THE STATE OF NEW HAMPSHIRE

BEFORE THE

SITE EVALUATION COMMITTEE

DOCKET NO. 2015-04

PRE-FILED DIRECT TESTIMONY OF ROBERT D. ANDREW

APPLICATION OF PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE D/B/A EVERSOURCE ENERGY FOR A CERTIFICATE OF SITE AND FACILITY FOR CONSTRUCTION OF A NEW 115 kV TRANSMISSION LINE

THE SEACOAST RELIABILITY PROJECT

April 12, 2016

Qualifications and Purpose of Testimony

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

A. My name is Robert D. Andrew. I am employed by Eversource Energy Service Company as a Director, System Planning. My business address is One NSTAR Way, Westwood, MA 02090. Eversource Energy Service Company provides centralized services to the Eversource Energy operating subsidiaries, including Public Service Company of New Hampshire d/b/a Eversource Energy ("PSNH").

Q. Briefly summarize your educational background and work experience.

A. I hold a Bachelor of Science in Electrical Engineering Degree with Concentration in Electric Power Systems from Northeastern University and also a Master of Science in Electrical Engineering with Concentration in Electric Power Systems from Northeastern University.

I have worked in the electric power field for more than 35 years. Starting in 1979 as a Distribution Engineer for PSNH, I then spent 12 years working in the generation area followed by another ten years as a Transmission system operator and Manager of Transmission System Operations in the Greater Boston area. Finally the last five years have been spent in the System Planning area. My resume is attached as Attachment A.

Q. Please explain your duties and responsibilities as Director, System Planning at Eversource.

A. Among my primary responsibilities is ensuring that, as various projects interconnect to the existing transmission system, the Eversource Energy transmission system will continue to operate reliably and that transmission system reliability is maintained within specified criteria prescribed by the Independent System Operator - New England ("ISO-NE") and consistent with broader criteria prescribed by North American Electric Reliability Corporation ("NERC") Reliability Standard TPL-001, which is available on the NERC website, www.nerc.com. These transmission system reliability criteria are aimed primarily at maintaining bulk power system voltages and assuring that transmission lines are not overloaded. Any entity proposing to connect a project to the transmission system must follow ISO-NE Planning Procedures. The types of projects that typically seek approval to connect to the transmission system vary, and

include: generator interconnections, distribution substations, elective transmission projects, and transmission reliability projects.

Transmission System Planning ensures the transmission system is designed to meet all NERC, NPCC and ISO-NE reliability criteria. If thermal and voltage issues are not addressed, transmission equipment could overload, line clearances above ground could sag to hazardous levels, or voltage levels could be outside of acceptable operating ranges under certain system conditions. Impacts could range from unsafe conditions to equipment damages to line and power outages.

Q. Have you previously testified before the Site Evaluation Committee?

A. No, I have not.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to describe the impact on system stability and reliability for the Seacoast Reliability Project (the "Project"), which will provide a new 115-kV transmission line between Madbury Substation in Madbury, NH and Portsmouth Substation in Portsmouth, NH. I will also address reliability of the transmission system in the Project area, the need the Project addresses, and why the Project is the cost-effective solution to meet the need.

System Stability and Reliability

Q. Please provide a general overview of the electric grid in the Seacoast Region.

A. The electric grid in the Seacoast Region is a network of transmission lines and equipment operating at voltage levels of 345,000 volts (345-kV[1]) and 115,000 volts (115-kV); which in turn supply substations that ultimately supply customer load. A wide variety of power generators (nuclear, fossil fuel fired, etc.) are connected to this grid. The power is generated at a low voltage and stepped up by a transformer to the high voltage grid and transmitted to distribution substations. The power loss along the transmission lines at high voltages is much lower than at low voltage levels. At the distribution substation, the power transmitted at high voltage is stepped down by a transformer to a

[1] kV is an abbreviation 1,000 volts, e.g. 115-kV = 115,000 volts.

lower voltage and distributed via lines that run along streets for ultimate delivery to homes and businesses.

Q. Please describe the ISO-New England approval process for this Project.

A. There are four key steps to the ISO-NE study process. First, a working group is formed and a needs study scope is prepared. This document, which lists the study assumptions to be used in the power flow analysis, is vetted by the ISO-NE Planning Advisory Committee (PAC)[2] to ensure that stakeholders' inputs were considered. Second, the working group undertakes additional detailed power flow analyses and develops a needs assessment documenting specific reliability concerns within the study area. This needs assessment is presented to the ISO-NE PAC. As a third step, the working group undertakes additional detailed power flow analysis to identify and evaluate alternative transmission system upgrades that could address the system needs, and to select a preferred solution. This work is documented in a solutions study, which is also presented to the ISO-NE PAC. Finally, the project proponent(s) undertake additional technical analysis for each project to demonstrate that operation of the proposed upgrade would have no adverse impacts on transmission system operation. This analysis is documented in a Proposed Plan Application (PPA), which is presented to ISO-NE planning committees and ultimately accepted by ISO-NE.

Q. Please provide a general explanation why transmission upgrades are necessary in the Seacoast Region.

A. The Seacoast Region consists of the towns east of Manchester, NH to the shoreline and from Rochester, NH south to the Massachusetts border. For a copy of the Seacoast Region Transmission Map, please see Appendix 27. The Seacoast Region's electric demand is increasing, and is expected to represent approximately 25% of New Hampshire's electric demand in 2020. The electric transmission system serving the Seacoast Region does not meet both mandatory criteria, putting the reliability of the system at risk even at today's electrical demand levels.

