

**STATE OF NEW HAMPSHIRE
PUBLIC UTILITIES COMMISSION**

DOCKET NO. DE 20-161

EVERSOURCE ENERGY 2020 LEAST COST INTERGRATED RESOURCE PLAN

REDACTED

DIRECT JOINT TESTIMONY OF

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Utilities Analyst IV
New Hampshire Department of Energy**

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River Consulting Group, Inc.**

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1 **I. INTRODUCTION AND QUALIFICATIONS**

2 **Q. Mr. Dudley, please state your full name and business address.**

3 A. My name is Jay E. Dudley. My business address is 21 South Fruit Street, Suite 10,
4 Concord, NH 03301.

5 **Q. Please state your employer and your position.**

6 A. I am employed by the New Hampshire Department of Energy (“DOE” or the
7 “Department”) as a Utility Analyst for the Regulatory Support Division.

8 **Q. Please describe your professional background.**

9 A. I started at the New Hampshire Public Utilities Commission (“Commission” or “PUC”)
10 in June of 2015 as a Utility Analyst in the Electric Division. Effective July 1, 2021, the
11 Electric Division was transferred to, and became part of, the newly created New
12 Hampshire Department of Energy and I am presently employed by that agency. Before
13 joining the Commission, I was employed at the Vermont Public Service Board (now
14 known as the Vermont Public Utilities Commission, “VT-PUC”) for seven years as a
15 Utility Analyst and Hearing Officer. In that position I was primarily responsible for the
16 analysis of financing and accounting order requests filed by all Vermont utilities,
17 including review of auditor’s reports, financial projections, and securities analysis. As
18 Hearing Officer, I managed and adjudicated cases involving a broad range of utility-
19 related issues including rate investigations, construction projects, energy efficiency,
20 consumer complaints, utility finance, condemnations, and telecommunications. Prior to
21 working for the VT-PUC, I worked in the commercial banking sector in Vermont for
22 twenty years where I held various management and administrative positions. My most
23 recent role was as Vice President and Chief Credit Officer for Lyndon Bank in

1 Lyndonville, Vermont, where I was responsible for directing and administering the
2 analysis and credit risk management of the bank's loan portfolio, including internal loan
3 review, regulatory compliance, audit, and coordinating periodic bank examinations by
4 state and federal regulators.

5 **Q. Please describe your educational background?**

6 A. I received my Bachelor of Arts degree in Political Science from St. Michael's College.
7 Throughout my career in banking, I took advantage of numerous Continuing Professional
8 Education (CPE) opportunities involving college level coursework in the areas of
9 accounting, financial analysis, real estate and banking law, economics, and regulatory
10 compliance. Also, during my tenure with the VT-PUC I took advantage of various CPE
11 opportunities including the Regulatory Studies Program at Michigan State University
12 (sponsored by the National Association of Regulatory Utility Commissioners "NARUC"),
13 Utility Finance & Accounting for Financial Professionals at the Financial Accounting
14 Institute, Standard & Poor's seminars on credit ratings for public utilities, and Scott
15 Hempling seminars on Electric Utility Law and Public Utility Regulation.

16 **Q. Have you previously testified before the Commission?**

17 A. Yes. I previously submitted Staff testimony to the Commission in Docket No. DE 14-
18 238, Public Service Company of New Hampshire Generation Assets; Docket No. DE 15-
19 137, Energy Efficiency Resource Standard; Docket No. DE 16-383, Liberty Utilities
20 Request for Change in Rates; Docket No. DE 17-136, 2018-2020 NH Energy Efficiency
21 Plan; Docket No. DE 19-064, Liberty Utilities Request for Change in Rates; Docket No.
22 DE 19-057 Public Service Company of New Hampshire for Change in Rates; Docket No.
23 DE 20-092, 2021-2023 Triennial Energy Efficiency Plan; Docket No. DE 21-030 Unitil

1 Energy Systems, Inc. Request for Change in Rates; and Docket No. DE 22-026 Unitil
2 Energy Systems, Inc. Petition for Approval of Step Adjustment Filing.

3 **Q. Mr. Willoughby, please state your full name and business address.**

4 **A.** My name is Ronald D. Willoughby. My business address is 1007 Wolfs Bane Drive,
5 Apex, NC 27539.

6 **Q. Please state your employer and your position.**

7 **A.** I am employed by Willoughby Consultant as its Owner. I am performing this engagement
8 as a subcontractor to River Consulting Group, Inc.

9 **Q. Are you registered as a Professional Engineer?**

10 **A.** Yes, I hold a license as a Professional Engineer in Pennsylvania.

11 **Q. Do you hold any patents in power engineering?**

12 **A.** Yes, I hold a U.S. Software Patent for improving the reliability of electrical distribution
13 networks.

14 **Q. Please summarize your educational and professional background.**

15 **A.** I received a Bachelor of Science in Electrical Engineering from the University of
16 Missouri-Rolla and a Master of Science in Electrical Engineering (Power Engineering)
17 from Carnegie-Mellon University.

18 I am a senior life member of the IEEE (Institute of Electrical and Electronics Engineers);
19 a senior member of the IEEE Power Engineering Society; a senior member of the IEEE
20 Industrial Applications Society; and a member of the honorary societies Phi Kappa Phi,
21 Eta Kappa Nu, Tau Beta Phi and Kappa Kappa Psi.

22 I have published over 60 articles relating to electric power systems analysis and
23 operation.

1 **Q. Please summarize your consulting and employment experience.**

2 A. I have been actively engaged in the utility industry for over 45 years, during which I have
3 had extensive experience in the following areas:

4 ■ Transmission and Distribution Planning – I have led engineering, procurement and
5 construction (EPC), and turnkey solutions for electric distribution automation,
6 medium voltage modular substations (distribution centers), and wind farm
7 distribution systems (from base of turbine towers through interconnection to utility
8 grid). I have also led distribution grid modernization planning efforts, focused on
9 systematic and incremental addition of smart grid devices, with technology,
10 performance, and cost central to the planning process.

11 ■ Distribution Substation Design and Specification Review – I managed an engineering
12 group that designed modular distribution substations and specified all corresponding
13 equipment.

14 ■ Advanced Protection, Automation & Control – I co-chaired (with the Director of
15 R&D at We-Energies) Distribution Vision 2010 LLC (DV2010), a consortium of
16 Investor-Owned Utility (IOU) companies to advance distribution automation and
17 equipment design.

18 ■ Distribution Grid Modernization Planning – I was principal engineer on distribution
19 automation and volt-var optimization projects, with an emphasis on conservation
20 voltage reduction (CVR).

21 ■ Renewable Energy Integration and the Impact on the Utility Grid - I was involved in
22 electric power system impact studies related to distributed energy resource

1 integration, including energy storage specification and integration, and related impact
2 studies.

- 3 ■ Conservation Voltage Reduction – I was the Project Manager and Technical Lead for
4 a major midwestern electric utility’s feasibility study to quantify energy and demand
5 savings using distribution Voltage Optimization techniques. Objectives: 1)
6 Minimize cost by initiating feeder upgrades to achieve minimum performance
7 thresholds. 2) Maximize energy savings by optimizing performance while staying
8 within Total Resource Cost (TRC) constraints. I also was the Co-founder of a CVR
9 Industry Consortium to guide CVR research, work with industry groups, develop
10 policy recommendations, promote implementation strategies, and document the
11 results.

12 I have participated in various international programs including:

- 13 ■ Invited by CEOs of Wind-2-Power-Systems (W2PS) and Hudson Energy to represent
14 the United States for a conference in Madrid to cover PV integration, grid integration,
15 energy storage, and DC infrastructure issues.
- 16 ■ Invited by CARILEC to chair two sessions on Transforming the Electricity Grid at
17 the Renewable Energy Forum, St Thomas, U.S. Virgin Islands.
- 18 ■ Invited by Prime Minister of Curacao to represent United States in 1st Annual
19 Durable Energy Conference to address renewables integration issues for the
20 transmission and distribution system.
- 21 ■ Conducted comprehensive seminar on electric power systems for the Ministry of
22 Water and Power in Peking, China.

- 1 ▪ Led projects sponsored by the Pacific Power Association (PPA) for power system
- 2 energy analysis and loss reduction on 20 islands in the South Pacific, 10 with U.S.-
- 3 style power systems, and 10 with European-style power systems.
- 4 ▪ Performed international power systems studies on power flow, transient stability,
- 5 shunt compensation, load shedding, motor starting, loss formula development, short
- 6 circuit, and protective device coordination.
- 7 ▪ Taught Westinghouse’s Advanced School on Power System Stability.
- 8 ▪ Managed commissioning and public relations for comprehensive distribution line
- 9 installation in the city of Smolensk, Russia.

10 **Q. Have you included a more detailed description of your qualifications?**

11 A. Yes. More detailed descriptions of my experience and qualifications are included as

12 Attachments RDW-1 and RDW-2.

13 **Q. Have you previously testified before the Commission?**

14 A. No.

15 **II. SUMMARY OF TESTIMONY**

16 **Q. Please describe the purpose of your testimony today.**

17 A. The purpose of our testimony is to provide the results of the Department’s review and

18 evaluation of Eversource Energy’s (“Eversource” or “the Company”) 2020 Least Cost

19 Integrated Resource Plan (“LCIRP or the Plan”) and the March 31, 2021 Supplement

20 (“Supplement”). This review and evaluation will determine whether Eversource’s LCIRP

21 is consistent with the provisions of RSA 378:37, :38, and :39, and whether the Company

22 has complied with the Commission’s Order No. 26,362 dated June 3, 2020 in Docket DE

23 19-139.

1 **Q. What is your general conclusion involving Eversource's LCIRP?**

2 **A.** We have concluded that the Company's 2020 LCIRP generally meets the requirements
3 set out in RSA 378:37 and RSA 378:38, but that Eversource did not specifically address
4 the criteria in RSA 378:39 in its Plan. Consequently, as discussed below, we recommend
5 that Eversource provide a supplemental filing addressing the criteria in RSA 378:39. We
6 further conclude that the Plan generally complies with the PUC's Order in Docket DE 19-
7 139. The Department also has several additional recommendations which are detailed at the
8 end of our testimony.

9 **III. REVIEW AND ANALYSIS OF EVERSOURCE 2020 LCIRP**

10 **Q. What does RSA 378:37 require Eversource to include in its LCIRP?**

11 **A.** RSA 378:37 New Hampshire Energy Policy requires utilities to comply with New
12 Hampshire's state energy policy in terms of meeting "the energy needs of the citizens and
13 businesses of the state at the lowest reasonable cost while providing for the reliability and
14 diversity of energy sources; to maximize the use of cost effective energy efficiency and
15 other demand side resources; and to protect the safety and health of the citizens, the
16 physical environment of the state, and the future supplies of resources, with consideration
17 of the financial stability of the state's utilities." New Hampshire utilities are expected to
18 demonstrate their compliance with these requirements through their planning process and
19 the content of their least cost integrated resource plans.

20 **Q. What does RSA 378:38 require Eversource to include in its LCIRP?**

21 **A.** RSA 378:38 requires LCIRPs to include, *as applicable*, the following:

22

23

I. A forecast of future demand for the utility's service area.

24

II. An assessment of demand-side energy management programs, including

25

conservation, efficiency, and load management programs.

1 III. An assessment of supply options including owned capacity, market
2 procurements, renewable energy, and distributed energy resources.

3 IV. An assessment of distribution and transmission requirements, including an
4 assessment of the benefits and costs of "smart grid" technologies, and the
5 institution or extension of electric utility programs designed to ensure a more
6 reliable and resilient grid to prevent or minimize power outages, including but
7 not limited to, infrastructure automation and technologies.

8 V. An assessment of plan integration and impact on state compliance with the
9 Clean Air Act of 1990, as amended, and other environmental laws that may
10 impact a utility's assets or customers.

11 VI. An assessment of the plan's long- and short-term environmental, economic,
12 and energy price and supply impact on the state.

13 VII. An assessment of plan integration and consistency with the state energy
14 strategy under RSA 12-P.

15 **Q. Are all of these requirements still applicable?**

16 A. The least cost planning statute was written and amended several times when Eversource
17 still owned large-scale electric generating facilities.¹ New Hampshire recently completed
18 its decades-long journey toward electric utility restructuring which included Eversource
19 divesting itself of its generating assets. This new context means the Commission must
20 review LCIRP filings using a different lens, one that recognizes the waning applicability
21 of some of the factors required in the statute. The statute recognizes the potential
22 evolution of least cost planning in New Hampshire, and qualifies the above enumerated
23 requirements by stating "Each such plan shall include, but not be limited to, the [above

1 enumerated factors], *as applicable*.” RSA 378:38 (emphasis added). In light of this
2 evolution, it would be an efficient allocation of resources for the Commission to shift the
3 focus of its LCIRP analyses to distribution planning processes and planned distribution
4 system investments.

5 **Q. Is the Department suggesting the provisions of RSA 378:38 focusing on energy**
6 **supply options are no longer relevant to the Commission’s review of LCIRP’s?**

7 **A.** No. While RSA 378:38 III is clearly intended to authorize the Commission’s
8 review of the supply portfolio of a vertically integrated utility, there are some scenarios
9 where it may still have relevance for restructured utilities. For example, RSA 374-G
10 allows for company ownership of distributed energy resources which, if deployed, might
11 bear relevance to RSA 378:38 III. Similarly, the New Hampshire Supreme Court
12 recently found that the “functional separation” of generation services from transmission
13 and distribution services should not be elevated above the other interdependent policy
14 principles in the restructuring statute. *Appeal of Algonquin Gas Transmission, LLC*, 170
15 N.H. 763, 774, 186 A.3d 865, 874 (2018). It is conceivable that this interpretation of the
16 restructuring statute might lead to electric distribution company investments which, if
17 deployed, might bear relevance to RSA 378:38 III.

18 In the instant case, no such scenarios are presented for the Commission to evaluate, so
19 RSA 378:38 III is not applicable. Therefore, the Department’s analysis of Eversource’s
20 LCIRP focuses on the other factors within the statute. The Department recommends that
21 Eversource’s next LCIRP should have a similar focus, unless facing a scenario where the
22 aforementioned provisions are somehow applicable. The Department also recommends
23 that the Company should participate in the processes set forth by the Commission’s

¹ The statute appears to have been enacted in 1990 and was most recently amended in 2021.

1 “guidance” in Docket IR 15-296, Order No. 26,575, to develop its next LCIRP, and that
2 the substance of that LCIRP should align with the expectations expressed by the
3 Commission in that Order.

4 **Q. Did Eversource consider the applicability of RSA 378:39 as part of its 2020 LCIRP?**

5 **A.** No. As part of the Department’s involvement in Docket DG 17-152 Liberty Utilities
6 (Energy North) LCIRP, the Department’s understanding of the issues associated with the
7 application of RSA 378:39 is that the Commission expects the utilities to file information
8 on the criteria that allows the Commission to perform an adequate assessment of those
9 areas. This expectation was expressed in Order No. 26,225 at 7 (March 13, 2019), in
10 Docket DG 17-152, where the Commission stated: “[w]e direct Liberty to submit a
11 supplemental filing, including supporting testimony, to address each of the specific
12 elements required under RSA 378:38 and RSA 378:39 that are not already addressed in
13 its LCIRP, with adequate sufficiency to permit the Commission’s assessment of potential
14 environmental, economic, and health-related impacts of each option proposed in the
15 LCIRP, as required by RSA 378:39.”² Given that Eversource’s LCIRP does not
16 specifically address the criteria in RSA 378:39, the Department finds that the Plan is not
17 fully compliant with the statutory requirements and recommends that the Company
18 provide a supplemental filing that complies with the expectation expressed in the
19 Commission’s Order in Docket DG 17-152. That is, Eversource is to provide the PUC
20 with sufficient information, especially as it relates to potential environmental, economic,
21 and health-related impacts, that allows the Commission to make an adequate assessment
22 of those criteria.

² See Docket No. DG 17-152, Liberty Utilities (Energy North) LCIRP, Tab No. 20, Order No. 26,225 at 7 (March 13, 2019), Denying Motion to Dismiss dated March 13, 2019, at 7.

1 **Q. Does the Company’s 2020 LCIRP comply with the requirements set out in the**
2 **Settlement Agreement in Docket No. DE 19-139 and approved in the PUC’s Order**
3 **No. 26,362 dated June 3, 2020?**

4 **A.** Yes, in part. As discussed further below, the LCRIP, taken together with the March 31,
5 2021 Supplement, constitutes a comprehensive plan as contemplated by the Settlement in
6 terms of containing the minimum level of detail. That is, the areas of planning and
7 budgeting processes, distribution operating procedures, distribution engineering manual,
8 equipment standards, planning criteria, load forecasts, future system needs, and planned
9 solutions were all addressed in the Plan.³ However, as discussed below, the Department
10 continues to have concerns involving the Company’s deployment of NWS.

11 **RSA 378:38, I – Demand Forecast**

12 **Q. Does Eversource’s LCIRP include a forecast of future demand for the utility's**
13 **service area?**

14 **A.** Yes. According to the Company’s Plan, Eversource’s system planning is a 10-year
15 timeframe forecast using historical peak load to establish a correlation for future
16 forecasting. An econometric model evaluates historical peak demand as a function of
17 peak day weather conditions and the economy. The econometric model utilizes two
18 different weather variables in forecasting summer peak demand: a three-day weighted
19 temperature humidity index and cooling degree days. The forecast assumes normal
20 weather conditions, which are based off the most recent 10-year period. Eversource
21 produces a 50/50 and a 90/10 peak demand forecast. The 50/50 forecast is based off
22 normal 10-year weather and has a 50 percent chance of being exceeded. The 90/10
23 forecast is the extreme weather scenario that has a 10 percent chance of being exceeded.

1 The economic history and forecast are provided by Moody's Analytics, an international
2 economic consulting company. Once the Eversource system level forecast is finalized,
3 bulk substation level forecasts are developed. Each bulk substation is forecasted using an
4 econometric model that evaluates substation historical demand as a function of the
5 Eversource system peak demand history and forecast.⁴

6 After a trend forecast is produced for each substation, the forecast is adjusted for energy
7 efficiency, distributed energy resources (DER), large customer projects, or other material
8 changes in load or supply. Company sponsored energy efficiency and behind-the-meter
9 solar PV are proportionally applied to each substation in proportion to historical peak
10 demand at each substation. Specifically identified large development projects or
11 expected changes in system operations that could not otherwise be predicted by the
12 econometric forecasts are applied to the affected substation. In addition, capacity
13 reserves are held for customer owned co-generation units which hold Standby Delivery
14 Service Contracts.⁵

15 **Q. Does the Department have any concerns about how the Company forecasts load on**
16 **its circuits?**

17 **A.** No. The Company's process to forecast its load is consistent with other utilities, and its
18 methodology to forecast the load at individual substations using an econometric model is
19 considered a leading practice.

20 **Q. What is the Department's assessment of Eversource's Plan in the areas of**
21 **equipment ratings, bulk substations, interconnected feeders, non-bulk substations,**
22 **and distribution circuit planning.**

³ Attachment JED/RDW-1 Data Request DOE 5-005.

⁴ LCIRP at Bates 19.

1 **A.** Eversource has adopted standard designs across Connecticut, Massachusetts, and New
2 Hampshire as much as practical, recognizing state-specific requirements can apply. The
3 Company’s *Distribution System Planning Guide (DSPG 2020)*⁶ contains planning
4 criteria, asset rating criteria, planning methodology, and non-wires alternatives/solutions
5 (NWAs or NWSs). Current industry standards are referenced and applied and the
6 Company’s equipment ratings, application guidelines, and system planning practices
7 appear to be consistent with these industry standard practices, e.g., ANSI, NERC, IEEE,
8 and EPRI.⁷

9 These design standards are contained in a set of on-line standards documents accessible
10 to Eversource staff referred to as a *T&D Engineering Standards Bookshelf*⁸. The
11 contents of the “Bookshelf” address equipment ratings and application guidelines, bulk
12 and non-bulk substations, distribution feeders, and system planning. Bookshelf
13 documents⁹ include the following: *Distribution System Engineering Manual (DSEM),*
14 *Specifications, System Planning, Transmission & Substation, Overhead, and*
15 *Underground.*

16 **Q.** **What is the Department’s assessment of Eversource’s revisions to its distribution**
17 **system planning criteria?**

18 **A.** Revisions to the distribution planning criteria (in DSPG 2020) were made by the
19 Company in part to address the concerns raised by PUC Staff and the OCA in Docket No.
20 DE 19-139 and to also proactively identify risks and potential mitigation alternatives. The

⁵ *Id.* at Bates 20.

