Eversource Energy

Report on
Least Cost Integrated Resource Planning 2020

October 1, 2020

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1 EXECUTIVE SUMMARY

Public Service of New Hampshire d/b/a Eversource Energy ("Eversource" or the "Company") submits this 2020 Least Cost Integrated Resource Plan ("LCIRP") consistent with the requirements of RSA 378:38 and Order Nos. 26,362 (June 3, 2020) and 26,371 (June 22, 2020) in Docket No. DE 19-139.

As a public utility, Eversource has the responsibility to plan, construct and operate an electric distribution system that not only provides safe, reliable, cost effective service to all customers connected to the system today, but also that meets the needs of customers in the future. For today, Eversource is focused on constructing the overhead system in a sturdier, more resilient manner to reduce the frequency of customer interruptions during routine operations. The bulk of the Company's core investments are targeted at overhead equipment and facilities upgrades that will make the distribution system more durable and resilient in major weather events, while also preparing a platform for the integration of advanced technologies that have the potential to produce multiple benefit streams.

For the future, the vision for electric companies is changing rapidly with the development, deployment and application of new technologies that are changing the way the electric system is planned, designed, and operated. For example, distributed energy resource ("DER") technologies that capture the intermittent energy of the sun and wind are deployed in a distributed manner, reducing demand on the electric grid at various hours of the day. However, these technologies also cause power to flow in the reverse direction, i.e., from the customer's premise *into* the electric grid, as opposed to one-way power flowing from a centralized point to customer premises. The existing grid was not designed to accommodate these two-way, reverse power flows. Therefore, with the current design and construction of the system, the ability to integrate advanced energy solutions is limited in many areas. The Company is working to convert the system to a platform that is capable of enabling and interconnecting advanced energy solutions at virtually any point on the system. Upgrading to newer, stronger infrastructure helps build a strong foundation for the distribution system and will aid in the successful integration of higher amounts of advanced energy solutions.

Moreover, DER impacts create operational challenges not only under system intact (N-0) conditions, but also under contingency (N-1) conditions. There are instances in New Hampshire

where DERs need to be accommodated through circuit tie closing operations in situations such as of the loss of single ended bulk stations, allowing for reliable integration of these resources through adjacent substation facilities. As a result, it is not just the normal, but also the *abnormal* – contingent conditions of the grid – that drive switching conditions to accommodate DERs, electric vehicles, and similar technologies.

In addition to increasing DER penetration, the changing nature of load is also affecting the grid in other profound, observable ways. For example, increased adoption of electric vehicles is changing the cycles of demand on grid resources; the proliferation of electronic loads is affecting power factor, harmonics and the relationship between voltage and demand; and increasing reliance on electricity by customers looking to charge their devices, heat and cool their homes and power their everyday lives has increased and shifted demand on the grid. The aggregate impact of these trends means that there needs to be a fundamental shift in the expectations and considerations of system planners.

Eversource's System Planning group also needs to consider the time-varying nature of load and DER output, as well as the likelihood of adoption of new load types in the future. Accordingly, the Company's distribution planning scenarios are changing from focusing on a single peak hour of the year to comprehensive time-series analyses of system performance over daily, seasonal and yearly (8760-hour) load cycles. The planning scenarios will incorporate forecasts of not just load growth, but also shifts in technology use, and penetration levels of DER, electric vehicles, and electrification alternatives to burning fossil fuels. Each of these technology trends offers opportunities and challenges to the Company's mission to not only provide reliable electric service but to also find ways to continue to improve upon that level of service.

The recent, and ongoing, experience with the Coronavirus pandemic has also provided a glimpse into a likely future with more people working from home, becoming even more reliant on a reliable, resilient electric distribution system. Although it is impossible to know with precision how long those changes will last or what the ultimate impacts will be, it is clear that a shift has occurred. Utilities must be ready to meet the demands of the shifting landscape, as well as those future challenges that cannot be fully anticipated today. Eversource has developed a new Distribution System Planning Guide that describes how the Company will be planning and designing the distribution system going forward. This guide establishes planning criteria and

methods that ensure rational development of a safe, secure, reliable distribution system to support load growth and expansion of new technologies, and to meet the challenges of the future.

The Distribution System Planning Guide also describes how Eversource will make prudent investment decisions in the best interests of customers, considering "non-wires" solutions ("NWS") alongside traditional utility investments while ensuring that the electric distribution infrastructure is maintained and modernized to meet the needs of our customers for decades to come. Eversource has an obligation to incorporate advances in technology, material and construction standards into the design of the electric system to enhance reliability and resiliency. Energy efficiency, demand response, and DER of various types need to be in the tool box of options that utility system planners have at their disposal to develop the most cost-effective solutions to meet the reliability and resiliency needs of the distribution system while maintaining the ability of the utility to operate the system safely.

Eversource is committed to adapting to the evolving needs of the electric system and the customers relying on that system by developing scenario-based planning tools and processes that lead to prudent investment decisions. These tools and processes will improve grid resiliency and reliability during major events, as well as on blue sky days, and allow customers to apply new technologies without degrading the performance of the electric system.

Through this LCIRP submission, Eversource will demonstrate to the Commission how it performs its ongoing (and ever evolving) planning activities to assess the short-term and long-term requirements and capabilities of the electric distribution system. These activities include: probabilistic load and DER forecasting at granular levels incorporating the likelihood of adoption of new technologies; distribution system analysis to assess and predict the performance of distribution circuits and substations; integrated electric system planning to evaluate the interaction with the transmission system, and the myriad (and growing) supply points; demand-side resource planning, including the integration of energy efficiency and other demand-side resources; and incorporation of new methodologies and technologies to create a more modern and responsive grid.

The result of these activities is the development of a least-cost, integrated plan for Eversource's distribution system that demonstrates the data sources and methodologies used by the Company to meet customer needs and expectations. The following sections describe the various planning activities performed by Eversource. The attached appendices include planning studies,

load forecasts, reliability planning, joint system planning and demand resource planning, as well as other supporting documentation. This document, together with the appendices, constitute Eversource's least-cost integrated transmission and distribution plan.

2. OVERVIEW OF LCIRP

The Company's distribution business consists primarily of the delivery of electricity to residential, commercial and industrial customers. As of August 31, 2019, Eversource furnished retail franchise electric service to approximately 530,000 retail customers, including approximately 441,450 residential customers, 75,000 commercial customers and 2,735 industrial customers. The Company provides distribution service in 211 cities and towns in New Hampshire, covering a service area of approximately 5,630 square miles. The Company's customer base represents approximately 70 percent of the total electric customers in the State of New Hampshire. The Company also provides wholesale delivery service to the New Hampshire Electric Cooperative, Inc. ("NHEC"), Unitil Energy Systems, Inc. ("UES") and several municipal electric companies.

The Eversource electric system in New Hampshire consists of approximately 1,040 miles of transmission lines, and 12,200 miles of overhead distribution circuits, including approximately 3,000 miles of roadside, three-phase distribution circuits and 600 miles of distribution lines within off-road rights-of-way. The Company also has approximately 1,800 miles of underground distribution lines. Approximately 17 percent of the distribution system is considered backbone and the remaining 83 percent of the system consists of overhead laterals stemming off backbone circuits. The longest, single circuit is 180 miles long and the shortest is just under one-tenth of a mile. Eversource has 139 distribution substations (including shared substations) in New Hampshire, and 184 substation transformers ranging from 1.5 MVA for a small 34-4 kV station to 140 MVA for the largest 345-34.5 kV stations. The Company maintains approximately 244,000 distribution poles on its distribution system and has facilities attached to more than 450,000 poles throughout the state.

