on a real-time basis. The futuristic capabilities envisioned for electric distribution facilities cannot be achieved without implementation of the DMS, making development of the DMS a "mission-critical" system. Yet, there are

few models to go by given that very few electric utilities in the United States have implemented a DMS to date.[5] Thus, a chief objective of the Company's planned investment in a DMS through the GMBC is to commence development of the conceptual plan and program requirements for the Eversource DMS.

Other elements of the GMBC are designed to meet similar objectives of serving as "enabling" tools and investments that are necessary prerequisites for transformation. Enabling investments included in the GMBC will advance three key characteristics necessary for the modern grid: (1) system resiliency and carbon-emissions reduction; (2) integration of DER and visibility into the operation and impact of DER on the Company's system in real-time; and (3) facilitation of DER customer engagement. As a first-step grid-modernization enablement plan, the GMBC is not designed to achieve an end-state vision, nor is it intended to confine the scope of the Company's work to reach an envisioned end-state. To the contrary, the Company fully anticipates that the GMBC will be expanded upon, modified and supplemented in significant dimension into the future. The GMBC represents a necessary and important first step in the progression to a transformed distribution system.

[5] Foundational Report Series: Advanced Distribution Systems for Grid Modernization, Argonne National Laboratory, Energy Systems Division, provided as Exhibit ES-GMBC-5.

Q. What is the specific authorization that the Company is seeking from the Department in this proceeding in relation to the GMBC?

A. In this proceeding, the Company is asking the Department to make two findings regarding the Company's proposed GMBC for implementation on January 1, 2018. First, the Company requests that the Department "pre-approve" the *proposed categories* of GMBC investments as reasonableand appropriate, and therefore, eligible for inclusion in rate base in the next base-rate proceeding.[6] This is the same standard that the Department stated would apply to the 2015 GMP in D.P.U. 15-122/15-123. D.P.U. 12-76-B at 22-25. The Company is not requesting the Department to "pre-approve" specific projects or to waive any future review of cost and cost containment. All of the GMBC investments would remain subject to the cost review applicable under the Department's prudence standard in the next rate case. See, D.P.U. 12-76-B at 22-25. However, the reasonableness of the Company's decision to make the identified investments would be confirmed in this proceeding.

Second, the Company is requesting that the Department find that the total, proposed budget amount associated with each proposed category of investment is reasonable and appropriate. Again, this is not to say that the Company will avoid any type of cost review or analysis of pre-construction and post-construction cost variance. Instead, the Company is simply asking the Department to confirm the relative share

[6] These categories are shown in Table ES-GMBC-2, below.

of the $400 million commitment allocated to each project category is reasonable and appropriate as compared to the amounts allocated to other investment categories proposed for the GMBC, i.e., that the relative share of the GMBC commitment allotted to each category reflects an appropriate emphasis for the Company's overall grid-modernization effort. The Company's proposal for the GMBC includes annual reporting on program expenditures in relation to the authorized budget amounts and anticipates that investment could shift between categories over time as experience is gained where the Department is in agreement that alteration of the original plan is warranted and appropriate.

Q. Does the Company's proposed GMBC allow for modifications or additions in the future to address new or modified grid modernization initiatives?

A. Yes. As discussed in the Company's testimony on the proposed Eversource Grid-Wise Performance Plan (Exhibit ES-GWPP-1), the Company is proposing to submit information on the GMBC as part of its annual compliance filing for the PBRM. Information submitted to the Department would include the Company's progress in developing the anticipated investments and other performance data in conformance with the metrics ultimately approved by the Department in this proceeding to demonstrate that the Company is meeting its commitments in relation to the *Eversource Grid-Wise Performance Plan*. Within this reporting mechanism, the Company plans to update the Department and other interested stakeholders

periodically on the status of the GMBC and the Company's experience with the investments made therein so that there is adequate information to evaluate progress, lessons learned and next steps. Changes to the plan, if and when appropriate, would be subject to review and approval by the Department through the annual PBRM proceeding.

In addition, the annual revenue-cap formula proposed by the Company includes a factor referenced as "GMP." The Company is committing to absorb the revenue requirement associated with up to $400 million of grid-modernization investments until the next base-rate case. Should the Department require or authorize grid-modernization investment above that amount over the next five years, recovery of the revenue requirement associated with non-GMBC investments would be recovered through the "GMP" factor in the PBRM. Unless and until this happens, the GMP factor would be set to zero in the annual PBRM.

Q. Are you sponsoring any exhibits through your testimony?

A. Yes. The table below lists the exhibits that we are sponsoring through our joint testimony:

Exhibit	Description
Exhibit ES-GMBC-1	Testimony of Hallstrom, Conner, Renaud, Schilling and Eaton
Exhibit ES-GMBC-2	GMBC Investment Plan
Exhibit ES-GMBC-3	Performance Metrics
Exhibit ES-GMBC-4	Executive Order #569, September 16, 2016
Exhibit ES-GMBC-5	*Advanced Distribution Systems for Grid Modernization*, Argonne National Laboratory, Energy Systems Division
Exhibit ES-GMBC-6	DOER Report on Energy Storage Initiatives
Exhibit ES-GMBC-7	Evaluation Framework for Electric Storage

Q. How is your testimony organized?

A. Section I of this testimony is the introduction. Section II of this testimony reviews the basic infrastructure on the Company's distribution system to provide an understanding of how the equipment used on the distribution will change over time. Section III reviews the Department's objectives for grid modernization and discusses the perspective applied by the Company in designing the GMBC for the *Eversource Grid-Wise Performance Plan* proposed to the Department in this proceeding. Section IV presents the details of the Company's proposed GMBC, which includes initiatives for an electric storage pilot program and development of electric vehicle charging infrastructure. Section V presents additional specificity on the Company's proposals for electric storage and electric vehicle charging infrastructure. Section VI presents

the Company's proposed performance metrics for the GMBC, as well as the overall *Eversource Grid-Wise Performance Plan*. Section VII is the conclusion.

II. OVERVIEW OF THE EVERSOURCE ELECTRIC DISTRIBUTION SYSTEM

Q. Would you please provide an overview description of the electric distribution system operated by Eversource in Massachusetts?

A. Yes. The Eversource electric distribution system in Massachusetts is comprised of the former operations of NSTAR Electric and WMECO. Both companies currently exist as individual, wholly owned subsidiaries of Eversource Energy. However, Eversource operates the legacy NSTAR Electric and WMECO electric distribution systems on a fully consolidated basis, with two geographic areas designated as "Eversource East" and "Eversource West." Through its Massachusetts electric operations, Eversource serves approximately 1.4 million customers in 139 cities and towns, or just less than one-half of the local municipalities in the Commonwealth of Massachusetts.

The service area designated as Eversource East encompasses the City of Boston and surrounding communities, extending west to Sudbury, Framingham, and Hopkinton, as well as communities in southeastern Massachusetts extending from Marshfield, south through Plymouth, Cape Cod and Martha's Vineyard, and west through New Bedford and Dartmouth. Within this geographic area, the Company serves

approximately 1.2 million residential, commercial and industrial customers in approximately 80 communities, covering approximately 1,700 square miles. The customer base includes approximately 1,013,077 residential customers and 164,869 business customers.

The service area designated as Eversource West encompasses the City of Springfield and surrounding communities, extending west to the New York border and north to Greenfield and the Vermont border. Within this geographic area, the Company serves approximately 209,000 residential, commercial and industrial customers in approximately 59 communities in western Massachusetts, covering approximately 1,500 square miles. The customer base includes approximately 189,507 residential customers and 18,961 business customers.

The Eversource electric distribution system is supplied by overhead and underground transmission lines that provide power to the system at voltages of 345 kV or 115 kV (in most cases). The transmission lines are connected to transformers in distribution substations that step down the higher voltage electricity entering the substation to lower voltages (4 kV to 25 kV) that can be supported by the distribution system. From the substation, power travels over “primary” distribution feeders (or circuits) to distribution transformers that are generally located on poles, pads, or in manholes or other strategic locations in the service area. The distribution transformers are used to

step down the distribution voltages of the primary circuits to utilization voltage levels (generally 120 to 480 volts) that are used to distribute power to customer homes and businesses or other service points on low-voltage or "secondary" distribution cables.

The distribution system consists of both overhead and underground conductor or cable systems that run generally on poles in the overhead system or through pipes and manholes in the underground system. Each of these support systems, i.e., poles and manholes, are engineered for specific uses and conditions and are analyzed to ensure the facilities will continue to perform the necessary function as new equipment is placed in or on the facilities, or the facilities are used in a different way than originally designed.

Power is distributed over bare and covered wire conductors in the overhead primary system and covered wire secondary cables in the secondary system. Poles used to carry overhead conductors are generally made from wood but also can be made from steel, concrete, or new composite materials that are used to improve resiliency under specific conditions.

The primary and secondary voltage cables used to distribute power throughout the underground distribution system are highly engineered systems consisting of multiple layers with each performing a specific function. Specifically, manholes are designed to: (1) provide access for system construction and maintenance; (2) provide access to

the conduits for the purpose of cable installations or replacement; (3) serve as a location where cable lengths may be "spliced" or joined together and interconnected; and (4) house transformers, switches, and facilities that support and protect the underground cable system, including grounding and bonding systems. Manholes are also the origin point for service connections to customer facilities and other electric equipment such as streetlights. Distribution cable is also sometimes encased in a steel or plastic pipe or "conduit," which in turn is generally housed in a concrete duct bank running between manholes. A single duct bank will house a grouping of two to twelve conduits, with the conduits ending at the manhole wall. Manholes are underground concrete vaults with multiple functions.

As has been the case for almost 100 years, the distribution system is designed to operate as a radial system with power delivered in a one-way direction from the transmission system to customers through the substation/distribution facilities described above. This delivery has traditionally occurred with little or no involvement from the customer, or with any interaction with customer-owned equipment. To accommodate broad-scale integration of DER, virtually every aspect of the Company's distribution protection and control system will need to be re-engineered to manage and balance two-way power flows in a way that optimizes system resources in a secure, safe and reliable manner.

Q. Are the specific characteristics of the infrastructure used to serve customers the same in the Eversource East and Eversource West distribution systems?

A. The Eversource East and Eversource West distribution systems encompass many of the same component facilities, but each system has distinct characteristics, such as differing degrees of customer density and of underground and overhead infrastructure, as well as differing use of network systems.

The Eversource East system consists of several low-voltage networks in downtown Boston; several smaller networks in Cambridge and New Bedford; extensive underground radial 4 kV and 13.8 kV systems in the more urban areas of Greater Boston, some limited underground outside the Greater Boston, and overhead systems of 4 kV to 25 kV throughout the territory. The Eversource West system consists of large overhead systems serving customers at 4 kV to 23 kV, as well as limited underground systems in Springfield and Pittsfield and smaller secondary networks in Springfield, Greenfield and Pittsfield.

In addition to the system differences, Eversource East is characterized by very densely populated urban areas in the Greater Boston area with short distribution circuits and much less densely populated rural areas in Cape Cod compared to the Eversource West service territory. The Eversource West territory is characterized by limited urban areas and large regions with long overhead circuits traversing sparsely populated territory.

Q. Would you provide a brief description of the Eversource East network distribution system?

A. Yes. There are a total of 12 low-voltage grids in the downtown Boston network, which are supplied from six network substations in the immediate area. Each network substation serves from one to three of the 12 low-voltage grids. The grids are designed so that each grid will continue to be supplied following the loss of any one of the transformers within the associated substation at peak-load intervals. In addition, the primary feeders to a given grid are arranged so that a fault on any 13.8 kV bus section in the station will not result in an outage to the system. The use of resistance grounding for the primary system for the secondary network results in improved power quality to customers served from the network. Not only are outages rare, but voltage sags for single line-to-ground faults on the primary system are virtually non-existent.

All primary feeders to the Eversource East underground networks in Boston are dedicated to the network, supplying only network transformers. This gives the greatest flexibility in operation and allows the use of sensitive ground-fault relaying. The system is designed to carry the peak load associated with any single primary feeder that may be out-of-service. Eversource East has strong track record of making technology investments on the Boston network system to maintain its reliability and resiliency. The loading on network transformers and protectors in the Boston system

is monitored in real time with a system that transmits data from the substation allowing system operators to have real-time data on loadings, network protector position, network protector fuse status, and other quantities in the network vault that might impact reliability. In effect, it allows Eversource East to conduct many of the vault-inspection functions on a daily basis without entering the vault.

Eversource East also operates network systems in Cambridge and New Bedford, Massachusetts, which are both relatively small in relation to the Boston network system.

Q. Could you provide a brief description of the Eversource East underground distribution system?

A. The Eversource East in-duct underground distribution systems operate at 4 kV and 13.8 kV. Although there are a number of different designs in these systems, the 4 kV system generally consists of a single feeder with either normally open or normally closed ties to adjacent feeders and loads tapped directly of the feeder. The 13.8 kV system employs a loop configuration with main feeders and lateral taps off that feeder that serve customers. In many of the 4 kV circuits, no matter where the fault occurs on the feeder or within a distribution transformer, the fault will cause an outage to all customers on the feeder. All of the Eversource East 4 kV underground feeders have isolation switches and at least one tie switch to other 4 kV facilities. The Company is able to restore service to most customers through switching protocols. Once the

failure is located and after the failure is repaired, the same switches are used to restore the system to its original configuration for normal operation.

Within the basic configuration of a 13.8 kV looped system, the main three-phase feeder is sectionalized with pad-mounted or submersible switches, with the loop open at one point. These switches can be either manually operated or equipped for remote operation. The main loop is supplied from two different sources at each end, from either the same or different substations. The taps off the main feeder are supplied through fuses from the pad-mounted switches that sectionalize the main feeder. The taps, either single or three-phase, are configured and operated in a normally open loop with ties to adjacent lateral taps. Should a fault occur on the main three-phase feeder, all the customers served from the faulted circuit will experience an outage. Similarly, should a fault occur on a fused tap, only the customers supplied from the fused tap will experience an outage. However, once the fault is located, whether on the main feeder or lateral, service can be restored to all customers simply by opening and closing the appropriate switches, without need to repair the fault.

Q. Would you provide a brief description of the Eversource East overhead distribution system?

A. The Eversource East overhead distribution system consists of 7,936 circuit miles of primary wire, consisting of three phase and single-phase service. The operating voltages are 4 kV and 13.8 kV in the Metro Boston area (former Boston Edison

Company). The wires are typically covered and configured in either cross-arm or spacer configuration. In the southeastern Massachusetts areas (former Commonwealth Electric Company) the common operating voltages include 4 kV, 13.2 kV and 23 kV. In those areas the primary wires are more typically uncovered (bare) installed on cross-arms, but in recent years have transitioned to more standard usage of covered wire and spacer cable. Customer density in the suburban areas is approximately 133 customers per mile, while in the urban areas the density is approximately 439 customers per mile. Distribution capacitor banks are installed where needed, and can either be group dispatched due to system loading or respond to local voltage conditions. Voltage regulation is performed at the station level but also using line voltage regulators where needed.

Distribution circuits are typically configured with multiple ties to either the distribution SCADA (or "DSCADA") system or manual control. However, some areas near the perimeters of the service regions and in the coastal areas there are more radial circuits due to geographic, road layout and customer density considerations. There is a significant amount of line recloser and line switching automation, including auto-restoration schemes that use fault data and logic to rapidly restore service to un-faulted line sections.

Q. What type of distribution automation has been installed on the Eversource East system over the past 10 years?

A. Eversource East has been investing in distribution automation for well over 25 years. Over that period, distribution automation equipment has continued to advance and Eversource has continued to successfully utilize the latest technology to provide better and more efficient service to customers. Since 2011, Eversource East has invested over $20 million in one of the most advanced distribution automation technologies in the industry, which is commonly referred to as "Grid Self Healing." Through this investment, Eversource East has installed over 1,700 automated switches on the overhead distribution system with over 5,000 sensors monitoring the system, and nearly 40 overhead automated transmission switches.

In addition to providing the Company with real time intelligence on system activity, this equipment allows the system to avert customer outages that would otherwise occur, as well as enabling automated restoration where outages do occur.

Q. Would you provide a brief description of the Eversource West distribution system?

A. Yes. Over 80 percent of Eversource West customers are served by 13.8 kV or 23 kV overhead construction. The typical overhead circuit consists of a circuit breaker and at least one radial recloser, which are not neccessarily tied into the DSCADA system. There is relatively low customer density in the Eversource West service area, with the average overhead circuit supplying 1,400 customers over an average span of 21 miles. Outside of the Springfield and Pittsfield metropolitan areas, there are multiple

circuits that extend over 100 circuit miles and a number of circuits with an average of 10 or fewer customers per mile. Over 95 percent of overhead circuits have at least one manual or automated tie to another circuit.