⁶ LCIRP at Bates 28 and Appendix D.

⁷ LCIRP, Appendix D, at Bates 111

⁸ Attachment JED/RDW-2 Data Request DOE 6-003, Attachment DOE 6-003(a) and (b).

⁹ *Id.* Attachment DOE 6-003(b).

1 Company stated “DSPG 2020 is today’s primary document for system planning criteria,
2 rating, and planning methodology.”¹⁰

3 For bulk transformers, the change from 75% top nameplate rating to 95% will result in a
4 higher transformer loading before a criteria violation occurs, which will reduce available
5 capacity to serve unexpected loading conditions but reduce the number of transformer
6 upgrades due to criteria loading. Both bulk and non-bulk transformers have three ratings:
7 Normal (top nameplate), long-term emergency (LTE), and short-term emergency (STE).

8 “The most significant change in calculating bulk transformer ratings was the
9 methodology used to calculate long-term and short-term emergency ratings. The
10 methodology changed from a calculated loss of life method using a 24-hour load curve
11 (referred to as TFRAT by Eversource) to a method that determined the rating by using a
12 constant load for a fixed loading period (i.e., 12 hours summer, 4 hours winter for LTE)
13 while limiting the hottest spot winding temperature to 140 degrees C. Eversource
14 adopted this methodology based on guidance provided in the IEEE standard for loading
15 mineral-oil-immersed transformers.”¹¹ The electric utility industry recognizes IEEE as a
16 credible technical source for equipment application and protection. We agree with
17 Eversource revising its guidelines to conform with IEEE standards.

18 The next most significant change in bulk transformer (substation) planning criteria is not
19 allowing any load loss under N-1 contingency conditions instead of allowing 30MW load
20 loss for up to 24 hours. From the Company’s perspective, there was a need to modify the
21 criteria to meet higher performance expectations for today’s customers who have
22 transitioned from simple tasks such as lighting, refrigeration, cooking, and water heating

¹⁰ Attachment JED/RDW-3, Data Request DOE 4-029.

¹¹ LCIRP, October 1, 2020, Bates 27

1 to more complex and dependent energy needs.¹² Customers working from home are
2 highly dependent on reliable computer operation. Because household appliances also
3 come with computer chips to optimize operation, today's consumer is further dependent
4 on continuous, high-quality electric power supply. While it is true customers can ensure
5 uninterrupted power through the use of UPS or whole-house back-up generator systems,
6 customer-specific situations may make this impractical due to fuel-supply or financial
7 reasons.

8 The "no loss of load" criteria will result in additional designs to maintain the desired
9 level of reliability. This is sometimes construed as overdesign. However, to resolve
10 criteria violations and satisfy reliability objectives, additional equipment and operating
11 practices are required. For example, for bulk substations, contingency criteria violations
12 can be resolved by implementing bus-tie breaker designs providing alternative source
13 feeds for distribution feeder loads. This results in increased capital investment to
14 implement the schemes, but in return, reliability objectives are met while making better
15 use of existing assets.

16 Eversource standard bulk substation design practices also call for automatic bus
17 restoration schemes (ABR) which "automatically isolate the secondary breaker of the
18 primary transformer supply to the bus and then close a normally open breaker to another
19 bus/transformer, restoring power to affected customers."¹³ There are two standard
20 designs: 1) Double-Bus Switchgear, and 2) Ring Bus. Application and protection

¹² RCG's anecdotal experience indicates customer tolerance of outages (even during major events) has markedly decreased.

¹³ Attachment JED/RDW-4, Data Request DOE 4-002, Attachment DOE 4-002(1), Distribution System Engineering Manual (DSEM) Section 2.8.

1 guidelines for each are provided in the referenced DSEM document. Both are consistent
2 with standard industry practice.

3 The use of covered conductor (tree wire) and spacer cable (3-phase application) is
4 defined in DSEM, Section 6.20.¹⁴ Covered wire is to be used in all cases except where
5 bare wire (not fully insulated) is allowed. Spacer cable is to be used where it is not
6 possible to get the necessary clearance for crossarm construction; or if required for
7 clearance when a secondary circuit is needed on the same pole. If reliability issues are
8 due to temporary tree limb contact, either cable option can be used, depending on
9 physical conditions. If reliability issues are due to mechanical damage from falling tree
10 limbs/trees, spacer-cable can help because of its inherent additional conductor strength.
11 However, spacer-cable is expensive to install and can result in pole damage under icing
12 conditions due to the weight of the cable. The better long-term fix is more aggressive
13 tree trimming if physical conditions allow. We reviewed several projects and found
14 Eversource to be applying spacer-cable only where needed and not broadly across the
15 system.

16 To summarize, the planning criteria revisions made by Eversource are reasonable and
17 consistent with industry standard practice. DSEM system design guidelines appear to be
18 reasonable and generally applied by Eversource engineers in the projects reviewed.

19 **Q. Did the Company estimate incremental costs associated with these criteria changes?**

20 **A.** The Company did not directly estimate the incremental costs associated with the changes
21 in its planning criteria. However, the Company noted “No projects were initiated solely
22 as a result of the adoption of SYSPLAN 010 from 2018 through 2020.”¹⁵

¹⁴ *Id.*

¹⁵ LCIRP at Bates 28

1 **Q. Are there other incremental costs related to these criteria and methodology?**

2 **A.** While the Company’s LCIRP did not explicitly address the cost implications of the
3 changes in criteria, the Department did explore projected cost impacts. In response to
4 Data Request DOE 4-16 the Company provided its 2021 five-year strategic plan as a
5 Confidential Attachment. This confidential attachment provided the five-year Eversource
6 NH Capital Forecast for 2022 through 2026 covering areas such as reliability, peak load
7 capacity, basic business, and new customers. While the capital forecast estimated
8 spending for these categories, it did not estimate the impact on customers. The
9 department followed up Eversource’s response to DOE 4-16 with DOE 5-009 to obtain
10 estimates of the impact on customers’ retail distribution rates. The Company’s response
11 indicated cumulative incremental revenue requirement of \$54.5 million over the period
12 2021-2026, or approximately \$9.1 million per year. While the impact would be subject
13 to decisions on interclass cost allocation to be made by the Commission in future rate
14 cases, the “...typical residential customer using 600 kWh in a month would see an
15 increase of \$5.89 or 4.4%.”¹⁶

16 **Q. Has the Company begun making investments based on these criteria changes?**

17 **A.** Since the Company has indicated the planning criteria are in place, we assume the
18 Company has started making investments driven (in part) by the updated planning
19 criteria. However, based on our review of Appendix C and D of the Supplement, many
20 projects are not planned for commencement until later in the forecast period (2024 –
21 2026).

22 In the 2020 planning study, Eversource developed a set of capital projects by region/area
23 required to resolve DSPG 2020 planning criteria violations according to the following

1 LCIRP guidelines: “When these criteria are violated, the system must be reinforced,
2 reconfigured, or upgraded to eliminate the constraints by the forecasted violation year.”¹⁷
3 Study results are summarized in a *2020 Design Violations Summary Report*¹⁸. For each
4 region (bulk) and area (non-bulk), planning violations are summarized by substation¹⁹.
5 Preferred alternative solutions are sometimes referred to by Eversource as “best overall
6 solution alternatives.”²⁰ Thirty-seven (37) bulk substation and twelve (12) non-bulk
7 substation projects were identified. Most violations were due to contingency conditions.
8 Preferred solutions (recommended by System Planning) involved load transfer switches,
9 bus-tie schemes, distribution automation implementation, selective capacity upgrades,
10 and equipment replacement/upgrades due to asset condition.
11 The Department did not detect any excessive construction trends. Corrective actions
12 were reasonable and appear to be according to Company’s standards/guidelines.
13 Consequently, it was clear to the Department that planned capital investments were being
14 based on the new planning criteria of DSPG 2020.

15 **Q. Is the Company planning any further revisions to its planning procedures?**

16 Yes. With respect to the integration of distributed energy resources (DERs), it is our
17 understanding that the Company plans to publish a comprehensive DER Planning Guide
18 by year-end 2022²¹ to serve as a supplement to DSPG 2020.
19
20

¹⁶ Attachment JED/RDW-5 Data Requests DOE 4-016 **REDACTED** and DOE 5-009.

¹⁷ LCIRP, Appendix D, Section 4.8.2, Bates 38.

¹⁸ Attachment JED/RDW-6 Business Process Audit, BPA 1-06 **REDACTED**.

¹⁹ All solutions are based on the yet-to-be-approved planning criteria outlined in DSPG 2020, and as a result, are subject to further study by System Planning as well as a critical review by the Eversource Solution Design Committee (SDC).

²⁰ Attachment JED/RDW-7, Data Request DOE 5-004.

1 **RSA 378:38, II – Demand Side Management**

2 **Q. Does Eversource’s LCIRP include a discussion of demand-side energy management**
3 **programs, including conservation, efficiency, and load management programs?**

4 **A.** The Company states that it has offered energy efficiency (EE) and other demand side
5 management (DSM) programs to its customers for the past twenty years. Since 2002,
6 Eversource has collaborated with the other New Hampshire utilities to deliver
7 coordinated energy efficiency solutions to customers, residential, municipal, commercial
8 and industrial throughout the state. These programs are offered under the NHSaves™
9 Programs (“NHSaves Programs”) brand. In 2016, Eversource was a party to a settlement
10 agreement filed with the Commission that lead to establishment of the state’s Energy
11 Efficiency Resource Standard (“EERS”). The EERS is the framework within which the
12 NHSaves Programs have been implemented since 2018. In 2022, HB 549 amended the
13 statute applicable to energy efficiency making the framework based on specific system
14 benefit charge rates instead of the EERS being the driving element of EE. In the current
15 LCIRP submittal, Eversource has provided extensive information regarding the
16 Company’s ratepayer funded EE programs, a description of the Active Demand
17 Reduction (ADR) pilot program offered to several of its Commercial and Industrial
18 customers, and discussion of a targeted approach to implementing Non-Wires Solutions
19 (NWS) using Eversource’s NWS/NWA (Non-Wires Alternative) screening tool for
20 system planning and for certain customers based on location and customer type.²²

21
22

²¹ Attachment JED/RDW-8, Business Process Audit, Interview No. 62 at 4.
²² LCIRP at Bates 42-48.

1

2 **Q. What is the Department’s assessment of Eversource’s DSM and NWA efforts?**

3 **A.** The LCIRP forecasts expected energy savings under the energy efficiency programs for
4 2021 through 2023.²³ The Company estimates the average cost of a saved lifetime kWh is
5 3.33 cents.²⁴

6 Eversource is also considering a behind the meter solar program but the program is still
7 in the conceptual phase and the Plan offers no detail on how the new program would be
8 implemented.²⁵ On March 31, 2021, the Company provided its Non-Wires Alternative
9 (NWA) Framework Version 2.0 which is “designed to enable rapid initial screening of
10 NWA options against traditional system upgrade projects.”²⁶ Our review of this NWA
11 tool indicates it is reasonably complete and covers a wide range of alternatives and
12 corresponding capital, operating, real estate and program costs.

13 The Company considers the following technologies suitable for potential NWA
14 applications: Energy efficiency (EE), demand response (DR), photovoltaic (PV), battery
15 energy storage systems (BESS), combined heat and power (CHP), conservation voltage
16 reduction (CVR), fuel cell (FC), and emergency generation (EG).²⁷ The following
17 Critical Suitability Criteria (CSC) is first applied to determine if NWA screening is
18 appropriate: 1) Asset Health Index <0.5 (means potential transformer insulation failure);
19 2) Year of First Violation \geq 2 (means violation has to appear within first 2 years of
20 planning period). Any project that does not pass the CSC test will not be considered for

²³ *Id.* at Bates 43.

²⁴ *Id.* at Bates 44.

²⁵ Supplement Appendix A-1 at Bates 31.

²⁶ Supplement, NWA Framework at Bates 8.

²⁷ LCIRP, Supplement, Appendix A-1, at Bates 11.

1 NWA and the Company will automatically move forward with a traditional solution. In
2 our opinion, the technologies are reasonable as are the suitability criteria.
3 However, the Company needs to be more proactive and aggressive at looking for
4 competitive NWA solutions, and consider third-party ownership as well. To date, no
5 NWA solution has been implemented in New Hampshire. Now that the NWA
6 Framework tool is available for use by System Planning and Engineering, we believe
7 more comprehensive NWA assessments should be expected.

8 CVR has yet to be implemented in New Hampshire.²⁸ Given the relatively high content
9 of residential system load --- 44% kWh residential sales; 50% kW residential peak
10 demand²⁹, we believe CVR implementation should be given a higher priority.

11 We also believe not enough attention is being given to NWA solutions as a way to
12 encourage behind-the-meter distributed energy resource (DER) adoption; e.g., PV, or
13 energy storage.

14 However, the appropriate test of a screening tool is whether it is actually used by the
15 Company's personnel and how accurately the costs are evaluated. At this point, we
16 cannot determine if the NWA Framework will be applied against more traditional
17 alternatives and the quality of this application. Eversource's utilization of the tool has
18 been limited since it is a recent addition to the Company's planning and evaluation
19 process and has been used on only three potential projects: Loudon Station, Monadnock
20 Substation, and Dover Substation.³⁰ Based on the Department's review of the analysis,
21 Monadnock and Dover were rejected by the tool as unsuitable due to asset conditions,

²⁸ Attachment JED/RDW-9 Business Process Audit, Interview No. 19 at 15.

²⁹ New Hampshire Residential Baseline Study submitted by Itron to the New Hampshire Evaluation, Measurement, and Verification Working Group, June 11, 2020, pages ES-2 and ES-3.

³⁰ Attachment JED/RDW-10 Data Request DOE 4-020. Also see Supplement Appendix A-2.

1 however, Loudon was found to be a possible candidate and was extensively analyzed by
2 the Company. The resulting recommendation was deployment of mobile generation
3 during seasonal peak loading periods as the most cost-effective solution. Surprisingly, it
4 does not appear that Eversource intends to implement that recommendation since Loudon
5 is still earmarked as a part of the Company’s System Planned Projects (Group 4) for
6 transformer replacement.³¹ No other target projects for the NWA tool have been
7 proposed but Eversource has begun incorporating the tool as part of its project
8 assessment.

9 Consequently, the Department concludes that the Company needs to clearly communicate
10 in its documentation its corresponding actions and results on a regular basis. This should
11 include a statement on every project authorization form (PAF) as to the appropriateness
12 of potential NWA solutions. As with any new tool or planning method, increased
13 vigilance by both the Company and regulators is needed during the initial
14 implementation, application and use of the NWA Framework tool. The Company should
15 be prepared to respond to this increased vigilance in its next rate case.

16 **RSA 378:38, III – Supply Options**

17 **Q. Does Eversource’s LCIRP include an assessment of supply options including owned**
18 **capacity, market procurements, renewable energy, and distributed energy**
19 **resources?**

20 **A.** As stated earlier, Eversource presently does not own any generating assets in its NH
21 service territory. The Company addresses DER growth in their system planning by
22 applying an “adoption rate” forecast in its forecast model beginning in 2020 and 2021.

23 As a result, Eversource is able to conduct scenario-based planning specific to individual

³¹ Supplement, Appendix D at Bates 423.

1 bulk substations and to conduct customized scenarios based on location specifics. Two
2 base case scenarios have been developed: 1) High Load Scenario based on Peak Gross
3 Load Model, and 2) High DG Scenario based on the Minimum Load Growth Model.
4 Eversource believes the two base case scenarios will be particularly useful in assessing
5 areas with increased distributed generation adoption and related impacts on system
6 conditions when generation outpaces load.³²

7 **RSA 378:38, IV – Distribution and Transmission Requirements**

8 **Q. Does Eversource’s LCIRP include an assessment of distribution and transmission**
9 **requirements?**³³

10 **A.** Yes. The LCIRP includes an assessment of distribution and transmission requirements
11 as described in the summaries below.

12 **Transmission**

13 Eversource actively participates in ISO-NE’s Regional System Plan (RSP) development
14 performed according to the North American Electric Reliability Corporation (NERC) and
15 the Northeast Power Coordinating Council (NPPC) planning standards. ISO-NE and New
16 England Transmission Owners (TOs) conduct periodic system needs-assessment studies.
17 Included are market assessments, utility-scale generation, distributed generation, and
18 energy efficiency measures.³⁴

19 If a reliability-related issue is identified within a 3-year period of a needs assessment
20 study, ISO-NE and affected TOs develop solution alternatives for review by ISO-NE’s

³² LCIRP at Bates 21-22.

³³ The statute requires that the assessment should include, as applicable, an assessment of the benefits and costs of "smart grid" technologies, and the institution or extension of electric utility programs designed to ensure a more reliable and resilient grid to prevent or minimize power outages, including but not limited to, infrastructure automation and technologies. RSA 378, IV.

³⁴ LCIRP at Bates 33.

1 Planning Advisory Committee (PAC). The RSP (published biennially) is an integral part
2 of this process.³⁵

3 To comply with regulatory requirements, Eversource's transmission planning process is
4 similar to the RSP development process. Local reliability needs are identified along with
5 alternative solutions. Preferred alternatives are identified as such. Eversource's Local
6 System Plan (LSP) is included in ISO-NE's annual RSP and presented to ISO-NE's PAC
7 on an annual basis.³⁶

8 ISO-NE completed (May 2021) Eversource New Hampshire's 2029 Needs Assessment
9 Study and 2029 Solutions Study. Both studies are posted on ISO-NE's web site, however,
10 because the studies involve Critical Energy Infrastructure Information (CEII), security
11 clearance is required from ISO-NE before accessing the reports.³⁷

12 **Distribution**

13 Eversource conducts distribution planning studies using industry-accepted third-party
14 software and detailed system models based on latest load forecasts.³⁸ Substation &
15 Transmission Engineering works with System Planning to develop solution alternatives
16 as issues and/or planning needs arise for assets inside the substation fence. Distribution
17 Engineering follows a similar process for assets outside the substation fence.

18 Studies are based on DSPG 2020 planning criteria and guidelines. What-if simulations
19 identify needs and potential solutions. Before/after simulations verify solution
20 alternatives.³⁹

³⁵ *Id.*

³⁶ *Id.*

³⁷ <https://www.iso-ne.com/system-planning/key-study-areas/vt-nh/>

³⁸ LCIRP at Bates 23-24.

³⁹ *Id.*

1 Studies are conducted to ensure reliability performance is maintained and/or improved,⁴⁰
2 based on specific study objectives. Capacity needs, asset condition
3 replacements/upgrades, and safety considerations are integral to the planning process.
4 Eversource defines five broad categories of capital projects: 1) Basic business (customer
5 connections); 2) grid modernization; 3) equipment obsolescence; 4) distribution line
6 work; and 5) distribution substation work.⁴¹ When reviewing project documentation, it is
7 important to understand which of the following Eversource solution alternatives apply:
8 Alternative Solution (all reasonable solutions); Feasible Alternative Solution (satisfies all
9 constraints); Technically Feasible Alternative (no technical constraints); Least-Cost
10 Alternative Solution (lowest reasonable cost per RSA 378:37); and Best Overall
11 Alternative Solution (Eversource calls this the “Preferred Solution”) (best combination of
12 performance, cost, future expandability, and ability to meet needed timeframe).⁴²
13 Project documentation needs to clearly define which alternatives (defined above) are
14 being presented along with the decisions/recommendations/justifications for each
15 alternative, especially when Preferred Alternatives are selected over Least-Cost
16 Alternatives. It is also unclear whether NWA solutions are being (or have been)
17 considered or not. If NWA is not applicable, a statement should be included in the
18 documentation to that effect.