Over the past 10 years as emerging technologies have entered the marketplace, Eversource has instituted changes that include organizational restructuring, processes improvements utilized in running the business, and utilization of technology with the sole focus of improving system reliability, system resiliency, operational efficiency and customer service. As stewards of the system, these foundational changes are designed to achieve maximum efficiency in operations and cost while improving the customer experience. Eversource continues to optimize its distribution business operations to capture the benefits of the following critical elements:

a. Implementing an organizational structure focused on operating, constructing and maintaining the system;

b. Making smart investments on the distribution system with technology and infrastructure to improve reliability, resiliency and operational efficiency;

c. Leveraging advanced technologies that promote situational awareness to improve restoration and reduce response time, along with increasing communications both internally and with customers; and

d. Improving planning and scheduling processes to execute the Company's work plan.

Under the Distribution System Planning section of this Plan, Eversource describes how it fulfills its responsibility to provide service that is reliable and resilient to all distribution customers, not only today, but into an uncertain future with increasing penetration of DER and electrification technologies.

The Transmission Planning and Investment section of the Plan describes how Eversource provides transmission service regulated by the Federal Energy Regulatory Commission ("FERC") and administered by ISO-New England ("ISO-NE"). The transmission section provides details regarding transmission planning and investment consistent with ISO-NE's Regional System Plan ("RSP").

The LCIRP also provides insight into energy efficiency and demand side management opportunities provided to Eversource customers; the benefits of grid modernization activities; and reliability improvements undertaken.

The appendices to this LCIRP provide perspective on how the plan will be implemented. Appendix A specifies the requirements applicable to Eversource's Plan. The Appendix refers the reader to the proper sections of the document or provides insight within the appendix. Additional appendices include guides, plans, process flows, and certain reports, as specified in the Plan.

3. TERMINOLOGY AND ACRONYMS

As used in this document, the following terms have the following meanings:

Bulk Distribution Substation – A collection of equipment and transformers used to step the Transmission source voltage (115 kV and higher) down to a Distribution voltage (usually 34.5 kV and below).

Non-bulk Distribution Substation – A collection of equipment and transformers used to step the Distribution source voltage (46 and 34.5 kV) down to a lower Distribution voltage (usually 12.47 kV and 4.16 kV).

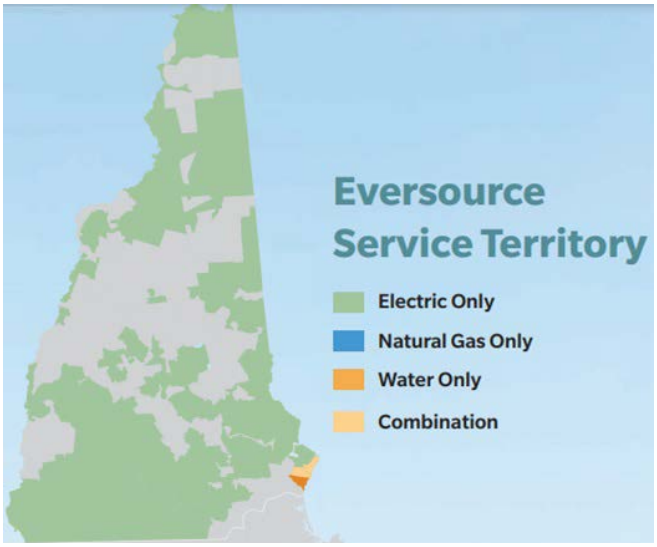
Commonly Used Acronyms

ABR	Automatic Bus Restoral scheme
ADR	Active Demand Response
AMI	Advanced Metering Infrastructure
C&I Customers	Commercial and Industrial Customers
CapEx	Capital Expense
DER	Distributed Energy Resources
DERMS	Distributed Energy Resource Management System
DES	State of NH's Department of Environmental Services
DG	Distributed Generation
DMS	Distribution Management System
DR	Demand Response
EE	Energy Efficiency
EERS	Energy Efficiency Resource Standard
EV	Electric Vehicle
FERC	Federal Energy Regulatory Commission
FLISR	Fault Location, Isolation and Service Restoration
GIS	Geographic Information System

IEEE	Institute of Electrical and Electronics Engineers
ISO-NE	Independent System Operator-New England or ISO-New England
LCC	Load Carrying Capability
LCIRP	Least Cost Integrated Resource Plan
LSP	Local System Plan/Planning
LTE	Long Term Emergency rating
NEPOOL	New England Power Pool
NHEC	New Hampshire Electric Cooperative
NWS	Non-Wires Solutions
OpEx	Operations Expense
PAC	Planning Advisory Committee
PTF	Pool Transmission Facilities
PTO	Participating Transmission Owners
PUC/NHPUC	State of New Hampshire Public Utilities Commission
PV	Photovoltaic (Solar)
ROW	Right of Way
RSP	Regional System Plan
SCADA	Supervisory Control and Data Acquisition
STE	Short Term Emergency Rating
TFRAT	Transformer Rating, used historically by legacy PSNH
TO	Transmission Owner
UES	Unitil Energy Systems
VVO	Volt VAr Optimization

4. SYSTEM OVERVIEW

Eversource's New Hampshire distribution system is comprised of 832 distribution circuits generally operating at primary voltages of 4.16, 12.47 and 34.5 kV. The system consists of approximately 12,300 miles of primary overhead facilities and 2,000 miles of primary underground facilities.



Most distribution bulk substations, which are sourced from the Eversource transmission system, supply distribution facilities from transformers which operate at 115 to 34.5 kV. There are three distribution substations that operate with 345 to 34.5 kV transformers, five that operate with 115 to 12.47 kV transformers, and one that operates with a 115 to 4.16 kV transformer.

Eversource has an extensive network of 34.5 kV lines in Rights of Way. These lines provide the sources for 75 distribution substations that serve customers at 12.47 or 4.16 kV. An approximate breakdown of the circuits by voltage is as follows:

- 4.16 kV – 80
- 12.72 kV – 125
- 34.5 kV – 620
  - 34.5 kV in ROW – 125
  - 34.5 kV Taps from Lines in ROW – 450

- 34.5 kV Street-side from Bulk Substations – 45

There are numerous independently owned and operated non-utility generating facilities connected to the Eversource system.

5. DISTRIBUTION SYSTEM PLANNING

The objective of the Eversource distribution planning process is to provide safe, reliable, cost effective electric service to customers. The planning methods and recommended solutions must be capable of adapting to customer expectations for a more resilient and reliable distribution system and accommodating changes in customer behavior regarding behind-the-meter DER, EV charging and other electrification technologies. Where the solution to asset condition, reliability, or capacity needs is determined to be an investment in traditional utility infrastructure, the Company will apply standard equipment and designs whenever possible consistent with the Distribution System Planning Guide.

5.1 Load Forecast

The load forecast is a critical component in the development of system models that are used to conduct distribution planning and identify planning criteria violations and the solution year of need. In 2016, Eversource transitioned from a methodology that relied upon regional historical trends and identified spot loads to a process that incorporated an econometric model and provided a load forecast at the bulk substation level.

The current forecasting process begins by forecasting the peak demand at the Eversource system level. The Eversource system level peak demand is forecasted using an econometric model that evaluates historical peak demand as a function of peak day weather conditions and the economy. The econometric model utilizes two different weather variables in forecasting summer peak demand: a three-day weighted temperature humidity index and cooling degree days. The forecast assumes normal weather conditions, which are based off the most recent 10-year period. Eversource produces a “50/50” and a “90/10” peak demand forecast. The 50/50 forecast is based off normal 10-year weather and has a 50 percent chance of being exceeded. The 90/10 forecast is the extreme weather scenario that has a 10 percent chance of being exceeded. The economic history and forecast are provided by Moody’s Analytics, an international economic consulting company.

Once the Eversource system level forecast is finalized, the bulk substation level forecasts are developed. Each bulk substation is forecasted using an econometric model that evaluates substation historical demand as a function of the Eversource system peak demand history and forecast. The substation econometric models measure how each substation performed relative to the Eversource system and then projects that relationship into the future.