[2] The Planning Advisory Committee (PAC) is an open stakeholder forum that provides input and feedback to ISO New England on the regional system planning process.

Q. Please describe the New Hampshire/Vermont Transmission System Needs Assessment (the "Needs Assessment").

A. The Needs Assessment documents the power flow study assumptions used and the results of the power flow simulations, under various system conditions. A typical study horizon is ten years into the future. The Needs Assessment was started in 2010, so the study horizon was determined to be 2020. The study focused on 2020 summer peak load conditions based on the ISO-NE load forecast (CELT). Also taken into account for the load forecast was the effect of energy efficiency (e.g. compact fluorescent lights, high efficiency appliances) and voluntary load reductions. Different combinations of system conditions were analyzed for the Seacoast Region, which covered: generation dispatch, power transfers from other regions that connect to New England such as New York and New Brunswick, and unavailability of transmission equipment.

Q. Please describe any particular electrical reliability concerns that exist in the Seacoast Region of New Hampshire.

A. The electric reliability in the Seacoast Region is susceptible to a number of criteria violations, as documented in the Needs Assessment. These occur under combinations of summer peak load, the unavailability of local 115-kV generation and loss of system equipment. The worst case violations occur with the loss of two 115-kV transmission circuits supplying the area. A possible scenario is that a 115-kV circuit supplying the Seacoast Region is assumed out-of-service. This could be a planned or unplanned outage. At the same time, there is an unexpected loss of another circuit supplying the area. This situation creates increased power flows on the remaining circuits supplying the Seacoast Region load, which can exceed the emergency thermal rating of the circuit.[3] Also, the system voltage can decrease to a point at which customer equipment is negatively affected.

If these criteria violations are not addressed, the risk of system overloads could lead to potential power outages in the Seacoast Region and surrounding area. The Seacoast Region was included in the Needs Assessment prepared and submitted to the

[3] Transmission circuit ratings are based on the amount of heating that the wire can tolerate before it sags to an unsafe height. Circuit must be designed so that the amount of sag (height above the ground) is within the applicable safety codes.

ISO-NE PAC, which consists of a collection of interested stakeholders including state regulators and consumer advocates. This Needs Assessment primarily consists of power flow simulations. The results of the Needs Assessment determined that there are transmission system criteria violations in the Seacoast Region. These violations are with respect to the thermal rating and operating voltage of transmission system equipment. These violations need to be addressed by transmission upgrades to avoid, under certain foreseeable system conditions, risks of equipment damage and line and power outages, and threats to public safety. SRP addresses overloads and voltage issues on the 115-kV system

Q. Please explain how SRP was chosen as the preferred solution to addressing reliability needs in the Seacoast Region.

A. Two transmission alternatives were developed to meet the Seacoast Region needs. Each major alternative was comprised of a suite of projects. Each of the major projects, within the suite, was presented to the ISO-NE PAC. Within the PAC presentation a number of different factors were compared, spanning a spectrum from estimated cost to non-cost factors; such as benefits to system performance. The final selection of the preferred solution, which included SRP, was primarily decided by reliability impacts and the fact that it was less costly than the competing alternative. The competing alterative included a new 345/115-kV autotransformer at a new substation in Newington and a new 115-kV transmission line between New Hampshire and Maine.

Q. Is SRP part of a suite of Projects in the region?

A. Yes. SRP is part of a suite of projects in the preferred solution for the Seacoast Region. As previously stated, through its study process, ISO-NE identified a number of criteria violations. To address these violations a suite of projects was proposed and were studied together as a potential solution. These projects are dependent on each other to solve the criteria violations and continue to provide reliable electric service to the customers in the Seacoast Region.

Q. Please describe the system electrical benefits that this Project and the associated upgrades provide to the Seacoast Region of New Hampshire.

A. By undertaking these needed upgrades, the reliability of the transmission system is improved by its ability to better withstand system disturbances due to severe

weather, equipment failures, unavailability of generation. The transmission system becomes more robust in its ability to maintain electric service to customers.

The Seacoast Region Solution, which includes SRP, directly provides system benefits by: adding new transmission circuits, upgrading existing circuits to increase the amount of electric power that a circuit can carry, and adding circuit breakers and capacitor banks. With the Seacoast Region Solution, the system operator will also have added flexibility to plan for scheduled system events (e.g. maintenance outages) and to react to unplanned system events (e.g. sudden loss of generation). It will also help reduce the stress on the adjacent parts of the system that connect to that portion of the system that serves the Seacoast Region and reduce the potential for large scale power outages in the Seacoast Region.

In addition to the above, SRP adds a transmission circuit which will connect the 'upper' and 'lower' Seacoast areas. This increases the resiliency of the system to withstand transmission and generator outages and continues to provide electric service to customers.

Q. Are there any other comments you would like to make at this time?

A. Yes. The electric transmission system in the Seacoast Region is nearly sixty years old and, until recently, had adequately served the customer load. However, current and projected demand, as well as increased standards of performance since the grid's inception, drive the need for improvements to the electric system, which has resulted in the need for the Seacoast Region Solution, including SRP.

Q. Does this conclude your pre-filed testimony?

A. Yes, it does.