19 **Smart Grid Technology**

20 **Q. Has the Company invested in smart grid technology in recent years?**

⁴⁰ *Id.* at Bates 26.

⁴¹ Attachment JED/RDW-11 Business Process Audit, Interview No. 13 at 16.

⁴² Attachment JED/RDW-7, Data Request DOE 5-004.

1 Eversource categorizes smart grid technologies as follows: Enhanced system visibility,
2 automation technologies, and optimization technologies.⁴³

3 The Company has been making investments in enhanced system visibility technologies
4 (sensors) by systematically installing smart devices on distribution lines to allow system
5 operators to better optimize load control; identify power quality issues serving voltage
6 sensitive industrial/commercial facilities; and locate system faults.

7 Investments in distribution automation technologies (smart switches/controls) are
8 underway to create distribution circuit taps to create load transfer options and limit
9 customer exposure to outages. Looped distribution feeder ties exist around the system,
10 mostly in the Southern, Central, and Eastern areas. In Northern and Western areas, fewer
11 looped connections exist.

12 Volt-var optimization (VVO) is an automation technology under consideration in NH but
13 not yet implemented. If implemented, VVO has the potential to provide both
14 environmental and economic benefits to customers.

15 A distribution management system (DMS) is a system optimization technology in the
16 process of being implemented in NH. DMS depends on enhanced visibility and
17 automation technologies being in place. Benefits include better utilization of system
18 assets and increased DER hosting capabilities.

19 **Planned Investments**

20 **Q. Did the Department conduct a review of the planned distribution investments**
21 **described in the LCIRP?**

22 **A.** Yes. Unlike a rate case, specific rate proposals and revenue requirements are not at issue
23 in an LCIRP proceeding, therefore the review of capital investments for least cost

⁴³ *Id.* at Appendix J.

1 planning is not considered to be sufficiently rigorous or specific to support an
2 independent finding of prudence. As the Commission stated in its Order No. 26,362 in
3 Docket No. DE 19-139, an LCIRP “provides a regular snapshot of the factors supporting
4 a utility’s investment decisions, which can be helpful in a later rate case when the
5 Commission determines whether the costs of an investment were prudently incurred.”⁴⁴
6 As such, the Commission’s approval of the LCIRP does not represent a finding of
7 prudence with respect to any particular capital investment described in the Plan. Indeed,
8 many of the capital projects proposed under Eversource’s Plan are scheduled for
9 implementation two to five years into the future and are still in the design phase. While it
10 would be impractical to evaluate each of the planned distribution system investments
11 identified in the LCIRP, in response to discovery request DOE 4-001, Eversource divided
12 the projects into six main groups which helped to make the Department’s review more
13 efficient: Group 1 Line and Station projects >\$250,000, Group 2 Solution Selection
14 Forms (six projects), Group 3 Proposed Reliability Projects, Group 4 System Planning
15 Projects (twenty projects), Group 5 System Solution Forms (three projects), and Group 6
16 Distribution Projects in the 2021 Capital Plan.⁴⁵ Based on the documentation provided,
17 all of the projects reviewed by the Department appeared to be compliant with the
18 planning criteria and assessments outlined in the LCIRP.
19 In addition to the project documentation, the Department also reviewed the Company’s
20 planning documentation which included the *2020-2029 Load Flow Study*⁴⁶ and a follow-

⁴⁴ Docket DE 19-139, Order No. 26,362 dated June 3, 2020 at 8.

⁴⁵ See Attachment JED/RDW-12 Data Request DOE 4-001.

⁴⁶ Supplement, Appendix B System Planning Studies.

1 up companion *2020 Design Violations Summary Report*.⁴⁷ Those documents reflect the
2 Company's investment priorities as outlined in the LCIRP which are illustrated by the
3 project mix: 1) Reliability/resiliency improvement focusing on upgrading overhead
4 equipment and facilities; and systematic replacement of aging equipment based on
5 quantifiable metrics. 2) Grid modernization focusing on electromechanical devices being
6 replaced with digital devices capable of automatically sending real-time information to a
7 central station; and manual switches being replaced with smart switches capable of
8 automatically transferring load from one source to another.

9 Not included in the above documents are system optimization projects that include the
10 previously mentioned distribution management system (DMS) (scheduled for completion
11 in 2022⁴⁸) to optimize data collected from smart devices located on the distribution
12 system; and the planned development of distributed energy resource (DER) capacity
13 hosting maps to facilitate identification of potentially feasible DER development sites.⁴⁹

14 We did not see evidence of volt-var optimization (VVO) projects underway to augment
15 energy efficiency efforts. However, we were told VVO implementation is also
16 planned.⁵⁰

17 A review of the Company's investments in engineering software tools, including in-house
18 developed tools (e.g., NWA Framework), indicated reasonable software investments are
19 being made. The challenge for a utility implementing an expanded suite of software is to
20 maintain data integrity as transitions are made from one software tool to another.

⁴⁷ Attachment JED/RDW-6 Business Process Audit, Data Request BPA 1-006, Attachment BPA 1-006
REDACTED.

⁴⁸ Attachment JED/RDW-13 Business Process Audit, Interview No. 16 at 6.

⁴⁹ Attachment JED/RDW-11 Business Process Audit, Interview No. 13 at 6.

⁵⁰ Attachment JED/RDW-9 Business Process Audit, Interview No. 19 at 12.

1 **Q. Were any of the planned investments included in the LCIRP also included in the**
2 **Company's third step adjustment request in Docket No. DE 22-030?**

3 **A.** Yes. Most of the projects included in Group 6 referenced above were part of
4 Eversource's third step adjustment filing. The Department is currently conducting a
5 review of those capital investments in that docket.

6 **RSA 378:38, V – Environmental Compliance**

7 **Q. Does the Eversource LCIRP include an assessment of plan integration and impact**
8 **on state compliance with the Clean Air Act of 1990, as amended, and other**
9 **environmental laws that may impact a utility's assets or customers?**

10 **A.** As stated earlier, the applicability of this provision of the statute is questionable given the
11 Company no longer owns generating assets. We note, however, that Eversource does
12 provide limited consideration of environmental impacts, risks, and clean-up costs in its
13 capital investment planning and project authorization analysis.

14 **RSA 378:38, VI – Environmental, Economic, and Energy Price and Supply Impact**

15 **Q. Does the Eversource LCIRP include an assessment of the plan's long- and short-**
16 **term environmental, economic, and energy price and supply impact on the state?**

17 **A.** As referenced above, Eversource's system and project planning process includes the use
18 of econometric modeling to consider demand, reliability, feasibility, cost, DER options,
19 and value-added benefits involving planned investments and alternatives. Planning
20 forecasts are over a ten-year period. Environmental impacts and risks are also measured
21 in the project planning process.

22 **RSA 378:38, VII Consistency with State Energy Strategy**

1 **Q. Does the Eversource LCIRP include an assessment of plan integration and**
2 **consistency with the state energy strategy under RSA 12-P?**

3 **A.** Yes. In our assessment, Eversource’s 2020 LCIRP is generally consistent with the state
4 energy strategy then in effect at the time of the Company’s filing on October 1, 2020.
5 Since that time, the Department released a new and revised state energy strategy in July
6 2022. The policy goals and objectives outlined in the new plan are not significantly
7 different those provide in the prior plan; therefore, we find that Eversource’s 2020 LCIRP
8 still remains consistent with state policy.

9 **IV. CONCLUSIONS AND RECOMMENDATIONS**

10 **Q. Please summarize your recommendations.**

11 **A.** The Company’s LCRIP and its supplemental filings such as the NWA Framework and
12 the Loudon Substation provide the outlines of how the Company will evaluate and plan
13 its distribution system in the future. To understand those outlines, the Department had to
14 engage the Company through data requests and technical sessions. We reviewed the
15 Company’s standards in the context of the expectations of a modern customer. We
16 recognize that the LCIRP process does not pre-approve any projects and that projects
17 evolve or change over time. As we stated above, for any particular project, the point of
18 meticulous review is when the Company requests its inclusion in rate base during a rate
19 case. Therefore, the Department recommends:

- 20 • Eversource provide a supplemental filing addressing the criteria in RSA 378:39.
21 • Eversource should participate in the processes set forth by the Commission’s
22 “guidance” in Docket IR 15-296, Order No. 26,575, to develop its next LCIRP, and

1 that the substance of that LCIRP should align with the expectations expressed by the
2 Commission in that Order.

3 • Eversource should continually evaluate the balance achieved between tree trimming
4 and the use of covered wire and spacer-cable to ensure that the appropriate option is
5 selected to maximize reliability and resiliency.

6 • Eversource should be prepared to demonstrate that NWA alternatives have been
7 developed and evaluated within its framework including, when appropriate, third-
8 party alternatives.

9 **Q. Does that conclude your testimony?**

10 A. Yes, it does.

11

12

Ronald D. Willoughby, PE

Position:	Executive Consultant
Years' Experience:	45+
Education:	Honorary Professional Degree of EE – University of Missouri-Rolla (MO Univ. of Science & Tech)(MS&T) Post Graduate Studies – Carnegie-Mellon Univ (CMU) MSEE Power Engineering – Carnegie-Mellon Univ. BSEE – University of Missouri-Rolla (UMR) Professional Engineer (PE) License – Pennsylvania

Key Qualifications:

Distribution Grid Modernization Planning: Systematic/incremental addition of smart grid devices; with technology, performance, and cost central to the planning process.

Renewables Integration and Impact on Utility Grid: Power system analysis/operation, architecture, configurations, distributed generation strategies, market analysis, portfolio analysis, wind power and PV integration.

Conservation Voltage Reduction (CVR): Using smart grid data points and controllable VAR sources to regulate distribution voltages in near real time to reduce demand, lower peaks (kW), and save energy (kWh).

Transmission & Distribution Planning: Power flows; reliability analysis; transient & long-term stability; load shedding; reconfiguration schemes; contingency analysis; root cause analysis; distributed generation; energy storage strategies; protection/coordination; systematic replacement/upgrade strategies; and special protection systems (SPS).

Advanced Protection, Automation & Control: Sensor, communication, sectionalizing, controllable VAR sources, voltage control, expert systems, demand, and energy reduction application strategies.

Distribution Substation Design and Specifications Review: Modular Integrated Transportable Substation (MITS) application, design, specification, and implementation; renewables integration; volt/VAR control; substation upgrades; and distribution automation/protection strategies.

Patents & Publications

Earned U.S. Software Patent 6549880 for *Improving Reliability of Electrical Distribution Networks* (2003).

More than 60 publications relating to electric power systems analysis and operation.

Project Types

Distribution Grid Modernization Planning: Systematic/incremental addition of smart grid devices; with technology, performance, and cost central to the planning process.

Conservation Voltage Reduction (CVR): Using smart grid data points and controllable VAR sources to regulate distribution voltages in near real time to reduce demand, lower peaks (kW), and save energy (kWh).

Renewables Integration: Main substation, collector systems, protection and control.

Power System Energy Use: Technical and non-technical loss evaluation and improvement measures; with specific expertise in island power systems.

Power System Automation: Application of sensor/communication packages, sectionalizing equipment, and SCADA systems to achieve performance targets.

Power System Reliability: Preventive actions and sectionalizing strategies to achieve reliability performance targets.

Power System Protection: Protection/coordination; systematic replacement/upgrade strategies.

Root Cause Analysis (RCA): For unexplained electric power system events.

Knowledge Management: Use cases for technical procedures associated with power system analysis/operation, expert systems, architecture, and configurations.

Project Management: Transmission analysis, distribution analysis, system protection, and reliability improvement.

Training: Power system design, reliability, protection, stability, and operation.

Representative Project Experience

Conservation Voltage Reduction (CVR)

- Project Manager and Technical Lead for Commonwealth Edison Company (ComEd) feasibility study to quantify energy and demand savings using distribution Voltage Optimization techniques. Objectives: 1) Minimize cost by initiating feeder upgrades to achieve minimum performance thresholds. 2) Maximize energy savings by optimizing performance while staying within Total Resource Cost (TRC) constraints.
- Co-Instructor of CVR workshop customized to meet specific ComEd engineering and energy efficiency department needs.
- Co-founder of a CVR Industry Consortium to guide CVR research, work with industry groups, develop policy recommendations, promote implementation strategies, and document the results.
- Technical lead for project commissioned by DOE to conduct a comprehensive study across the USA on CVR, including deployment strategies, costs, benefits, barriers, and potential solutions, through a broad market outreach effort.

Advanced Protection, Automation, & Control for Transmission & Distribution

- Co-Chaired (with the Director of R&D at We-Energies) Distribution Vision 2010 LLC (DV2010), a consortium of Investor Owned Utility (IOU) companies. Mission: To create and execute a roadmap of equipment and service requirements important to cost-effectively operating a reliable electric distribution system; 2002-2006. DV2010 was accountable to CEOs and CFOs of member utilities.
- Led EPC and turnkey solutions in support of electric utility companies for electrical distribution automation, medium voltage modular substations (distribution centers), and wind farm electrical distribution systems (from the base of the turbine towers through interconnection to the utility grid); 1985-1988.
- Invited by the Director of Power & Energy Initiative at the University of Pittsburgh to be an Instructor for a graduate course on Smart Grid Technologies & Applications. Subject: Substation Automation and Protective Relaying; on-going.
- Participated in U.S./Canada Power Outage Task Force led by the Department of Energy (DOE), Natural Resources Canada, and the North American Electric Reliability Council (NERC) created to study the blackout of August 14, 2003, the largest electrical outage event in U.S. history.
- Led comprehensive Root Cause Analysis (RCA) for PJM executive management in response to a July 1999 low voltage condition stemming from record peak loading conditions on the bulk transmission system. Proactive corrective measures prevented future occurrences.

Renewables Integration and Impact on Transmission & Distribution Systems

- Invited by Prime Minister of Curacao to represent USA in 1st Annual Durable Energy Conference in Curacao to address renewables integration issues for the transmission and distribution system; March 2012.
- Invited by CEOs of Wind-2-Power-Systems (W2PS) and Hudson Energy to represent USA for conference in Madrid to cover PV integration, grid integration, energy storage, and DC infrastructure issues; February 2012.
- Invited by CARILEC to chair two sessions on Transforming the Electricity Grid at the Renewable Energy Forum, St Thomas, U.S. Virgin Islands; September 2011. CARILEC represents CEOs, COOs, and CFOs for 33 island utilities in the Caribbean.

Transmission & Distribution Planning

- Led distribution grid modernization planning efforts, focused on systematic and incremental addition of smart grid devices, with technology, performance, and cost central to the planning process
- Led EPC and turnkey solutions for electric distribution automation, medium voltage modular substations (distribution centers), and wind farm distribution systems (from base of turbine towers through interconnection to utility grid). Accountable for success of these focused areas when measured against sales and margin goals, internal and

external budget constraints, and overall customer satisfaction. Routinely augmented internal direct staff with external resources according to project needs. Matrix managed project teams to effectively utilize project resources.

- Co-founder of industry-wide consortium focused on strategic, business, regulatory, and technical issues associated with Conservation Voltage Reduction/Regulation (CVR) at investor-owned utilities, electric cooperatives, and municipals.
- Managed commissioning and public relations for comprehensive distribution line installation in the city of Smolensk, Russia. Project was collaborative effort between U.S. Trade & Development Agency (TDA) and Cooper Power Systems (CPS); 2002-2004.
- Developed distributed CVR measures to conserve energy and reduce overall losses without compromising end-user reliability or power quality.
- Developed emergency generation integration strategies for major industrial complexes in the USA.
- Conducted comprehensive seminar on electric power systems for the Ministry of Water and Power in Peking, China; 1984.
- Performed international power systems studies on power flow, transient stability, shunt compensation, load shedding, motor starting, loss formula development, short circuit, and protective device coordination; 1974-2000. Interfaced with Engineering Planning Managers.
- Led projects sponsored by the Pacific Power Association (PPA) for power system energy analysis and loss reduction on 20 islands in the South Pacific, 10 with U.S.-style power systems, and 10 with European-style power systems. Interfaced directly with CEOs and PPA throughout study.
- Taught Westinghouse Advanced School on Power System Stability; 1980-1988.

Professional Development Activities

NERC Compliance; IEC 61850; DMVP (DMEDI) Process Improvement; Professional Development Seminars on Management (Management Grid, Management Techniques, Team Building); Interpersonal Skills; Time Management; Managing the Software Project; Sales Techniques; SPIN Sales Training; Pricing Strategies; Finances; Technical Writing; Safety; Problem Solving & Decision Making; IEEE Seminars on Relay Coordination and Reactive Power Control; Root Cause Analysis; Reliability Analysis; Intellectual Property; Environmental Compliance; Corporate Ethics; Toastmasters International.

Company Affiliations

Willoughby Consulting, Raleigh, NC (2012 to Present)

Executive Consultant, Electric Power Systems Planning & Operation - Owner

Modular distribution substation application, specification, and implementation. Quantifiable Conservation Voltage Reduction (CVR) assessments for energy efficiency energy savings (kWh) and peak power reduction (kW); CVR application strategies. Emergency backup

power supply needs assessment and solution strategies for large industrial/commercial facilities. Portfolio analysis, go-to-market strategies, and operations support related to electric power systems. Specific service areas include transmission and distribution planning, renewables integration strategies, energy efficiency measures, system protection strategies, distribution automation schemes, data management, and business plan development.

River Consulting Group (RCG), Clayton, GA (2018 to Present)

Executive Consultant - Contract

Advisory services related to distribution grid modernization planning efforts involving systematic and incremental addition of smart grid devices, with technology, performance, and cost central to process.

ABB, Inc. (ABB), Raleigh, NC (2016 to 2017)

Executive Consultant - Contract

Advisory services related to distribution grid modernization planning efforts involving systematic and incremental addition of smart grid devices, with technology, performance, and cost central to process.

Advanced Microgrid Solutions (AMS), San Francisco, CA (2015 to 2017)

Executive Consultant - Contract

Advisory services regarding business strategy, competitive intelligence, and energy services pricing strategies related to the company's business development efforts.

Applied Energy Group (AEG), New Brunswick, NJ (2012 to 2015)

Principal, Executive Consultant - Contract

Energy efficiency (savings) analysis methods, project procurement, and project execution. Innovative applications of existing technologies to advance the art. Industry-wide investigations. Direct responsibility for project teams, including subcontractors.

Dell Innovation Services, Peoria, IL (2012 to 2014)

Vice President, Electricity Transmission & Distribution - Contract

Design and apply substations (including modular) for emergency power supply. Develop electrical site one-line diagrams and associated loading profiles. Conduct power demand audits.

KEMA, Raleigh, NC (2006 to 2012)

Vice President, Electricity Transmission & Distribution

Strategic leadership of the U.S. technical T&D practice in North America, focusing on client issues related to electric power system T&D planning, asset management, protection and reliability, advanced technology applications, and future power systems. Direct responsibility for team of 30 professionals.

Cooper Power Systems, Franksville, WI (1989 to 2006)

Director, Industrial Development & Technical Services Marketing; Manager, Systems Integration Solutions; Director, Thomas A. Edison Technical Center; Manager, Systems Engineering Group

Technical solution development for electrical distribution automation, substations, distribution operating centers, and wind farm integration. Accountable for sales, margins, budget, and customer objectives. Directed project teams to matrix manage overall resources (which included marketing, sales, and engineering staffs) to promote services, identify

opportunities, and secure business. Participated in strategic alliances and acquisitions. Managed high power laboratory (500 MVA short circuit generator), high voltage laboratory (2 million volts), and full materials laboratory, with direct responsibility for a team of 110 professionals. Managed group responsible for Modular Integrated Transportable Substation (MITS) application, design, specifications, implementation, and support (69 kV and below) (10 MVA and below).

Westinghouse Advanced Systems Technology, Pittsburgh, PA (1974 to 1988)

Manager, Transmission Planning Section; Manager, T&D Software Services

Responsible for a staff of 8 involved in the application of technical transmission and distribution software, including marketing and customer service.