After a trend forecast is produced for each substation, the forecast is adjusted for energy efficiency, DER, large customer projects, or other material changes in load or supply. Company-sponsored energy efficiency and behind-the-meter solar PV are proportionally applied to each substation in proportion to historical peak demand at each substation. Specifically identified large development projects or expected changes in system operations that could not otherwise be predicted by the econometric forecasts are applied to the affected substation. In addition, capacity reserves are held for customer owned co-generation units which hold Standby Delivery Service Contracts.

Figure 1 and Table 1, below, provide the historical peak load as well as the 50/50 and 90/10 forecast using this methodology. Detailed historical and forecasted loads at the regional and substation levels are included in Appendix B and Appendix C, respectively.

Figure 1: Historical Peak Loads and Planning Forecast

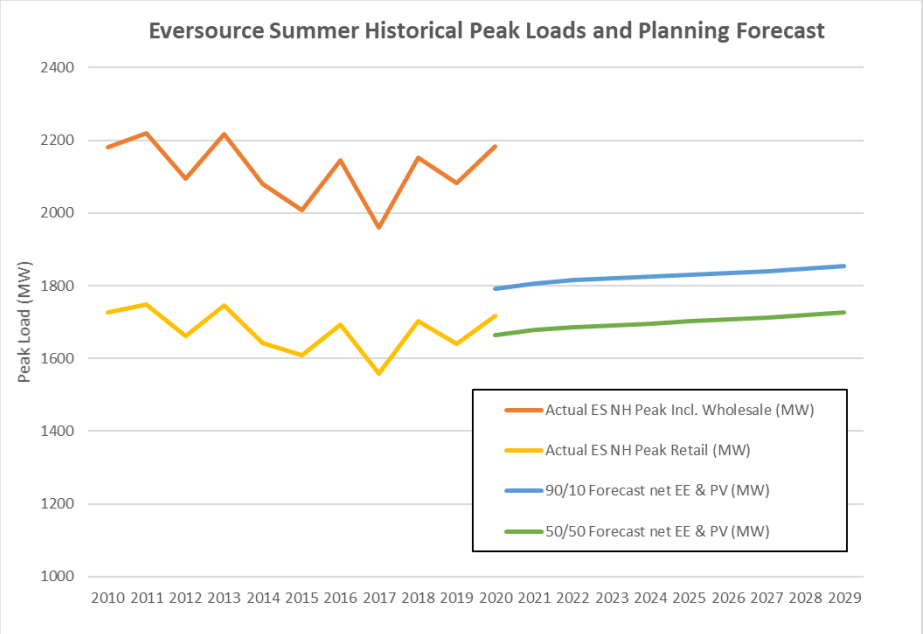


Table 1: Eversource 50/50 and 90/10 Peak and Design Load Forecasts

Year	Eversource New Hampshire	
	Average (50/50) Peak Load (MW)	Peak (90/10) Design Load (MW)
2020	1663	1792
2021	1679	1807
2022	1686	1815
2023	1692	1820
2024	1696	1824
2025	1702	1830
2026	1707	1835
2027	1712	1840
2028	1719	1847
2029	1726	1854

The detailed load forecasting methodology is documented within Section 4.4 of the Distribution System Planning Guide (Appendix D). In addition to the process described above, Eversource will be adding adoption-rate forecasts for specific technologies, such as Electric

Vehicles, Distributed Generation, fossil fuel conversion technologies and other DER, to the forecast model throughout 2020 and 2021. Alongside those forecasts, Eversource will be developing new probabilistic models to account for the uncertainty in those forecasts and to better evaluate alternative technologies such as NWS. These probabilistic adoption-rate forecasts will be developed using a bottoms-up approach and aggregated at the substation level using socio-economic data on a zip-code by zip-code basis.

Through the use of probabilistic adoption-rate forecasts, Eversource is able to conduct scenario-based planning specific to individual bulk substations to ensure reliability at a granular level. In addition to customized scenarios based on locational specifics, two base case scenarios will be developed and applied in each study, as documented in Section 4.5 of the Distribution System Planning Guide:

1. High Load Scenario based on the Peak Gross Load Model
2. High DG Scenario based on the Minimum Gross Load Model

These two base scenarios will especially be applicable in areas with increased distributed generation adoption to better plan for system conditions when generation outpaces load.

5.2 Equipment Ratings

Thermal ratings of the conductors and equipment in the distribution system are identified to determine safe and efficient utilization of distribution system capacity while also protecting the useful life and asset condition of the relevant assets. The most limiting series equipment is identified within each modeled segment when modeling and determining system capacity.

Bulk substation transformers have three ratings: Normal, Long-Term Emergency (LTE), and Short-Term Emergency (STE). Presently, non-bulk substation transformers have only one rating for both continuous and contingency conditions – the Long-Term Emergency (formerly TFRAT). With the publication of the Distribution System Planning Guide, Eversource will be utilizing a Normal, LTE and STE ratings for these transformers as well. The rating process for substation transformers is described in SYSPLAN 008 with conditions specified in the Distribution System Planning Guide.

Line equipment (conductors, regulators, step transformers, switches, etc.) is provided one or two ratings: a nameplate or Normal rating, and an Emergency rating. Ratings for this equipment

are presented in the Distribution System Engineering Manual[1]. Protective devices are provided a third rating that reflects the trip setting of the respective device developed by Protection & Control Engineering.

5.3 Bulk Distribution Substations & Associated Interconnected Feeders

Modeling and power flow simulations of the bulk distribution substations and the interconnected 34.5 kV and 12.47 kV distribution systems they supply are currently performed using Siemens PTI PSS/E power flow software. The effects of hot weather conditions on demand and the lower seasonal thermal ratings during summer months present the greatest thermal constraints on Eversource's equipment. Historically, most of Eversource's New Hampshire bulk substations peak in the summer. As a result, a steady-state load flow study is performed at summer peak conditions, with winter peak feeders reviewed as necessary.

The three-phase, balanced distribution model lies under a model of the transmission system created by ISO-New England. The model mimics the actual conditions during their most recent summer peak hour, including substation feeder flows, generation output and device status/configuration. Details of the line impedance, capacitor bank sizes and locations, transformer ratings, etc. are updated as projects are completed and when System Operations announces a configuration change. During the annual model creation, bus loads are scaled to match feeder loading. Bus-by-bus load updates on feeders are performed as needed, with load data originating from the PI historical database. Large customers expecting incremental growth or that account for a significant proportion of the load of a feeder are modeled as a separate bus load. This customer-specific spot load enables forecast study models to capture customer projected growth or maintain a consistent load level year-to-year, allowing the remainder of the substation load to grow at the forecasted level. Sections 4.3 to 4.5 of the Distribution System Planning Guide document the forecasting and model-building process System Planning will adopt going forward.

During Eversource's study process, the interconnected 34.5 kV distribution model is the starting point for forecast model development. System improvements, configuration changes, and known individual customer load adjustments are made. Once all planned projects expected to be

[1] A copy of the Distribution System Engineering Manual was provided to PUC Staff in September 2019. Changes have been made to Section 19 Distributed Generation Policies. A complete, updated Section 19 is included in Appendix E of this filing.

in-service in a particular year are modeled in the base case of that year, the model is then grown so that the bus loads per substation and respective system losses match bulk substation peak forecasted load levels for each year of the study. Non-utility generators are left at their output levels from the base model, but during analysis the largest generator in an area under review is modeled offline. Due to their intermittent nature (river flows and wind patterns), hydroelectric and wind generators are modeled with no output. Section 4.4. of the Distribution System Planning Guide addresses the treatment of PV in the planning models. For future years, System Planning uses the study year model to identify violations and operating constraints, and to develop associated solutions to ensure safe, reliable operation under the loading conditions.