The conventional 13.8 kV or 23 kV underground systems serve approximately 15 percent of Eversource West customers predominantly in the Springfield and Pittsfield areas. The typical underground circuit consists of a DSCADA breaker providing service either with site-specific switchgear or area fused loops. All circuits have ties to other circuits and all load groups are supplied by a primary and alternate source configuration. The average underground circuit serves 500 customers and extends six miles. Although a small percentage of customers are currently served by 4 kV underground supply, Eversource West plans to convert these circuits to higher voltages by the end of 2018.

The remaining three percent of customers are served by secondary network systems in Springfield, Pittsfield and Greenfield. These network systems operate similarly to the Boston area networks, with multiple sources of redundancy and high levels of reliability. The Eversource network operating philosophy is similar across the state, although there is currently less real-time network monitoring capability in Eversource West.

Q. What type of distribution automation has been installed on the Eversource West system over the past 10 years?

A. On the overhead system, automation on the Eversource West distribution system has been based on recloser loop schemes. These schemes use local sensors to detect loss of voltage and initiate action. The reclosers operate locally to isolate the fault to the smallest possible segment and automatically re-supply customers in unaffected segments using tie reclosers. Over 60 percent of customers supplied by the Eversource West overhead system are located in a zone with automatic resupply using a recloser loop scheme, with an average zone size of under 700 customers. An additional 25 percent of overhead customers are served by circuits with automation; but, the benefit is limited to the fault isolation feature of the scheme. On the underground system in Eversource West, the Company typically installs switchgear with auto transfer between a primary and alternate source of supply. As a result, over 80 percent of customers on the underground system benefit from automation.

Q. What are the current network system enablers for the Eversource system?

A. The Company has made significant investments in a number of systems that allow Eversource to collect, manage and store data. These systems include:

- **SCADA** to monitor and/or control field devices such as substation transformers and breakers.

- **Energy Management System** ("EMS") to enable real-time transmission system modeling and analysis, training and advanced control functions.

- **Outage Management System** ("OMS") to manage and prioritize outage calls, provide customer self-service for outages, provide automated information back to customers on restoration status, and to manage dispatch repair crews.

- **Graphical Information System** ("GIS") to store and display asset type and location.

- **Billing Systems** to manage the processing of bills and payments, transmitting and receiving fuel payment and collection agency payments, commercial deposit processing, processing of internal and external suppliers, and provide a generation point for meter and service orders.

- **Metering and Meter Data Management Systems ("MDM")** to provide route assignment and data management for handheld and mobile meter data collection for 1.5 million meters, provide interval meter collection for time of use ("TOU") meters, provide interval data for ISO-NE load data management and analysis, and interval data for customer supplier subscriptions.

In addition to these systems, Eversource also operates extensive communication systems that consist of a fiber-optic network and microwave and radio systems for voice, field device and other communications.

Q. Would you please summarize the range of capabilities that will need to be incorporated into the existing distribution system infrastructure to achieve the model of the modernized electric grid envisioned for the future?

A. In managing the existing distribution system infrastrure, Eversource has consistently demonstrated commitment to the goal of maintaining an advanced, reliable and consumer satisfaction. Technological advances are making it possible to continue to transform the electric distribution grid from its current model of one-way power flow and rudimentary mechanical or even manual operation and control, to one that embraces digital automation, intelligence-based control, and DER to deliver significant enhancements in safety, reliability, resiliency and asset optimization. There are tremendous opportunities to further modernize the grid by leveraging technology and operating practices to meet the goals of customers and the communities in which they reside. resilient electric grid for the benefit of its customers. However, in this highly dynamic and demanding operating environment, raising that commitment to a new level requires a paradigm shift. The grid-modernization initiative launched by the Department in 2012 is founded on the principle that the current operating environment requires a paradigm shift and that a planned, coordinated and comprehensive approach involving a range of stakeholder constituencies is necessary to raise the bar and achieve tangible success in grid modernization. Over the next ten years, a robust electric power distribution system

has the potential to play an even more critical role in enabling economic growth, environmental sustainability and

In developing the GMBC, the Company is seeking to maximize benefit to customers by providing a balanced portfolio of technology improvements that provide tangible near term improvements in service levels; platforms upon which the Company will be able to build future modernization efforts; and incremental learning to inform investment decisions going forward.

Investments such as overhead automated feeder reconfiguration, urban underground automation and remote fault indication will provide immediate benefits in terms of improved reliability and better workforce utilization. At the end of the five-year horizon, the system will be highly sectionalized with the majority of customers benefiting from some form of automation. Similarly, the system load flow, customer portal and hosting capacity maps will be completed as a result of the GMBC, driving meaningful improvements in the interconnection of DER across the system.

The DMS will provide a platform to enable advanced capabilities to improve reliability and better manage the system in a model of two-way power flow. Over the next five years, the DMS will be deployed in areas such as southeastern MA and western MA to better understand how to best use the system tools in areas with high penetration of DER and system automation.

A number of investments are expected to provide near-term benefit but will also serve to greatly increase the Company's knowledge and understanding of the costs and benefits of wider deployments of emerging technologies. Volt/VAR optimization, adaptive protection and energy storage are such technologies. The use cases included in the GMBC are intended to maximize learning about different sources of benefit as well as the challenges associated with deployment. These elements reflect the Company's view that it is important to make decisions about the pace and extent of investment in new and emerging technologies based on a thoughtful, experienced based review and assessment.

With respect to key foundational technologies, the Company will continue to build capabilities leveraging state of the art technology to ensure continued cost effectiveness. Investments in communications infrastructure will continue beyond the five-year time horizon to ensure maximum effectiveness of DSCADA devices and to enable even more capabilities for applications such as Volt/VAR optimization. Eversource will also continue to invest in advanced sensing and monitoring. Although some assets, such as feeder breakers will be almost completely DSCADA enabled at the end of five years, advances in technology for monitoring and control will extend to assets across the distribution system, including more sensing on the urban secondary networks.

Planning and execution of this vision will involve iteration as new technologies and processes are put in place allowing for evaluation and operational learning, and subsequent adjustment as experience is gained. The Company's GMBC is designed to initiate this effort and commence the learning process with investments that are targeted at specific objectives and that can be implemented and evaluated in areas on the Eversource system where there is already a concentration of DER, such as in southeastern and western Massachusetts. The Company's expectation is that the GMBC will be expanded upon, modified and supplemented in significant dimension into the future. However, the GMBC is a necessary and important first step in the progression to a transformed distribution system.

III. GRID MODERNIZATION OBJECTIVES

Q. What are the Department's stated objectives for grid modernization?

A. In Electric Grid Modernization, D.P.U. 12-76-B (2014), the Department identified four objectives for modernization of the electric distribution grid. These objectives are: (1) reducing the effects of outages; (2) optimizing demand, which includes reducing system and customer costs; (3) integrating distributed resources; and (4) improving workforce and asset management. D.P.U. 12-76-B at 2.

For the first objective, the Department has said that it is essential that electric distribution companies maximize their use of technologies to reduce outages and

speed restoration, especially after major weather events. D.P.U. 12-76-B at 10. Therefore, the Department has found that companies should prioritize technologies that will: (1) make further progress in meeting the Department's service-quality goals; (2) reduce the numbers and duration of outages due to extreme weather, which are largely excluded from service quality metrics; and (3) enhance resiliency in the face of climate change. Id.

For the second objective, the Department has stated that it seeks time varying rates and processes to send pricing signals to customers in order to drive a reduction in their peak demand usage. Id. at 11-12.

For the third objective, the Department has stated that integrating distributed energy resources, such as renewables, electric vehicles and storage is central to achieving the Commonwealth's climate and resiliency goals and statutory requirements. Id. at 12. The Department has also stated that grid modernization investments should effectively address system imbalances caused by intermittent energy resources and that grid modernization will enable the safe interconnection and full integration of greater quantities of intermittent distributed energy resources. Id. at 12-13.

For the fourth objective, the Department has stated that efficient management of an electric distribution company's workforce and assets is another important objective of grid modernization. Grid modernization can provide substantial benefits in this area,

such as reduced costs of operations and maintenance and more effective deployment of resources for storm response and other outage events. The Department has indicated that it anticipates that companies will continually improve their operational efficiency and will use all available resources to that end.

Q. How do these identified objectives correlate to the challenges that Eversource is experiencing in relation to its distribution system?

A. The Department's four objectives for grid modernization provide critical focus for efforts to address the unyielding forces of change that Eversource is confronting on the electric distribution system. Moreover, the Department's recognition that "grid modernization" should be a fundamental policy goal of the Department is consistent with the reality that operational innovation and technological advancement must occur in order to increase the accessibility and efficiency of the distribution system for the purposes of climate change goals and service reliability. In particular, the proliferation of DER on the Company's system is changing characteristics of the system in relation to voltage profiles along circuits and the direction of power flow.

Distribution infrastructure such as voltage regulators and relays that protect the system, employees and the public from faulted equipment must now be able to function in a more complex operating environment. Historically, these devices needed only to manage flows down the feeder toward customer premises and now these devices are called on to manage flows in the other direction, while continuing to

perform their normal function. The Company is facing challenges daily in working through these changes both operationally and technologically to provide easy access to DER, while maintaining service reliability. The greater integration of DER will require a fundamental change in how the distribution system is operated and protected. Improvements in how information is collected and how it is used will need to be made that allow the Company to manage the distribution network actively and in real time.

The Company's GMBC proposal is designed to lay the groundwork for accomplishing these improvements and enabling the safe utilization of distributed energy resources on the electric distribution system. At the same time, the Company is working to address changing expectations for customer communications. The quest for a greater level of instantaneous information about the circumstances of a customer's service is ever-present and the Company cannot meet that challenge without making and leveraging technology investments across all facets of its operations.

Q. What is the impact that the integration of DER and other changing dynamics of the electric industry are having on the Company's capital-investment requirements?

A. There are several factors that are changing and increasing requirements for system investments. First, DER integration is a sought after goal of the Commonwealth's

climate change policies, but it is an objective that requires reconfiguration of the distribution system to accommodate changing power flows, while heightening the need for a strong focus on security, safety, reliability, and resiliency. Traditional electric distribution systems were not designed to monitor and control two-way power flows and, as a result, these capabilities must be incorporated into the distribution system. In some cases, technologies that can help manage two-way power flows can also be useful in assessing outages on the distribution system and restoring service to customers experiencing those outages as quickly as possible. The more "eyes on" on the system that the Company can create, and the more tools that the Company has for quickly and efficiently limiting the extent of outages and restoring power when an outage does occur, the more successful the Company can be at maintaining a high level of service reliability for business and residential customers as they both generate and consume power.

The characteristics of DER are also different than traditional customer load served by the distribution system. Many DERs such as wind and solar sources are intermittent in nature resulting in very fast changes in output, both up and down. These changes create rapid voltage changes on the distribution system that cause a perceptible "flicker" in lights for customers connected to the same distribution circuit. In many cases, additional distribution facilities are needed to mitigate this negative characteristic of the intermittent resource.

Moreover, the integration of DER will not offset the need for peak-load investment absent electric-storage capabilities or other means of dispatch. Eversource has added over 200 MW of solar photovoltaics ("PV") to its Massachusetts system since the beginning of 2015. The installation of large amounts of DER is having an undeniable impact on the region's load curve. However, to be valuable in avoiding peak load investment, the resources must be available when and where the resources are needed to offset peak demand. Peak solar output can reduce demand in the mid afternoon hours, but as the peak demand shifts to later in afternoon solar PV has a limited impact. In most areas of the Eversource service territory the peak is between 2PM and 6PM during a weekday afternoon. In southeastern MA, the peak most likely occurs between 5PM and 8PM potentially even on the weekend. Solar PV and other intermittent resources are, by definition, variable. Without having the ability to dispatch resources at the exact time when the resources are necessary, reliance on these resources is risky, potentially setting up the system for failure to meet customer peak demand when needed.

In addition, there are other dynamics that must be accounted for both in terms of the Company's traditional investments and grid-modernization investments. For example, although it is clear that the increased proliferation of DER, expanded energy efficiency programs and the development of stringent building-code requirements, among other influencing factors, have had the desired effect of curbing total system

load growth, the Company continues to experience pockets of customer load growth, requiring substantial investment and buildout of the Company's system to achieve greater capacity. The Company's construction of its new Electric Avenue and Seafood Way Substations in the Eversource East service territory and the Montague substation in the Eversource West territory are examples of the types of capital projects that remain an important focus of the Company's system planning efforts. Eversource is designing and constructing these types of capacity investments to incorporate consideration of the grid-modernization outcomes, particularly in relation to anticipated climate-change impacts and outage prevention.

In addition to climate-change considerations, all of the Company's infrastructure investments now must assure capabilities providing for significant physical and cyber security requirements and providing for real-time data collection and communication at a level that far exceeds historical requirements. Among other factors, the 2015 hack of Ukraine's electric grid has put the industry on high alert.

Q. What is the Company's perspective on grid modernization should progress to achieve the long-run outcomes and objectives?

A. Eversource supports the Department's overarching objectives for grid modernization, while recognizing that there are certain foundational elements that must be completed initially in order to enable the overall vision. Eversource's aim is to be a catalyst for clean energy initiatives furthering the Commonwealth's important climage change

goals. While continuing to deliver outstanding reliability and superior service to its customers, Eversource is in a position to makes investments that will transition the distribution system to meet the expectations of the "next generation" electric distribution utility. With that in mind, the GMBC is not designed to represent an all-encompassing end-game plan that would confine the Company's grid-modernization investments in the future. The Company recognizes that there is a lot that remains to be learned about the optimal solutions to grid modernization and that this learning will start with implementation of certain foundational elements. Therefore, the GMBC is aimed at implementing those foundational elements, making progress and gaining experience toward the future-state electric distribution utility.

More specifically, the investments identified by the Company as appropriate for the GMBC are threshold investments that are needed in order to implement other aspects of grid modernization and/or that represent initiatives that have a strong, immediate potential to increase the resiliency of the electric distribution system or reduce greenhouse gas emissions, which are all objectives identified by the Department in Grid Modernization, D.P.U. 12-76-B.

Q. What are the specific criteria that the Company has applied to develop the GMBC?

A. Eversource applied several criteria to determine the appropriate structure of the GMBC. These criteria are the following:

(a) Achieve the Department's Grid-Modernization Objectives

The Company has placed particular emphasis on technologies and investments that achieve multiple grid modernization objectives simultaneously, and each of the investments included in the GMBC satisfy multiple objectives to a certain extent.

(b) Focus on Customer Engagement

Customer engagement is the crux of the grid-modernization effort. Eversource customers seek high levels of service reliability, shorter restoration times and lower, stable prices as their key energy expectations. At the same time, customers want more information; an increased number of choices to lower energy costs and different opportunities to explore customer-side energy technologies. Investments that reduce the impact of outages, optimize demand, integrate distributed energy resources and improve workforce and asset management will serve the interests of customers across the Eversource system.

(c) Implement Cost-Effective Investments

Given the rate at which technology is advancing and the turnover on technologies, it is critical to identify and invest in technologies and programs that will deliver meaningful and sustainable benefits over the full life of the asset. At the same time, Eversource recognizes that important investments, especially those related to reliability, have benefits that are difficult, if not impossible, to quantify in dollar

terms. The Company has endeavored to identify investments that provide the highest return in relation to achieving system-related or public policy goals as compared to other possible investments.

(d) Advance State Policy Goals

In developing the GMBC, Eversource sought to make a meaningful contribution to advancing state policy goals. Massachusetts has been at the forefront of policy initiatives that support the advancement of energy efficiency, clean transportation, energy storage deployment, and clean energy resources. Absent accelerated investment to modernize the grid, it will become increasingly challenging to support customer demand for more ways to reduce their environmental impact. In particular, Eversource is an active partner in achieving the Commonwealth's goal of increasing the penetration of distributed energy resources, meeting the Commonwealth's Zero Emissions Vehicle ("ZEV"), energy storage, and greenhouse gas emissions goals, and in assuring that DER integration occurs in a manner that does not jeopardize the reliability of the system, and is done in a cost effective manner. Many of the investments included in the GMBC are directly focused on making distributed energy resources, inclusive of energy storage, an integral part of a dynamic grid optimized for two-way power flow.

(e) Leverage Grid Modernization Experience

Eversource has successfully invested in grid modernization technologies in

the past. These investments and experiences influenced the development of the GMBC and facilitate the Company's efforts to analyze new and emerging technologies based on practical experience.

(f) Adopt Transformational Technologies

The GMBC includes deployment of transformational technologies that make a meaningful contribution to supporting innovation and finding new and smarter ways to deliver benefits to Eversource's customers. The path to a truly modern grid will require shifts in the business of delivering electricity to end-use customers. With advances in sensing, communication, energy storage, and remote intelligence, Eversource will be positioned to leverage new technologies to deliver the benefits of an increasingly modernized grid. This is particularly important given the increasing complexity of the grid due to technological advancements in power distribution equipment and the proliferation of distributed energy resources.