Black & Veatch Consulting Engineers, Kansas City, MO (1971 to 1974)

Coop student while with the University of Missouri - Rolla

Professional Memberships

- IEEE – Life Senior Member
- IEEE Power Engineering Society – Senior Member
- IEEE Industrial Applications Society – Senior Member
- Phi Kappa Phi – Member
- Eta Kappa Nu – Member
- Tau Beta Pi – Member
- Kappa Kappa Psi – Member
- Wake County NC – Precinct Election Official (2017-2019)

Professional Recognition

- 2016 Achieved **Life Member** status for the Institute of Electrical and Electronics Engineers (IEEE).
- 2012-14 Invited **Instructor** for **University of Pittsburgh** graduate course on *Smart Grid Technologies & Applications*. Subject: *Substation Automation and Protective Relaying*.
- 2013 Co-Founder of an industry-wide **CVR Consortium** focused on increasing energy savings by resolving strategic, business, and technical issues preventing more wide-spread deployment by electric utility companies.
- 2012 Earned **Order of the May** honors recognition from Carnegie-Mellon University for more than 10 years of continuous and consistent support. Citation includes these words: "This special order honors those who embody all the best characteristics for which the society was originally founded in 1947."
- 2011 Invited **Chairman**, 2 Sessions, *Transforming the Electricity Grid*, **Carilec Renewable Energy Forum**, September 20-21, St. Thomas, U.S. Virgin Islands.

- 2003 Awarded **Honorary Professional Degree of Electrical Engineering**, Univ of MO-Rolla (UMR), based on “outstanding professional and personal achievements”
- 2003 Elected **President**, *Academy of Electrical & Computer Engineers*, UMR
- 2001 Elected VP, *Academy of Electrical & Computer Engineers*, University of Missouri-Rolla
- 2001 Co-Chair, Steering Committee to develop **Distribution Vision 2010 LLC (DV2010)**, consortium of Investor Owned Utility (IOU) companies
- 2001 Appointed **Chairman**, Technical Paper Committee, USA National Committee, **CIRED**
- 2000 Appointed to **Industry Advisory Council**, Rensselaer Polytechnic Institute (RPI), NY
- 1998 Appointed to **Industrial Liason Council (ILC)** for the College of Engineering and Applied Science, University of Wisconsin-Milwaukee
- 1997 Elected to **Academy of Electrical & Computer Engineers**, University of Missouri-Rolla for “outstanding contributions to the profession of electrical engineering and for leadership in the community and profession.” Requires minimum 20 years experience to qualify.
- 1991 Selected for **USA Trade Mission** on Electric Power to East Germany. Represented USA distribution equipment technologies. [E & W Berlin concrete wall fell Nov 1989]
- 1989 Appointed to **Industry Advisory Council**, University of Missouri-Rolla (UMR).
- 1985 **Westinghouse Engineering Achievement Award** for “high level technical contribution to the development and implementation of profitable engineering courses in the Electric Utility and Industrial markets.”
- 1985 **Senior Member** status for Institute of Electrical & Electronics Engineers (**IEEE**).
- 1984 Elected **Chairman** of the only **Quality Circle** in operation at Westinghouse Advanced Systems Technology (AST)
- 1982 Appointed to first **Engineering Advisory Council** for Westinghouse AST
- 1978 Earned **PROFESSIONAL ENGINEER (PE) License** from the Commonwealth of Pennsylvania
- 1972 Received **Outstanding Bandsman** award from Kappa Kappa Psi band fraternity
- 1969 **Valedictorian** and **Student Council President**, Grandview Senior High School

Publications

Ronald Dean Willoughby, PE

Willoughby, Ronald D, Bob Grant, and George Fandos. “Unbiased 360-Degree DER Evaluations and Assistance,” EnergyCentral - Utility Professionals Group, April 20, 2020.

Willoughby, Ronald D. “Why Do It?,” *EnergyPulse* from Energy Central – Intelligent Utility, March 21, 2018.

Willoughby, R., S. K. Gill, E, Zhang, J. Silvers. “Distributed Energy Resources Supporting Power Grid Reliability,” CIGRE US National Committee, 2016 Grid of the Future Symposium, November 2016.

Willoughby, Ronald D. “Grid Modernization is Like Remodeling a House,” Energy Central - Electric Power Systems Planning & Operation, July 20, 2016.

Willoughby, Ronald D. “The Power of Incrementalism,” *EnergyPulse* from Energy Central - Communications & Security, February 10, 2016.

Willoughby, Ronald D. “Aging Workforce Presents Knowledge Management Opportunities,” *EnergyPulse* from Energy Central - Human Resources, November 13, 2015.

Willoughby, Ronald D. “SEPB CVR Proposal Response Review,” Report for AEG for TVA on behalf of SEPB, PO 916082, June 8, 2015.

Willoughby, Ronald D. “Distribution Automation and Conservation Voltage Reduction,” *EnergyPulse* from Energy Central - Grid Operations; April 17, 2015.

Willoughby, Ronald D. “CVR Fundamentals,” White Paper, January 5, 2015.

Willoughby, Ronald D., et al. “Final Report - Voltage Optimization (VO) Feasibility Study,” AEG for ComEd VO Study, Contract No. 01146430, January 6, 2015.

Willoughby, Ronald D. “Order of the 9’s,” *EnergyPulse* from Energy Central - Grid Operations, June 2, 2014.

Willoughby, Ronald D. “Analysis Paralysis,” *EnergyPulse* from Energy Central - Business Corporate, January 16, 2014.

Willoughby, Ronald D. “CVR and the Lost Revenue Conundrum,” *EnergyPulse* from Energy Central, August 9, 2013.

Willoughby, Ronald D. “Time to Take a Second Look at Conservation Voltage Regulation?” *Intelligent Utility Update*, June 4, 2013.

Willoughby, Ron, Kellogg Warner. “Voltage Management: A Hidden Energy Efficiency Resource,” GTM Research *Energy Efficiency Newsletter*, May 7, 2013.

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Updated: April 2020

Willoughby, Ron, Kellogg Warner. "Conservation Voltage Regulation: An Energy Efficiency Resource," *IEEE Smart Grid Newsletter*, April 10, 2013.

Willoughby, Ronald D. "Thinking Through Grid Modernization: It's a Chinese Puzzle – Moving Each Piece Moves Another," article written by Phil Carson of *Intelligent Utility Daily* after an exclusive interview with Mr. Willoughby, June 17, 2012.

Willoughby, Ronald D. "Power System Automation Drives Need for Data Acquisition," *Distributed Energy Magazine*, April 2012.

Willoughby, Ronald D. and Juan Gers. "IEC 61850 Primer," DNV KEMA *TECH Notes*, April 2012.

Willoughby, Ronald D. "Power System Automation Drives the Need for Smart Grid," DNV KEMA *Sherpa* Web Site, December 1, 2011.

Willoughby, Ronald D. "System Automation Drives Need for Data Acquisition," *Electric Light & Power Magazine*, November 2011.

Willoughby, Ronald D. "System Automation Drives Need for Data Acquisition," *PowerGrid International Magazine*, September 2011, pp 52-56.

Willoughby, Ronald D. "The 'Next Big Thing,'" article written by Phil Carson of *Intelligent Utility Daily* after an exclusive interview with Mr. Willoughby, April 21, 2010.

Willoughby, R. D., S. French Smith, S. Varadan. "A Knowledge Framework for Sustaining Business Growth and Success," Panel Session Submission 2010TD0574, IEEE T&D World Conference & Exposition, April 2010, New Orleans.

Willoughby, R. D. (Contributing Expert). *Utility of the Future, Volume 2, The Promise of Energy Storage*, KEMA, December 2009.

Willoughby, R. D. "The Evolving Convergence of Distribution Automation and Advanced Metering Infrastructure," KEMA Automation Insight, June 2007.

Willoughby, R. D. and L. A. Kojovic. "Integration of Distributed Generation In A Typical USA Distribution System," CIRED 2001, Amsterdam Netherlands, June 2001.

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Willoughby, R. D. and L. A. Kojovic. "Digital Models Simulate Physical Test Facilities," *IEEE Computer Applications in Power Magazine*, April 1995.

Willoughby, R. D., C. A. McCarthy, et al. "Power Quality and Reliability Services," Electric Power '99 Conference *Proceedings*, Baltimore MD, April 1999.

Willoughby, R. D., C. Gilker, and E. Strauss. "Education Highway for the Practicing Engineer: What Next in the Age of Deregulation?" *Systems Engineering Group Bulletin SE9901*, February 1999.

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Updated: April 2020

Willoughby, R. D. and S. R. Mendis. "Harmonic Filters Provide The Key To Plant Reliability," PPE Magazine, April 1996.

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Willoughby, R. D., C. Gilker, et al. "Training for TODAY'S Practicing Electrical Distribution Engineer," Systems Engineering Group Bulletin SE9402, Cooper Power Systems, August 1994.

Willoughby, R. D. and K. Argiropoulos. "Hybrid Surge Arrester Technology," US Technology for the Production, Transmission, & Distribution of Electric Power Seminar, Berlin, Germany, October 1991.

Willoughby, R. D. and K. Argiropoulos. "Overcurrent Protection Devices for Overhead Distribution Systems," US Technology for the Production, Transmission, & Distribution of Electric Power Seminar, Berlin, Germany, October 1991.

Willoughby, R. D. and K. Argiropoulos. "Voltage Regulation Equipment for Overhead Distribution Systems," US Technology for the Production, Transmission, & Distribution of Electric Power Seminar, Berlin, Germany, October 1991.

Willoughby, R. D. and S. R. Mendis. "Power Quality Problems in Electric Power Systems," US Technology for the Production, Transmission, & Distribution of Electric Power Seminar, Berlin, Germany, October 1991.

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Willoughby, R. D., R. W. Johnson, and R. A. Whiteside. "Computer-Aided Protective Device Coordination: Advantages," Congress on Protective Systems for Electrical Installation, Puerto la Cruz, VZ, July 29-31, 1987.

Willoughby, R. D., et al. "A Key to Plant Reliability: System Studies," Pakistan Electrical Conference, February 1987.

Willoughby, R. D., and S. Rubino. "Power Systems Studies can Predict and Resolve Harmonic Resonance Problems in Industrial Plants," IEEE Petroleum and Chemical (PCIC) *Conference Record*, September 1985.

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Willoughby, R. D. "Limitations on Local Shunt Compensation Studied with WESTCAT™," the Westinghouse *AST/Group News*, Pittsburgh, Pennsylvania, Winter 1983/84.

Willoughby, R. D. "New Program for Modelling Induction Motors," the Westinghouse *AST/Group News*, Pittsburgh, Pennsylvania, Summer 1983.

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Updated: April 2020

Willoughby, R. D., J. A. Juves and S. S. Waters. "A Streamlined Procedure for Obtaining Regulatory Approval for New Transmission Lines," *Final Report*, Electric Power Research Institute, EPRI EL-1404, Contract TPS-733, December 1982.

Willoughby, R. D., R. W. Powell, and T. E. Szabo. "The Effects of Shunt Compensation on Local Generation Requirements," Fourth (4th) Conference on Electric Power Supply Industry *Proceedings*, Bangkok, Thailand, 1982.

Willoughby, R. D. and S. S. Waters. "Modeling Induction Motors for System Studies," IEEE Industrial Applications Society (IAS) *Transactions*, San Francisco, California, 1982.

Willoughby, R. D. and P. M. Myers. "Special Industrial System Studies to Insure Plant Reliability," IEEE Petroleum and Chemical (PCIC) *Conference Record*, St. Louis, Missouri, 1982.

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Willoughby, R. D. and E. R. Taylor, Jr.. "Practical Application Limit for Shunt Compensation Before Generation Addition," Pennsylvania Electric Association (PEA) Biannual System Planning Committee Meeting *Record*, Hershey, Pennsylvania, September 1981.

Willoughby, R. D., R. S. Hahn, S. Dasgupta, and E. M. Baytch. "Maximum Frequency Decay Rate for Reactor Coolant Pump Motors," IEEE *Transactions on Nuclear Science*, Vol NS-26, No. 1, February 1979, pp. 863-870.

Willoughby, R. D. and R. W. Johnson. "Stability Study Commentary and Interpretation of Computer Printout for Sonatrach LNG Plant Electrical Power System," *Final Report*, Report No. AST-75-1000-08, Westinghouse Advanced Systems Technology, Pittsburgh, Pennsylvania, June 1975.

Willoughby, R. D. and J. W. Skooglund. "Transient Stability Study for Central Nuclear de Almaraz," *Final Report*, Report No. AST-75-1023, Westinghouse Advanced Systems Technology, Pittsburgh, Pennsylvania, May 1975.

Willoughby, R. D. and R. W. Johnson. "Load Flow Study Commentary and Interpretation of Computer Printout for Sonatrach LNG Plant Electrical Power System," *Final Report*, Report No. AST-75-1000-06, Westinghouse Advanced Systems Technology, Pittsburgh, Pennsylvania, April 1975.

Willoughby, R. D. and R. W. Johnson. "Protective Device Coordination Study Commentary and Interpretation of Computer Printout for Sonotrach LNG Plant Electrical Power System," *Final Report*, Report No. AST-75-1000-04, Westinghouse Advanced Systems Technology, Pittsburgh, Pennsylvania, March 1975.

Willoughby, R. D. and R. W. Johnson. "Short Circuit Study Commentary and Interpretation of Computer Printout for Sonotrach LNG Plant Electrical Power System," *Final Report*, Report No. AST-75-1000-02, Westinghouse Advanced Systems Technology, Pittsburgh, Pennsylvania, February 1975.

Public Service Company of New Hampshire d/b/a Eversource Energy
Docket No. DE 20-161

Date Request Received: April 15, 2022
Data Request No. DOE 5-005

Date of Response: April 27, 2022
Page 1 of 3

Request from: Department of Energy

Witness: Freeman, Lavelle A

Request:

Refer to the Settlement Agreement (March 11, 2020) in Dkt. No. DE 19-139 and both of the Company's LCIRP filings. In the Settlement Agreement (March 11, 2020) in Dkt. No. DE 19-139, the Company agreed that it would meet certain specifications (a/k/a responsibilities) for its next LCIRP submission(s). The specifications were described in the Settlement Agreement (S/A) at pp 4 through 6, approved by the Commission in Order No. 26, 362 at 5-6 (June 3, 2020) (referencing the Company's 2020 LCIRP commitments). Has the Company met all of the specifications? Please explain in detail. Please provide any matrix, summary, listing, checklist, or cross reference between the Company's responsibilities as described in the Settlement Agreement (3/11/2020) (Docket No. DE 19-139) pages 4 through 6, and the sections of the Company's LCIRP filing(s) to demonstrate that the Company's responsibilities/specifications were met. The specification/responsibility topics include:

- a. Comprehensiveness of 2020 LCIRP
 - i. Load Forecast
 - ii. Assessment of Distribution System requirements
 - iii. Assessment of Demand Side Management Programs
 1. NWS Candidates
 2. Detailed NWS Potential Analysis
 3. Incorporation of NWS into Utility Planning
- b. Planning Criteria Revisions

Response:

Appendix A of the October 1, 2020 filing provides a summary of the Company's compliance with the LCIRP requirements set forth in RSA 378:38, RSA 4-E:1, and the Settlement Agreements approved by the Commission in Docket No. DE 19-139 and Docket DE 17-136.

As set forth in Appendix A, the Company complied with the Settlement Agreement approved in DE 19-139 as follows:

Public Service Company of New Hampshire d/b/a Eversource Energy
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Load Forecast

The forecast of future demand for the Company's service area is described in Section 5.1 of the LCIRP. Details are provided in Appendices B (regional level) and C (substation level).

Assessment of Distribution System Requirements

The October 1, 2020 LCIRP filing provides the following assessments: Equipment Ratings (Section 5.2), Bulk Substations and Feeders (Section 5.3), Non-Bulk Substations (Section 5.4), Distribution Circuit Planning (Section 5.5), Distribution System Planning Criteria (Section 5.6), and Smart Grid (Section 10 and Appendix J). The Distribution System Planning Guide is provided in Appendix D.

The October 1, 2020 LCIRP filing Appendix K (Grid Needs Assessment) includes information on the grid needs estimated at greater than \$250,000 for Bulk Substations, Non-bulk Substations, and distribution lines.

The October 1, 2020 LCIRP filing Appendix L (Project Authorization Forms) provides approval documentation for non-bulk substation and distribution line projects approved by the New Hampshire Project Approval Committee or the Solution Design Committee.

The March 31, 2021 LCIRP Supplemental filing (Appendix B, C, D, E and F) provides planning studies and project approval documents related to numerous substation and line projects.

Assessment of Demand Side Management Programs

Demand Side Energy Management programs are described in the October 1, 2020 LCIRP filing (Section 11).

NWS Candidates

As described in the October 1, 2020 LCIRP filing Appendix A, Section 2 (Bates pages 55-56), the Company developed a list potential non-wire solutions candidate that was shared with Commission Staff and the Office of Consumer Advocate in August 2020.

Detailed NWS Potential Analysis

Following selection of the Loudon Substation as the location for the detailed NWS analysis, the Company included the NWS analysis as Appendix A-2 to March 31, 2021 Supplemental filing (Bates pages 47-86). The Company also provided the Non-Wires Alternative Framework describing the screening tool used to conduct the Loudon Substation analysis as Appendix A-1 of its supplemental filing.

Docket No. DE 20-161
Joint Direct Testimony of Jay E. Dudley
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Public Service Company of New Hampshire d/b/a Eversource Energy
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Incorporation of NWS into Utility Planning

The October 1, 2020 LCIRP filing (Section 11.4) describes how NWS alternatives are incorporated into utility planning. See also the Distribution System Planning Guide (October 1, 2020 LCIRP filing Appendix D, section 4.8.3) and the NWA Framework provided in the March 31, 2021 LCIRP Supplemental filing (Appendix A-1).

Planning Criteria Revisions

The Planning Criteria Revisions are described in Section 5 of the LCIRP. Appendix D of the LCIRP also provides the newly developed Distribution System Planning Guide that will be the basis for distribution system planning at Eversource. As noted above, the Company's supplemental filing included a description of the non-wires alternative screening tool.

Public Service Company of New Hampshire d/b/a Eversource Energy
Docket No. DE 20-161

Date Request Received: May 16, 2022
Data Request No. DOE 6-003

Date of Response: May 27, 2022
Page 1 of 2

Request from: Department of Energy

Witness: Hebsch, Jennifer J

Request:

Reference data response DOE 4-2. Please supply the following information for the T&D Engineering Standards Bookshelf:

- a. "Screen Shot of Books" in pdf format of what the user sees when the Bookshelf is initially accessed.
- b. Table of contents for each book/standard in the Bookshelf.
- c. Process for adding-to and/or updating Bookshelf contents.

Response:

- a. Attachment DOE 06-003(a) is a pdf screen shot of the Standards Bookshelf.
- b. Attachment DOE 6-003(b) includes the table of contents, as applicable, for each book in the Standards Bookshelf.

Distribution System Engineering Manual – Only the front page/contents of this book is attached.

Emergency Procedures – Only the front page/contents of this book is attached.

Maintenance Program - EMP – Only the front page and index for this book is attached.

Material – Only the front page/contents of this book is attached.

New Services – The front page of the book is attached with the NH Requirements for Electric Service Connections table of contents.

Overhead – Only the front page/contents of this book is attached.

Specifications – Only the front page/contents of this book is attached.

System Planning – All table of contents attached.

Tool & Equipment – Only the front page/contents of this book is attached.

Transmission & Substation – All table of contents attached.

Underground - Only the front page/contents of this book is attached.

Work Methods – Two levels into the table of contents of this book is attached.

Public Service Company of New Hampshire d/b/a Eversource Energy
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The Company's **Environmental and Facility Procedures** is no longer populated and therefore is not included in Attachment DOE 6-003(b).

- c. Attachment DOE 6-003(c) is TD Procedure - TD003 Document Control Process which describes the process for adding-to and/or updating Bookshelf contents.