In the future, Eversource will continue to maintain the PSS/E model for joint planning studies and use by System Operations, but almost all planning studies will be performed within Synergi Electric power flow software. Synergi models are generated from multiple internal company databases that provide connectivity, loads, circuit topology, equipment ratings, control types, etc., providing a detailed single-phase (per-phase), unbalanced distribution model of the entire Eversource distribution system. The model development for base study models and simulations are described in detail in the Distribution System Planning Guide. Once the base models are developed, two probabilistic forecasts are to be applied; a peak load driven forecast (low DG impact) and a generation driven minimum load forecast (high DG impact). From this, Eversource then performs its analyses to determine substation and feeder capacity, reliability, and power quality deficiencies.

In both power-flow programs, normal system configuration and all design contingencies are reviewed at the forecasted load levels for each year of the study. System deficiencies identified in accordance with the system design criteria in the Distribution System Planning Guide are documented. The solution options are determined through a detailed solution study and follow the project technical review and approval process presented in the process flow narrative and diagram provided as Appendix F. During this process, various Eversource departments contribute to the development of appropriate cost-effective solution options.

5.4 Non-Bulk Distribution Substations

Non-bulk distribution substation loads are projected by Distribution System Planning based on the forecasts (both Average and Peak) of the respective supply bulk substation. Load projections

are based on the recent summer peak and forecasted 10 years, mirroring the time span of the bulk substation forecast available. New customer load that is very likely to appear on the system beyond each non-bulk transformer is identified and added to the non-bulk forecast. This forecasted load is analyzed to ensure load will not exceed the capacity of the transformer. Capacity deficiencies based on the criteria in the Distribution System Planning Guide are identified.

Solutions to the capacity violations are developed through a detailed solution study and follow the project technical review and approval process presented in the process flow narrative and diagram provided as Appendix F. The retirement of 4 kV substations through a voltage conversion to a higher standard distribution voltage is considered when developing the solution alternatives.

5.5 Distribution Circuit Planning

As noted earlier, all 34.5 kV and 12.47 kV distribution feeders that provide a potential path between bulk substations using SCADA controlled devices (i.e. that contribute to the Load Carrying Capability of a substation) are modelled in PSS/E and are reviewed annually by the Distribution System Planning department. The remaining distribution circuits are the responsibility of the Distribution Engineering Department.

5.5.1 Distribution Circuit Load Projections

Distribution Engineering does not prepare load forecasts for every individual distribution circuit. Actual demand on the circuits is highly dependent on the addition or removal of spot loads. Regional field engineers use their local circuit knowledge and historical peak load data collected from equipment on the circuits to identify those circuits where load growth is a concern and conduct analyses as needed based on those projections.

5.5.2 Distribution Circuit Element Loading and Voltage Criteria

Design criteria limits conductor, recloser, and regulator loading to 100% of the normal rating. Step transformers are of significant interest since a failure of such a device would lead to a lengthy outage. Individual assessments are made for step transformers that exceed 100% of nameplate. Peak loading of up to 120% of the nameplate is typically accepted on step transformers installed as a single unit per phase. Step transformers configured with parallel 333 kVA or 500 kVA per phase are limited to 100% to account for differences in impedance and the significant number of customers served.

The primary voltage must be maintained between 97.5% and 105% of the nominal voltage.

5.5.3 Circuit Models

Circuit models are currently created in DistriView using an extract from the GIS to ensure the most recent circuit information. Models are created on an as-needed basis for specific studies. The Field Engineers typically prepare the circuit models for the following reasons:

- To perform coordination studies to improve reliability or when load growth requires changes in the sizes or placement of protective devices.
- In response to potential low voltage conditions identified by an Eversource employee, a Company owned piece of equipment, or a customer voltage concern.
- An element of the circuit has exceeded, or is expected to exceed, its rating.
- A new residential or commercial development or individual customer load addition is proposed which the Field Engineer determines warrants further study.

Eversource is in the process of adopting Synergi as the enterprise distribution circuit modeling tool. New Hampshire is expected to transition from DistriView to Synergi in 2021. Once Synergi is deployed, all primary distribution circuits will be completely modeled in Synergi, as described in the Distribution System Planning Guide.

5.5.4 Distribution Circuit Study Results

Distribution Engineering conducts specific circuit studies to address reliability, voltage concerns, and the addition of customer load throughout the year. Upgrades needed to address protective device coordination, add protective devices or to address voltage regulation are typically inexpensive and time sensitive for the customer. Therefore, upgrades are identified, designed, and completed in a short time frame. Upgrades necessary to serve specific customer load additions are identified, designed and completed based on the customer's identified need date.

Eversource analyzes a variety of reliability metrics and reports to assess the performance of the distribution system and to identify opportunities for improvement. The annual review of the worst performing circuits and the monthly review of customers experiencing multiple interruptions are just two examples. The Company also conducts program improvements each year. Examples include constructing circuit ties to large radial circuits, adding pole-top SCADA controlled devices to reduce the number of customers impacted by an event and to provide situational awareness to

the system operators, and replacing fuses with devices that have reclosing functionality to avoid permanent outages for temporary faults. A report discussing the reliability analyses and improvement efforts is attached as Appendix G.

Each summer, the Distribution Engineering department reviews peak circuit equipment loading to identify violations or predicted violations of the loading criteria. Low cost solutions, such as increasing the size of a step transformer, are identified to be engineered and completed before the following summer. Criteria violations requiring larger investments are reviewed to determine alternatives.

Recommended system enhancements to address circuit loading and/or reliability that are estimated at greater than $100,000 are presented at the Distribution Capital Review (Challenge Session) meeting where the recommended solutions, as well as alternatives, are reviewed by New Hampshire Leadership. The proposed projects generally require less than a year to engineer and construct. Load forecasts at the distribution circuit level are driven by relatively small spot loads that are generally not known with any degree of certainty until months before they are added to the circuit. Therefore, circuit upgrades to address loading are constructed to be put in service at the time of need, thereby allowing the most prudent use of capital investment.

5.6 Distribution System Planning Criteria Revisions

In 2018, Eversource adopted company-wide procedures for the Calculation and Documentation of Bulk Distribution Transformer Ratings (SYSPLAN 008) and the Bulk Distribution Substation Assessment Procedure (SYSPLAN 010). These two procedures superseded elements of the PSNH Distribution System Planning and Design Criteria Guidelines (ED3002).

The most significant change in calculating bulk distribution transformer ratings with the adoption of SYSPLAN 008 was the methodology used to calculate long-term and short-term emergency ratings. The methodology changed from a calculated loss of life method using a 24-hour load curve (referred to as TFRAT by Eversource) to a method that determined the rating by using a constant load for a fixed loading period (i.e. 12 hours summer, 4 hours winter for LTE) while limiting the hottest spot winding temperature to 140 degrees C. Eversource adopted this methodology based on guidance provided in the IEEE standard for IEEE Guide for Loading Mineral-Oil-Immersed Transformers. Section 8.2.1 of C57.91 (2011) includes the following note:

"*Operation at hottest-spot temperatures above 140 °C may cause gassing in the solid insulation and the oil. Gassing may produce a potential risk to the dielectric strength integrity of the transformer or voltage regulator and this risk should be considered when the guide is applied*." The SYSPLAN 008 procedure remains active.

The newly developed Distribution System Planning Guide supersedes SYSPLAN 010 and is attached as Appendix D. This document, rather than SYSPLAN 010 will be the basis for distribution system planning at Eversource going forward. No projects were initiated solely as a result of the adoption of SYSPLAN 010 from 2018 through 2020. The changes to system planning resulting from the adoption of the Distribution System Planning Guide are presented here.