(g) Establish a Flexible Foundation for the Future

Each investment included in the GMBC provides a strong foundation for the future evolution of the modern grid. Proposed investments are designed to reliably integrate into the current system, but to also provide the needed flexibility to adapt to changes in the technology landscape to support further innovation over time. In addition, the GMBC is designed to set the foundation for further advanced grid modernization

using a common platform of investments between the Eversource East and Eversource West operations.

IV. DETAILS OF THE GRID MODERNIZATION BASE COMMITMENT

Q. What are the primary components of the proposed GMBC?

A. The investment programs anticipated by the Company as part of the GMBC fall into two overarching categories: Distribution System Network Operations and Customer Engagement & Enablement. Within these two broad categories, the Company has identified a number of specific initiatives that are designed to enable the integration of distributed energy resources; to leverage system automation and modernization initiatives for both DER enablement and system resiliency; and to facilitate customer engagement in achieving clean energy goals.

Q. What are the specific investments that the Company is anticipating within these two overarching categories?

A. There are several specific investments within the overarching categories of Distribution System Network Operations and Customer Engagement and Enablement. Investments within the Distribution System Network Operations category are designed to enable the Company to operate its electric grid with the level of control and visibility necessary to allow easier, less expensive integration of DER and the associated two-way power flows across the system, while continuing to improve

system reliability and resiliency. Investments within the Customer Engagement and Enablement category are designed to enable customer involvement in DER integration and emissions reductions. Specific investments are shownin Table ES-GMBC-2, below:

Table ES-GMBC-2

GMBC Investment Initiatives

Characteristics of a Modern Grid	Major Initiatives	Investments	Program Budget ($, millions)
Distribution System Network Operations	Distribution System Network Operator	Distribution Management System Advanced system load flow Volt VAR Optimization	$44
	Automation	Automated Feeder Reconfiguration Urban underground system automation Adaptive protection (DER integration)	$84
	Foundational Technology for DMS and Automation	Advanced sensing technology (substation SCADA) Remote fault indicators (underground and overhead) Communications (middle mile and mesh)	$111
	Energy Storage	Energy storage research & demonstrations	$100
Customer Engagement & Enablement	Customer Tools for DER Integration	Customer portal Hosting capacity maps and tools Automated billing for improved customer service	$15
	Electric Vehicles	EV infrastructure and vehicle conversions	$45
TOTAL			$400

The investments grouped within the category of Distribution System Network Operation include the development of the conceptual plan and program requirements for the DMS, which is a necessary prerequisite for many of the capabilities that the modernized system will utilize; a Volt/VAR optimization program, which will facilitate active voltage management in direct response to distribution system changes; demonstration of advanced energy storage projects to better balance load on the distribution system and implementation of communications infrastructure, advanced sensing technology, tools to automate the system and tools to model and sumulate how power is flowing on the system. These investments will enable the integration of distributed energy resources and accommodate two-way power flows, while increasing the flexibility and reliability of the grid. Increased automation is also an important element of distribution system network operations.

The Customer Engagement and Enablement investments are designed to allow customers to participate in the achievement of the Commonwealth's clean energy goals through creation of a platform for customers to more easily integrate DER applications and to expand the deployment of electric vehicles. Specific investments in this category include electric vehicle charging infrastructure and the development of customer tools that allow customers to gain insight into the locations on the distribution system that can more easily accommodate interconnection and

information to make the intterconnection process easier and more transparent through an online application portal and a hosting capacity tool.

A. Distribution System Network Operations

Q. Would you please briefly describe the investments planned to increase network system flexibility to incorporate DER and improve system resiliency?

A. Yes. As we noted previously in this testimony, all of the investments planned as part of the GMBC are foundational investments necessary to implement other aspects of grid modernization or to otherwise meet the Commonwealth's clean energy policy objectives. Without these investments, the Company cannot accommodate the anticipated increase of DER integration on the distribution system in an efficient manner, while maintaining or improving reliability. The investments planned in the category of Distribution System Network Operations are as follows:[7]

1. Distribution System Management

Distribution Management System ("DMS"): The DMS is the cornerstone of a modernized electric grid and the single most important element required to manage the distribution system under dynamic circumstances, including the wide-scale integration of DER. Exhibit ES-GMBC-5 provides a copy of an article published by Argonne National Laboratory regarding the importance of a DMS for successful grid

[7] The Company has included its Electric Storage initiative in the category of Distribution System Network Operations. The Company's proposal on Electric Storage is discussed in Section V, below.

modernization.[8] As explained in this article, the "modernized" grid is expected to address many of the current challenges in the electrical power industry, such as making the electric grid more reliable, more resistant to incursions and capable of self healing. Advancements in information technology and data communication capabilities have led to the availability of new DSCADA and DMS systems to operate in the environment of the future modernized grid.

Eversource anticipates that the DMS would be implemented as a module addition to the Enterprise Energy Control System ("eECS") to enable advanced system automation for feeder reconfiguration and control based on real-time loading and DER information. The DMS will allow the Company to optimize distribution system performance to minimize electrical losses; improve asset utilization; improve reliability; and integrate DER.

The DMS investment consists of three elements: (1) DMS hardware and software licenses to allow system operators to use the functionality of the DMS; (2) interfaces with existing systems; and (3) resources required to build out circuit level models in the DMS system to provide an accurate representation of system conditions. This system will have the ability to accept and process large amounts of data as compared

[8] **Argonne National Laboratory** is a science and engineering research national laboratory operated by the University of Chicago for the U.S. Department of Energy. The Argonne National Laboratory is engaged in basic science research, energy storage and renewable energy, environmental sustainability, supercomputing and national security.

to the Company's current capabilities, while allowing the Company to react in real time and proactively operate equipment with greater efficiency in response to emerging problems. DMS deployment is supported by investment in system load-flow tools that provide accurate and regularly updated infrastructure models In addition, the DMS will serve as the base to enable advanced applications, such as Automated Feeder Reconfiguration and Volt/VAR Optimization. The Eversource investment in DMS will total approximately $9.0 million over five years. *The DMS investment meets all four of the Department's grid modernization objectives.*

System Load Flow: Eversource plans to invest in the development of a state-of-the-art real-time power flow model that will simulate the power flow characteristics of the distribution system. The capability to model power flows will improve the Company's ability to study the impact of DER on the distribution system. Without this additional information, the Company is forced to make conservative assumptions regarding the impact that a proposed resource will have on the system to assure there is no negative impact to the system. With an advanced load flow modeling capability, the Company will be positioned to make better informed decisions to integrate increasing levels of DER. This is an important building block to a distribution management system because it is one of the tools necessary to model two-way power flow on the grid. The model will also be able to simulate the interconnection of intermittent DER under various system configuration and

contingencies. The system load flow proposal would allow the Company to run a load-flow analysis at any time. The proposed technology would house all of the necessary data, including conductor size and voltage regulator settings and enable real-time load flow analysis. The Company proposes to invest approximately $20.0 million in network load flow over five years. *System Load Flow capability meets the objectives of (1) integrating DER, and (2) workforce and asset management.*

Volt/VAR Optimization: One of the capabilities of the modern grid will be advanced technologies aimed at reducing energy consumption and optimizing demand using voltage and VAR optimization ("VVO"). The concept of reducing service voltage to customers in order to reduce line losses and energy consumption is not new. Utilities have long recognized that customer usage decreases with a decrease in voltage such that a few percent lowering of voltage will result in a reduction in energy consumption. In fact, in the 1990's Eversource implemented programs known as conservation voltage reduction ("CVR") by lowering voltage at the substation bus to a level that was expected to keep voltage within the +/- 5 percent tolerance range for all customers on the associated feeders and manually changing line regulator and capacitor bank settings. Without real-time sensing, communication and control of line regulators and capacitors, however, it proved difficult to achieve meaningful levels of savings while ensuring reliable, high quality power service to customers. As the electric power grid became more complex over

time with basic automation and increased penetration of DER, CVR techniques were increasingly insufficient and the programs were terminated.

Advanced grid technology and communications capabilities have the potential to be game changers for Eversource in its ability to implement voltage management programs. In particular, the ability of the DMS to collect voltage data from along feeders in real-time, process the data and immediately send commands to substation transformers, line regulators and capacitor banks is a major departure from the CVR techniques. With visibility into real-time feeder conditions, a VVO system will reduce the potential for customers to experience low voltage. Customers are also less likely to experience voltage flicker once devices are automatically controlled based on actual field conditions rather than static settings and system models.

With the increasing penetration of DER on the system, the Company needs the capability to automatically monitor and adjust system voltages as DER output changes in response to changing weather conditions or other factors.

In addition, the Company needs the capability to observe system conditions in real time so that operators can react or so that automated mitigation steps will be taken by other systems. This is similar to the capability available on the transmission system to react to unexpected events in real time. In the context of the GMBC, the Company will implement Volt/VAR for small portions of the system as a pilot program over the

next five years in order to allow for study and assessment prior to determining the system-wide deployment strategy. The Company proposes to invest $14.8 million in Volt/VAR Optimization over five years. *Volt/VAR Optimization meets the objectives to (1) optimize demand, and (2) integrate DER.*

2. Automation

Automated Feeder Reconfiguration: One of the most fundamental and valuable capabilities of a modern grid is the ability for dynamic reconfiguration to minimize the impact to customers in the event of a fault condition. With advanced technology, the grid will 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. This capability makes the grid flexible and dynamic with the goal of maximizing system safety and reliability. This investment will be applied to the parts of the system that have little automation capability or will benefit from further sectionalization of the system to provide additional control points for enhanced network operations. Not only will this allow the Company to isolate problems on the system and restore power faster, but the system will be more flexible and able to optimize the use of available resources to meet system demand at all times. In addition, the Company will reduce the average number of customers in each isolating zone, which elevates the flexibility of the system and increases reliability. As a part of the GMBC, Eversource will deploy advanced technology on

the overhead system in both the Eversource East and Eversource West service areas with a proposed investment of $45.1 million over five years. *Automated Feeder Reconfiguration meets the objectives of (1) reducing the impact of outages, and (2) workforce and asset management.*

Urban Underground Switch Replacement: Like other enabling investments encompassed in the GMBC, automating and upgrading the existing 4 kV switching, sectionalization and SCADA infrastructure in the Greater Boston area will lay the groundwork for implementing additional modern technology going forward. The current, existing 4 kV sectionalization was installed in the period 1920-1940. This is the least modernized portion of the system, but a critical component of the system because it serves high-density population areas. This upgrade will allow integration of fault location, isolation and substantially improved switching capabilities. As a part of the GMBC, Eversource will deploy advanced technology on the Company's 4 kV underground systems in the Boston metro area with a proposed investment of $37.5 million over five years. *4 kV Automation & Switch Replacement meets the objectives of (1) reducing the impact of outages, and (2) workforce and asset management.*

Adaptive Protection: A complex and modern distribution system characterized by two-way power flow and sophisticated automation will require state-of-the-art

protection capabilities to ensure that all automated operations are coordinated with each other such that they function without negative impact to other operations of the distribution system. Investments to pilot adaptive protection and two-way power flow will provide valuable insight into how these technologies may support safe and reliable interconnection of greater levels of DER on the system and allow DER to continue to operate following automatic or manual changes to system topology. As a part of the GMBC, Eversource will invest $1.1 million in adaptive protection and two-way power flow over five years. *Adaptive Protection meets the objectives to (1) reduce the impact of outages, (2) integrate DER, and (3) workforce and asset management.*

3. Foundational Technologies for DMS and Automation

Advanced Sensing Technology: Widely deployed sensing and monitoring is a threshold requirement for a modern grid because it is the foundation upon which all advanced intelligence and real-time response depends. It is critical to have accurate, timely data on the operation of the system from the substation; overhead and underground lines; and secondary network. Today, that capability is limited to the more critical assets and in many cases is difficult to access in a consolidated view that is easy to process and use for decision making purposes. Consequently, advanced sensing technology must be considered an enabling investment for many of the

investments included in the GMBC. As part of the GMBC, the Company is proposing to invest approximately $59.9 million over five years. *Advanced Sensing Technology meets the objectives of (1) reducing the impact of reducing the impact of outages, (2) integrating DER, and (3) workforce and asset management.*

Remote Fault Circuit Indication: Like automated feeder reconfiguraton, remote fault indicators will increase the reliability of the system. Remote fault circuit indication will benefit customers affected by an outage, but will also provide core reliability to the system as a whole. Currently, when an underground fault occurs it is a very long process to identify the location of the fault in order to sectionalize and repair. This technology will allow the Company to locate faults remotely and substantially reduce the time for locating and repairing damage. In order to reduce the impact of outages, there are three key opportunities: deploy automation to limit the number of customers affected; reduce the time it takes to find the damage; and reduce the time it takes to repair the damage. Next generation remote faulted circuit indication is an innovative and cost effective way to reduce the time it takes to locate damage on the system. Remote fault circuit indication will be installed on both the underground and overhead system as part of the plan. The Company proposes to invest $21.2 million over five years. *Remote fault circuit indication meets the objectives of (1) reducing the impact of outages, and (2) workforce and asset management.*

Communications Infrastructure: A modern grid will require a secure, high-bandwidth, high-speed communication system to enable real-time, automated communications with end-use distribution operating equipment. As part of the GMBC, Eversource will make investments to enhance fiber and radio penetration across the service territory. The primary focus of the investment in upgraded communications capabilities will be to bring fiber to substations in both the Eversource East and Eversource West service territories where that infrastructure is absent today. The investment will also support expansion of Eversource's existing core network, which provides transport for DSCADA communications. Wireless point-to-multipoint and mesh-base stations will be built to extend the network out from the fiber core. These improvements will allow for increased data retrieval from each device and improved real-time remote access for event information gathering and reconfiguration. As part of the GMBC, the Company is proposing to invest approximately $30 million over five years.[9] *Investment in enhanced communication infrastructure meets all four of the Department's grid modernization objectives.*

4. Energy Storage

Q. Is the Company proposing investment in Energy Storage as part of the Distribution System Network Operations category of the GMBC?

[9] This investment is not designed to satisfy the communications functionality necessary to support TVR. Additional investment would be needed on communications should the Department determine it appropriate to move forward with TVR in the D.P.U. 15-122/D.P.U. 15-123 proceeding.

A. Yes. The Company is proposing to initiate a pilot program to validate the benefits of incorporating Energy Storage on the distribution system to facilitate DER interconnection, improve power quality, and manage system peak loads. This proposal is discussed in detail below in Section V of this testimony.

B. Customer Engagement and Enablement

Q. Please describe the planned investments in the category of Customer Engagement and Enablement.

A. There are three components of the Company's planned investment in the category of Customer Engagement and Enablement. First, the Company is proposing to develop hosting capacity maps. These maps will allow the Company to use a load-flow tool that simulates the impact of adding new facilities in certain locations to determine the ease of interconnection. This will increase transparency for customers by providing valuable information about interconnecting in a specific location before a customer spends time and money on an interconnection study. These maps will also offer customers information on alternative sites where interconnection may be easier.

Q. What is the second component of the Company's planned investment in Customer Engagement and Enablement initiatives?

A. The second component is the customer portal. The customer portal is an opportunity for interconnection customers to manage the interconnection of DER on an efficient and expeditious manner. Customers will be able to submit applications and track the

progress of studies and work orders through the portal. This increases transparency for the interconnection application process which will be important as the number of such applications increases over time.

Q. What is the third component of the Company's planned investment in Customer Engagement and Enablement initiatives?

A. The third component of the Company's planned investment in Customer Engagement and Enablement is the development of electric vehicle charging infrastructure. This proposal is discussed in detail below in Section V of this testimony.

Q. Are there any other initiatives that are planned within the Customer Engagement and Enablement category?

A. Yes. The billing process remains the Company's primary interface with customers because this contact occurs on a monthly basis. Distributed generation in Massachusetts has grown substantially creating increased manual billing and manual allocations of net metering credits. This manual intervention impacts the overall time to produce a bill, and is hampered at times by manual entry errors that must be corrected. The proposed improvements for the billing systems would fully automate the calculation of distribution generation credits and allocation of net metering credits. These billing system improvements will provide tangible benefits to customers. The automation of this process will provide more timely and accurate billing, which is overall more efficient in the administration.

Q. How will these planned investments assist in engaging and enabling customer participation in clean energy goals?

A. The Company has experienced an influx of DER and a strong interest from customers to connect to the electric grid. This is a trend that the Company fully expects to continue (and flourish) based on the Commonwealth's clean energy goals and mandates. The Company's Customer Engagement and Enablement initiatives are designed to establish foundational tools that will enable developers to avoid siting DER in places where costly mitigation will be required. This ability to strategically place new facilities is designed to reduce the timing lags sometimes experienced by customers in getting new facilities connected. Strategic placement of distributed energy resources also makes it easier for the Company to address or avoid adverse impacts on customers (e.g., high voltage impairing operation of customer equipment).