T & D Engineering
Standards Bookshelf
Click on a book title.
Q Search

Distribution System Engineering Manual
Emergency Procedures
Environmental & Facility Procedures
Maintenance Program - EIMP
Material
New Services
Overhead
Specifications
System Planning
Tool & Equipment
Transmission & Substation
Underground
Work Methods

The Bookshelf has been updated. Click [Here](#) for full details.
Some legacy stock codes were not converted into Maximo. They are identified with an asterisk.
Seeing old versions of documents? Click [Here!](#)

Area of Responsibility Over & Under Procedures TIBs & PIBs Other

000050

Distribution System Engineering Manual

- 01 – General
- 02 – Reliability
- 03 – Economics
- 04 – Calculations
- 05 – Design General
- 06 – Overhead Design
- 07 – Underground Design
- 08 – Conductors
- 09 – Arresters
- 10 – Protection
- 11 – Switches & Switchgear
- 12 – Capacitors
- 13 – Regulators
- 14 – Transformers
- 15 – Overhead Services & Secondaries
- 16 – Underground/DB Service & Secondaries
- 17 – Power Quality
- 18 – Substation
- 19 – Distributed Generation

Common Abbreviations:

- By Name
- By Abbreviation

Index of Distribution
Engineering Reports (DERs)

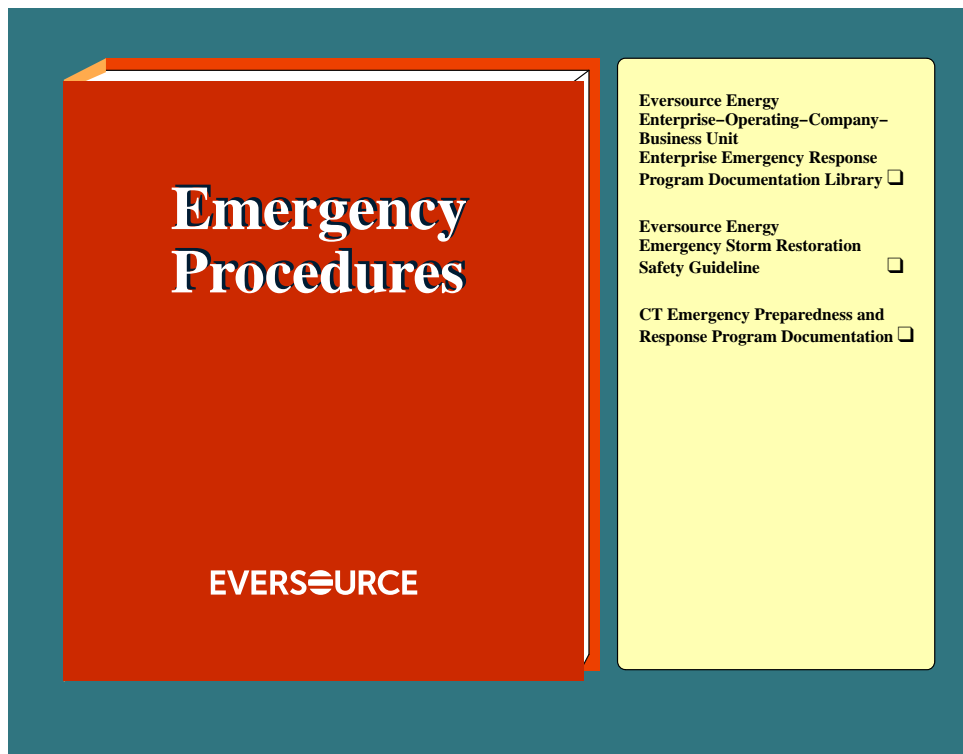
Eversource Standard
Consolidation

Technical Information

EVERSOURCE
Changes / Additions

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Eversource Maintenance Program

Maintenance Books

- Transmission & Distribution System
- Gas System

User Feedback System

- Submit New Feedback
- Feedback History
- Print User Feedback Form

INDEX OF EVERSOURCE MAINTENANCE PROGRAM

Subject	Document Number	Revision Number	Effective Date MM/DD/YYYY
Maintenance Policy	n/a	2	8/6/2014
Introduction - Distribution Maintenance	5.00	5	10/1/2013
Spare			
Aircraft Warning Lights	5.74	1	7/1/2015
Arresters, Lighting	5.25	7	1/1/2017
Spare			
Batteries and Chargers	5.03	6	8/31/2016
Spare			
Cable Pump Houses & Controls	5.68	0	6/1/2015
Capacitors	5.05	5	7/1/2015
Circuit Breakers			
SF6	5.38	5	6/21/2021
Oil	5.39	6	6/21/2021
Vacuum, outdoor	5.40	6	6/21/2021
Air	5.41	6	6/21/2021
Circuit Breakers - Vacuum, Switchgear	5.42	5	7/1/2015
Circuit Switchers	5.07	3	6/1/2015
Spare			
Compressors - Air	5.08	4	6/1/2021
Customer Above Ground Installations	5.10	3	7/1/2015
Direct Buried Systems	5.11	4	6/1/2015
Spare			
Fault Indicator, Overhead	5.32	3	1/1/2017
Spare			
Generator, Emergency	5.18	3	7/1/2015
Infrared Survey	5.22	5	7/1/2015
Load Tap Changers - Superseded by EMP 5.58	5.27	4	11/23/2021
Meters - Transducers	5.75	0	6/1/2015
Spare			
Network Protectors	5.29	3	7/1/2015
Neutral Isolations	5.66	3	7/1/2015
Spare			
Overhead Plant	5.33	5	1/1/2017
Poles, Metal Streetlight	5.52	3	7/1/2015
Poles, Wood	5.61	3	7/1/2015
Power Line Carrier	5.02	0	1/7/2021

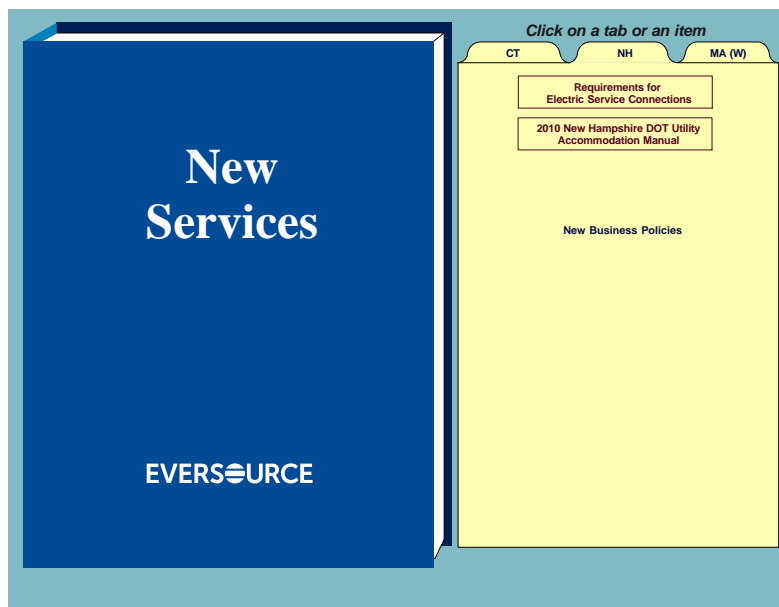
INDEX OF EVERSOURCE MAINTENANCE PROGRAM

Subject	Document Number	Revision Number	Effective Date MM/DD/YYYY
Reactor, Air Core	5.70	0	6/1/2015
Reclosers and Sectionalizers	5.44	4	7/1/2015
Regulators, Voltage	5.01	4	7/1/2015
Relay, Distribution Protective	5.17	3	7/1/2015
Spare			
Resistive Potential Devices - RPD	5.72	0	6/1/2015
Right of Way Inspection	5.45	4	1/31/2017
SCADA RTU	5.76	0	6/1/2015
Spare			
Static Compensator	5.69	0	6/1/2015
Streetlights and Floodlights	5.48	1	8/19/2011
Substation Property Inspection	5.56	3	8/31/2016
Spare			
Spare			
Switches, Disconnect	5.15	4	7/1/2015
Switches, Substation Vacuum	5.31	3	7/1/2015
Switches, Transfer	5.47	2	6/1/2015
Switches, Underground	5.51	2	7/1/2015
Switchgear, Metal-Clad	5.65	2	7/1/2015
Switchgear, Pad-Mounted	5.34	3	7/1/2015
Spare			
Touch Potential	5.62	2	7/1/2015
Transformer, Coupling Capacitor Voltage (CCVT)	5.71	0	6/1/2015
Transformers, Network	5.30	3	6/1/2015
Transformers, Potential	5.43	5	6/2/2021
Transformers, Station Service	5.67	0	6/1/2015
Transformers, Substation	5.58	5	7/1/2015
Transformers, Underground	5.55	3	7/1/2015
Transmission Cables	5.77	0	2/10/2016
Transmission Overhead	5.78	0	2/10/2016
Spare			
Spare			
Vault, Underground	5.59	4	10/12/2015
Vegetation Management	5.60	2	7/1/2015



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**REQUIREMENTS FOR
Electric
Service
Connections**

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Overhead Distribution

Construction Standards

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- 04 – Clearances
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- 07 – General Information/ Antennas
- 08 – 4.8kV Pre-Build
- 09 – Conversions Minimum Reconstruction
- 10 – Distribution Pole Tops
- 11 – 27.6 kV & Multiple Circuits
- 12 – Risers
- 13 – Secondaries
- 14 – Services
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Construction Standards

- 16 – Arresters & Grounds
- 17 – Transformers
- 18 – Cutouts and Solid Blade Disconnects
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- 19 – Capacitors
- 20 – Regulators
- 21 – Lighting
- 32 – Conductors – General
- 33 – Connectors & Splices
- 35 – Metering
- 36 – Distributed Generation

Common Abbreviations:

By Name

By Abbreviation

OH DTR Locator

Search

EVERSOURCE
Changes / Additions



System Planning

System Planning Manual

- Transmission
- Distribution
- DER

System Planning

- Distributed Generation Policies
- SysPlan Index

Technical Information

EVERSOURCE

EVERSOURCE	<h2>System Planning</h2>
<h3>System Planning Index</h3>	

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RETIRED DOCUMENTS

	Section	Applicability	Doc #	Revision Number	Effective Date
1.0	Creation, Review and Approval of System Planning Group Procedures	All	SYSPLAN 000	1	5/15/2014
2.0	Transmission Reliability Standards	All	SYSPLAN 001	0	4/20/2018
3.0	Transmission Planning Procedure - Transmission System Modeling	All	SYSPLAN 002	1	1/20/2019
4.0	Transmission Planning Procedure - Bulk Power System Assessment Methodology	All	SYSPLAN 003	2	11/10/2011
5.0	System Planning Procedure - Major Project Planning and Development Process	All	SYSPLAN 004	1	7/14/2008
6.0	Planning Assessments of Pilgrim Nuclear Power Station Transmission and Back-up Supply	All	SYSPLAN 005	1	3/29/2010
7.0	Determining Transmission System Facility Ratings on the EMA Transmission System	EMA	SYSPLAN 006	2	6/10/2016
8.0	Calculation and Documentation of Auto Transformer Ratings	EMA	SYSPLAN 007	0	5/15/2014
9.0	Calculation and Documentation of Bulk Distribution Transformer Ratings	All	SYSPLAN 008	1	6/11/2008
10.0	Bulk Distribution Substation Assessment Procedure	All	SYSPLAN 010	1	8/1/2018
11.0	Evaluation of Distributed Generation Interconnection Applications	All	SYSPLAN 011	0	3/15/2013
12.0	Transmission Interconnection Process Roadmap	All	SYSPLAN 012	0	8/21/2012
13.0	Eversource EMA Load Shedding Program	EMA	SYSPLAN 014	1	12/30/2014
14.0	Consequential Load Loss Guideline	All	SYSPLAN 015	0	4/20/2018

EVERSOURCE	System Planning
RETIRED System Planning Index	

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	Section	Applicability	Doc #	Revision Number	Effective Date

	<h2>Distribution System Engineering Manual</h2>
<h1>Distributed Generation Policies</h1>	

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1.0	General Design Considerations	
1.1	Interconnection Transformer Winding and Grounding	19.009
1.2	Power Quality Requirements (Flicker)	19.010
1.2.1	Transformer Reverse Power Capability	19.012
1.2.2	VAR Power Factor	19.013
1.2.3	VAR Operation Frequency	19.014
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1.4	Utility Scale DER	
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1.4.2	Substation Modification	19.022
1.4.3	Express Feeders	19.023
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1.4.5	Power Factor Correction	19.025
1.4.6	Compliance with ISO–NE Operating Procedures 14 & 18	19.026
1.4.7	OP–17 Compliance Survey	19.027
1.4.8	Analyzing Non–Export Batteries, CHPs, and Base Loading Generation	19.028
1.5	DER Ride Through Settings	19.030


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	2.1 Maximum Allowable DG Fault Current Contribution	19.040
	2.2 Impact of DERs on Substation High Speed Bus Transfer Schemes	19.041
	2.3 Under-Frequency Load Shedding	19.042
	2.4 Closed Transition Generators	19.043
	2.5 Open Transition Generating Facilities	19.044
	2.6 Generator Step-Up Transformer Configurations	19.045
3.0	Transfer Trip Schemes	
	3.1 Anti-Islanding Studies	19.050
4.0	Secondary Network Connections	
	4.1 General Considerations	19.055
	4.2 Spot Networks	19.056
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5.0	Screening and Planning Studies	
	5.1 Analyzing Non-Export Batteries, CHPs, and Base Loading Generation	19.060
6.0	Testing & Maintenance Requirements	
	6.1 Commission Test Requirements	19.062
7.0	Remote Monitoring & Control	
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	8.1 Battery Storage Equipment	19.070
9.0	Microgrids	TBD
10.0	FERC vs State Jurisdiction	
	10.1 FERC vs State Jurisdiction	19.071



STATE OF TEXAS
DEPARTMENT OF
TRANSPORTATION
DRAFT



1000

**Northeast Utilities
Administrative Transmission Line Standards**

Key:

00 Completed Standard
00 Incomplete Standard

00 Index
01 Preparation, Review, and Approval of Transmission Standards
02 Master Standards List
03 Spare
04 Control of As-Built (Record) Drawings
05 FTP Site Access
06 Incorporation of Documents into Transmission Standards by Cover Sheeting
08 – 99 Spare
09 Bases Documents

Revision History

Rev 0 – Original Index Posted 07/28/08

Index			
Northeast Utilities Approved by: KMS	Administrative NU Confidential Information	ADM 00	Rev 0
		Page 1 of 1	8/13/2008

**Northeast Utilities
Administrative Transmission Line Standards**

Key:

00 Completed Standard
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00 Index
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06 Incorporation of Documents into Transmission Standards by Cover Sheeting
08 – 99 Spare
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Revision History

Rev 0 – Original Index Posted 07/28/08

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Key:

OTRM 000 Posted
OTRM 000 Unposted

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OTRM 001	Spare
OTRM 002	Transmission Line Design Process
OTRM 003	Drawing Numbering System
OTRM 004	Plan and Profile CAD Requirements
OTRM 005	Design Considerations for Air Navigation Safety
OTRM 006	PLS-CADD Design Standards
OTRM 007	HOLD
OTRM 008	HOLD
OTRM 009	Spare
OTRM 010	NU Standard Structure Types
OTRM 011	Spacing of Transmission Lines in Rights-of-Way
OTRM 012	EMF Calculation Protocol
OTRM 013	Life Cycle Cost Evaluations for CL&P & WMECO
OTRM 014	- 019 Spare
OTRM 020	Project Specifications
OTRM 021	HOLD
OTRM 022	HOLD
OTRM 023	Right of Way Encroachments and Uses (Superseded by M7-EN-3003)
OTRM 024	- 029 Spare
OTRM 030	Right-of-Way Vegetation Initial Clearance for 115kV, 230-kV, and 345kV Transmission Lines
OTRM 031	Structure Worksite and Access Areas
OTRM 032	HOLD
OTRM 033	Spare
OTRM 034	- 049 Spare
OTRM 050	Guidelines for Blasting near Utilities
OTRM 051	Transmission Line and Substation Terminal Structure & Lightning Mast Foundations
OTRM 052	HOLD
OTRM 053	- 058 Spare
OTRM 059	Communication Antennas on Transmission Structures
OTRM 060	Extreme Wind & Ice Loading on Transmission Line Structures
OTRM 061	HOLD
OTRM 062	HOLD
OTRM 063	Natural Wood Pole Structures
OTRM 064	Structure Grounding and Counterpoise
OTRM 065	Lightning Arresters
OTRM 066	Transmission Line Terminal Structures

OTRM 067 Overhead to Underground Transition Structures (69/115kV only)
OTRM 068 HOLD
OTRM 069 HOLD
OTRM 070 Wire Sizes, Design Tensions and Deadends, Modeling of Wires & Cables
OTRM 071 Fiber Optic OPGW, ADSS, & Shield Wire
OTRM 072 Mitigation of Wind Induced Conductor Motion
OTRM 073 Insulators and Devices
OTRM 074 Transmission Phase Designaton
OTRM 075 Overhead Transmission Line Ampacity and Thermal Ratings
OTRM 076 Conductor Shielding
OTRM 077 Clearance of 69kV, 115kV, 345kV Conductor to Ground & Other Facilities
OTRM 078 Conductor Clearances within the Supporting Structure (115kV & 345kV)
OTRM 079 AM Radio Noise Consideration – 345-kV Conductor Corona
OTRM 080 Audible Noise Guide
OTRM 081 Evaluation of Stationary Conducting Objects in ROW
OTRM 082 AC Interference Studies

Revision History

Rev 0 -- Original Index Posted 11/22/05
Rev 1 -- Several Additions to Index 8/4/06.
Rev 2 -- Changes to Sections 10 thru 13 11/17/06
Rev 3 -- Upgraded and Changed Index Layout 3/01/2007
Rev 4 -- Changed OTRM 006 from Aerial Laser Survey Criteria to PLS-CADD Design Standards. Also changed approved from RLO to KMS 1/22/2008
Rev 5 -- Revised title of OTRM 070 to include "Deadends" 1/28/2008
Rev 6 -- Revised title of OTRM 064 slightly 1/29/2008
Rev 7 -- Added 070.1
Rev 8 -- Changed Font to Gray on unused Standards. Updated Header & Footer
Rev 9 -- Changed Northeast Utilities to Eversource; changed series numbers in use from Spare to HOLD 07/13/2016
Rev 10 -- Updated title of OTRM 011 03/13/2018

Key:

OTRM 000 Posted
OTRM 000 Unposted

OTRM 100 OTRM Procurement Standards Index
OTRM 101 Spare
OTRM 102 HOLD
OTRM 103 HOLD
OTRM 104 HOLD
OTRM 105 Unused
OTRM 106 LiDAR Acquisition Requirements and Feature Codes
OTRM 107 Property Survey
OTRM 108 Engineering/Design Survey
OTRM 109 Spare
OTRM 110 Wood and Steel Structures Material Matrix
OTRM 111 HOLD
OTRM 112 HOLD
OTRM 113 HOLD
OTRM 114 – 119 Spare
OTRM 120 HOLD
OTRM 121 HOLD
OTRM 122 HOLD
OTRM 123 Unused
OTRM 124 – 129 Spare
OTRM 130 HOLD
OTRM 131 HOLD
OTRM 132 HOLD
OTRM 133 Spare
OTRM 134 – 149 Spare
OTRM 150 HOLD
OTRM 151 HOLD
OTRM 152 Soil Boring and Testing Requirements OH Transmission Facilities
OTRM 153 – 158 Spare
OTRM 159 HOLD
OTRM 160 Technical Requirements for Steel Pole Structures
OTRM 161 Technical Requirements for Lattice Steel Structures
OTRM 162 Glue-Laminated Wood Transmission Structures
OTRM 163 Natural Wood Pole Transmission Structures
OTRM 164 Resistance and Resistivity Measurements
OTRM 165 HOLD
OTRM 166 HOLD
OTRM 167 HOLD
OTRM 168 HOLD