5.6.1 Bulk Transformer Loading (Transmission Level to Distribution Level Voltage)

The peak loading under the normal system configuration (base case) is limited to 95% of the highest nameplate value associated with the transformer's level of cooling. Under ED3002, the transformer peak loading under base case was allowed to exceed the nameplate rating, limited by a long-term emergency rating which was referred to as the TFRAT. This TFRAT value was typically 115% - 150% of the nameplate value. Loading critical equipment such as substation power transformers above their nameplate value under base case conditions is not an acceptable practice because it accelerates aging, potentially leading to premature failure. The 95% of nameplate limitation for bulk substation transformers has been selected as the base case criteria. The uncertainty associated with load forecasting and the penetration and performance of distributed energy resources are related reasons for utilizing the 95% value. This also provides additional capacity under contingency to aid in the restoration of customers and allows for unforeseen delays in executing a solution to a system need.

5.6.2 Non-Bulk Transformer Loading (Distribution Level to Distribution Level Voltage)

The peak loading under base case is limited to 100% of the highest nameplate value associated with the transformer's level of cooling. Under ED 3002, the transformer peak loading under base case was allowed to exceed the nameplate rating as explained above.

5.6.3 Bulk Substation Contingency Planning

An event that results in the loss of any single piece of equipment located within a bulk

substation will not result in a permanent outage to customers. The loss of one transformer in a two-transformer substation will utilize an Automatic Bus Restoral (ABR) scheme to restore customers automatically. Under ED3002, the planning criteria allowed the permanent interruption of up to 30 MW for up to 24 hours for a transformer failure. For all of Eversource's electric operating affiliates, the distribution design is such that a single transformer contingency event in a bulk substation does not cause loss of load for customers.

5.6.4 Non-Bulk Substation Contingency Planning

There is no change from the ED3002. The loss of a transformer in a non-bulk substation relies upon a mobile transformer to be installed within 24 hours when adequate circuit ties are not available.

5.7 Incorporating Non-Wires Solutions in the Planning Processes

Eversource understands that the DER technology landscape is ever evolving and that there is the potential for some of these technologies to defer capital investments under the right circumstances. However, a diligent, comprehensive analysis of near- and long-term system needs, as well as solution characteristics, is required to ensure continuity of service quality and reliability while assuring that the most cost-effective solution is applied for the customers.

As discussed in the Distribution System Planning Guide, NWS applicability to a planning problem can be guided by criteria related to the type of project, the timeline of the need, and the size of the solution (in MW and/or dollar cost). General considerations outlined in the Guide include:

- State-specific regulations, settlements, and/or other guidance will be used to develop more specific screening criteria.
- Existing Asset Considerations: If assets are part of the proposed capital projects that through their age or asset health index pose a reliability risk, a traditional system upgrade is to be prioritized.
- System Obsolescence: For aging and/or obsolete systems traditional system upgrades should be prioritized.
- Project Type Suitability: Looking at categories of traditional projects that might share similar attributes can help identify projects most suitable for NWS solicitation.
- Timing Criteria: NWS should only be considered where they can be deployed in

time to address a need.

With an emphasis on finding the most technically and economically viable alternatives, Eversource is currently developing a Non-Wires Solutions Screening Tool ("The NWS Screening Tool") to provide a company-wide standardized methodology for reviewing the feasibility and applicability of a broad spectrum of NWS technologies. Until the NWS Screening Tool goes live in first quarter of 2021 as expected, the criteria and methodologies for NWS evaluation are codified as part of the Eversource standard distribution planning process outlined in the Distribution System Planning Guide and discussed above. The NWS Screening Tool and the underlying considerations described in the Distribution System Planning Guide Section 4.8.3 are part of the solution development process for capital projects. This ensures that traditional capital projects will be screened against NWS opportunities to determine if NWS is a viable alternative. The NWS Screening Tool will aim to evaluate pure NWS or hybrid (traditional + NWS) solutions considering, among other things, the total cost of ownership (CapEx and OpEx), safety, reliability, potential revenue streams from the NWS, and deployment timelines.

Both the standardized Distribution System Planning Guide and the NWS Screening Tool will utilize bulk substation-level ten-year forecasts to determine: when system investment is needed; whether NWS can avoid or defer that investment; the respective cash flow over the planning horizon; and the net present value of savings. Lastly, it is important to note that the NWS Screening Tool and the underlying screening criteria for NWS will not only apply to the capital plan projects but will also apply to DER interconnection projects that would require capital investments.

6. JOINT SYSTEM PLANNING

Eversource participates in an annual joint system planning process with UES and NHEC. UES provided the following description of the Joint Planning Process in its 2016 LCIRP filing and included discussion about its objectives, guidelines and design criteria. Eversource and UES have agreed that this description remains accurate today and, UES has agreed that it is appropriate for Eversource to include in this submission. Eversource's planning process with NHEC is similar to that described for UES.

6.1 Eversource-UES Joint Planning Objectives

The UES 2016 LCIRP Filing states the following:

> The goal of the Joint System Planning between UES and Eversource is to develop the most cost-effective alternatives for the combined UES and Eversource system. Absent this process, UES and Eversource customers may be subject to more expensive system enhancements due to duplication of facilities between UES and Eversource. This process is intended to promote coordinated planning efforts between Unitil and Eversource to develop a single "best for all" plan that potentially affects both companies. The objective is to provide a consistent approach for the planning of safe, reliable, cost effective, and efficient expansion and enhancements to each other's local area systems while meeting regulatory and contractual requirements.
>
> By agreement, this process establishes a Joint Planning Committee of Eversource and UES representatives. This committee meets several times on an annual schedule to bring all parties together to coordinate each company's individual plans. The committee considers the application of consistent planning criteria using agreed upon system data; the total cost of planned additions, including internal costs of each utility; the reliability impact of planned additions and modifications; operational considerations, system losses, and maintenance costs; technical considerations for standardized designs and equipment; and the intent of the wholesale supply contract.

6.2 Guidelines and Design Criteria

The UES 2016 LCIRP Filing states as follows:

Each company uses its own guidelines and design criteria for their own individual planning. For joint planning, utility-specific criteria are applied for planning of Dedicated Use Facilities – those facilities which provide electric service to a single company. The design criteria of the affected system is applied for the planning of Dual Use Facilities – those facilities which provide both retail and wholesale service to more than one company. If there is a discrepancy between design criteria, the companies mutually agree on the solution.

Financial models for comparison of options employ a Net Present Value methodology, identifying capital expenditures on an annual basis. An annual return on equity shall be used in the Net Present Value calculations and is subject to review and agreement by each party annually.

System operating constraints and appropriate methods of evaluation are employed to determine preferred options. This includes but not be limited to: operation and maintenance costs, system losses, environment, reliability, and power quality. These criteria are mutually agreed upon.

Technical preference is often considered when evaluating alternatives. Technical preferences may include standard versus non-standard design. It may also refer to concerns such as age and condition of facilities, availability of spare parts, ease of maintenance, ability to accommodate future expansion, or ability to implement. These criteria are mutually agreed upon.

6.3 Joint Planning Report

A joint planning report documents the contingency evaluation, system improvement options, and additional items that were discussed during the joint effort of the two affected utilities. The Eversource/UES 2020 Joint Planning Report is attached as Appendix H. The Eversource/NHEC 2020 Joint Planning Report is attached as Appendix I.

7. TRANSMISSION PLANNING AND INVESTMENT

7.1 Regional Transmission System Planning

Ten-year transmission system planning is performed to develop a regionally coordinated plan to reliably meet customer demands for electricity in addition to supporting the delivery of power across the region. New Hampshire transmission facilities are needed for reliability and to support the expansion of the New Hampshire economy. As noted by the Commission in Order No. 25,459 (January 29, 2013), Eversource's transmission requirements are considered within the purview of the ISO-NE regional transmission planning process. Eversource actively participates in the development of the ISO-NE Regional System Plan (RSP).