In approaching grid modernization, the Company has also endeavored to balance innovation with prudent use of customer dollars. The GMBC is designed to strike a balance between moving forward with innovative grid solutions, while assuring the best use of customer funds. Hosting maps are a good example of this balance. The Company did not include host maps in the 2015 GMP proposal pending before the Department because at that time the Company could not provide reliable, accurate host maps. In the interim, the Company has gained better insight through research and shared information with other utilities. Technology has improved to a point

where the Company is now confident that the host map capability can be developed on a reliable and accurate basis for customers.

Q. Are the Company's initiatives for Customer Engagement and Enablement aimed at existing or new DER customers?

A. The Company's planned initiatives for Customer Engagement and Enablement seek to benefit both those customers that have and have not adopted DER to date. Several of the components encompassed in the Company's proposed GMBC are designed to reduce interconnection costs for developers and therefore provide a benefit most directly to the Company's prospective DER customers. In addition, energy storage will allow distributed generation to flow back into the grid when needed (e.g., when solar may be unavailable on a cloudy day). This ability to better manage distributed generation resources will benefit all customers. In 2016, the Company received over to 8,500 applications to interconnect DER a number comparable to the number of requests for new service over the same period. This underscores the need for action to implement the foundational elements of grid modernization as quickly as possible.

C. Summary of GMBC

Q. Has the Company developed a GMBC Investment Plan to memorialize the parameters of the proposed GMBC?

A. Yes. Exhibit ES-GMBC-2 provides the GMBC Investment Plan with supporting detail for each of the Company's planned investments, including annual progress and

investment milestones. The GMBC Investment Plan is designed to deliver the benefits responsive to customer demands for an increasingly modern electric grid utilizing advanced technologies and capabilities. Grounded on the grid modernization objectives identified by the Department and supported by the Company, Eversource developed its GMBC vision by first identifying the key attributes that a grid modernization plan should strive to achieve in the long term. These attributes form the basis of the investments included in the GMBC.

Q. What is the Company aiming to accomplish with the GMBC?

A. Advances in digital sensing and communications technologies have opened up significant opportunities to modernize the electric distribution system. These technologies now provide cost-effective approaches for companies like Eversource to increase its level of understanding of the status of the distribution network in real-time, and at any point in time. In addition, sophisticated analytical engines enable the processing of large amounts of data to provide actionable insights to better operate and manage the distribution grid. Lastly, increased awareness of system conditions coupled with distribution management systems allow grid operators like Eversource to take real-time actions on the grid for the benefit of its customers. Taken together, investments of these types will enable Eversource to: (1) have more grid-wide awareness to enable DER integration and increase system resiliency; (2) use advanced analytics to inform decisions; and (3) take real-time actions to improve

reliability, efficiency and customer satisfaction in an environment where DER is pervasive on the system.

In that regard, Eversource has experienced a significant increase in the number and size of DER deployments over the last five years and the pace of requests to interconnect to the system has grown consistently. Over the next ten years, Eversource anticipates the level of deployment of DER to increase exponentially given the Commonwealth's strong policy support for these resources, as evidenced by the legislature's enactment of the Green Communities Act, the Global Warming Solutions Act and other enactments, and most recently, as expressed in the Baker Administration's Executive Order #569, issued in September 2016 (provided as Exhibit ES-GMBC-4). Eversource's highest priority has been, and will continue to be, the safe, reliable and cost-effective provision of service to its customers. The interconnection of DER into the distribution grid must be accomplished in a manner that does not detract from this core responsibility. Through its GMBC commitment, Eversource will help shape a future where one of the key characteristics of the grid is to continue to implement enhanced approaches to integrate DER in a manner that is safe, reliable and cost-effective.

V. ENERGY STORAGE AND ELECTRIC VEHICLE CHARGING INFRASTRUCTURE

A. Energy Storage

Q. What is the Company's proposal for implementation of electric storage within the GMBC?

A. Through the GMBC, the Company is committing to invest $100 million of capital in multiple energy-storage system ("ESS") demonstration projects across Massachusetts. This commitment is intended to help foster the market for energy storage in the Commonwealth, while enabling the Company to obtain valuable real-time operating data from the energy storage installations. This operating data will be critical to the Company as it evaluates future energy storage deployments and to validate the benefit streams available from the installation of energy storage on the distribution system.

Energy storage systems have the capability of serving multiple applications including peak shaving, peak shifting, system resilience, renewable intermittency mitigation and ancillary services. In certain instances, energy storage systems may be able to achieve certain of these applications simultaneously; thereby, combining multiple benefit streams for each project.

Moreover, there are certain areas on the Company's distribution system where DER integration associated with large solar photovoltaic facilities is so concentrated that

the Company must take steps to ensure system voltage stability. Consequently, Eversource is proposing to deploy energy storage systems to demonstrate and address intermittency and; smooth voltages.

The Company proposes to invest $100 million in energy storage over five years as part of the GMBC. *Energy Storage meets the grid-modernization objectives to (1) optimize demand, (2) integrate DER, and (3) enable workforce and asset management.*

Adding energy storage to the distribution grid enables customers to interconnect distributed generation in areas where the costs and time would otherwise be prohibitive, to enhance the power quality in locations where significant distributed generation is already installed, and supplant aging diesel generators.

Q. Where are the locations that the Company is evaluating to install and evaluate energy storage?

A. The Company is currently evaluating four energy storage projects in the following communities: Martha's Vineyard, Wellfleet, New Bedford and Pittsfield.

For example, the Company is evaluating energy storage on Martha's Vineyard. Martha's Vineyard is an island that relies on local generation as a back-up to electricity supplied from the mainland by undersea cable. Martha's Vineyard has limited capacity to accommodate additional DER due to difficulties in managing

voltage stability, with a high ratio of generation to load. With this level of DER integration, it is costly to interconnect incremental DER because a transmission upgrade becomes necessary. Adding energy storage combined with better visibility and network capabilities could allow the Company to avoid the greenhouse gas ("GHG") emissions associated with the aging diesel generators providing back-up supply, while enhancing system reliability on Martha's Vineyard and creating opportunities to integrate additional DER. Similarly, the proposal for Wellfleet could obviate the need for a new transmission line through the installation of a combined distribution line and energy-storage system to satisfy local load growth on Cape Cod.

The projects proposed for New Bedford and Pittsfield equally provide opportunities for the Company to enhance power quality for Eversource customers and integrate additional intermittent renewable resources in areas with existing DER. For example, the Pittsfield project is in the area of two of the Company's new proposed solar investments and which may be able to increase the potential for these resources to interact with one another. These projects are aimed at plugging the gaps that are expected to occur with the intermittent output of renewable resources. This outcome is critically important if the system is going to rely on installed DER to act as an alternative to a traditional "wires" solution.

Q. Why is the potential value of electric storage significant enough to warrant the investment proposed by the Company through the GMBC?

A. Energy storage holds the promise to fundamentally change the way the Company plans for and delivers electricity on the distribution system. As described in the *State of the Charge, Massachusetts Energy Storage Initiative* issued by the Massachusetts Department of Energy Resources ("DOER") (the "DOER Storage Initiative Report") in fall 2016, the existing electricity delivery model relies on a near perfect balance between supply and demand; thus, requiring the amount of electricity supplied to a location to match demand at that location instantaneously.[10] A copy of the DOER Storage Initiative Report is provided as Exhibit ES-GMBC-6.

Energy storage provides an opportunity to store electricity produced during periods of lower demand for delivery or use during periods of greater demand. For example, ISO-NE has noted that peak solar generation in the New England market is typically non-coincident with peak demand.[11] In these circumstances, energy storage offers the opportunity to store all or a portion of the generation produced locally by solar for use later in the day when demand peaks. Furthemore, energy storage in these circumstances would assist the Company with integrating DER by permitting the energy storage system to mitigate voltage flicker and other power-quality effects due

[10] Massachusetts Department of Energy Resources, *State of the Charge- Massachusetts Energy Storage Initiative*, Pg. i-ii.

[11] ISO-NE, *State of the Grid: ISO on Background* January 26, 2016, Pg. 34.

to the intermittent nature of solar generation; mitigate the voltage-rise effects of DER during light-load periods; and avoid reverse power flows that could otherwise be caused by a concentration of distributed generation resources in the area.

The absence of meaningful levels of energy storage compels the Company to plan for and build distribution system infrastructure that is sufficient to deliver electricity during all periods, including periods of extreme peak demand. However, when demand is not at peak levels, this additional capacity is often unused, as it is not needed to meet lower levels of demand. By integrating energy storage into the distribution system, the Company may be able to enhance the ability to integrate distributed generation and improve the resiliency of the Eversource system in areas with energy storage installations.

Q. Has the Company established objectives for the pilot deployment of energy-storage systems in the four specified locatins?

A. Yes, Eversource has established the following goals and objectives for the pilot deployment of energy storage in the four specified locations:

- Safely install, operate, and maintain utility-scale energy-storage systems within Eversource's service territory.
- Provide an energy storage system control and monitoring capability that can be managed by the appropriate local field personnel and control center with

limited distruption to the day-to-day operations of the other operational entities within Eversource.

- Demonstrate and evaluate metrics and techniques that enhance Eversource's ability to design and model the appropriate energy storage capacities (energy and power) for future large scale energy-storage system deployment efforts.
- Demonstrate and evaluate the benefits of open standards, including the Modular Energy Storage Architecture ("MESA"), to enhance the scalability of energy storage system integration with utility operations.
- Utilize system level and field measurements to quantify the technical and economic benefits of each individual energy storage system function, as well as the sum of the combined use-cases for energy storage systems.

These overall objectives for the Eversource energy storage pilot deployment are designed to build Eversource's familiarity with energy storage systems, while allowing the Company to integrate energy storage as a tool within its typical distribution system planning efforts.

Q. Please describe the types of energy storage being explored by the Company.

A. The Company is currently evaluating a range of advanced energy storage technologies for its demonstration projects including: lithium-ion options; and other emerging chemical battery technologies that may provide longer-term

deployment opportunities. Currently, the Company expects to use lithium-ion for each of the projects identified above. However, the Company will continue to identify and evaluate the maturity of other energy storage technologies that may present a cost-effective deployment opportunity. The Company is also separately pursuing other energy storage technologies and opportunities outside of GMBC through energy efficiency efforts aimed at commercial and industrial customers. The technologies considered in the energy efficiency efforts include both chemical batteries and thermal storage technologies on the customer-side of the meter.

Q. What are the benefits to the distribution system and to customers of installing energy storage on the Company's distribution system?

A. The DOER Storage Initiative Report identified more than $800 million of potential net benefits to customers from the installation of up to 600MW of energy storage in Massachusetts.[12]

These potential benefits are cost savings to customers from:

- Reducing the price paid for electricity;
- Lowering peak demand;
- Reducing GHG emissions (and the effective cost of compliance);
- Reducing the cost to integrate renewable generation; and

[12] Massachusetts Department of Energy Resources, *State of the Charge- Massachusetts Energy Storage Initiative*, Pg. i-ii.

- Increasing the grid's overall flexibility, reliability and resiliency.

By completing a series of demonstration projects in Massachusetts, Eversource expects to validate this analysis with pragmatic experience and actual data.

Q. How will the Company's commitment to energy storage enable greater integration of renewable generation?

A. As identified earlier, energy delivery systems have been designed to deliver energy from centrally located power generators to demand centers. This traditional one-way power flow was implemented to simplify the design of the energy delivery system and lower the cost of the power distribution equipment installed on the system, and was reasonable for the energy delivery model envisioned when such systems were designed. The proliferation of DER such as solar and wind applications, has introduced new power management challenges that must be managed to avoid damage to equipment or negative effects on power quality. Although these resources are often designed to primarily serve the demand of the customer who installed the distributed resource, excess power may flow into the distribution system from the customer site during periods of lower demand at the customer site. That reversal of power flow must be managed and may cause periods of high voltage in homes or businesses that are electrically near the customer that installed the distributed generating resource.

Q. How will the Company's commitment to energy storage potentially reduce GHG emissions and assist in reaching the Commonwealth's clean-energy goals?

A. Currently, during periods of peak electricity demand, ISO-NE must call upon certain peaking generators to rapidly respond to increases in demand. These resources provide ample flexibility for the New England power system, but are often less efficient when utilized in this manner, and therefore higher emitting, than the resources that are run in a base load or mid-merit fashion. In addition, these resources may utilize higher emitting fuel types during certain seasons when the availability of lower cost natural gas may be limited by constraints on the interstate natural gas system. Because many energy-storage technologies are similarly able to rapidly respond to changes in electricity demand, such resources offer the opportunity to displace electricity generated by the less efficient and higher-emitting power plants that are currently used to meet short-term increases in demand.

Q. How would energy storage be deployed on Martha's Vineyard?

A. Martha's Vineyard is currently served by four subsea distribution cables and five legacy emergency diesel generators located on the island for which Eversource contracts to maintain reliability. In past years, certain of the subsea distribution cables experienced significant outages and necessitated extended operation of the five 2.5MW emergency diesel generators. Energy storage offers the opportunity to maintain and improve the reliability and resiliency of the system serving Martha's

Vineyard by replacing one or more of the aging emergency diesel generators with new energy storage systems that are able to respond to demand or reliability needs as an on-island resource. Moreover, by displacing the energy produced by the aging diesel generators, Eversource could avoid the GHG, NOx, and particulate emissions from operating the emergency diesel generators.

Martha's Vineyard has also experienced substantial DER integration and Eversource is challenged to integrate additional DER given the limits of the existing distribution system serving the island. By locating energy storage on Martha's Vineyard, Eversource would be better positioned to integrate additional renewable distributed energy resources on Martha's Vineyard. For instance, Eversource may be able to use the energy storage system to avoid system issues such as voltage flicker, impacts on distribution voltage regulation equipment, and light-load voltage rise.

Lastly, in 2016, the Company experienced significant growth in peak load on Martha's Vineyard that is increasing the stress on the existing transmission and distribution system serving Martha's Vineyard. There was a multi-day heat wave in August of 2016 that resulted in a peak load of 65.9MVA (as compared to the peak load in 2015 of 54.5MVA, a year-over-year peak load increase of 11.4MVA, or 21 percent). On eight days, the peak load exceeded the (N-1) + (12.5MVA diesel) load

flow limit.[13] In addition, the diesel generators were dispatched to provide energy to reduce loading on the four submarine cables on at least eight high-load days. As a result, Eversource is increasingly challenged to meet its N-1 contingency planning criteria on the Island and may soon be in a position where it must consider either upgrading or adding to the subsea cables or the diesel generators serving Martha's Vineyard.

Q. What is the current expected cost of completing an energy-storage system to serve demand on Martha's Vineyard?

A. Eversource is currently exploring a two-phase deployment of energy storage on Martha's Vineyard. The first phase of this project would install an estimated 5 MW, 20 MWh energy-storage system in late 2018 or early 2019, at a non-binding estimated cost of approximately $10-15 million.[14] A second, larger energy-storage system capable of provide 10 MW of power and 64 MWh of energy could be deployed in 2022, at a preliminary non-binding estimated cost of $20-30 million. These cost estimates were developed by Eversource's third-party consultant who designed the preliminary system specifications based on a power-flow study of the

[13] The N-1 planning contingency standard requires that Eversource plan to serve customer demand assuming the loss of the single largest resource used to meet the demand served from a particular portion of the Eversource distribution system. For Martha's Vineyard this is the loss of the largest undersea distribution cable. The N-1 plus 12.5 MVA planning contingency is similar to the N-1 contingency, but accounts for the additional emergency generating capacity located on Martha's Vineyard that can be used to serve load.

[14] Eversource is continuing to develop and evaluate its cost estimates. Eversource anticipates filing definitive, detailed cost estimates with the Department prior to undertaking any energy-storage project.

distribution system in the area and is subject to change as additional, detailed analysis of the project opportunity is completed in 2017.

Q. How could energy storage enhance the reliability and resiliency of the Company's distribution system on the outer Cape?

A. Eversource is also considering energy storage as a possible solution to an N-1 reliability contingency at the Wellfleet substation. Currently, this substation is served by a single 115-kV line and a single backup 23-kV line from the Orleans substation. During normal operations these lines are sufficient to serve demand in Wellfleet, Eastham, Truro, and Provincetown. Nonetheless, in scenarios in which Eversource loses use of the 115-kV line serving the Wellfleet substation, the remaining 23-kV line and backup substation supplying it have insufficient capacity to fully meet demand without exceeding load flow limt of 40MVA and subjecting customers in the lower Cape area to unacceptably low voltages. However, the size of the energy storage system that would be specified to fully solve this challenge at the Wellfleet substation may necessitate the combination of an energy storage solution and a distribution upgrade to reliably serve the growing demand in the area.