- OTRM 169 HOLD
- OTRM 170 HOLD
- OTRM 171 Technical Requirements for Composite Optical Ground Wire
- OTRM 172 HOLD
- ~~OTRM 173 Specification for 115-kV Polymer (NCl) Insulators (Cancelled- NCl use banned)~~
- OTRM 174 HOLD
- OTRM 175 HOLD
- OTRM 176 HOLD
- OTRM 177 HOLD
- OTRM 178 HOLD
- OTRM 179 AM Radio Broadcast Frequency Signal Strength Measurements along Proposed EHV Rights-Of-Way
- OTRM 180 HOLD
- OTRM 181 HOLD
- OTRM 182 HOLD
- OTRM 183 - 189 Spare
- OTRM 190 UAS, Survey Inspection, and Photography of Transmission Lines
- OTRM 191 - 197 Spare
- OTRM 198 Inspection and Supplemental Treatment of Transmission Wood Poles (formerly OTRM 268)
- OTRM 199 Inspection and Supplemental Treatment of Transmission Steel Structures

Revision History

- Rev. 0 – Original Index Posted 11/22/05.
- Rev. 1 – Several Additions to Index 8/24/06.
- Rev. 2 – Revised Index Layout and Added 152 8/1/07.
- Rev. 3 – Added 107 & 108
- Rev. 4 – Changed Font to Gray on unposted Standards. Updated Header & Footer. 7/23/08
- Rev. 5 – Unknown changes
- Rev. 6 – Changed Northeast Utilities to Eversource; changed series numbers in use from Spare to HOLD 07/13/2016
- Rev. 7 – Updated title of OTRM 152 05/14/2018
- Rev. 8 – Added OTRM 190 and OTRM 199 5/31/18
- Rev. 9 – Added OTRM 198 6/14/18

Key:

OTRM 000 Posted
OTRM 000 Unposted

OTRM 200	Index
OTRM 201	Spare
OTRM 202	HOLD
OTRM 203	HOLD
OTRM 204	HOLD
OTRM 205	Unused
OTRM 206	Construction Staking and As-Built Surveying Requirements
OTRM 207	HOLD
OTRM 208	HOLD
OTRM 209	Spare
OTRM 210	HOLD
OTRM 211	HOLD
OTRM 212	HOLD
OTRM 213	HOLD
OTRM 214 – 219	Spare
OTRM 220	HOLD
OTRM 221	Transmission Line Construction - General
OTRM 222	Operation of Equipment on Eversource Rights-of-Way
OTRM 223	Unused
OTRM 224 – 229	Spare
OTRM 230	Vegetation Clearing Procedures and Practices for Transmission Line Sections
OTRM 231	Access Roads and Structure Work Site
OTRM 232	Identification and Warning Signs
OTRM 233	Spare
OTRM 234 – 249	Spare
OTRM 250	Drilling and Blasting
OTRM 251	Transmission Line, Substation Terminal Structure, and Lightning Mast Foundations
OTRM 252	HOLD
OTRM 253 – 258	Spare
OTRM 259	HOLD
OTRM 260	Steel Pole Installation
OTRM 261	Transmission Line Steel Lattice Towers
OTRM 262	Laminated Wood Pole Structure Construction
OTRM 263	Wood Pole Structures
OTRM 264	Counterpoise Installation General Specification
OTRM 265	HOLD
OTRM 266	HOLD

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Key:

UTRM 000 Posted
UTRM 000 Unposted

UTRM 000	UTRM Design Standards Index
UTRM 001	Cross Reference to OTRM Standards
UTRM 002	Transmission Safety and Environmental Design Considerations
UTRM 003	Spare
UTRM 004	Spare
UTRM 005	Spare
UTRM 006	Spare
UTRM 007	Spare
UTRM 008	Spare
UTRM 009	Cable Thermal Ratings
UTRM 010	Spare
UTRM 011	Spare
UTRM 012	Spare
UTRM 013	Unused
UTRM 014	Spare
UTRM 015	Spare
UTRM 016	Power Cable Structures and Bridge Attachments
UTRM 017	Spare
UTRM 018	Spare
UTRM 019	Spare
UTRM 020	Unused
UTRM 021	Spare
UTRM 022	Unused
UTRM 023	Spare
UTRM 024	Spare
UTRM 025	Spare
UTRM 026	Spare
UTRM 027	Spare
UTRM 028	Spare
UTRM 029	Spare
UTRM 030	Spare
UTRM 031	Spare
UTRM 032	Spare
UTRM 033	Spare
UTRM 034	Unused
UTRM 035	Unused
UTRM 036	Unused
UTRM 037	Unused
UTRM 038	Spare

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Joint Direct Testimony of Jay E. Dudley
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UTRM 149 Spare
UTRM 150 Unused
UTRM 151 Unused
UTRM 152 Soil Boring and Testing Requirements UG Transmission Lines
UTRM 153 Spare
UTRM 154 Spare
UTRM 155 Spare
UTRM 156 Spare
UTRM 157 Spare
UTRM 158 Spare
UTRM 159 Spare
UTRM 160 Spare
UTRM 161 Spare
UTRM 162 Spare
UTRM 163 Spare
UTRM 164 Unused
UTRM 165 Spare
UTRM 166 Unused
UTRM 167 Spare
UTRM 168 Spare
UTRM 169 Spare
UTRM 170 Cable – XLPE, EPR, HPFF
UTRM 171 Unused
UTRM 172 Thermocouple Temperature Monitoring System
UTRM 173 XLPE Cable Support and Restraint System
UTRM 174 Unused
UTRM 175 Terminations – XLPE, EPR, HPFF
UTRM 176 Spare
UTRM 177 Unused
UTRM 178 Spare
UTRM 179 Underground Cable Splices
UTRM 180 – 191 Spare
UTRM 192 Pre-cast Concrete Splice Vaults
UTRM 193 – 199 Spare

Revision History:
Rev. 0 – Original Index Posted
Rev. 1 – Changed Font to Gray on unposted Standards. Updated Header & Footer.
Rev. 2 – Changed from UTRM 101 to UTRM 100. Updated Standards Titles

Key:

UTRM 000 Posted
UTRM 000 Unposted

UTRM 200	UTRM Construction Standards Index
UTRM 201	Cross Reference to other Applicable Standards
UTRM 202	Transmission Safety and Environmental Construction Considerations
UTRM 203	Spare
UTRM 204	Spare
UTRM 205	Spare
UTRM 206	Spare
UTRM 207	Spare
UTRM 208	Spare
UTRM 209	Unused
UTRM 210	Spare
UTRM 211	Spare
UTRM 212	Spare
UTRM 213	HPFF Pipe and Accessories Installation
UTRM 214	Spare
UTRM 215	Spare
UTRM 216	Spare
UTRM 217	Spare
UTRM 218	Spare
UTRM 219	Spare
UTRM 220	Unused
UTRM 221	Spare
UTRM 222	Pressurization Plant Installation
UTRM 223	Spare
UTRM 224	Spare
UTRM 225	Spare
UTRM 226	Spare
UTRM 227	Spare
UTRM 228	Spare
UTRM 229	Spare
UTRM 230	Spare
UTRM 231	Spare
UTRM 232	Spare
UTRM 233	Spare
UTRM 234	Duct Bank Construction
UTRM 235	Conduit Material and Installation
UTRM 236	Marking of Underground Cable Systems in Rights-of-Way
UTRM 237	Post Construction Duct and Pipe Cleaning and Inspection
UTRM 238	Spare

UTRM 239 Spare
UTRM 240 Spare
UTRM 241 Spare
UTRM 242 Spare
UTRM 243 Spare
UTRM 244 Spare
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UTRM 246 Spare
UTRM 247 Spare
UTRM 248 Spare
UTRM 249 Spare
UTRM 250 Drilling and Blasting (Refer to OTRM 250)
UTRM 251 Horizontal Directional Drilling
UTRM 252 Pipe Jacking and Boring
UTRM 253 Spare
UTRM 254 Spare
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UTRM 256 Spare
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UTRM 264 Unused
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UTRM 267 Spare
UTRM 268 Spare
UTRM 269 Spare
UTRM 270 Cable – XLPE, EPR, HPFF
UTRM 271 Temperature Monitoring and Communication Cable Installation
UTRM 272 Temperature Monitoring Thermocouple Installation
UTRM 273 Spare
UTRM 274 Unused
UTRM 275 Unused
UTRM 276 Spare
UTRM 277 Unused
UTRM 278 Spare
UTRM 279 Unused
UTRM 280 291 Spare
UTRM 292 Precast Concrete Vault Installation
UTRM 292.1 Retrofit of Concrete Splice Vault with Round Frame and Cover

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Joint Direct Testimony of Jay E. Dudley
and Ronald D. Willoughby
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5/16/2022
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UTRM 293 – 299 Spare

Revision History

Rev 0 – Original Index Posted 12/19/05
Rev 1 – Additions to Index Section Descriptions 11/03/2006
Rev 2 – Added UTRM 234 & 235
Rev 3 – Changed Font to Gray on unposted Standards. Updated Header and Footer
Rev 4 – Changed from UTRM 201 to 200. Updated Standards Titles.
Rev 5 – Added UTRM 292.1

**Northeast Utilities
Real Estate Standards**

Key:
REAL 000 Posted
REAL 000 Unposted

REAL 000 Index
REAL 001 Property Disposition Checklist
REAL 002 Real Estate Revenue Lease/License Procedure
REAL 003 Surplus Property Review
REAL 004 Corporate Approval To Divest Of Real Estate

Revision History

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Underground & URD Distribution

Construction Standards

00 – General

32 – Cables

33 – Connectors

35 – Metering

36 – Distributed Generation

42 – Clearances

43 – Tagging / Identification / Labeling

54 – Secondary / Service

56 – Grounds / Bonds

58 – Transformers

60 – Switchgear / Switches

UG DTR Locator

Search

Construction Standards

61 – Controls / Sensing / Communication

62 – Fault Indicators / Fuses

63 – Foundations / Box Pads / Handholes

64 – Joints / Splices / Tubing

65 – Miscellaneous Equipment / Tools

66 – Special Projects

67 – Terminations

Risers

76 – Manholes / Vaults / Conduits / Ducts

84 – Network / Conventional

Common Abbreviations:

By Name

By Abbreviation

Public Service Company of New Hampshire d/b/a Eversource Energy
Docket No. DE 20-161

Date Request Received: February 18, 2022
Data Request No. DOE 4-029

Date of Response: March 07, 2022
Page 1 of 2

Request from: Department of Energy

Witness: Labrecque, Richard C, Freeman, Lavelle A

Request:

Please define the following for the 3 sets of planning criteria provided in the above Excel spreadsheet, i.e., DOE 4-28.1 Attachment 1:

- a. When each was/is used, including first use.
- b. How each is used and by whom.
- c. How each will be used going forward and by whom, including which is the Company's first choice.
- d. What has been done and planned by the Company to help Staff better understand the need for three sets of criteria, and the potential consequences if the preferred set is not accepted/approved by Staff.

Response:

Of the three criteria being compared in DOE 4-28.1 Attachment 1, only two are documents that set System Planning criteria: ED-3002 and the Distribution System Planning Guide (DSPG 2020). The third document being referenced is a system study report that references the criteria in the Distribution System Planning Guide. The following responses compare the use of ED-3002 and the Distribution System Planning Guide.

- a. Of the different documents guiding New Hampshire System Planning design criteria, the first is ED-3002, which was originally issued January 10, 2003. This document was the primary guidance for NH System Planning until SYSPLAN-010 was revised.

SYSPLAN-010 was a criteria document created in 2014. In 2018, the first effort to bring all planning criteria of the different operating companies into one document occurred. The revised SYSPLAN-010 document was adopted by all three states on August 1, 2018 and supersedes ED-3002. However, some specific planning criteria not addressed by SYSPLAN-010 are still applicable from ED-3002.

Public Service Company of New Hampshire d/b/a Eversource Energy
Docket No. DE 20-161

Date Request Received: February 18, 2022
Data Request No. DOE 4-029

Date of Response: March 07, 2022
Page 2 of 2

The Distribution System Planning Guide, adopted September 22, 2020, is today's primary document for system planning criteria, rating, and planning methodology. The DSPG 2020 supersedes SYSPLAN-10 and ED-3002, by extension. However, some specific items not addressed by the DSPG 2020 are still applicable in SYSPLAN-010 and ED-3002.

- b. All documents are used by New Hampshire Distribution System Planning for criteria on how to study the distribution system and ensure system capacity needs are fulfilled, and system voltage remains within limits for base case and contingency scenarios.

ED-3002: Portions not superseded by DSPG 2020 and SYSPLAN-010, used by New Hampshire

SYSPLAN-010: Portions not superseded by DSPG 2020, used by Connecticut, Massachusetts, and New Hampshire

DSPG 2020: Used by Connecticut, Massachusetts, and New Hampshire

- c. The Company's primary distribution system planning criteria document is the Distribution System Planning Guide, released in 2020. Any items not addressed by the DSPG 2020, are supplemented, first by SYSPLAN-010 and then by ED-3002. Based on changing roles and responsibilities, some items are still referenced in SYSPLAN-010 by Transmission Planning and in ED-3002 by Distribution Engineering, until replacement guides/policies can be written.
- d. The new Distribution System Planning Guide was included in the Company's initial filing in this docket. Eversource's initial filing highlighted the implementation of the new DSPG and changes to the criteria were described. Subsequent to the initial filing of the LCIRP, Eversource and Staff discussed the new planning criteria at a technical session. The Eversource response to data request DOE 4-028 provides additional details. Eversource is committed to these new criteria as a means to ensure system reliability under various single contingency events. Customers will be exposed to the risk of prolonged outages if the system is not planned and designed to these criteria.

Public Service Company of New Hampshire d/b/a Eversource Energy
Docket No. DE 20-161

Date Request Received: February 18, 2022
Data Request No. DOE 4-002

Date of Response: March 10, 2022
Page 1 of 1

Request from: Department of Energy

Witness: Hebsch, Jennifer J

Request:

Please provide a copy of the latest distribution standards for Eversource and any studies or memos supporting any recent changes covering the minimum requirement for Class 2 poles, covered wire, pole construction configuration, etc.

Response:

Eversource is providing the following Standards in Attachment DOE 4-002 (1):

- Distribution System Engineering Manual (DSEM)
- Overhead Construction Standards
- Underground Construction Standards

To access the above books, perform the following:

1. Unzip the files to a separate directory
2. Open the file called Standards.pdf
3. This opens the “bookshelf” with the three books in it.
4. Click on the book title which will open the book and allow the user to open the various table of contents and documents.

Additional supporting information is also included:

- Attachment DOE 4-002(2) – Eversource Policy: Use of Steel Poles on Distribution Lines

Note that Eversource is working on a topic-by-topic review to consolidate its standards so that each section identifies enterprise-wide as well as operating company level standards within the section. Some standards apply to certain operating companies while others apply to all operating companies.

Use of Steel Poles on Distribution Lines



This policy applies to Eversource NH installations

Responsibility

All Engineering and Operations personnel are expected to understand and abide by this policy.

Policy

New poles installed in Eversource three phase lines in distribution Rights-of-Way are to be direct embedded self-weathering steel poles, class and height to be determined by the Transmission Line Engineering group.

The use of steel poles in other situations such as for single phase lines, jointly owned facilities, or other special situations is by exception only and requires approval from managers or above in Operations and Engineering.

Steel poles shall not be used for service poles.

See the attached Supervisor Briefing Sheet for additional information.

Revision History

0	Created new policy, <i>effective 10/3/2019</i>	
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Use of Steel Poles on Distribution Lines

Steel Pole FAQ (Sabre weathering steel poles)

- 1. Are there Eversource standards for steel poles?** Refer to Section 10 of the Overhead book, 9.1--9.4.
- 2. Do we build to 200 kV BIL?** Steel Construction in the Distribution ROW is built to 350BIL - Wood construction is built to 200 kV BIL. Consult OH Standards book for correct material.
- 3. What do we use for guy attachments? Our current attachment has teeth.** Consult Standards - on angles and dead ends where a guy will be attached, a Tee Plate is used on steel construction (SC:532221). It is flat and will sit flush to the pole.
- 4. Can we equipotentially ground on a steel pole? How to ground?** Equipotentially grounding a line is done in almost the same way as a wood pole. The only difference is that you can use a step rung to attach a ground to in lieu of the cluster bracket; however, a cluster bracket is also an acceptable method.
- 5. Should caulk guns be purchased - how much caulking is required?** Caulk or RTV is required to seal the drill holes to keep out moisture after a bolt is inserted.
- 6. How do you drill holes or work in the air if steps are only on one side?** The preferred method would be to drill the poles on the ground before they are set. Poles now have step rung brackets on three sides above the neutral to assist with drilling and reaching outside phases. To reach outside phases where only one side has steps, a diving board can be utilized or hot stick methods.
- 7. Is there a special type of rubber to be used on these poles?** No, the rubber we use on wood poles provides the same insulating value regardless of the material it is covering. Proper inspection of rubber goods and Insulate/Isolate techniques shall be followed when working on steel poles.
- 8. Can we glove out of the bucket on an energized steel pole?** Yes, these poles can be worked energized using proper PPE and insulate/isolate methods.
- 9. Can the Skylift lift and set steel poles?** The Skylift is limited by weight - use lifting chart on machine to determine if the machine can handle the load. Listed below are the 5 most common size distribution poles and their weight.

Height/Type	Weight
40' Class I	818 lbs.
45' Class I	946 lbs.
50' Class I	1,078 lbs.
45' H1	993 lbs.
50' H1	1,137 lbs.

- 10. Who is responsible for setting and working on the steel ROW poles? Can the AWC's ask for help from the Transmission group?** *The AWC's are responsible for all distribution lines in their*

Use of Steel Poles on Distribution Lines

area both off-road and road side. If there is a need for an off-road machine, call the Supervisor on-call and the determination will be made whether the Transmission group will be able to assist, or a contractor will be called.

- 11. If an off-road machine is needed for assistance, who takes the lead?** In a non-storm event and the Transmission group is called to an event in the ROW, they will generally send one or two guys with the machine to assist the crew currently working.
- 12. Where are the steps? How many are needed? What is the process for installing the step?** Each work center was issued a cage of steps to use if needed. The number of steps is determined by pole size but generally they require 15-20 depending on application. A PowerPoint Presentation is available showing the installation of the steps - contact your supervisor if you were not shown the PPT.
- 13. What belts are required to climb?** Steel Poles can be climbed with either a climbing belt, a Ladder belt or a harness. *100% fall arrest must be maintained at all times.* When climbing - the best method is to loop the climbing belt or lanyard around a step above you and take a few steps up. Next, take a separate belt or lanyard and loop it around a step above you. Repeat process until you get to your desired location.
- 14. Are we going to be trained on how to climb using 100% fall arrest?** A video will be available on how to climb a steel pole.
- 15. Are we going to be trained in the rapid rail system?** Rapid Rail is a fall arrest system used on Transmission structures. This system is not used on the Distribution system.
- 16. Are these poles set with a strap or chain?** There is no difference between setting a wood pole and steel pole as far as work procedures go.
- 17. Is there a cluster bracket we can use to hang equipment to avoid drilling holes?** Currently there is no approved bracket, holes must be drilled to attach equipment.
- 18. Copper ground wire is exposed at the bottom of the pole, will this get stolen?** Most of the D-ROW system is well off road and the likelihood of this wire being stolen is low. The pole is made of steel and will act as a ground in the event the wire is stolen.
- 19. How do we use the mag drill to drill holes?** Consult the owner's manual that came with the drill to become familiar with it. A video is also being made available to show the operation of the unit on a steel pole.
- 20. Where is pole top equipment mounted on the poles?** Refer to OH standards on the equipment that is being installed. There is no change between wood and steel poles - same measurements will be used.
- 21. How do we perform pole top rescue on these poles?** It is the same method we currently use for wood poles.

Attachment JED/RDW-5 is CONFIDENTIAL. Since the bulk of the information is confidential, this page is a placeholder for Bates 00106-00133 and content has been omitted in its entirety.

Public Service Company of New Hampshire d/b/a Eversource Energy
Docket No. DE 20-161

Date Request Received: April 15, 2022
Data Request No. DOE 5-009

Date of Response: April 27, 2022
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Request from: Department of Energy

Witness: Paruta, Marisa B

Request:

Refer to Eversource's Response to DR DOE 4-016. Please provide any planning studies, calculations, estimates or evaluations of the impact on customers' retail distribution rates (\$ per kWh, \$ per customer-month or any other customer measure used by the Company) if the capital forecast included in Attachment DOE 4-016 Page 3 were completed, implemented and/or constructed by the Company, and the Company were to request recognition of these capital amounts in retail distribution rates at current, approved or expected ROI, depreciation, and customary recovery of taxes, O&M and other expenses. Please provide all supporting workpapers.