The regional transmission system planning process is performed in compliance with applicable planning standards of the North American Electric Reliability Corporation and the Northeast Power Coordinating Council Inc. The Federal Energy Regulatory Commission (FERC) has given authority to ISO-NE to operate and perform regional system planning of the transmission system in New England. The ISO-NE regional transmission planning process for the New England pool transmission facilities (PTF) is performed in accordance with the ISO-NE Transmission, Markets, and Services Tariff (ISO-NE Tariff) Attachment K. This planning process is coordinated with transmission-owning entities, other entities interconnected to the New England transmission system, and the owners and planning authorities of neighboring systems to ensure the reliability of the New England transmission system and ensure compliance with national and regional planning standards and criteria. As described in Appendix 1 to Attachment K of the ISO-NE Tariff - Local System Planning Process, the Participating Transmission Owners (PTOs) are responsible for the Local System Planning (LSP) process for the Non-PTF of the New England Transmission System.

As part of the regional planning process, stakeholder input is provided to ISO-NE by the Planning Advisory Committee (PAC). Specifically, the PAC reviews and provides input on: (i) the development of the RSP; (ii) assumptions for studies; (iii) the results of Needs Assessments and Solutions Studies; and (iv) potential market responses to the needs identified by ISO-NE in a Needs Assessment or the RSP. ISO-NE and New England Transmission Owners (TOs) conduct periodic assessment studies (Needs Assessments) of the New England transmission system. These assessments are performed to identify system needs over a long-term planning horizon. ISO-NE incorporates market responses, including utility-scale generation, distributed generation, and

energy efficiency, as the first step in meeting needs identified in the Needs Assessments. If market responses do not eliminate or address the needs identified in Needs Assessments, ISO-NE develops and evaluates regulated transmission solutions in response to the needs identified by ISO-NE.

When a system reliability need is identified from a Needs Assessment, ISO-NE begins a process to address the need. Starting May 18, 2015, ISO-NE decides whether it must conduct a competitive process to determine the transmission solution. This process is used if the reliability problem is not expected to materialize within three years of the date of completion of the Needs Assessment and any qualified developer, including incumbent providers such as Eversource, can participate. If the reliability problem is expected to materialize within three years, ISO-NE and the TO(s) affected by the reliability problem develop transmission system alternatives to resolve the reliability need and ensure compliance with the national and regional reliability standards. No matter which process is used, the transmission system alternatives are evaluated by ISO-NE and presented to PAC. In all cases, transmission system solution options are further evaluated to determine their feasibility of construction, potential for environmental impacts, estimated costs, longevity, operational differences, etc. When analysis of the options is complete, ISO-NE recommends a proposed transmission project to the PAC.

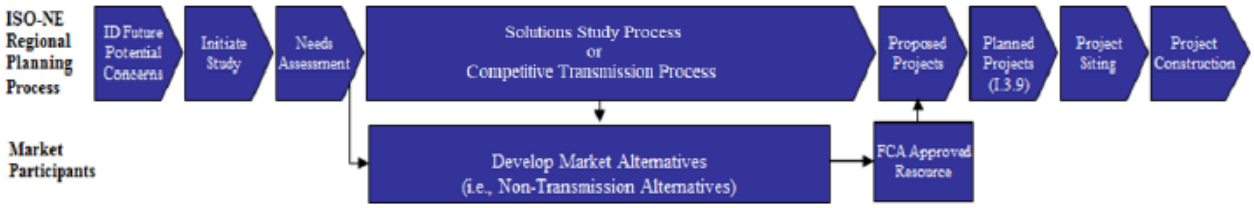
The centerpiece of the regional planning process is the development of the RSP. The RSP is typically published on a biennial basis and contains the assumptions, methods and needs for the New England regional transmission system. ISO-NE develops the RSP for approval by the ISO Board of Directors following stakeholder input through PAC. The RSP also provides information on a broad variety of power system requirements that serve as inputs for assessing the reliability of the New England transmission system, reviewing the design of the markets, and assessing the overall economic performance of the system. The RSP also describes the coordination of ISO-NE's regional system plans with regional, local, and inter-area planning activities.

ISO-NE also develops, maintains and posts on its website cumulative lists reflecting the regulated transmission solutions selected by ISO-NE to meet reliability needs identified in response to Needs Assessments (RSP Project List). The RSP Project List is a cumulative representation of the regional transmission planning expansion efforts ongoing in New England. The project listing is periodically updated by ISO-NE to follow the progression of a project, from the initial selection of a project by ISO-NE, through construction, and until a project is placed in-service. The planned

project status changes when the project is under construction. ISO-NE maintains a similar list (the Asset Condition List) reflecting projects developed by the TOs to address asset condition issues identified by the TOs on their existing transmission facilities.

Another part of the stakeholder process is the review of project plans by the New England Power Pool (NEPOOL). Once the preferred transmission solution has been reviewed by PAC, the project is then analyzed in accordance with section I.3.9 of the ISO-NE Tariff. The project sponsor performs detailed engineering and power flow analyses that is the basis of a Proposed Plan Application (PPA) that is submitted to ISO-NE for review by NEPOOL and final approval by ISO-NE. This review is needed to ensure that a preferred project will have a no significant adverse effect on the stability, reliability, or operating characteristics of the TO's transmission facilities, the transmission facilities of another TO, or the system of a Market Participant in New England.

The transmission planning process is shown below.



ISO-NE Transmission Planning Process

To comply with applicable regulatory requirements, Eversource's local transmission planning process employs methodologies similar to the ISO-NE regional planning process. The consideration and evaluation of multiple alternatives to address local reliability needs and the final development of a recommended local system plan are coordinated with ISO-NE as part of the overall regional planning process and the development of the annual ISO-NE RSP. This information is identified in the Eversource Local System Plan (LSP) as presented to PAC on an annual basis.

7.2 New Hampshire Transmission Planning

The New Hampshire transmission plan is discussed in detail at the following web site:

https://www.iso-ne.com/system-planning/key-study-areas/vt-nh/

The RSP notes that ISO-NE is taking action to address transmission system reliability issues

in all six New England states and has developed preferred solutions to serve customer needs. A number of studies of the New Hampshire system have been conducted. Most recently, ISO-NE completed the New Hampshire 2029 Needs Assessment, and the companion New Hampshire 2029 Solutions Study is underway. This study has identified the need for 115 kV transmission support in the central and western portions of the State and 345 kV or 115 kV transmission support in the southern portion of the State.

Because Eversource's transmission requirements are within the purview of ISO-NE, the RSP should be consulted for a complete understanding of the New England transmission planning process.

8. RELIABILITY PERFORMANCE

For Eversource, reliability performance is more than a key performance indicator. Eversource embeds reliability performance and analysis into all of its operations for the direct, long-term benefit of customers. Eversource views that customer demands for an increasing level of reliability are important and reflect a change in how customers rely on electric service for their daily lives. Reliability performance is the focus of daily conference calls for both the Operations and Engineering organizations. Analyses of outage causes, number of customers affected, frequency, and duration are the cornerstone of distribution project proposals and investments.

The distribution system is inherently vulnerable to adverse weather conditions and customers are becoming increasingly reliant on uninterrupted electric service. The Reliability Enhancement Program, integration of Geographical Information and Outage Management Systems, and extensive expansion of Distribution Automation have advanced the capabilities of the Eversource system and built resiliency on behalf of its customers. Eversource's construction standards have also been updated over recent years to reinforce the distribution system, hardening it against such adverse conditions. Eversource's standards now specify Class 2 poles, covered wire, composite crossarms, and more.

Engineering and Operations Teams continually investigate options to maintain and improve reliability performance and resiliency. In addition to the Distribution Planning and Smart Grid discussions in Sections 5 and 10, additional details about Eversource's reliability performance and its programs are included in Appendix G.