Q. What is the current expected cost of completing an energy-storage system to serve demand on the outer Cape?

A. As with the Martha's Vineyard project opportunity, Eversource is continuing to evaluate the installation of energy storage on the outer Cape. Based on the

preliminary analysis completed to date, an energy-storage system with 12 MW of capacity and 100 MWh of energy is estimated to cost $35-45 million with deployment in 2020 or 2021. This cost estimate was developed by Eversource's third party consultant who designed the preliminary system specifications based on its power flow study of the distribution system in the area and is subject to change as additional, detailed analysis of the project opportunity is completed in 2017.

Q. How could installing energy storage in New Bedford enhance power quality and reliability for Eversource's customers serviced from the New Bedford substation?

A. The area around the New Bedford Industrial Drive substation is currently experiencing certain power-quality issues including short, intermittent outages and transient voltage dip and surge conditions that affect certain of the commercial and industrial customers served from this substation. For example, a large manufacturer served from the New Bedford substation has noted the manufacturing challenges it faces due to momentary outages and transient voltage conditions during certain parts of its manufacturing process. Since 2014, this manufacturer reported ten facility events resulting from various concerns including permanent distribution faults, flickering light conditions, momentary distribution outages due to weather events affecting other distribution circuits out of the same substation, and outages due to voltage transients due a lightning strike on the 115kV transmission system. By installing energy storage at this location, Eversource would be better able to respond

to the momentary fluctuations in voltage and improve the power quality in this location.

Q. What is the current expected cost of completing an energy storage system to meet demand served by the New Bedford substation?

A. The New Bedford energy storage project opportunity is at the earliest stages of development. Eversource's preliminary estimates for this project opportunity are approximately $10-15 million based on an energy-storage system designed to provide 6 MW of capacity and 4 MWh of energy. This estimate is based on the preliminary energy storage system capacity and public cost estimates for such facilities. Eversource is currently undertaking a detailed analysis of the project opportunity with a third party and expects to have further developed cost estimates available in Spring 2017.

Q. Why is the Company exploring the possibility of installing energy storage as part of its Pittsfield solar project?

A. The Partridge Road substation that serves the Pittsfield area currently has a large amount of DER connected to its circuits including large solar photovoltaic facilities and the Berkshire Wind facility. In addition, Eversource is currently in the process of expanding its solar generating portfolio in MA and has identified this area for additional large scale solar installations. By installing energy storage in this area, paired with its solar facility, Eversource would be better able to respond to the

momentary fluctuations in voltage and improve the power quality in this location. There is also the potential to integrate additional DER in this area with the installation of advanced energy storage at the Partridge Road substation.

Q. What is the current expected cost of completing an energy storage system to meet demand served from the Partridge Road substation?

A. Like the New Bedford project opportunity, the Pittsfield energy storage project opportunity is at the earliest stages of development. Eversource's preliminary estimates for this project opportunity are approximately $10-15 million based on an energy storage system designed to provide 6 MW of capacity and 4 MWh of energy. This estimate is based on the preliminary energy-storage system capacity and public cost estimates for such facilities. Eversource is currently undertaking a detailed analysis of the project opportunity with a consultant and expects to have further developed cost estimates available in Spring 2017.

Q. Is Eversource considering other opportunities to install energy storage on its system to improve the flexibility, reliability and resiliency of its system?

A. Yes, the Company is currently undertaking strategic planning exercises to programmatically identify the specific criteria and objectives that will be used to evaluate opportunities to further deploy energy storage on the Eversource distribution systems. These criteria will assist the Company and the distribution system planners in identifying future energy storage projects while better understanding the specific

use cases for which energy storage should be considered. For example, Eversource anticipates developing a standardized playbook that can be used to evaluate opportunities to install energy storage systems in locations challenged to integrate additional distributed energy resources or facing additional transmission or distribution upgrades. By this planning effort, Eversource expects to identify additional, future opportunities to deploy energy storage on its distribution system.

Q. Please describe the Company's proposed evaluation plan for the energy-storage projects.

A. To evaluate the energy-storage demonstration projects, Eversource expects to complete a two part evaluation process for each project, involving (a) a project-development evaluation; and (b) a project-operations evaluation.

For each project, the project development evaluation will review the siting and permitting process; engineering and design process; the commercial strategies employed; the construction process; and the operational turnover process for operational experiences that can be used to enhance future energy storage projects. Eversource anticipates completing this evaluation within 12 months of the commercial operations date of each project.

The project operations evaluations will be conducted 24 months after the completion of each project. The project operations evaluation will be used to identify the extent

to which each project was able to validate the intended primary and secondary functions. These functions are currently described at a high-level in Exhibit ES-GMBC-7, and will be subject to further development as the projects are refined. Upon completion of each project, Eversource will use the metrics identified in Exhibit ES-GMBC-7 to determine the ability of each project to meet these functions.

Q. Is Eversource committing to completing the four energy-storage projects identified above through the GMBC?

A. In part. Based on the preliminary cost estimates developed to date, Eversource anticipates that it will be able to complete up to four energy storage projects within its $100 million capital commitment to energy storage assuming battery cell and power conversion system prices continue to decline as predicted. This price reduction is assumed in the analysis conducted by Eversource's third-party consultants.

In addition, Eversource is continuing to evaluate these and other potential energy-storage demonstration projects that provide value for Eversource customers and foster the development of energy storage in Massachusetts. Although these four projects have strong potential to produce customer benefits and represent the types of energy-storage projects that should be undertaken to study the realm of benefits available for Eversource customers, the specific energy-storage projects may change if other, more beneficial project opportunities are identified through the Company's evaluation process.

Q. How will Eversource determine whether to proceed with each of the energy storage projects identified above?

A. To determine whether to proceed with the specified storage projects listed above, Eversource will conduct detailed technical and financial evaluations of each project. From a technical standpoint, the Company will consider the design of the system including the power and energy requirements of each energy-storage system and its ability to address the needs of each location. From a financial perspective, Eversource is evaluating the cost effectiveness of installing an energy-storage system in each location including avoided transmission or distribution investments and wholesale market revenues. Lastly, Eversource will consider the non-monetary benefits of each project such as how a project may permit the Company to integrate additional DER or enhance local power quality, reliability or resiliency.

For example, Eversource is working with a third-party consultant to design the system for the Martha's Vineyard project taking into consideration the capacity limits of the existing undersea distribution lines and the diesel generators located on Martha's Vineyard. From this analysis, Eversource and its consultant have developed preliminary cost estimates and a potential two-phase deployment schedule to solve the challenges faced on Martha's Vineyard. Eversource is now working to evaluate the benefits associated with installing an energy storage system on Martha's Vineyard including the avoided cost of operating the existing diesel generators, as well as

potential wholesale market revenues. In addition, Eversource is evaluating other, non-monetary benefits associated with installing the energy-storage system, including the ability to integrate additional DER, enhanced resiliency and improved power quality. Similar efforts are underway for completing the Cape Cod, New Bedford and Pittsfield storage opportunities.

Q. Will Eversource decide whether to proceed with each energy-storage opportunity solely on the basis of the financial benefits derived?

A. No. Eversource is evaluating the technical, financial and other, non-monetary benefits that can enhance the reliability, quality and resiliency of its distribution system. These non-monetary benefits are also critical to improve system operations in the face of increased DER integration. Eversource also recognizes the Commonwealth's efforts through legislation and the policy work of the Department of Energy Resources to demonstrate the viability of energy storage in Massachusetts. In that regard, Eversource expects to develop these projects as demonstration projects that validate the use cases and business models associated with energy storage. Eversource plans to conduct an annual process to provide information and obtain stakeholder input on the direction, progress and achievement of the GMBC in advance of each annual compliance filing and will report on this collaboration in those filings.

Q. Will the Department retain oversight of the energy-storage projects the Company selects to pursue as part of the GMBC?

A. Yes. Eversource recognizes that its efforts to identify develop, and implement energy storage projects are at a beginning stage. Therefore, it is important for the Company to provide progress reports and obtain input of interested stakeholders for the Department information as to the direction and progress of the Company's efforts, as well as providing specifics on selected projects.

Eversource will identify the specific demonstration projects or groups of projects selected for deployment in its annual reports to the Department. The final reports will be submitted in the annual PBRM update. The Company recognizes the importance of continued dialogue with various stakeholders and the dissemination of information on the analytical process within the annual PBRM filings to facilitate the Department's review of project milestones.

Eversource currently anticipates it will complete its analysis of the first energy storage projects in late 2017. The Company anticipates continuing to evaluate additional energy storage opportunities so that a second phase of energy storage projects will be identified for the Department in 2019 or early 2020.

Eversource anticipates that completion of these two phases of energy storage projects will fully utilize its $100 million commitment to advance the deployment of energy

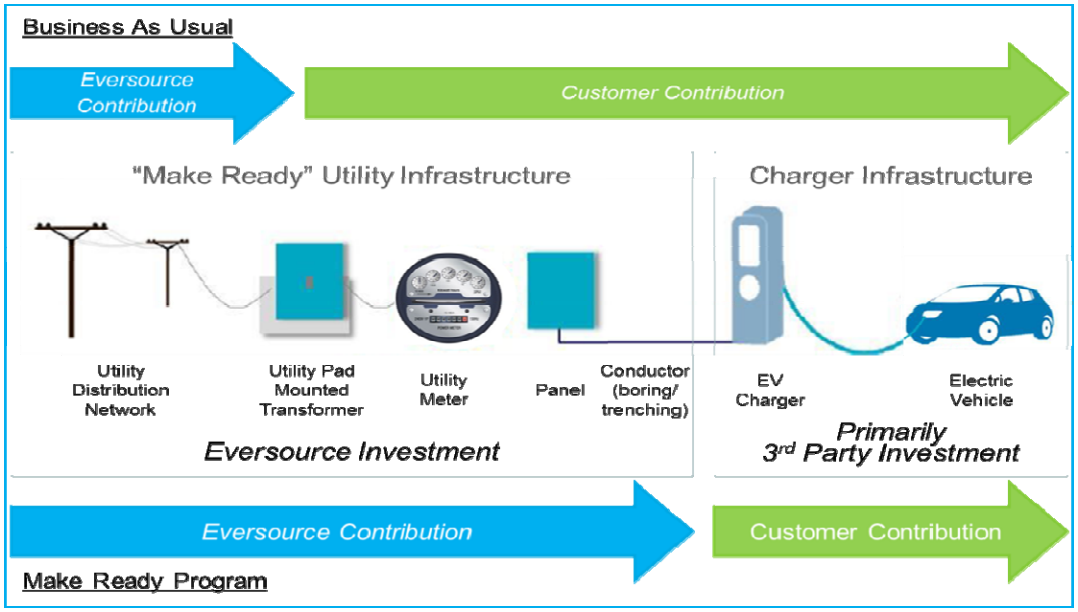
storage in Massachusetts. However, utility-scale storage alternatives are emerging and storage equipment prices are continuing to decline. Therefore, it may be possible to reduce the cost of future deployment projects. To the extent the Company is able to develop the initial energy storage projects at a lower than anticipated cost, Eversource will identify additional demonstration projects to meets its total capital commitment and deliver additional benefits to Eversource customers.

B. Electric Vehicle Charging Infrastructure

Q. What is the Company's proposal for electric vehicle charging infrastructure?

A. As part of the GMBC, the Company is proposing to implement an Electric Vehicle Infrastructure and Education Program to facilitate more widespread adoption of electric vehicles ("EV") in Massachusetts. The Company's proposal on the development of EV is the construction of the make-ready EV charging infrastructure necessary to expand the network of charging stations, as shown in Figure. ES-GMBC-1.

Figure ES-GMBC-1
Eversource EV Make-Ready Infrastructure



The make-ready infrastructure the Company is proposing to install will include the following electrical equipment and connections:

- The distribution primary lateral service feed;
- The necessary transformer and transformer pad;
- The new service meter;
- The new service panel; and
- The associated conduit and conductor necessary to connect each piece of equipment.

This initiative represents a substantial increase in the service infrastructure supported by the Company for the new service connection process.

The expanded network of charging stations enabled by the Company's program is essential to assist the Commonwealth to meet its GHG reduction goals. The Commonwealth's clean-energy goals including the relevant provisions of the Global Warming Solutions Act and the Massachusetts Executive Office of Energy and Environmental Affairs campaign to encourage zero emission vehicle ("ZEV"),[15] including commitment to the goal of 300,000 ZEVs registered in Massachusetts by 2025. Currently, barriers exist to these goals.

For example, despite numerous good-faith efforts undertaken by the Commonwealth and other stakeholders toward these goals, only 8,450 EVs were registered in Massachusetts as of September 30, 2016.[16] The Company's proposed Electric Vehicle Infrastructure and Education Program – in combination with the Commonwealth's existing programs and similar infrastructure programs proposed by other distribution companies – is expected to accelerate the purchase and registration of ZEVs in the Commonwealth. This will substantially increase the Commonwealth's ability to achieve EEA's commitment of 300,000 ZEVs by 2025 in furtherance of the emission reduction goals set forth in the GWSA.

[15] Plug in electric vehicles are a subset of ZEVs and therefore the Company's EV proposal will further the Commonwealth's emission goals, including increasing the number of ZEVs. Fuel cell vehicles are a second form of ZEVs; however, fuel cell vehicles are not directly supported through the Company's EV infrastructure proposal.

[16] Alexander, M. Registration Report Through September 2016. Unpublished Internal Document, Electric Power Research Institute, November 2016.

Q. Has the Department established a standard of review for EV charging proposals that is relevant to this proposal?

A. Yes. The Department opened an investigation regarding electric vehicles and electric vehicle charging in 2013. The proceeding remains open and ongoing. However, at the conclusion of the first part of the investigation the Department issued an order establishing the standard of review that would be applied to any electric distribution company's proposal for cost recovery associated with ownership and operation of EV supply equipment. Specifically, any such proposal must: (a) be in the public interest; (b) meet a need regarding the advancement of EV in the Commonwealth not likely to be met by the competitive EV charging market; and (c) not hinder the development of the competitive EV charging market. D.P.U. 13-182-A at 13.

Q. In your opinion, does the Company's EV proposal satisfy these three criteria?

A. Yes, it does. The program is in the public interest because it will further the Commonwealth's emission reduction goals. In addition, EV charging infrastructure will fill a need that has not been, nor is likely to be met by the competitive market. Lastly, because the Company is proposing to invest in make-ready infrastructure for EV chargers, but not the actual EV charging stations, there will be no risk that the Company's program will hinder the development of the competitive EV charging market. This is exactly the type of proposal that the Department's Order in D.P.U. 13-182-A sought to encourage.

Q. Please explain how the program meets a need regarding the advancement of EV charging that is not likely to be met by the competitive EV charging market.

A. A dramatic increase in the investment in EV charging infrastructure will be needed to meet the Commonwealth's carbon-emission reduction goals. The EEA reported that, "[a]s of August 5, 2015, there are 874 public charging outlets throughout the state at 321 electric stations."[17] According to the National Renewable Energy Laboratory (NREL) Regional Charging Infrastructure Analysis for Plug-in Electric Vehicles, Massachusetts will need, 37,413 to 45,270 workplace ports and 4,935 to 44,645 public ports to achieve the 2025 goal of 300,000 ZEVs registered in Massachusetts.[18] To date the majority of this investment in EV charging infrastructure has been achieved through a combination of private financing, together with federal and state grant assistance, including the Massachusetts Electric Vehicle Incentive Program ("MassEVIP").

However, it does not appear that private investment alone will be sufficient to produce the scale of infrastructure needed by 2025. Washington-state commissioned a study that found that "charging station business models that rely solely on direct revenue from EV charging services currently are not financially feasible" and that

[17] Massachusetts Zero Emission Vehicle Action Plan: A Roadmap to Reach 300,000 Zero Emission Vehicles on Massachusetts Roads by 2025, Commonwealth of Massachusetts, Executive Office of Energy and Environmental Affairs, August 2015.

[18] Wood, E., Raghavan, S., Rames, C., and Eichman, J. Regional Charging Infrastructure for Plug-In Electric Vehicles: A Case Study of Massachusetts, National Renewable Energy Laboratory, November 2016

viable business models must "capture other types of business value in addition to selling electricity."[19] The Eversource program lowers the investment barriers faced by private investment in EV charging infrastructure, leverages and expands the opportunity for private investment to own the charging stations themselves while at the same time enables the overall EV market.

Q. Is it possible that the Company's proposal will interfere with the development of the competitive market for EV chargers?