Response:

See Attachment DOE 5-009 for an illustrative presentation and calculation of the impact on revenue requirements if the capital forecast included in Attachment DOE 4-016, page 3, were completed, implemented and/or constructed by the Company. For purposes of this illustrative presentation, the Company used several assumptions that were based on: (1) historical information, including the capital structure, rate of return, whole life depreciation rates, property tax rates, income tax rates, plant retirements, and sales volume, consistent with the most recently filed Docket No. DE 19-057 2020 Step Adjustment (Step #2) for calendar year 2020 plant in service, approved on July 30, 2021, and the most recent base distribution rate case Settlement Agreement, approved on December 15, 2020, and (2) forecasted assumptions, including accumulated depreciation, that were developed using information available at the time the calculation was compiled.

In addition, the Company has developed a measure of the impact of these capital investments to base distribution rates, and to a typical residential bill. The cumulative incremental revenue requirements of \$54.5 million over the period 2021-2026 (see Attachment DOE 5-009, page 1) if applied to current rates would result in an overall average increase of 0.388 cents/kWh, and would vary on a class basis, as shown in Attachment DOE 5-009, page 7. A typical residential customer using 600 kWh in a month would see an increase of \$5.89, or 4.4% (see Attachment DOE 5-009, page 8).

ILLUSTRATIVE REVENUE REQUIREMENT

Line	Description	Year-Ending 12/31/2020 (A)	Year-Ending 12/31/2021 (B)	Year-Ending 12/31/2022	Year-Ending 12/31/2023	Year-Ending 12/31/2024	Year-Ending 12/31/2025	Year-Ending 12/31/2026	Reference
1	Total Utility Plant in Service	\$ 2,345,505,174	\$ 2,451,293,636	\$ 2,556,772,098	\$ 2,663,304,560	\$ 2,770,613,023	\$ 2,878,916,485	\$ 2,994,162,947	Page 2, Line 1
2	Accumulated Provision for Depreciation	633,383,630	678,518,775	727,145,733	774,886,383	831,957,767	892,557,751	954,518,363	Page 2, Line 2
3	Net Utility Plant	<u>\$ 1,712,121,544</u>	<u>\$ 1,772,774,861</u>	<u>\$ 1,829,626,366</u>	<u>\$ 1,888,418,178</u>	<u>\$ 1,938,655,256</u>	<u>\$ 1,986,358,734</u>	<u>\$ 2,039,644,584</u>	Line 1 - Line 2
4	Gross Plant Change (year over year)		\$ 105,788,462	\$ 105,478,462	\$ 106,532,462	\$ 107,308,462	\$ 108,303,462	\$ 115,246,462	Line 1 Current Col. - Line 1 Prior Col.
5	Net Plant Change (year over year)		\$ 60,653,317	\$ 56,851,504	\$ 58,791,812	\$ 50,237,078	\$ 47,703,478	\$ 53,285,851	Line 3 Current Col. - Line 3 Prior Col.
6	Rate of Return		6.87%	6.87%	6.87%	6.87%	6.87%	6.87%	Page 3, Line 8
7	Gross Revenue Conversion Factor		1.37142	1.37142	1.37142	1.37142	1.37142	1.37142	Page 4, Line 7
8	Return		\$ 5,713,974	\$ 5,355,816	\$ 5,538,607	\$ 4,732,690	\$ 4,494,007	\$ 5,019,906	Line 5 x Line 6 x Line 7
9	Depreciation Rate		3.15%	3.15%	3.15%	3.15%	3.15%	3.15%	Page 5, Line 71
10	Depreciation		\$ 1,910,579	\$ 1,790,822	\$ 1,851,942	\$ 1,582,468	\$ 1,502,660	\$ 1,678,504	Line 5 x Line 9
11	Property Tax Rate		2.06%	2.06%	2.06%	2.06%	2.06%	2.06%	Page 6, Line 3
12	Property Taxes		\$ 2,174,903	\$ 2,168,529	\$ 2,190,199	\$ 2,206,152	\$ 2,226,609	\$ 2,369,350	Line 4 x Line 11
13	Total Revenue Requirement		<u>\$ 9,799,456</u>	<u>\$ 9,315,168</u>	<u>\$ 9,580,747</u>	<u>\$ 8,521,310</u>	<u>\$ 8,223,275</u>	<u>\$ 9,067,760</u>	Line 8 + Line 10 + Line 12

ILLUSTRATIVE DISTRIBUTION PLANT

Line	Description	Year-Ending 12/31/2020 (A)	Year-Ending 12/31/2021 (B)	Year-Ending 12/31/2022	Year-Ending 12/31/2023	Year-Ending 12/31/2024	Year-Ending 12/31/2025	Year-Ending 12/31/2026	Reference
1	Total Utility Plant In Service	\$ 2,345,505,174	\$ 2,451,293,636	\$ 2,556,772,098	\$ 2,663,304,560	\$ 2,770,613,023	\$ 2,878,916,485	\$ 2,994,162,947	Line 9 below
2	Accumulated Provision for Depreciation	633,383,630	678,518,775	727,145,733	774,886,383	831,957,767	892,557,751	954,518,363	Step 2/Company Forecast
3	Net Utility Plant	<u>\$ 1,712,121,544</u>	<u>\$ 1,772,774,861</u>	<u>\$ 1,829,626,366</u>	<u>\$ 1,888,418,178</u>	<u>\$ 1,938,655,256</u>	<u>\$ 1,986,358,734</u>	<u>\$ 2,039,644,584</u>	Line 1 - Line 2
4	Gross Distribution Plant Change (year over year)		\$ 105,788,462	\$ 105,478,462	\$ 106,532,462	\$ 107,308,462	\$ 108,303,462	\$ 115,246,462	Line 1 Current - Line 1 Prior
5	Net Distribution Plant Change (year over year)		\$ 60,653,317	\$ 56,851,504	\$ 58,791,812	\$ 50,237,078	\$ 47,703,478	\$ 53,285,851	Line 3 Current - Line 3 Prior
6	Beginning Plant Balance	\$ 2,250,917,651	\$ 2,345,505,174	\$ 2,451,293,636	\$ 2,556,772,098	\$ 2,663,304,560	\$ 2,770,613,023	\$ 2,878,916,485	Step 2/Prior Year Line 9
7	Additions	123,141,060	134,342,000	134,032,000	135,086,000	135,862,000	136,857,000	143,800,000	Step 2/Base Capital Forecast
8	Retirements	(28,553,538)	(28,553,538)	(28,553,538)	(28,553,538)	(28,553,538)	(28,553,538)	(28,553,538)	Step 2 Retirements
9	Ending Plant Balance	<u>\$ 2,345,505,174</u>	<u>\$ 2,451,293,636</u>	<u>\$ 2,556,772,098</u>	<u>\$ 2,663,304,560</u>	<u>\$ 2,770,613,023</u>	<u>\$ 2,878,916,485</u>	<u>\$ 2,994,162,947</u>	Line 6 + Line 7 + Line 8

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COST OF CAPITAL PER DE 19-057

Line	Description	Fixed Percentage (A)	Cost (B)	Rate of Return (C) = (A) x (B)	Reference
1	Short-Term Debt	2.44%	2.07%	0.05%	
2	Long-term Debt	43.15%	4.08%	1.76%	
3	Common Equity	54.41%	9.30%	5.06%	
4	Total Capital	100.00%		6.87%	Line 1 + Line 2 + Line 3
5	Weighted Cost of				
6	Debt			1.81%	Line 1 + Line 2
7	Equity			5.06%	Line 3
8	Cost of Capital			6.87%	Line 6 + Line 7

COMPUTATION OF GROSS REVENUE CONVERSION FACTOR

Line Description	12/31/2020	12/31/2021	12/31/2022	12/31/2023	12/31/2024	12/31/2025	12/31/2026	Reference
1 Operating revenue percentage	100.000%	100.000%	100.000%	100.000%	100.000%	100.000%	100.000%	
2 Less: New Hampshire corporate business tax	7.700%	7.700%	7.700%	7.700%	7.700%	7.700%	7.700%	
3 Operating revenue percentage after state taxes	92.300%	92.300%	92.300%	92.300%	92.300%	92.300%	92.300%	Line 1 - Line 2
4 Federal income tax rate	21.000%	21.000%	21.000%	21.000%	21.000%	21.000%	21.000%	
5 Federal income tax	19.383%	19.383%	19.383%	19.383%	19.383%	19.383%	19.383%	Line 3 x Line 4
6 Operating income after federal income tax	72.917%	72.917%	72.917%	72.917%	72.917%	72.917%	72.917%	Line 3 - Line 5
7 Gross revenue conversion factor	137.142%	137.142%	137.142%	137.142%	137.142%	137.142%	137.142%	1 / Line 6

Note: Amounts shown above may not add due to rounding.

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SUMMARY OF ESTIMATED SURVIVOR CURVES, NET SALVAGE PERCENT, ORIGINAL COST AND
AND CALCULATED ANNUAL AND ACCRUED DEPRECIATION RELATED TO ELECTRIC PLANT AS OF DECEMBER 31, 2018
WHOLE LIFE DEPRECIATION - AMR RECOVERY OVER 9 YEARS

LINE	PLANT ACCOUNT	DESCRIPTION	SURVIVOR CURVE	NET SALVAGE PERCENT	ORIGINAL COST AS OF DECEMBER 31, 2018	CALCULATED ANNUAL ACCRUAL AMOUNT	RATE	CALCULATED ACCRUED DEPRECIATION
	(A)	(B)	(C)	(D)	(E)	(F)	(G)=(F)/(E)	(H)
1								
2								
3		ELECTRIC PLANT						
4								
5		INTANGIBLE PLANT						
6								
7	303.00	MISCELLANEOUS INTANGIBLE PLANT	5-SQ	0	18,278,819.53	1,769,835	9.68	14,600,391
8	303.00	MISCELLANEOUS INTANGIBLE PLANT - AMR	5-SQ	0	2,864,448.00	95,483 *	3.33	2,660,846
9	303.20	MISCELLANEOUS INTANGIBLE PLANT - 10 YEAR	10-SQ	0	31,771,797.33	486,807	1.53 **	28,607,554
10								
11		TOTAL INTANGIBLE PLANT			52,915,064.86	2,352,125	4.45	45,868,791
12								
13		DISTRIBUTION PLANT						
14								
15	340.20	LAND AND LAND RIGHTS	75-R4	0	4,123,039.65	54,836	1.33	2,204,822
16	361.00	STRUCTURES AND IMPROVEMENTS	75-R3	(25)	26,387,975.26	438,700	1.66	6,187,652
17	362.00	STATION EQUIPMENT	55-S0.5	(25)	303,092,439.65	6,895,353	2.28	65,238,205
18	362.10	STATION EQUIPMENT - ENERGY MANAGEMENT SYSTEM	25-R2.5	0	3,155,937.71	126,238	4.00	1,015,444
19	364.00	POLES, TOWERS AND FIXTURES	53-R0.5	(90)	303,587,829.37	10,901,646	3.59	110,737,706
20	365.00	OVERHEAD CONDUCTORS AND DEVICES	55-R1	(35)	582,095,634.35	14,302,889	2.46	154,119,837
21	366.00	UNDERGROUND CONDUIT	60-R2	(40)	38,757,668.49	906,154	2.34	9,625,266
22	367.00	UNDERGROUND CONDUCTORS AND DEVICES	54-R1.5	(40)	133,741,822.05	3,463,913	2.59	42,368,714
23	368.00	LINE TRANSFORMERS	40-S0	(2)	262,481,157.73	6,693,270	2.55	73,140,846
24	369.10	OVERHEAD SERVICES	44-R2	(125)	81,721,434.74	4,173,922	5.11	47,501,588
25	369.20	UNDERGROUND SERVICES	55-R1.5	(125)	76,631,011.71	3,138,040	4.10	32,482,673
26	370.00	METERS	18-L1	0	44,821,891.75	2,479,416	5.53	19,961,157
27	370.00	METERS - AMR	18-L1	0	31,614,492.00	2,981,203 *	9.43	5,819,204
28	371.00	INSTALLATION ON CUSTOMERS' PREMISES	17-L0	(50)	6,563,781.88	578,892	8.82	3,082,834
29	373.00	STREET LIGHTING AND SIGNAL SYSTEMS	27-L0	(10)	5,130,537.46	208,813	4.07	2,083,777
30								
31		TOTAL DISTRIBUTION PLANT			1,903,906,643.80	57,342,485	3.01	575,569,725
32								
33		GENERAL PLANT						
34								
35	389.20	LAND AND LAND RIGHTS	65-R4	0	26,976.55	415	1.54	13,692
36	390.00	STRUCTURES AND IMPROVEMENTS	50-S0.5	(10)	84,363,470.03	1,854,713	2.20	20,052,815
37	390.10	STRUCTURES AND IMPROVEMENTS - LEASEHOLD	20-S0.5	0	50,859.53	2,543	5.00	19,095
38	391.10	OFFICE FURNITURE AND EQUIPMENT	20-SQ	0	9,755,154.62	487,758	5.00	4,695,337
39	391.20	OFFICE FURNITURE AND EQUIPMENT - COMPUTER EQUIPM	5-SQ	0	1,672,250.89	243,506	14.56	960,508
40								
41		TRANSPORTATION EQUIPMENT						
42								
43	392.00	OTHER	15-S4	15	30,225.00	1,714	5.67	14,507
44	392.10	CARS	6-L3	15	97,593.41	13,828	14.17	13,479
45	392.20	LIGHT TRUCKS	11-S1	15	8,605,166.97	664,878	7.73	2,687,250
46	392.30	MEDIUM TRUCKS	14-S3	15	2,764,714.96	167,791	6.07	767,426
47	392.40	HEAVY TRUCKS	15-S2.5	15	26,391,434.00	1,496,262	5.67	8,212,511
48	392.50	ROLLING EQUIPMENT	13-L2.5	15	1,321,753.47	86,396	6.54	235,242
49	392.60	TRAILERS	13-L3	15	4,958,571.11	324,117	6.54	1,661,871
50	392.70	ELECTRIC VEHICLE CHARGING STATION	10-R4	0	7,902.10	790	10.00	5,244
51								
52		TOTAL TRANSPORTATION EQUIPMENT			44,177,361.02	2,755,776	6.24	13,597,530
53								
54	393.00	STORES EQUIPMENT	20-SQ	0	3,257,904.89	162,895	5.00	1,109,379
55	394.00	TOOLS, SHOP AND GARAGE EQUIPMENT	25-SQ	0	14,194,677.76	567,787	4.00	4,037,342
56	395.00	LABORATORY EQUIPMENT	20-SQ	0	2,072,746.95	96,433	4.65	1,339,656
57	396.00	POWER OPERATED EQUIPMENT	15-L4	0	159,421.09	10,633	6.67	71,720
58								
59		COMMUNICATION EQUIPMENT						
60								
61	397.10	MICROWAVE	15-SQ	0	5,646,707.11	240,089	4.25	3,854,488
62	397.20	OTHER	15-SQ	0	22,098,802.35	1,279,811	5.79	10,667,691
63	397.30	GPS	5-SQ	0	443,487.30	54,399	12.27	366,151
64								
65		TOTAL COMMUNICATION EQUIPMENT			28,188,996.76	1,574,299	5.58	14,888,330
66								
67	398.00	MISCELLANEOUS EQUIPMENT	20-SQ	0	1,279,168.86	63,958	5.00	658,566
68								
69		TOTAL GENERAL PLANT			189,198,988.95	7,820,716	4.13	61,443,970
70								
71		TOTAL DEPRECIABLE PLANT			2,146,020,697.61	67,515,326	3.15	682,882,486
72								
73		NONDEPRECIABLE PLANT						
74								
75	301.00	ORGANIZATION			45,057.29			
76	360.10	LAND			5,830,013.57			
77	389.10	LAND			4,806,992.04			
78								
79		TOTAL NONDEPRECIABLE PLANT			10,682,062.90			
80								
81		TOTAL ELECTRIC PLANT			2,156,702,760.51	67,515,326		682,882,486
82								
83		* AMR METERS NET BOOK VALUE BEING DEPRECIATED OVER 9 YEARS						
84		** NEW ADDITIONS TO THIS ACCOUNT WILL BE DEPRECIATED USING A 10.00% RATE						
85								
86		Less Transportation Equipment				(2,755,776)		
87		TOTAL ELECTRIC PLANT				64,759,550		

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Joint Direct Testimony of Jay E. Dudley
and Ronald D. Willoughby
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PROPERTY TAX RATE CALCULATION

Line	Description	Year-Ended 12/31/2020	Reference
1	Total Distribution Property Taxes	\$ 48,644,096	Step 2 CY 2020 Property Tax expense
2	Gross Distribution Plant In Service	\$ 2,366,075,567	Total Distribution Plant @ 12/31/2020
3	Gross Property Tax Rate	<u>2.06%</u>	Line 1 / Line 2

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Illustrative Distribution Revenue Allocation

Current Rate Distribution Revenue	\$ 417,434	Source: Line 55, Column F
Estimated Requirements 2022-2026	\$ 54,508	DOE 5 - 009 P1 Line 13
Proposed Distribution Revenue	\$ 471,942	Line 11 + Line 13
Incremental Increase	\$ 54,508	Line 15 - Line 11
Incremental Change	13.06%	Line 15 / Line 11

	A	B	C = B * Line 19	D = B + C	E	F = E - B	G = F / A	H = E / B
	Test Year 2018 Billed Sales (MWh)	Current Rate Distribution Revenue (Rev \$000)	D Change (Rev \$000)	Distribution Target (Rev \$000)	Proposed Rate Distribution (Rev \$000)	Difference Proposed vs Current (Rev \$000) c/kWh % Chg.		
R	3,144,509	\$ 236,433.4	\$ 30,873.0	\$ 267,306.5	\$ 267,312.5			
K-TOD	402	40.0	2.3	40.0	40.0			
	3,144,971	236,474.1	30,878.3	267,352.4	267,353.2	\$ 30,879.1	0.982	13.06%
R-WH	92,916	4,749.7	620.2	5,369.9	4,749.7			
G-WH	3,379	155.5	20.3	175.8	155.5			
LCS-R	36,777	781.2	102.0	883.2	781.2			
LCS-G	4,510	76.1	9.9	86.0	76.1			
	137,582	5,762.4	752.4	6,514.8	5,762.4	-	0.000	0.00%
G	1,715,822	100,361.8	13,105.0	113,466.9	100,361.8			
G-TOD	856	209.1	27.3	236.4	209.1			
	1,716,678	100,570.9	13,132.4	113,703.3	100,570.9	-	0.000	0.00%
G-SH	5,452	241.7	31.6	273.2	241.7	-	0.000	0.00%
GV	1,665,676	43,396.4	5,666.6	49,063.0	43,396.4	-	0.000	0.00%
LG	1,172,439	22,580.3	2,948.5	25,528.8	22,580.3	-	0.000	0.00%
B-GV	2,778	253.3	33.1	286.3	253.3			
B-LG	80,345	1,564.9	204.3	1,769.3	1,564.9			
	83,123	1,818.2	237.4	2,055.6	1,818.2	-	0.000	0.00%
EOL	11,371	2,149.1	280.6	2,429.7	2,149.1			
OL	17,130	4,441.0	579.9	5,020.9	4,441.1			
	28,501	6,590.2	860.5	7,450.7	6,590.2	0.0	0.000	0.00%
Total Retail	7,954,422	\$ 417,434.1	\$ 54,507.7	\$ 471,941.8	\$ 448,313.2	\$ 30,879.1	0.388	7.40%

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**Comparison of Rates Effective March 1, 2022 and Illustrative Rates
 for Residential Service Rate R**

(A) Effective Date	(B) Charge	(C) Distribution Charge	(D) Transmission Charge	(E) Stranded Cost Recovery Charge	(F) System Benefits Charge	(G) Regulatory Reconciliation Adjustment	(H) Electricity Consumption Tax	(I) Energy Service Charge	(J) Total Rate
March 1, 2022	Customer charge (per month)	\$ 13.81							\$ 13.81
	Charge per kWh	\$ 0.05196	\$ 0.03046	\$ 0.00458	\$ 0.00743	\$ (0.00032)	\$ -	\$ 0.10669	\$ 0.20080
Illustrative	Customer charge (per month)	\$ 13.81							\$ 13.81
	Charge per kWh	\$ 0.06178	\$ 0.03046	\$ 0.00458	\$ 0.00743	\$ (0.00032)	\$ -	\$ 0.10669	\$ 0.21062

Calculation of 600 kWh monthly bill, by rate component:

	3/1/2022	Illustrative	\$ Change	% Change in each Component	Change as a % of Total Bill
Distribution	\$ 44.99	\$ 50.88	\$ 5.89	13.1%	4.4%
Transmission	18.28	18.28	-	0.0%	0.0%
Stranded Cost Recovery Charge	2.75	2.75	-	0.0%	0.0%
System Benefits Charge	4.46	4.46	-	0.0%	0.0%
Regulatory Reconciliation Adjustment	(0.19)	(0.19)	-	0.0%	0.0%
Electricity Consumption Tax	-	-	-	0.0%	0.0%
Delivery Service	\$ 70.29	\$ 76.18	\$ 5.89	8.4%	4.4%
Energy Service	64.01	64.01	-	0.0%	0.0%
Total	\$ 134.30	\$ 140.19	\$ 5.89	4.4%	4.4%

Attachment JED/RDW-6 is CONFIDENTIAL. Since the bulk of the information is confidential, this page is a placeholder for Bates 000143-000301 and content has been omitted in its entirety.