In addition, the fundamental purpose and design of the Company's distribution planning and investment plan is to establish the foundation for enhanced reliability, resilience, operational efficiency and the incorporation of grid-modernization investments, which is a necessary precursor to grid modernization. This was acknowledged in Commission Order No. 25,877 (April 1, 2016) in Docket No. IR 15-296, where the Commission stated that it expects the benefits of grid modernization to include the improving the reliability, resiliency, and operational efficiency of the grid; reducing generation, transmission, and distribution costs; empowering customers to use electricity more efficiently and to lower their electricity bills; and facilitating the integration of distributed energy resources.

The Company's grid modernization plan will encompass some of the same objectives of the Commission (i.e., reliability, resiliency and operational efficiency), but will also encompass the steps necessary to allow for the integration of DER. Advanced energy solutions may be defined as technologies, both established and emerging, that are and will deliver a clean, secure, and affordable energy system for the future. Existing examples of these are DER (solar, wind, fuel cells, etc.) and energy storage devices. Future technology advances are expected to introduce new devices, not yet conceived. Among other challenges involved in installing these technologies to the distribution system, the integration of these technologies creates an urgent need for more granular visibility and monitoring of the distribution system on a near-time and real-time basis. Successful integration of these technologies requires continued focus on the condition and integrity of the distribution system.

9. DISTRIBUTED ENERGY RESOURCES INTERCONNECTIONS

DER Planning manages the interconnection to Eversource's distribution system of: (1) Eversource-owned generation and storage; (2) customer-owned generation and storage (behind a retail meter); and (3) independently owned generation and storage (i.e., merchant generators). All requests to interconnect generation follow an application review process administered by the DER Planning group, which is part of the Eversource engineering organization.

Eversource-owned generation and storage are subject to the same interconnection requirements as independently owned resources. These resources could be used to defer capital investments, are directly under the control of Eversource system operations, and would be evaluated along with other potential non-wires solutions to deliver the lowest cost solution with the greatest electric system benefit.

Customer-owned generation consists of small-scale renewables, such as solar photovoltaic (PV) and wind, as well as a few natural gas, methane gas, and biomass fueled generation and co-generation units. There has been a modest but growing amount of customer-owned solar installed in Eversource's New Hampshire territory. These resources primarily participate in the net metering program in accordance with the Commission's Puc 900 rules. The small scale and intermittent nature of these systems results in a minimal impact to the planning process. The treatment of behind-the-meter resources in the Eversource load forecast is described in the Distribution System Planning Guide (Appendix D). A summary of net-metered generation is provided to the Commission each month in the form of the US Department of Energy form EIA-826.

Independently owned merchant generation interconnections to the distribution system primarily consist of hydro, landfill gas, biomass, and wind generation. In recent years, the majority of applications for interconnection have been proposals for large-scale solar generation.

Eversource DER Planning, in conjunction with ISO-NE, is currently processing a number of interconnection requests from large-scale merchant solar developers. These projects range in size from 10 MW to 20 MW. Eversource cannot be certain which, if any, of these resources will ultimately achieve commercial operation status.

DER impact is accounted for in the distribution planning process in several ways as described in the Distribution System Planning Guide, from inclusion in the forecast model, to

representation in Synergi simulations, to consideration as mitigation options in NWS.

10. SMART GRID

Eversource recognizes that the future economic well-being of New Hampshire will continue to be fostered by a resilient, modern and integrated grid. Eversource's customers expect to take service from an electric grid that is resilient and reliable, allows for more options to reduce energy costs and enable opportunities to explore emerging customer-side energy solutions like solar, storage and electric vehicles. Smart grid technologies have the potential to transform the grid into a customer-centric platform that enables a cleaner energy future while continuously improving the safety, security, reliability, resiliency and cost effectiveness of the electric power system in New Hampshire. Smart grid technologies and associated programs can be assessed in three categories: visibility, automation and optimization. The costs of smart grid technologies and programs will vary based on the nature and extent of the programs. The associated benefits, in terms of improved reliability and resiliency and support for clean energy objectives, can be characterized based on specific investment types within the three smart grid categories. Appendix J details the benefits associated with specific smart grid investment types.

11. DEMAND SIDE ENERGY MANAGEMENT PROGRAMS

Eversource is recognized as a national leader in providing comprehensive energy efficiency programs to our customers. The Company places a strong emphasis on planning and executing on impactful and cost-effective energy efficiency programs. Eversource continuously evaluates programs and collaborates with regulators, stakeholders, vendors and customers to improve energy efficiency offerings and is committed to continued efforts towards achieving all-cost effective efficiency.

In New Hampshire, Eversource has been providing energy efficiency services for more than 20 years. Since 2002, Eversource has collaborated with the other New Hampshire utilities to deliver coordinated energy efficiency solutions to customers, residential, municipal, commercial and industrial throughout the state. These innovative and cost-effective programs are offered under the NHSaves™ Programs ("NHSaves Programs") brand. In 2016, Eversource was a party to a settlement agreement filed with the Commission that lead to establishment of the state's Energy Efficiency Resource Standard ("EERS"). The EERS is the framework within which the NHSaves Programs have been implemented since 2018. Under the EERS framework, Eversource and the other New Hampshire utilities are required to file triennial plans, to pursue annual savings goals, and to work toward the long-term objective of achieving all cost-effective energy efficiency. Eversource participates fully in all stakeholder discussions related to energy efficiency program planning, in quarterly reporting and quarterly meetings on program results, and annual reporting. The programs are audited yearly by the Commission's Audit Division.

Under the EERS, Eversource has increased energy savings from energy efficiency each year. The next triennial plan, if approved by the Commission, will continue the trajectory of increased energy savings.

Energy Savings as a Percent of Sales Under EERS

Year	2018 Actual	2019 Actual	2020 Planned	2021 Filed	2022 Filed	2023 Filed
Energy Savings as a % of 2014 sales	0.97%	1.18%	1.35%	N/A	N/A	N/A
Energy Savings as a % of 2019 sales	0.99%	1.21%	1.39%	1.44%	1.70%	2.09%

11.1 Energy Efficiency Program Offerings

From 2002 to 2019, Eversource electric customers have saved over 12.7 billion lifetime kilowatt-hours. When compared to average retail prices, this translates into customer cost savings of more than $1.8 billion. The energy efficiency programs are designed to achieve cost-effective energy savings and provide accessible avenues to participation for a wide variety of customer types and needs.

11.1.1 Commercial, Industrial and Municipal Programs

Small Business Energy Solutions Program. This retrofit and new equipment and construction initiative offers technical expertise and incentives to small business customers who lack the dedicated staff, time, or resources to address energy costs.

Municipal Program. This energy efficiency solution provides technical assistance and incentives to municipalities and school districts to help them identify energy-saving opportunities and implement projects.

Large Business Energy Solutions (Retrofit and New Equipment & Construction) Program. The program offers technical services and incentives to assist large C&I customers who are retrofitting existing facilities or equipment, adding or replacing equipment that is at the end of its useful life, or constructing new facilities or additions.

Large Business Energy Rewards RFP ("Energy Rewards") Program. The Energy Rewards program encourages customers to propose energy efficiency projects through a competitive solicitation process.

11.1.2 Residential Programs

ENERGY STAR Homes Program. This residential single-family and multifamily new construction program provides incentives and contractor support through two pathways: (1) Drive

to ENERGY STAR and (2) ENERGY STAR 3.1.

ENERGY STAR Products Program. This high-volume program with broad reach is designed to help residential customers overcome the extra expense of purchasing and installing ENERGY STAR-certified appliances, electronics, HVAC equipment and systems, hot water-saving equipment, and lighting.

Home Energy Assistance Program. The program serves New Hampshire's income-eligible homeowners and renters to help reduce their energy costs, optimize their home's energy performance, and make their homes safer, healthier, and more comfortable.

Home Performance with ENERGY STAR. This energy efficiency solution provides comprehensive energy-saving services at significantly reduced cost to customers' existing homes, and covers lighting improvements, space heating and hot water equipment upgrades, weatherization measures, and appliance replacements.