A. Currently, the market is failing to meet the needs of customers that either use, or wish to use, electric vehicles. The Massachusetts ZEV Commission received a proposal in November 2015 discussing the need for additional EV infrastructure; a proposal supported by ChargePoint, one of the industry's leading providers of EV chargers.[20] Deployment of EV infrastructure by utility companies is also supported by the Natural Resources Defense Council ("NRDC") report, "Driving Out Pollution: How Utilities Can Accelerate the Market for Electric Vehicles" (the "NRDC Report"). Based on analysis by the National Renewable Energy Laboratory ("NREL"), the NRDC concludes that a new model for deployment of EV infrastructure is necessary to deliver the comprehensive network of charging stations that is needed to meet

[19] Nigro, N. and Frades, M. Business Models for Financially Sustainable EV Charging Networks, Center for Climate and Energy Solutions, March 2015.

[20] ChargePoint operates is the world's largest electric vehicle charging network with over 31,100 total charging spots and over 390 Express Direct Charging ("DC") fast locations. See www.chargepoint.com/files/charpointfacts.pdf.

long-term emission reduction goals. NRDC Report at 7.

In addition, ChargePoint has committed to spend up to $20 million toward deployment of a national network of high-speed charging stations as part of a public-private partnership. See White House Press Release, Fact Sheet: Obama Administration Announces Federal and Private Sector Actions to Accelerate Electric Vehicle Adoption in the United States (July 21, 2016).[21],[22] Specifically, ChargePoint has committed to work with the federal, state, and local government agencies and private entities to identify optimal locations for high-speed charging stations and to secure financing. Id. Therefore, ChargePoint has already agreed to partner with other entities to accelerate the availability of EV chargers in the market place.

Lastly, by providing for the installation of make-ready infrastructure, the Company is enabling a system whereby a wide range of EV charging station models from multiple suppliers will be offered. This will not only prevent interference with the competitive market but will also maintain customer choice.

Q. Please characterize the various types of EV chargers.

A. EV chargers are generally divided into three market segments: (1) Level I chargers;

[21] www.whitehouse.gov/the-press-office/2016/07/21/fact-sheet-obama-administration-announces-federal-and-private-sector.

(2) Level II chargers; and (3) DC Fast Chargers. Level I charging is generally considered to include plugging the EV into a typical 110 volt household outlet and may require nearly a full day or more to fully charge existing EVs, depending on battery capacity.[23] Level II chargers rely on a 240 volt connection and are capable of fully charging most existing EVs in approximately 8 hours or less depending battery capacity. Lastly, DC Fast Chargers utilize direct current and are the fastest method for charging an EV. However, DC Fast Chargers are also the most expensive form of charger. Existing DC Fast Chargers permit a typical EV drive to obtain a full charge over lunch.[24] Among these three market segments, there are numerous differences and enhanced capabilities such as smart charging[25] or even higher capacity DC Fast Chargers.[26]

The program is intended to support the installation of primarily Level II chargers at targeted, long dwell-time locations such as workplaces, hotels, healthcare facilities, and educational facilities. The program will also support installation of a select

---

[22] Eversource Energy is also a signatory to the *Guiding Principles to Promote Electric Vehicles and Charging Infrastructure*, the public-private collaboration pursuant to which ChargePoint makes these commitments.

[23] In certain cases less than a full charge may be necessary to complete a typical daily commute.

[24] The statements of charger capacity and rates of charging are based on typical existing chargers within each category and typical battery sizes. Charger manufacturers continue to improve charging technology to shorten charging times for compatible vehicles.

[25] Smart charging is the intelligent charging of EVs, where charging can be shifted based on grid loads and in accordance to the vehicle owner's needs.

number of DC Fast Chargers at targeted locations in cooperation with governmental entities, charging network operators or private entities.

Q. What is the current status of EV infrastructure in the United States?

A. Certain automakers, BMW, Volkswagen and Nissan, have pledged to help finance more than 1,000 publicly available charging stations in the United States. NRDC Report at 7. This investment increases customer valuation of EVs. Id. Without adequate charging infrastructure customers are unlikely to purchase EVs. Id., Nissan market research that found that sufficient charging infrastructure would double the number of repeat EV purchasers.

Q. Please describe the provisions of the GWSA that are relevant to the program.

A. The GSWA was signed in law in August 2008 and created a framework for reducing greenhouse gas emissions. [Acts of 2008, c. 298, § 6]. The key provisions of the GWSA set forth GHG emission-reduction targets for the Commonwealth to be achieved by 2020 and 2050. Id. The emission-reduction target for 2020 is a 25 percent reduction from the Commonwealth's 1990 baseline level of GHG emissions.

[26] Higher capacity DC Fast Chargers would accelerate the speed of charging and permit EV charging to more closely approximate the time required to fill an existing vehicle with gasoline.

Id.[27]

A recent report issued by the EEA notes that the Commonwealth has achieved a reduction in GHG emissions of approximately 19 percent relative to the 1990 baseline.[28] Therefore, GHG emissions need to be reduced an additional six percent in order to reach the GWSA's goal of a 25 percent reduction in GHG emissions in 2020.[29] In addition, the report notes:

> A common conclusion across past 2050 planning studies, including the study that was completed to support the original CECP, is that the only viable path to deep reductions in GHG emissions is through a combination of reduced energy consumption (through increased energy efficiency in vehicles and buildings), expanded availability of clean electricity, *and electrification of the transportation and heating sectors. Electrification poses a particular challenge because of the need for new infrastructure, including transmission lines, storage capacity, and consumer-facing components such as public vehicle charging stations and smart meters.* The scope of the challenge can be summarized in three words: reduce, electrify and decarbonize."[30]

Q. In order to meet these GWSA goals has the Commonwealth established a specific goal for registering ZEVs in Massachusetts?

A. Yes. The EEA recognized that the transportation sector is a significant contributor to

---

[27] See also Executive Office of Energy and Environmental Affairs, "Massachusetts' Progress towards Reducing Greenhouse Gas (GHG) Emissions by 2020", available at: http://www.mass.gov/eea/air-water-climate-change/climate-change/massachusetts-global-warming-solutions-act/.

[28] See also Executive Office of Energy and Environmental Affairs, "Massachusetts Clean Energy and Climate Plan for 2020 – 2015 Update", available at: http://www.mass.gov/eea/docs/eea/energy/cecp-for-2020.pdf.

[29] Id.

[30] *Id., at 50.*

GHG emissions, stating that, "[s]ince the transportation sector accounts for 42% of the emissions associated with climate change, clean vehicles contribute greatly to the greenhouse gas reduction goals of our Global Warming Solutions Act (GWSA)."[31] For that reason, the EEA stated that "Massachusetts committed to the bold goal of 300,000 ZEVS registered in the state by 2025."[32]

Q. Does the Companu's proposal specifically target ZEVs?

A. Yes. Electric vehicles are a subset of ZEVs.[33] The Company's proposal will support an increased number of plug in electric vehicles in the Commonwealth. Plug in electric vehicles include both battery electric vehicles ("BEVs") and plus in hybrid electric vehicles ("PHEVs"); both BEVs and PHEVs are subsets of EVs and will each be supported by the Company's proposal.

Q. Do you know how many EVs are currently registered in Massachusetts?

A. Eversource receives monthly updates on EV registrations from the Electric Power Research Institute. According to this data, there are 8,450 EVs registered in Massachusetts as of September 30, 2016. [34] It is estimated that about 3,750 of these

---

[31] See Executive Office of Energy and Environmental Affairs, "The Massachusetts Zero Emission Vehicle Commission and Mass Drive Clean Campaign", available at: http://www.mass.gov/eea/waste-mgnt-recycling/air-quality/ma-zero-emission-vehicle-commission-and-mass-drive-clean-campaign/.

[32] Id.

[33] ZEVs also include fuel cell vehicles. Fuel cell vehicles are not directly supported by the Company's proposal because such vehicles rely on hydrogen stations rather than electric charging stations.

[34] Alexander (2016) Id.

vehicles are registered in the Eversource service territory. As a result, electricity accounts for a very small component of vehicle "fuel." Instead, traditional fuels (petroleum, diesel and ethanol) constitute nearly 100 percent of the fuel currently used for transportation in the Commonwealth.

Q. Although the GWSA was adopted over eight years ago, why is the number of ZEVs registered in Massachusetts well below the pace needed to timely achieve the EEA's goal of 300,000 ZEVs by 2025?

A. The Commonwealth, through the EEA, the Department of Environmental Protection ("DEP"), the DOER and the Department, along with other public and private stakeholders, should be commended for the efforts that have been taken to promote the goals of the GWSA including adoption of ZEVs. These efforts have included, for example, establishing the Massachusetts Electric Vehicle Task Force; issuing a draft "Massachusetts Zero Emission Vehicle Action Plan;" and initiating the "Mass Drive Clean" campaign, which is the first statewide test drive program to help educate consumers about the specific benefits of these vehicles, overcome any confusion, and allow drivers to experience how ZEVs can work for them.[35] However, despite these good faith efforts, the 2025 goal will not be achieved if ZEVs continue to be registered in the Commonwealth at the current pace.

[35] See Executive Office of Energy and Environmental Affairs, "The Massachusetts Zero Emission Vehicle Commission and Mass Drive Clean Campaign", available at: http://www.mass.gov/eea/waste-mgnt-recycling/air-quality/ma-zero-emission-vehicle-commission-and-mass-drive-clean-campaign/

From the Company's perspective, the principal reason for the status quo is that the Commonwealth and other stakeholders assumed that market forces would spur private investment in a sufficient number of EV charging stations in non-residential public and workplace settings and at multi-unit dwellings, which are necessary to provide consumers with sufficient confidence to purchase EVs. Although this assumption was reasonable based on information available at the time, private investment in EV charging stations sufficient to support the number of EVs needed to meet the GSWA emission reduction goals has not occurred.

Q. In addition to the GWSA goals, does Massachusetts have other requirements that call for increased levels of ZEV registrations in the Commonwealth?

It is estimated that Massachusetts will have to register 300,000 vehicles to comply with the ZEV mandates established in the Massachusetts Low Emission Vehicle (LEV) program.

The Massachusetts LEV Program was established by DEP and requires all new passenger cars and light-duty trucks, medium-duty vehicles, and heavy-duty vehicles and engines sold and registered in Massachusetts to meet California emission and compliance requirements, as set forth in Title 13 of the California Code of Regulations. The automobile manufacturers must comply with the ZEV sales and greenhouse gas emissions requirements promulgated in these regulations in Massachusetts (see, 310 C.M.R. § 7.40).

Q. Do you know how many charging stations have been constructed in Massachusetts?

A. According to the NREL , there are 996 public charge points in Massachusetts through 2015.[36] NREL also found that Massachusetts will need, 37,413 to 45,270 workplace ports and 4,935 to 44,645 public ports to achieve the 2025 goal of 300,000 ZEVs registered in Massachusetts.[37]

Q. Has Eversource identified barriers to EV market acceleration?

A. Yes. Eversource has identified multiple barriers to accelerating the EV market that include insufficient EV infrastructure; the upfront cost of EVs of at-home charging equipment, the complexity of installing at-home charging equipment, and a lack of market awareness of the benefits of EVs. The Company's make-ready infrastructure is intended to address the insufficient EV charging infrastructure, while expanding customer awareness of the benefits of EVs. As it relates to the remaining adoption barriers, the Company has identified other government and manufacturer programs aimed at addressing each barrier.

The lack of infrastructure is a particularly important barrier that needs to be addressed. According to the Natural Resource Defense Council's "Driving Out Pollution: How Utilities Can Accelerate the Market for Electric Vehicles" report, "[i]t

[36] Wood, 2016, Id.

[37] Id.

is becoming increasingly clear that a new model is needed to deliver the robust charging network necessary to accelerate EV adoption. Market research shows that consumers' top four reasons for rejecting EVs were all related to lack of infrastructure or range."[38] Survey analysis by the National Renewable Energy Laboratory (NREL) shows that the lack of infrastructure for alternative-fuel vehicles is as much of a barrier to adoption as incremental vehicle price.[39]

The Natural Resource Defense Council continues, "to date, the limited charging infrastructure that exists beyond single-family homes has generally been deployed by government, automakers, and startup charging service companies. This model is unlikely to deliver the comprehensive network needed to meet long-term emissions reduction goals. Electric utilities are singularly positioned to close the charging infrastructure gap." Each of these barriers is further magnified for disadvantaged communities as these communities tend to face disproportionate amounts of ground level air pollution providing an opportunity to increase the impact of the program by including disadvantaged communities in the implementation of make-ready infrastructure.

[38] Peterson, David, "1700 Fast Chargers by 2016'" presentation to the California PEV Collaborative, Nissan North America, March 10, 2015, slide 6 citing survey by PG&E and RDA Group, 2014.

[39] Malaina, M., Y.Sun, and A. Brooker, "Vehicle Attributes and Alternative Fuel Station Availability Metrics for Consumer Preference Modeling," NREL Transportation Center, presented at Energy Commission Workshops, Sacramento, California, March 19, 2015 at 16-22.

Q. Is it reasonable to assume that, between 2017 and 2025, the private sector will make the necessary investment in charging stations, infrastructure and education that are necessary to achieving the Commonwealth's 2025 goal?

A. No. Between the passage of the GWSA in 2008 and September 30, 2016 only 8,450 EVs were registered in Massachusetts. One of the barriers facing the acceleration of the EV market, cost and complexity, must be addressed through intervention by regulated utilities. Non-residential charging stations do not provide a classic "return on investment" business case and therefore the owners of properties best suited for away from home charging stations (employers, parking facility owners) are likely to be reluctant to undertake the steps necessary to navigate a complex, costly, and possibly confusing market. The implementation of the make ready infrastructure relieves a substantial portion of this upfront burden.

Based on past private investment and the expiration of available federal grants and key tax credits designed to encourage private investment, it is unreasonable to assume that that a significant uptick in investment will occur. Further, the federal grants from the American Reinvestment and Recovery Act of 2009 and the federal tax credits that supported purchases of EV charging stations by private entities will expire on December 31, 2016.[40] The Company's EV program is proposed in response to this pattern of under-investment in electric vehicle infrastructure by private entities, and

[40] This incentive originally expired on December 31, 2013, but was retroactively extended through December 31, 2016, by H.R. 2029.

in recognition of the fact that a bold and innovative program is needed in order to meet the EEA EV goals.

Q. Will increased amounts of EV charging infrastructure help increase consumer adoption of EVs?

A. Investments in EV charging have been shown to increase both consumer EV purchase behaviors and purchase intentions. Automakers such as Nissan and Tesla have been analyzing customer survey data and monitoring the influence of EV charging infrastructure on EV sales activity. Nissan's market research has indicated that sufficient charging infrastructure would approximately double the number of Nissan Leaf owners who would repurchase an EV.[41] In addition, Nissan saw an increase in Leaf sales in 2013 when Nissan installed DC Fast Charging stations in select markets.[42] Tesla has witnessed similar results with its Supercharger network of DC Fast Charging stations. Tesla officials report their DC Fast Charging network has been critical to growing sales of the Model S sedan.[43]

---

[41] Peterson, David. "1700 Fast Chargers" Approximately 36% of owners were likely or very likely to repurchase with the existing charging infrastructure, whereas approximately 80% are likely or very likely to repurchase ideal infrastructure.

[42] Rovito, M., "Will Nissan's No Charge to Charge Program Drive Leaf Sales?" Charged Electric Vehicles Magazine, July 3, 2014.

[43] Baumhefner, M., Hwang, R. And Bull, P., "Driving Out Pollution: How Utilities Can Accelerate the Market for Electric Vehicles," Natural Resources Defense Fund, June 2016, citing Lankton, Cal, Director of EV Infrastructure, Tesla Motor Company, "Plenary Panel: Technology Marches On – The Impact of New Vehicle and Infrastructure Technologies," EPRI Plug-in 2014 conference, San Jose, California, July 2014.

Q. Are there particular segments where there is a need for such infrastructure that can drive increased adoption of EVs?

A. Yes. The Company intends to target three types of charging locations. Each of these three charging locations provides opportunities to increase EV ownership and use, while also facing barriers to infrastructure investment. Specifically, because each of the three target segments provides charging stations to third-party EV owners the direct incentive to invest in EV charging station infrastructure is lacking. By providing the infrastructure investment, the Company's proposal will bridge this gap.

Q. What are the three types of charging station locations that the Company will target?

A. The first type of location the Company will target is multi-unit dwellings, including apartment complexes. These multiunit dwellings present a particular challenge for at-home EV charging infrastructure because at-home charging access is essential to EV ownership. Unlike EV drivers in single family detached homes, residents of apartments and other multiunit dwellings often lack the ability install EV charging infrastructure in these locations because these drivers may not have ownership or control of the space where the charging station will be installed. As discussed above, this is due in part to the property owners' building owners or landlords' lack of incentive to invest in EV infrastructure without a corresponding direct benefit.