Public Service Company of New Hampshire d/b/a Eversource Energy
Docket No. DE 20-161

Date Request Received: April 15, 2022
Data Request No. DOE 5-004

Date of Response: April 27, 2022
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Least Cost Alternative Solution – the alternative solution with the least cost. As set forth in RSA 378:37, it is New Hampshire’s energy policy that “least cost planning” requires selection of solutions that represent the “lowest reasonable cost” based on consideration of factors other than cost including reliability and diversity of energy sources.

378:37 New Hampshire Energy Policy. – The general court declares that it shall be the energy policy of this state to meet the energy needs of the citizens and businesses of the state at the lowest reasonable cost while providing for the reliability and diversity of energy sources; to maximize the use of cost effective energy efficiency and other demand side resources; and to protect the safety and health of the citizens, the physical environment of the state, and the future supplies of resources, with consideration of the financial stability of the state's utilities.

The Company takes these considerations into account when planning the distribution system.

Best Overall Alternative Solution – Eversource typically refers to this as the “Preferred Alternative.” This is the alternative with the best combination of electrical performance, cost, future system expandability and feasibility to comprehensively address all of the identified needs in the required timeframe.

Transcript

Interview #: 62

Date: February 01, 2022 – 10:00 am

Interviewer(s): Ron Willoughby, Bob Grant, Joe DeVirgilio

**Interviewee: Rick Labrecque, Manager NH Distribution System Planning (+)
Manager DER Planning (dual management role)**

Excerpt Page 4:

- Rick: [00:12:31](#) Whereas if you build a non-PTF chunk of system in say the outskirts of Maine and New Hampshire, and it's really only serving chunks of Maine or New Hampshire, it's not doing anything for the power flows around the grid. They're going to say, "Why should Connecticut and Mass pay for a chunk of that investment?" So they have a different cost recovery mechanism for that.
- Bob: [00:13:00](#) Okay. I was just curious. I wasn't sure what that was. Go ahead, Ron.
- Ron: [00:13:04](#) The New Hampshire Distribution System Planning Guidelines are actually part of the LCIRP for New Hampshire. Do those guidelines mirror the other two states and then identify the state exceptions or how do those guidelines compare with... Since you're trying to standardize as much as possible. Could you explain that?
- Rick: [00:13:31](#) Yep. A couple of years ago there was a 3-state process to harmonize the planning criteria amongst the three states. They looked at existing practices, existing documentation, best practices, and develop this common distribution system planning guide. For the most part it is uniform throughout but there are exceptions in there that are called out if Mass, Connecticut, or New Hampshire has a particular difference. It's signaled in that document.
- Ron: [00:14:21](#) Are the DER guidelines part of that or is that a separate document? I'm trying to remember.
- Rick: [00:14:30](#) I believe there's a very short paragraph in there about DER. **We are creating our a new DER Planning Guide**, and that's been a long time coming. We're getting closer to the first final draft and it's going to be a living document. I think even more so than the Distribution System Planning Guide that the DER state of the art and criteria and standards and study methodologies are... We've come a long way but there's still new things that new technologies and new study methodologies and tools that haven't fully incorporated yet. So our plan is to get a DER planning guide, finalized, published that'll be 90% of all the good stuff and we'll just revise it as needed.

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- Bob: [00:15:41](#) When is that expected?
- Rick: [00:15:45](#) Maybe by the end of the first quarter (2022). Some will definitely be there in the first half of the year.
- Bob: [00:15:59](#) Let me ask you this. I know you're dealing with distribution, but at some point in distribution, you have to integrate your thinking with the transmission and substation folks because of the substations. How does that work from the planning perspective?

Transcript

Interview #: 19

Date: November 16, 2021 – 9:00 am

Interviewer(s): Ron Willoughby, Bob Grant

Interviewee: Ryan West, Director NH Grid Modernization

Excerpt Pages 12 and 15:

Page 12:

Hampshire is to really look at all the use cases. Let's work together here and say, all right, strategically, we want to do all of this. Here's the enabling stuff that we got to get to before we can apply it.

Ron: [00:37:12](#) For the difference between DMS and DERMS, DERMS is like a distribution SCADA, right? I mean, that's like transmission level at the distribution level. Is that DERMS?

Ryan: [00:37:23](#) Yes.

Eric: [00:37:24](#) And then DMS is a step back from that. Am I correct?

Ryan: [00:37:30](#) Yeah. Not necessarily. Let me define it because I know DMS and DERMS in the industry is used all over the place, and it is used all over the place and means different things. So for us, a **DMS** system is initially the core value there is reliability. So we look at it as the logic to automate our distribution devices optimally for restoration. So the FLISR capability (fault location, isolation and service restoration), that core functionality is reliability driven. And that's how we that's why we're implementing DMS and really trying to drive how we can operate the system more efficiently and respond to outages and really continue the improvement of reliability. So the DMS, for us, in our systems it is the GE products, the eCare distribution is the product, the DMS product.

Ryan: [00:38:39](#) It is very closely, I'll call it an integration, but it's essentially in line, we have a GE SCADA system. So it is two separate software tools, but very closely integrated because it is their whole package. So it is, in our realm, we have a SCADA combined T&D SCADA. We'll have the DMS is same package. We do have a separate OMS vendor, the Oracle OMS system. So for DMS, what we're deploying is again, that flow capability, the real time power flow is the basis. And then when we look forward, this is where I mentioned the VVO is an application module that we have to enable in the DMS, in the future. We're not doing that yet, but we want to enable that. And there's other, a contingency analysis tool is

in the DMS suite, but we're not implementing it right now. That's on the roadmap.

Ryan: [00:39:47](#) There's some other advanced applications that the product has that we're working our way toward. And then so for DERMS, we are, I would say, still evaluating the marketplace on DERMS. If you've, I'm sure you've probably attended a conference in the last five years, people, vendors called everything DERMS.

Ron: [00:40:10](#) Yeah.
Ryan: [00:40:15](#) And so they went from demand response systems to register just demand response to the other side where you've got utility scale

Page 15:

Ryan: [00:46:52](#) Not in the DERMS or CVR space, really. Nothing.

Bob: [00:46:59](#) Right. So you still got a dum system.

Ryan: [00:47:03](#) So the distribution automation program that where we... I don't know if you've heard yet or that there's the over 1700 devices on the system. That provides individual phase measurement for voltage currents, megawatts, MVAR. So we get a lot of information. And in an operator, we do have visibility into the power flow from device to device, right? And this is focused on the backbone. So it's on the three phase backbone of the system. And so the DMS, when we get the power flow solving, it gives us that next level all the way out to the ends of the distribution system.

Ron: [00:47:47](#) Now, the DMS. I had a note here that the phase one, I guess it's phase one for New Hampshire's to be completed in 2022. Are my notes correct on that?

Ryan: [00:47:59](#) That is correct, yep. [inaudible 00:47:59] service in 2022, yep.

Ron: [00:48:02](#) When you're doing levels of communication for that DMS, you have the local, let's say if it's a recloser, it can communicate obviously with itself, but it can communicate with other devices on that line. You move up to the substation. That's another level of communication. And then between substations is another level of communication. All those levels of communication, is that what's being implemented now for DMS?

Ryan: [00:48:32](#) Yeah. I'll quickly talk about the communication architecture. The automation strategy, if you will, was intended... When all those devices were deployed, it was intended with the end goal of having a DMS path logic to control them. So we don't have any peer to peer communication between devices in the field. And we also don't do any peer to peer communication of the substations. And that is based on the fact that we didn't want logic happening and then having the DMS come and have its logic to essentially do the same thing. So the communication structure is very much, we have the remote device communicating typically to the base station tower. And then that comes back to our data system. And that data system is processing all the data to present it to the DMS, for it to solve the... Just to have the logic for isolation and restoration current event. Right? So we don't do any of the peer to peer schemes on the distribution side.

Ron: [00:49:58](#) Everything is coming back to one place. Everything on the system is coming back to one place rather than intermediate places.

Ryan: [00:50:05](#) Correct.

Public Service Company of New Hampshire d/b/a Eversource Energy
Docket No. DE 20-161

Date Request Received: February 18, 2022
Data Request No. DOE 4-020

Date of Response: March 08, 2022
Page 1 of 1

Request from: Department of Energy

Witness: WALKER, GERHARD, Freeman, Lavelle A

Request:

Please provide 2020-2021 NWA solution options for New Hampshire categorized as either accepted or rejected along with the corresponding reasons why (accepted or rejected).

Response:

The Company has conducted the full and detailed analysis on the following stations:

- Loudon Station

For Loudon Station, the Company has provided the results of the analysis in report format as part the Company's supplemental filing in this proceeding submitted on March 31, 2021 as Supplemental Appendix A-2.

One project that is in conceptual engineering and another that is in design engineering were both rejected for NWA.

- Monadnock Substation, presently in the design phase, has an asset condition issue with transformer TB40 and substandard station design (no transformer breakers nor high-side circuit switchers) in addition to N-1 contingent capacity limitations. Based on Eversource NWA suitability criteria, asset condition related projects are not typically considered for NWA solutions.
- Dover Substation, presently in the conceptual phase, has asset condition issues at the substation including an oil circuit breaker and electromechanical relays in addition to N-1 contingent capacity limitations of approximately 28.8 MW. A full NWA analysis was not performed since that magnitude of peak load was considered unachievable in the present NWA regulatory environment. In addition, based on Eversource NWA suitability criteria, asset condition related projects are not typically considered for NWA solutions.

All other design violations identified in the 2020-2029 Load Flow Study Report have yet to be studied within local area studies where a detailed NWA screening analysis will be performed to assess the feasibility of the solutions.

Transcript

Interview #: 13

Date: November 17, 2021 – 9:00 am

Interviewer(s): Ron Willoughby, Bob Grant

Interviewee: Digaunto Chatterjee, VP System Planning

Excerpt Pages 6 and 16:

Page 6

Ron: [00:18:09](#) We saw somewhere that you have... I forget the number exactly, somewhere between 400 and 500 installed megawatts for DER in New Hampshire. Is that an accurate number, or is that too high?

Digaunto: [00:18:26](#) That doesn't sound... That sounds too high. 107 is the precise number that is installed, eight megawatts are under construction, so yeah. 115 megawatts.

Ron: [00:18:38](#) And then I also read somewhere... Let me see...

Digaunto: [00:18:43](#) By the way, that's in our footprint. So it could be you have Unitell, and...

Ron: [00:18:46](#) Oh, okay. Okay.

Digaunto: [00:18:52](#) That may be where you're getting 400 MWs.

Ron: [00:18:53](#) It may be because there was a project, a large interconnection project, more than 200 megawatts a single interconnection. That doesn't sound like you guys though, right?

Digaunto: [00:19:03](#) Yeah, no. We will kick them out if they're trying to connect to our distribution system. We'll study them from transmission interconnection system.

Bob: [00:19:14](#) So let me ask this question. With those six sites in mind, how have you changed the distribution system, or some of these going directly to transmission or sub transmission, how have you changed your distribution requirements for them, and what you have to do on your circuit in order to accept them for two-way flow?

Digaunto: [00:19:42](#) First things first, hosting capacity maps have to be published, so just showing DER developers where, how much capacity you actually have to interconnect. That's just step one. So we've been using our Synergi tool for that in Massachusetts and Connecticut, we're about to roll it out in New Hampshire as well, so that's just step one. So you incentivize,

inform DER customers. The other thing, which is a much more complicated, scary topic, we'll get to it.

Digaunto: [00:20:24](#) We've now started to look at non-wires alternative (NWA) as one of the tools in the toolbox for our distribution system upgrades to the extent we have a capacity overload, and you have a large or a number of PDs down at the customer site, we have taken a position that we will consider those behind the meter customer cited PDs, as one of the many solutions to our... Call it feeder reconductoring or adding a new transformer, replacing transformers, so we build a very cutting edge tool (NWA Tool) that synthesizes all of this into one package and informs what is really the least cost, long-term, most cost effective solution, so you shouldn't to do.

Page 16

Ron: [00:48:48](#) Okay.

Digaunto: [00:48:49](#) A bulk electric system. High side is 115 kV. In New Hampshire we have high side, but some of these bulk transformers are 345 kV. You have 345 kV to 34.5 kV transformers. That's a bulk transformer, and then a lot of New Hampshire non-bulks are 13.8 kV to 4 kV. 34.5 kV to 13.8 kV. Those are non-bulks.

Ron: [00:49:13](#) So everything on the line, including transformers on the line, that's the distribution engineering folks?

Digaunto: [00:49:19](#) Distribution engineering takes care of that.

Bob: [00:49:23](#) He washes his hands [inaudible 00:49:25].

Ron: [00:49:23](#) Yeah, he quickly did that. Okay.

Bob: [00:49:33](#) I want to drop back because we're taking a whole different path in our 25 pages of questions here.

Ron: [00:49:40](#) It's okay.

Bob: [00:49:40](#) You get the cliff notes, we get the details. I just want to go back and talk a little bit about capital programs.

Digaunto: [00:49:47](#) Yeah.

Bob: [00:49:47](#) Can you explain your role in capital programs?

- Digaunto: [00:49:51](#) Sure. So, capital program, broadly speaking, they're... I would say there are five broad categories. They're basic business, the stuff you've just got to do to connect new customers. You've got your grid modernization program and then you've got equipment obsolescence, and then you've got your distribution line work, and then finally distribution station work.
- Digaunto: [00:50:22](#) So my role as VP system planning is twofold. It's number one, taking care of my own house. It is the substation projects that come out of system planning, making sure that their justification, their planning criteria violations are deeply grounded in foundational analysis, the rooted solid justification that I can testify in court that they are absolutely necessary. That's number one, making sure all of their system impacts are well grounded, submitted twice in new England for bulk transformers because it touches the transmission system. There's an I39 process, it's basically a... You have to do a transmission impact analysis.

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Docket No. DE 20-161

Date Request Received: February 18, 2022
Data Request No. DOE 4-001

Date of Response: March 11, 2022
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Request from: Department of Energy

Witness: Hebsch, Jennifer J, Johnson, Russel D, Freeman, Lavelle A, Labrecque, Richard C

Request:

Reference: Eversource's October 1, 2020 Least Cost Integrated Resource Plan ("LCIRP") and the March 31, 2021 Supplement ("Supplement"), including all Attachments (providing various area planning studies, solution selection forms, and project authorization forms.)

- a. Please provide a table that lists each planned project Eversource has identified in its LCIRP (2020) and 2021 Supplement. Please indicate -- in the table-- if the project was the "least cost option." In the table, please list the "alternative options" (to resolve the same issue) and list the costs for the selected solution and each option. Please identify the sections of the 2020 LCIRP and Supplement, by bates numbered page, that reference the project and alternative options.
- b. For each instance where the Company did not choose the least cost option discussed in the area planning studies, solution selection forms, and project authorization forms, please explain in detail why the project was selected. The explanation should be in narrative form, referencing the table.
- c. Please provide supporting documents, including economic analysis and calculations.

Response:

The LCIRP (including the Appendices and the Supplemental filing) identifies projects in the following locations:

Group #1 - Original Filing Appendix K – this is a Grid Needs Assessment that lists numerous line and station projects >\$250K.

Group #2 - Original Filing Appendix L – provides Solution Selection Forms ("SSFs")/Project Authorization Forms ("PAFs")/Initial Funding Requests ("IFRs") for 6 different projects.

Group #3 - March Supplement – Appendix C – this is a listing of Proposed Reliability Projects (distribution line reliability) that have been proposed but have not been funded by the 2021 or previous years capital budgets.

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Date of Response: March 11, 2022
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Group #4 - March Supplement – Appendix D – contains early versions of the IFRs for 20 System Planning projects that are in early development (SSFs have not been created).

Group #5 - March Supplement – Appendix E – contains early SSFs for White Lake, Dover, and Monadnock

Group #6 - March Supplement – Appendix F – contains PAFs for Distribution Line projects in the 2021 Capital Plan.

Response to Parts (a) and (b): Attachment DOE 4-001 provides the requested data for planned projects in Group #2, Group #5, and Group #6, totaling 37 projects.

The projects in Groups #1, #3, and #4 have either not progressed to the planned stage or are duplicates of projects included in Groups #2, #5, or #6.

Response to Part (c): Supporting documentation for these projects (SSFs and PAFs) are included in either the original LCIRP filing or the Supplement. For each project, specific additional supporting documentation is available on request.

Interview #: 16

Date: November 8, 2021 - 12:30 pm

Interviewer(s): Ron Willoughby, Bob Grant

Interviewee: Russel Johnson, Director NH Distribution Engineering

Excerpt Page 6:

*Well, here's something [00:27:00] we can spend about 20 minutes talking about. I'll start with the definition of what our **hit list worst performing circuit** is up here, which is a contribution to company [SAIDI 00:27:17] measure.*

Their approach here is considered a standard practice, but important to identify potential critical system weaknesses and move to ensuring all customers receive the same reliable service.

That's the nature of it. And, by the way, it's one year. [00:28:30] It's not a rolling four years. So what tends to happen is that you have perennial circuits that have to be... The 150 mile circuits that are serving 8,000 customers, just because of the exposure they have, are generally in the top 10. But then you have a great deal of volatility just by the fact that it only looks at one year.

34.5Kv designs allows a utility the opportunity to run very long circuits with less issues of voltage sag. However, by the very fact that the circuits are much longer, they are exposed to more opportunities for interruptions. This is particularly true for radial circuits. The solution if appropriate is to loop the circuit or tie it with another circuit to allow fault isolation, and limit the outage to the impacted line segment, thereby reducing the total number of customers impacted by the outage and reducing the total number of customer minutes out. RCG believes this is what Eversource is trying to accomplish.

I would have to say it's a consideration, but we're not focused on the top 10. And the reason why is because some of these circuits have been in the top 10 for a decade and [crosstalk 00:29:58] we spent tons of money on [00:30:00] them, addressing specific things. But I'll give you a perfect example was the 31 41 X circuit was always on the hit list because it was a massive circuit that fed somewhere between eight and 9,000 customers with no real backup. So

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and Ronald D. Willoughby
Attachment JED/RDW-13
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when we put a line from a Kingston, new Kingston substation [00:30:30] and tied it into the end of this and split the circuit in half, it dropped out of the top 10 immediately just because now we had a circuit tie, so you split it in half. And so my point is, is that yes, we're very aware of the circuits that are on the hit list.

The 31 41X circuit is an example of the long circuit issue we described. And they finally came to the conclusion to split the circuit. These kind of examples