11.2 Impact of Eversource Energy Efficiency Programs on Energy Consumption

The table below summarizes Eversource's actual expenditures, lifetime kilowatt-hour savings, annual kilowatt-hour savings and customer participation during the 2019 program year by customer sector and program. Based on the 2019 results, Eversource saved kilowatt-hours at an average cost of 3.33 cents per lifetime kilowatt-hour as compared to the June 2019 average retail price per kilowatt-hour of $16.88 cents[2].

[2] US Energy Information Administration, Electric Power Monthly, Table 5.6.A. Average Price of Electricity to Ultimate Customers by End-Use Sector, https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_6_a

Eversource 2019 Energy Efficiency Program Results

2019 Eversource Energy	Expenditures (in $000s)	Annual kWh Savings	Lifetime kWh Savings	Customer Participation
Residential Programs				
Home Energy Assistance	$ 7,295.4	1,371,331	17,245,196	1,220
Energy Star Homes	$ 1,259.2	894,233	19,612,979	402
Home Performance with Energy Star	$ 2,869.8	736,533	12,816,238	1,224
Energy Star Products	$ 4,148.9	14,715,501	104,823,377	199,274
Home Energy Reports	$ 722.3	4,420,562	12,124,554	79,120
Customer Engagement Platform	$ 193.1	-	-	
ISO-NE Forward Capacity Market	$ 12.5	-	-	
Subtotal Residential	$ 16,501.3	22,138,159	166,622,345	281,240
Commercial/Industrial Programs				
Large Business Energy Solutions	$ 9,179.3	40,199,700	27,741,168	493
Small Business Energy Solutions	$ 6,674.6	23,655,091	09,379,852	753
Municipal Energy Solutions	$ 1,304.5	3,365,248	44,033,687	127
C&I Customer Partnerships	$ 17.2	-	-	-
Energy Rewards RFP Program	$ 528.2	3,625,832	2,201,712	8
Customer Engagement Platform	$ 289.9	-	-	-
Education	$ 277.5	-	-	-
ISO-NE Forward Capacity Market	$ 29.3	-	-	-
Large Business DR Initiative	$ 332.1			
Subtotal C&I	$ 18,632.5	70,845,870	923,356,419	1,381
Smart Start	$ 24.5			
Total	**$ 35,158.2**	**92,984,030**	**1,089,978,764**	**282,621**

11.3 Impact of Eversource Energy Efficiency Programs on Capacity or Peak Reduction

In addition to kilowatt-hour energy savings, Eversource's programs also provide capacity or peak demand reductions. Installation of energy efficiency measures to reduce kilowatt-hours typically also result in a reduction of kilowatts coincident with the New England Peak. Such peak demand reductions can be referred to as "passive" demand reduction because they occur as a secondary result of the energy efficiency measure.

Eversource 2019 kW Savings from Energy Efficiency Measures

2019 Eversource Energy	Summer kW	Winter kW
Residential Programs		
Home Energy Assistance	145.7	322.0
Energy Star Homes	197.3	110.3
Home Performance with Energy Star	151.4	75.6
Energy Star Products	1,800.5	3,962.2
Home Energy Reports	368.4	504.6
Subtotal Residential	2,663.3	4,974.7
Commercial/Industrial Programs		
Large Business Energy Solutions	4,495.1	4,586.3
Small Business Energy Solutions	3,653.7	3,188.4
Municipal Energy Solutions	421.9	367.0
Energy Rewards RFP Program	349.4	238.7
Subtotal C&I	8,920.0	8,380.4
Total	**11,583.31**	**13,355.08**

In 2019 and 2020, Eversource began offering a pilot Active Demand Response ("ADR") Initiative through the energy efficiency programs. The goals of ADR programs are to flatten peak loads, improve system load factors, and reduce long-term system costs for all grid-tied New Hampshire customers. Active Demand savings (kW) are realized by dispatching resources during

the ISO-NE peak demand period. Reducing load during ISO-NE peak hours also has the effect of reducing New Hampshire's share of the installed capacity ("ICAP") cost allocation. Successful pilot results and evaluation information have led Eversource to propose moving ADR from a pilot phase to a full program in the 2021-2023 Term.

Eversource 2019 and 2020 ADR Pilot

Eversource Energy	2019 Actual Active kW*	2020 Planned Active kW
Residential		
Wi-Fi Thermostat Direct Load Control	N/A	500
Battery Storage	N/A	100
Subtotal Residential	N/A	600
Commercial/Industrial Programs		
C&I Interruptible Load Curtailment	3,933	6,500
Subtotal C&I	3,933	6,500
Total	**3,933**	**7,100**

* Because 2019 is a pilot offering Eversource did not claim Active kW savings as part of the Energy Efficiency Program performance incentive calculation.

11.4 Demand Side Energy Management and Non-Wires Solutions

Demand side energy management such as energy efficiency and active demand reduction can contribute to non-wires solutions in particular locations. There are two avenues for incorporating efficiency and ADR in a non-wires effort. The first would be to utilize existing energy efficiency and demand reduction program offerings and market them in a targeted way to the area of desired impact. Expected energy reductions as a result of the offerings would depend on the types of customers in the location, the potential for reduction at those customer sites, and the willingness of those customers to engage with the energy efficiency or ADR program to achieve savings. The existing energy efficiency and ADR offerings are already designed and approved as part of the Company's cost-effective program offerings.

The second avenue for incorporating efficiency and ADR in a NWS would be to design a set of specific offerings for the particular location of interest, rather than relying on existing

programs. New or modified offerings could potentially incorporate higher incentives levels to increase the likelihood of customer participation or otherwise be targeted to the particular needs of the customers in the area of desired impact. If these new or modified offerings did not meet the existing energy efficiency program parameters, additional benefit-cost testing and/or funding sources may be needed. The overall potential for usage reduction in the location would still be depended on the customer mix, the potential for reduction at individual customer sites and the willingness of the customers to participate and achieve energy reductions.

Review of locations for potential inclusion of energy efficiency and ADR measures as part of a NWS should take into account the following factors:

- Number of residential, commercial, industrial and residential space heating customers in the area.
- The relative demand from each customer segment.
- The potential for energy use reductions within each customer segment and the potential for energy use reductions from individual higher-use customer sites.
- How many customers from each segment have already participated in energy efficiency or ADR programs.
- Which higher-use customers have already participated in energy efficiency or ADR programs.

As part of its planning process outlined in the Distribution System Planning Guide, Eversource has incorporated energy efficiency and active demand response in the range of possible solutions for resolving bulk station capacity violations. The enhanced probabilistic forecast methodology will, in the future, also include the trend in EE growth by substation area, projected down to a granular level. In addition, the NWS Screening Tool includes an assessment of both the technical and financial viability of EE and ADR for reducing violations.

12. CONCLUSION

In Eversource's view, the approaches to planning laid out in this submission reflect a prudent balance of traditional investments alongside the application of advanced tools and techniques to integrate and support a more dynamic and distributed electric grid. As an example of advanced tools and techniques, the Company is working to develop a Non-Wires Solution Screening Tool, which will be integral to developing and applying alternative, non-traditional solutions at the lowest reasonable cost to our customers, while protecting and enhancing the safe, secure and reliable operation of the Eversource electric system. This tool and many others will be continually adapted to help Eversource meet future challenges.

Considering the new and rapidly evolving demands being placed on modern electric systems, System Planning must adapt to keep pace with customer needs and to anticipate changes in technology and customer expectations. Eversource has taken steps, as demonstrated in this LCIRP and the attached Distribution System Planning Guide, to analyze, understand, and plan for these future challenges while providing required system performance and reliability. In Eversource's assessment, this submission is consistent with the requirements of the New Hampshire statutes governing the scope and purpose of the LCIRP, as well as Commission directives.

APPENDICES