In Massachusetts, about 62.1 of households are owner-occupied housing.[44] The remaining households face a difficult EV ownership experience if they are unable to secure reliable access to EV charging. Installing charging stations at apartment buildings and other multifamily dwellings could unlock a broader and larger market for EVs.

The second type of location is places of employment and other long-dwell-time locations such as universities or hospitals, which are another important segment where charging stations would spur additional vehicle sales. These other long-dwell locations face obstacles to infrastructure investment that are similar to the obstacles faced by multi-family dwellings. Adding charging stations in these locations can extend the daily range achievable with a EV and create a "showroom effect" to increase EV visibility. Nissan credits a workplace charging initiative with a fivefold increase in monthly EV purchases by employees at Cisco Systems, CocaCola, Google, Microsoft, and Oracle.[45] Likewise, the U.S. Department of Energy ("DOE") recently concluded that employees of companies participating in its Workplace

[44] United States Census Bureau, Owner-occupied housing unit rate, 2011-2015

[45] Baumhefner, M., Hwang, R. And Bull, P., "Driving Out Pollution: How Utilities Can Accelerate the Market for Electric Vehicles," Natural Resources Defense Fund, June 2016, citing White, Brandon, Senior Manager of EV Sales Operations, Nissan North America, "Taking the 'Work' Out of Workplace Charging," presentation at EPRI Plug-in 2014 conference, San Jose, California, July 2014.

Charging Challenge[46] were 20 times more likely to drive a EV than the average worker.[47] Workplace charging can also increase electric miles driven, especially for drivers of plugin hybrid vehicles with shorter all-electric ranges, reducing their reliance on petroleum.

The third type of location is public parking spaces, which represent another important segment where additional charging stations are expected to drive increased EV adoption by allowing flexible charging station opportunities for EV owners. Unfortunately, this infrastructure is the costliest EV charging infrastructure. Without extremely high utilization rates, it is difficult for private investors to recoup the installation cost and cover operating expenses. Consumer research shows that the lack of "robust DC fast charging infrastructure is seriously inhibiting the value, utility, and sales potential" of typical battery electric vehicles.[48]

Q. In addition to helping the Commonwealth meet its EV goals, are there other benefits associated with the Company's proposed program?

A. Yes. The widespread adoption of EVs could lead to substantial consumer cost

[46] The DOE Workplace Charging Challenge is a partnership between DOE and private employers intended to increase the number of PEV charging stations available at places of employment by facilitating adoption of charging infrastructure through disbursement of information, including available incentives and rebates.

[47] DOE, Workplace Charging Challenge—Progress Update 2014: Employers Take Charge, November 2014.

[48] Hajjar, Norman, New Survey Data: BEV Drivers and the Desire for DC Fast Charging, California Plug-in Electric Vehicle Collaborative, March 11, 2014.

savings by allowing EV drivers to fuel with lower cost electricity rather than higher cost gasoline. In addition, a long-term goal of the program is to allow the Company to evaluate the cost and utilization of utility EV infrastructure deployment in order to assess long-term costs and benefits for all utility customers. This will allow the Company to continue to adjust and refine the program to best enable the EV market and provide long-term benefits to customers. Evaluation of the program will include assessing whether it is necessary to redesign the eligibility requirements associated with the program or place a greater emphasis on a single segment of the EV charging market.

In addition to these primary benefits, the program will have secondary benefits to Massachusetts including EV manufacturers and dealers, and charging technology companies, installers, and service providers to invest in Massachusetts. This growth will provide economic opportunities.

Lastly, the program will support the Company's grid-modernization efforts by providing the Company with information necessary to design future grid integration strategies, including demand response, that are capable of managing vehicle charging as a flexible load source. The technologies necessary to fully enable these grid integration strategies are in the nascent stages of development; thus, it is necessary to monitor the development and deployment of such technologies.

Q. Will the program provide any specific benefits for economic justice communities?

A. Yes. Eversource will target deploying up to 10 percent of the EV charging infrastructure in environmental justice communities and will provide rebates for the cost of the EV chargers located in these communities. Due to the upfront costs associated with purchase of a EV, the Company expect a lower, initial adoption of EVs in these communities. Therefore, Eversource will reduce the minimum charging station communities to two per participating site when appropriate. This will further reduce barriers to deployment of EV infrastructure in these communities.

Q. How will the "environmental justice" communities be selected?

A. The Company will select environmental justice communities using the criteria established by EEA. The criteria used to identify environmental justice communites by EEA are as follows: (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 or more of the population in the communities must identify as a race other than white; and/or (3) 25 percent of households lack a person over the age of 14 that speaks only English or speaks English very well. Eversource will select environmental justice communities based on the presence of any two of the three environmental justice criteria established by EEA.

Q. How will Eversource encourage more EV adoption in these environmental justice communities?

A. Eversource will collaborate with federal, state, and local agencies to leverage the EV incentives available for these communities. Eversource is also proposing to include, as part of the education and outreach component, specific efforts intended to reach these environmental justice communities. Targeted education and outreach programs will educate customers, residents, fleet operators, and workplaces located in environmental justice communities about how fuel costs and vehicle emissions can be lowered by switching from gasoline to electricity and the available opportunities under the program, including available EV incentives.

Eversource will have targeted outreach to environmental justice communities and stakeholders to gain input, guidance, and suggestions regarding make ready implementation and market education efforts. Eversource will document and use this input to refine and enhance implementation and communication and implementation of the program.

Q. Why is the Company proposing implementation of the EV program at this time?

A. In addition to the clear need for additional infrastructure necessary to meet the Commonwealth's emission goals provided above, the number of ZEVs offered by the marketplace is rapidly increasing adding to the urgency of this need for charging stations. Seven automakers launched EVs in 2015: Mercedes, Volvo, Tesla, BMW,

Chevrolet, Hyundai and Nissan. An additinal 18 EV models were launched in 2016 by 13 automakers. The additional automakers include Audi, Cadillac, Mitsubishi, Volkswagen, Chrysler and Ford. This is more than aq twofold increase in available EV models from a widening range of automakers (i.e., EVs are increasingly available from non-luxury brands), which indicates the need for an acceleration of EV infrastructure deployment in the near term to support this developing market. Furthermore, major automakers are planning substantial and additional investment in EV models to further expand the range of available EVs. For instance, Ford Motor Company noted during its September 2016 investor day that it plans to spend $4.5 billion on new electric vehicles, charging infrastructure and market education.[49]

Q. Please summarize the Company's proposed EV program.

A. The planned program has two primary components. (1) increased investment in long dwell-time[50] EV charging make-ready infrastructure in public and workplace settings and at multi-unit dwellings ("MUDs"), which are necessary to increase consumer confidence in purchasing EVs; and (2) increased market education outreach and transportation electrification advisory services to increase overall customer awareness

[49] Ford Investor Day, September 16, 2016, Pg. 39.

[50] Dwell time is a measure of how long a driver parks their vehicle at a given site for charging during a visit. Since Level II charging can take three hours or more to fully charge a vehicle it is important to target Level II infrastructure to sites with dwell times that are long enough to sufficiently charge a vehicle. DC Fast Chargers would tend to better match the PEV charging infrastructure with the vehicle's charging needs at sites with shorter dwell times.

of EVs and the associated benefits. The Company will also evaluate whether investment in the electrification of the Company's fleet of vehicles, including supporting infrastructure would be appropriate. Table ES-GMBC-3, below, illustrates the estimated cost of the proposed EV program over the five-year period of January 1, 2018 to December 31, 2022.

Table ES-GMBC-3

EV Program Cost

	2018	2019	2020	2021	2022	Total
Capital	5.7	7.2	10.7	10.7	10.7	45.0
O&M plus Marketing[1]	1.2	1.7	2.1	2.3	2.6	9.9

(a) Component #1: Investment in Infrastructure

Q. Please describe the first component of the program that proposes to increase investment in make-ready EV charging infrastructure.

A. First, it is important to reiterate that the Company is not proposing to own EV chargers. Instead, the Company is proposing to provide the necessary infrastructure for EV chargers. Eversource is proposing to offer a full-service, turn-key solution for its customers that participate in the program. The infrastructure will be utilized by the competitive market to place EV chargers in specific locations that the Company and the site hosts have jointly determined are positioned to attract customer use. Specifically, Eversource is targeting long dwell-time locations (i.e., locations where

drivers are expected to remaining for four hours or more). This component of the program will use a two-phased approach. Phase I of the program will support customer deployment of up to 30 DC fast charging stations and approximately 1,000 Level II charging stations at various sites throughout the Company's service territories.[51] Phase II of the program will support customer deployment of approximately 36 additional DC fast charging stations and approximately 3,100 Level II charging stations at customer sites. The precise number of charging ports deployed in each phase of the program will be determined in collaboration with the site hosts and based on the specific layout of the sites. In all cases, the Company will take steps to maximize the number of charging ports that can be deployed in order to further enable the EV market.

Q. Is it important for the Company to maintain flexibility when implementing the program?

A. Yes. It is critical for the Company to maintain flexibility in implementing the program as the EV charging market is continuing to evolve and the technology to charge EVs continues to mature. By maintaining flexibility in the program design, the Company will be able to respond to changes in the rates and location of EV adoption, as well as the response of potential site host to participating in the program. Similarly, flexibility in the program design will allow the Company to change is

[51] For purposes of this testimony, Eversource is assuming one charging point per charging station while

focus from one class of EV chargers to another if the alternative EV chargers show greater promise for enabling the EV adoption. As an example, the Company may elect to focus greater efforts on deploying additional DC Fast Chargers as higher capacity DC Fast Chargers become available and the cost of such equipment continues to decline. In other words, flexibility is necessary to ensure the program supports the EV market to the greatest extent possible.

Q. What infrastructure improvements is the Company proposing?

A. The Company is proposing to provide new service connections for each charging location. Each host site will be served by a new meter that is separate from the existing meter(s) at the selected site. For each site, the following infrastructure will be installed through the program: a primary lateral service feed from the existing circuit, any necessary transformer and transformer pad, the new meter, a new service panel, and the associated conduit and conductor to connect the electrical equipment to the EV charger. Of this work, internal Eversource resources will install distribution primary lateral service feed, transformer and pad, and the new meter ("Eversource-side Infrastructure"). For installation work beyond the meter, Eversource will contract with third-party electrical contractors to complete the installation of any required transformer vaults, new service panels, and the connection to the EV chargers ("Participant-side Infrastructure").

---

recognizing that certain charging stations provide for more than one charging point per station.

For the sites at which Level II chargers will be installed, Eversource will work closely with the site host to identify the number of chargers the site host reasonably expects to install at the location and size the infrastructure to avoid costly future excavation work while ensuring the site host reasonably anticipates installing the additional chargers in the near future. The Company expects the Level II chargers will serve approximately five percent of the total parking spaces at the host site and to install the make-ready infrastructure for no less than two and no more than 10 Level II chargers at a single host site. For site host that anticipate installing DC fast chargers, Eversource expects to size the make-ready infrastructure for a minimum of two, and a maximum of five, DC fast chargers.

To assist in the evaluation of the program, Eversource issued a Request for Information ("RFI") to electrical contractors and third-party suppliers of charging stations in 2016. The RFI was used to inform the Company's development of cost-estimates of installing Participant-side Infrastructure for various site configurations that the Company expects to encounter during the course of the program. In mid-2017, Eversource will issue a formal Request for Proposal ("RFP") to electrical contractors and charging station network owners to obtain definitive commercial terms for completing the Participant-side Infrastructure performed under the program.

Q. Will Eversource perform all of the work necessary to install the infrastructure?

A. Through the program, Eversource will be responsible for the typical upgrades to install a new service connection up to the new service meter. Behind the meter, Eversource will select third-party contractors to perform the necessary electrical work subject to Eversource oversight.

Eversource will work directly with customers to determine the infrastructure needs for each site and to identify the most suitable locations on the site for installation of EV charging equipment. Eversource will work to locate the make-ready equipment where it will have reasonable access to existing Eversource distribution facilities. Eversource reserves the right to reject applications where facilities would be located more than 300 feet from existing distribution facilities or if the cost to serve an individual make-ready site is more than 150 percent of the average cost for make-ready infrastructure approved as part of the program for either a Level II or DC Fast Charging site and adjusted for the number of charging ports at the site.

Q. How will the third-party contractors be selected by Eversource?

A. Eversource will issue an RFP to accept bids for the installation work. Bids from third-party contractors will be required to set forth a proposed deployment plan including preparation of architectural and engineering materials. The selected third-party contractors will be responsible for configuring the charging stations after installation of the chargers. Eversource will verify that the installation is correct and

operational prior to connection.

Q. Where is the Company proposing to locate the EV infrastructure improvements?

A. The location of the EV infrastructure improvements through a two-fold process. First, the Company will work through their existing account executive teams to identify commercial and industrial customers, as well as owners of multi-unit dwellings, that are interested in adopting EV charging infrastructure. For those customers proactively seeking to adopt EV infrastructure improvements, the Company has identified the following site selection requirements to assist in ensuring benefits from the investment: (a) the property must be connected to the distribution system; (b) vehicles must regularly park at the site for periods of four or more hours; (c) the site must have easy access to a transformer; and (d) the site must provide easy access for EV drivers. Access to a transformer will include a determination that the existing transformer serving the site has sufficient unused capacity to serve the new load from the charging stations. The Company has identified these criteria in an effort to achieve both economies of scale and to control costs.

Secondly, Eversource anticipates working closely with government and non-governmental entities to identify key locations where EV charging infrastructure improvements are likely to assist in enabling the EV market due the location of the site, types of locations, the types of drivers that frequent the location, and access to

existing infrastructure. In these instances, the Company's marketing teams will target their outreach efforts to specific potential site host to educate the site host of the opportunity to enable the EV market. In case the potential site host is not interested in installing and maintaining the EV chargers, Eversource will also seek to connect the site host with qualified third-party charging station owners and operators that are interested in leasing portions of the site to install the EV chargers.

Q. Are there target customer segments for Level II EV charging infrastructure?

A. Eversource will target site hosts at locations with long-dwell time parking patterns. These locations match the speed of charging with the existing parking patterns. Level II charging takes approximately four hours.[52] Therefore, the program will target installation of Level II charging infrastructure at sites where EV drivers typically park for durations of at least four hours. Eversource has identified the following types of sites for Level II charging infrastructure:

- Workplaces,
- Colleges and Universities,
- Fleet parking facilities,
- Public parking garages, parks, stadiums, beaches, airports, train stations,
- Hotels, hospitals, and clinics,
- Federal, State & Municipal properties,

- Select dining, entertainment and shopping venues, and
- Apartment buildings.

Q. What are the target customer segments for DC fast charging infrastructure?

A. Eversource will target sites hosts for DC Fast Charging Infrastructure at locations that serve medium and long distance travelers across Massachusetts. At DC Fast Charging locations, it is desirable for vehicles to move out of the charging station space as soon as the charging session is complete to make it available to other drivers. Locations with shorter duration parking patterns. The targets for DC Fast Charging Infrastructure include:

- Travel locations along high density travel corridors, and
- Community charging in high travel density areas.

Q. Please describe the marketing channels Eversource will use to recruit potential site hosts.

A. The two primary outreach channels for this program will be through Eversource's existing account executives and through EV infrastructure providers. Eversource has active relationships with its Commercial and Industrial customers through its team of account executives. These positive relationships have enabled Massachusetts to be ranked number one in the American Council for Energy Efficient Economy ("ACEEE") annual rankings of energy efficiency. Eversource will also work with

---

[52] Chevrolet Volt Charging FAQs. Accessed November 20, 2016.

active EV infrastructure providers in the state who are looking to sell, invest or expand the EV charging infrastructure in Massachusetts.

To supplement the primary outreach efforts by Eversource, a series of complementary activities will be pursued to develop interest by site hosts including the following activities:

- Webinars for Eversource customers to inform them of the program and to share success stories,
- EV infrastructure announcements,
- Social media support of EV infrastructure projects, and
- Digital media support of EV infrastructure projects.

Q. Will Eversource be responsible for operating and maintaining the charging stations?

A. No. Participants in the program will own and operate the charging stations. This operation will include responsibility for energy costs. In addition, participants will be required to agree to maintain the charging station in working order for ten years following installation, if selected. This maintenance requirement includes an obligation to incur all costs associated with maintenance of the charging station. Participant sites will also be required to support EV promotion activities and/or a ride and drive event at the selected facility.

(b) Component #2: Increased Market Education and Awareness

Q. Please describe the second component of the program that proposes to overall customer awareness of EVs and the associated benefits.

A. Education is a key component of the Company's program because increased education, outreach and awareness are critical to encourage additional consumers to invest in EVs. The National Academy of Sciences found that the " Lack of consumer awareness and knowledge about EV offerings, incentives, and features is a barrier to the mainstream adoption of EVs.[53] Eversource is uniquely positions to educate its customers on the benefits of fueling from the grid because its customers already view the Company as trusted energy advisors and look to Eversource for answers to infrastructure-related questions. In order to leverage this relationship, the Company is proposing a broader market education campaign that will target potential car buyers in Eversource's service territories (including both current EV owners and individuals not currently considering EVs). The effort is intended to expand awareness about EVs and the benefits of fueling from the electric grid, including increased use of utility assets, reduced GHG emissions, and lower rates for off-peak charging. The market education component will include broad efforts and targeted efforts while minimizing costs. Broad efforts will include digital media and radio. Targeted efforts will include bill inserts, the Company's website, and test drive events with

[53] Transportation Research Board and National Research Council. 2015. Overcoming Barriers to Deployment of Plug-in Electric Vehicles. Washington, DC:

EVs.

Q. How will Eversource conduct the market education and outreach for the Make Ready Program?

A. Developing broad awareness about the benefits of fueling vehicles from the grid is an integral element of Eversource's proposal. Eversource is uniquely positioned to educate our customers on the benefits of fueling from the grid because our customers already view us as a trusted energy advisor and look to us to answer infrastructure-related questions. Therefore, in addition to education and outreach activities specific to the Make Ready Infrastructure Program, Eversource proposes a broader complementary market education effort that will target potential car buyers in Eversource's service territory. The effort will expand awareness of EVs and the benefits of fueling from the electric grid, including increased utilization of utility assets, reduced GHG emissions, among others.

Q. Has the Company reached out to stakeholders regarding the market education component?

A. Yes. The Company expects stakeholders to use the market education as a platform to increasing the reach of the EV awareness and education campaign. For example, the Sierra Club has indicated that it is looking forward to building on the Company's outreach to provide education to its members and the general public.

(c) Component #3: Electrification of the Company's Vehicle Fleet

Q. Please describe the third component of the program involving the electrification of the Company's fleet of vehicles.

A. The Company is seeking to preserve the flexibility to invest a portion of the overall commitment to the EV market into electrifying the Eversource fleet. By maintaining this flexibility, the Company will be able to ensure it continues to deploy capital in support of the EV market even if potential site host are slow to respond to the Company's marketing efforts. More specifically, the Company's bucket trucks utilize hydraulics for deployment of the bucket features during repair or inspection work. The electrification portion of the program would electrify the hydraulics function such that it would be operated using an electric power take off (ePTO) technology. The ePTO technology will reduce vehicle emissions and fuel use; as well as reduce the time the vehicles diesel engines idle to power the truck's hydraulics. In the event that additional portions of the Eversource fleet are electrified, the Company's proposing additional infrastructure and charging stations specifically for operation of these vehicles. This infrastructure is separate from the make-ready infrastructure component of the program.

Q. What are the benefits of electrifying the Company's bucket trucks?

A. The Company's bucket trucks are used to make repairs to the overhead system during routine or post-storm events. In order to run the hydraulics for the bucket features,

the trucks must idle. Pursuant to environmental regulations, idle time is restricted and therefore electrifying the vehicles will not only cut down on idle time thereby reducing noise and emissions, but will also increase the efficiency of the Company's lineworkers because the trucks can remain operational continuously (i.e., the bucket trucks will not need to be turned off in compliance with environmental regulations prior to completion of repair work). This increased efficiency will result in lower operations and maintenance costs. An additional benefit that will result from electrification of the Company's fleet is that the Company will be able to use the batteries to provide local power during an outage event. Lastly, the electrification component represents another research and development opportunity for the Company that can inform future EV projects and programs.

Q. Is the Company proposing to recover the entire cost of these partially electrified bucket trucks as part of the program costs?

A. No. First, Eversource will only invest Make-Ready Program dollars into the electrification of its fleet to the extent that the Company is unable to attract sufficient Level II site hosts in each phase of the program. If that is the case, Eversource will seek to use program funds to invest in the electrification of its fleet in the following year. Eversource typically purchases five new bucket trucks per year; these costs are already included in the Company's cost of service. The Company is proposing to include the incremental costs associated with purchase of the partially electrified

bucket trucks in the program costs. Other costs included in this portion of the program are the costs associated with the necessary infrastructure, including charging stations.

Q. Has the Company developed an evaluation plan for the Program?

A. Yes. The Company has developed a two-part evaluation plan. The first part of the evaluation plan will apply to Year 1 and 2 of the program. The second part will apply to Year 3 through 5 of the program.

Q. Please describe the evaluation plan for the first two years of the program.

A. During the first two years of the program, the Company will focus on acceleration of EV adoption in Massachusetts, developing the marketing, customer education and outreach strategies, and validating processes for the following:

- Qualifying charging stations for participation in the program;
- Procuring deployment contractors and related services;
- Establishing Eversource's internal processes for the Program;
- Creating and upgrading Eversource's IT systems.

In order to evaluate the Company's progress towards meeting these objectives, the Company will collect data regarding the following:

- Key barriers to deployment of EV charging infrastructure;

- Time and costs to deploy EV charging infrastructure (actual versus estimated);
- Differences between expected post-deployment impacts and actual post-deployment impacts (e.g., EV adoption, load impact, transmission and distribution system upgrade);

Based on this data, the Company will determine the potential for long and short-term impacts on the grid. In addition, the Company will determine whether EV charging load might offset the costs of the program. Lastly, the Companu will use this data to evaluate and refine the marketing and education strategies deployed during this initial phase of the program.

Q. Please describe the evaluation plan for the third through fifth years of the program.

A. During the second phase of the program, the Company expects the make-ready infrastructure to be in place to enable installation and use of charging stations. The Company's focus will shift at that time to monitoring and reporting utilization of the make-ready infrastructure (e.g., are the maximum number of chargers being installed) and use of the charging stations once enabled. The Company will also continue to collect data regarding adoption of EVs to determine the impact of increased availability of charging stations and to evaluate the Company's education campaign. Specifically, the Company will collected data regarding EV driver enrollment, use

rate by site and by charger type, price of kWh and use of kWh by price, charging load profiles (aggregate and by charger), and load impacts. In addition to this data, the Company will collect data regarding avoided emissions from expected increases in EV adoption.

Q. How will the Company share the lessons learned from the EV program?

A. The Company intends to file a report as part of the Company's annual PBRM filing with the Department regarding the status, achievements, and lessons learned from the program, as well as a summary report at the conclusion of the five-year period. This report will include information and ideas gathered from the company's targeted outreach with various stakeholders and work with environmental justice communities and stakeholders. This summary report will include the following information: number of EV charging stations and sites deployed; site host enrollment, number of electric vehicle supply equipment tools installed, costs, and deployment in or adjacent to disadvantaged communities. In addition, the lessons learned and operational experiences will be used further refine the market education and outreach component of the program.

Q. Please describe the benefits to Eversource customers and Massachusetts residents from the Eversource Make-Ready Program?

A. It is important to understand the benefits the Eversource EV Make-Ready Program

can provide to Eversource's customers as well as residents of Massachusetts located outside of the Eversource service territories but who transit to or through areas in which the Company install the make-ready infrastructure. These benefits include the following:

- Supporting the build out of a more robust network of EV charging infrastructure;
- Increased EV adoption in Massachusetts;
- Avoided fuel costs from refueling from the grid; and
- A reduction in greenhouse gas emissions due to decreased vehicle emissions from EV adoption, including reduced ground level emissions.

These benefits accrue through the implementation of the Make-Ready Program in the Eversource service territories, while also providing work and public place charging infrastructure for all EV owners.

Further, EVs can help balance off peak power supplies by shifting charging load to utilize renewable power when generation is high, increasing revenue to Eversource that would otherwise be unrealized and avoiding new capacity investments by encouraging off-peak charging. Lastly, in the long run EVs may provide additional demand response services and assist with the integration of renewable energy resources by optimizing customer charging patterns during periods low demand or high renewable generation.

Q. Has Eversource quantified to the overall benefit to Massachusetts residents from a widespread adoption of EVs?

A. In 2016, MJ Bradley & Associates conducted an independent cost-benefit analysis of the impact of Massachusetts complying with the ZEV mandate of 300,000 ZEVs by 2025 on behalf of an entity not affiliated with Eversource. That study suggested the "net present value of cumulative net benefits from greater EV use in Massachusetts will exceed $5.4 billion statewide by 2050."

Q. Why is the Company proposing to recover the costs of EV infrastructure ultimately from customers instead of from the private entities installing chargers?

A. The Company is proposing to recover its investment costs ultimately through customer rates instead of a customer contribution in aid of construction ("CIAC") due to the market failures discussed above in more detail. The Company and other market observers expect the deployment of EV charging infrastructure will increase by lowering the upfront investment required by site hosts to install EV charging infrastructure. Given that the benefits of assisting the Commonwealth in meeting its ZEV goals will inure to the benefit of all Massachusetts residents through decreased GHG emissions and improved air quality, it is appropriate for Eversource to recover the make-ready infrastructure costs from its customers. Thus, the Company has determined that providing the supporting infrastructure to customers without significant upfront cost will enable the program's success.

VI. PERFORMANCE METRICS

Q. Is the Company proposing to institute any performance metrics to provide transparency into the Company's progress on the GMBC commitments?

A. Yes. In preparing the GMBC for the Department's review in this case, the Company has devoted significant time and consideration to the establishment of appropriate metrics to monitor and evaluate the Company's progress with its GMBC commitments. The Company's proposed program goals and progress metrics are detailed in Exhibit ES-GMBC-3.

Q. Would you briefly describe how the Company has approached the development of progress metrics in relation to the GMBC?

A. It is important to note that the GMBC is designed and proposed as a first-step grid-modernization enablement plan. The GMBC is not designed to achieve an end-state vision, nor is it intended to confine the scope of the Company's work to reach an envisioned end-state. No definitive construct has yet emerged within the electric industry as to the exact nature and characteristics of the future, modernized grid. For that reason, the Department's generic investigation into grid modernization focused on identifying "the range of capabilities that collectively define a modern distribution framework."[54] There is a range of potential capabilities, activities and enablers that may result in the desired outcomes for grid modernization and the effectiveness of

[54] D.P.U. 12-76, *Massachusetts Electric Grid Modernization Stakeholder Working Group Process: Report to the Department of Public Utilities from the Steering Committee*, Final Report, July, 2 2013, at 11.

each potential capability and enabler may be dependent upon many factors, thereby requiring consideration and evaluation over time by the Department, electric distribution companies, consumer advocates and other stakeholders.[55]

Within this context, the Company has identified a series of 14 metrics within six investment categories within the GMBC that will provide detailed information about the Company's activities and progress in specified areas of interest, with explicit targets for each the five years contemplated for the GMBC. The metrics are designed with the specific intention to yield information and insight into the Company's activities and progress in specified areas of interest, with explicit targets for each of the five years contemplated for the GMBC. The metrics are also designed to produce gains in knowledge and experience that will inform future development of the modernized electric grid. Performance on these metrics will be the basis for discussions with stakeholders over the investment horizon of the GMBC, and will help to confirm the course of action or to suggest other potential success areas.

As discussed above, electric distribution companies are operating largely the way they have operated for nearly 100 years and completing the envisioned (and anticipated) transformation will take years of hard work, substantial capital investment and collaboration among a range of constituencies. Planning and

[55] Id.

execution of this vision will involve iteration as new technologies and processes are put in place allowing for evaluation and operational learning, and subsequent adjustment as experience is gained. The Company's GMBC is designed to initiate this effort and commence the learning process with investments that are targeted at specific objectives and that can be implemented and evaluated in areas on the Eversource system where there is already a concentration of DER, such as in southeastern and western Massachusetts.

This point is important because it directly affects the nature of the performance metrics established for this first-step, foundational grid-modernization investment plan. Within the context of an initial, first-step investment plan, the Company's performance metrics are designed to provide transparency as to the intended investment objectives and to allow for monitoring and evaluation of progress on the GMBC investment so that the benefit to customers is apparent. The performance metrics are not designed to secure specific *outcomes* for the grid-modernization effort. The Company is effectively using customer funds to make the identified investments and it is necessary for the Company to have the chance to explore modernization initiatives with a level of caution and flexibility so that investment can be carefully targeted to initiatives that have a substantial probability of *ultimately* achieving the desired outcome for customers.

With this in mind, Exhibit ES-GMBC-3 presents a program goal; implementation metric and customer-benefit metric for each proposed investment category. As noted above, these metrics are not tied to specific outcomes, but rather are tied to progress milestones, spending parameters and other similar indicators. The Company's performance metrics will assure progress in implementation without presuming an outcome before the Company even has a chance to implement initiatives and gather valuable and useful information to evaluate next steps.

Q. Is the Company proposing any penalties or financial incentives in association with the identified performance metrics?

A. No. The Company is not proposing that the Department assess penalties or financial incentives in association with the identified performance metrics. The Company is proposing to implement the *Eversource Grid-Wise Performance Plan* encompassing the PBRM and GMBC. Through the GMBC, the Company is making a substantial commitment to grid modernization. The PBRM is designed to provide the Company with the replacement of sales revenues that are needed to have the flexibility and efficiency to pursue innovation and customer-engagement initiatives. However, the PBRM is also designed to provide the Company with strong incentives for cost control in relation to the GMBC, but also in relation to the Company's traditional investments and operating costs. Thus, incentives and penalties are inherent in the *Eversource Grid-Wise Performance Plan* in that the incentive to succeed with the

GMBC is inherent in the authorization of the PBRM. Without the GMBC, the PBRM is not as effective in achieving the goal of furthering the Commonwealth's clean energy program or in creating strong cost control incentives; and therefore may not be supported by the Department. Conversely, without the PBRM, the Company is not able to make or carry out the commitment encompassed in the GMBC. Accordingly, the performance construct in encompassed within the two, interrelated PBRM and GMBC components and an important feature of the overall construct is transparency into Eversource's progress on the GMBC commitments.

As discussed in the Company's testimony presenting the Eversource Grid-Wise Performance Plan (Exhibit ES-GWPP-1), the Company expects to submit an Annual Grid-Wise Performance Plan Compliance Filing to the Department on or before September 15 of each year, for implementation of new rates on the subsequent January 1, in the event that the Department approves the PBRM. The Annual Compliance Filing would include, among other items: (1) the calculation of the annual revenue-cap adjustment, including an earnings sharing computation and documentation associated with any exogenous costs, if applicable; (2) the development of new rates consistent with the revenue-cap formula, (3) class-by-class bill impacts; and (4) a report on the Company's progress on the GMBC in accordance with the performance metrics.

The first annual compliance filing for the PBRM computation would be submitted to the Department on or before September 15, 2018. Within this annual compliance mechanism, the Company would report on its progress in accordance with the approved metrics, and also update the Department and other interested stakeholders on any other information relating to the Company's experience with the GMBC investments so that there is adequate information to evaluate progress, lessons learned and next steps. Changes to the plan, if and when appropriate, would be subject to review and approval by the Department through the annual PBRM proceeding. Through this monitoring, evaluation and discussion, the Company will be positioned to achieve the goals of the *Eversource Grid-Wise Performance Plan.*

Q. Is it the Company's expectation that its GMBC investment plan may be subject to change over the next five years?

A. Yes. In fact, the Company fully anticipates that the GMBC will be expanded upon, modified and supplemented in significant dimension into the future. It is the Company's full expectation that GMBC investment could shift between categories over time as experience is gained, so long as the Department is in agreement that alteration of the original plan is warranted and appropriate. Information submitted to the Department on an annual basis would include the Company's progress in developing the anticipated investments and other performance data in conformance with the metrics ultimately approved by the Department to demonstrate that the

Company is meeting its commitments on the GMBC. Within this reporting mechanism, the Company plans to update the Department and other interested stakeholders routinely on the status of the GMBC and the Company's experience with the GMBC investments so that there is adequate information to evaluate progress, lessons learned and next steps. Changes to the plan, if and when appropriate, would be subject to the Department's review and approval in the annual PBRM proceeding.

VII. CONCLUSION

Q. Are there any other comments that you have on the scope or significance of the Company's rate filing in this proceeding?

A. Today, electric distribution companies operate largely the way they have operated for upward of 100 years and completing this envisioned transformation will take years of hard work, substantial capital investment and collaboration among a range of constituencies. Planning and execution of this vision will involve iteration as new technologies and processes are put in place allowing for evaluation and operational learning, and subsequent adjustment as experience is gained. In this case, the Company is presenting its proposed PBRM and GMBC within the *Eversource Grid-Wise Performance Plan* to initiate this effort and commence the learning process with investments that are targeted at specific objectives and that can be implemented and evaluated in areas on the Eversource system where there is already a concentration of

DER, such as in southeastern and western Massachusetts. The Department's approval of the Company's proposal is a critical, significant first step in bringing the sought-after benefits of a modernized electric grid to customers.

Q. Does this conclude your testimony?

A. Yes. On behalf of Eversource, we appreciate the Department's consideration of the Company's proposals in this case.