THE STATE OF NEW HAMPSHIRE

BEFORE THE

NEW HAMPSHIRE SITE EVALUATION COMMITTEE

DOCKET NO. 2015-06

PRE-FILED DIRECT TESTIMONY OF KENNETH BOWES

IN SUPPORT OF THE
APPLICATION OF NORTHERN PASS TRANSMISSION LLC
AND PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
D/B/A EVERSOURCE ENERGY
FOR A CERTIFICATE OF SITE AND FACILITY TO CONSTRUCT A NEW HIGH VOLTAGE TRANSMISSION LINE AND RELATED FACILITIES IN NEW HAMPSHIRE

February 26, 2016

Qualifications and Purpose of Testimony

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

A. My name is Kenneth Bowes. I am a Vice President of Engineering at Eversource Energy ("Eversource"), currently assigned to the Northern Pass Transmission Project ("Northern Pass" or the "Project") being developed by Northern Pass Transmission LLC, an Eversource company ("NPT" or the "Company"). My business address is 107 Selden Street, Berlin, Connecticut, 06037.

Q. Briefly summarize your educational background and work experience.

A. I hold a Bachelor of Science degree in Electrical Engineering from the University of New Hampshire in Durham, New Hampshire and a Master's of Science degree in Electrical Engineering from Rensselaer Polytechnic Institute in Hartford, Connecticut. I presently serve on the Edison Electric Institute ("EEI") Transmission Committee and the EEI Security Committee. As a result of my work at Eversource, I have received awards from EEI for Emergency Recovery Award in 2013, Emergency Assistance Award in 2013, the Institute of Electrical and Electronic Engineers ("IEEE"), Power Engineering Society, Working Group Award in 1998. I have considerable engineering and operations experience in the many areas of transmission and distribution, including engineering, construction, maintenance and operations. I have overseen the entire project life-cycle for numerous transmission line and substation projects for Eversource and have served as a company officer and director in a variety of roles in support of our transmission and distribution systems.

I previously held the role of Director of Transmission Projects where I was responsible for the siting, permitting, engineering, design, construction, testing and commissioning of more than 500 transmission projects in New England totaling more than $2 billion in investments. Specific projects included the: Long Island Replacement Cable, Glenbrook Cables Projects, Killingly Substation, Fitzwilliam Substation, 345-kV autotransformer additions at Haddam, Barbour Hill, Scobie Pond, Deerfield, Berkshire and Ludlow.

Prior to this role, I was the Director of Transmission Construction, Test & Maintenance responsible for the field operations, construction and maintenance of the Eversource transmission system. Previous to this position I was the Director of Transmission & Distribution maintenance responsible for the field operations and maintenance of the Eversource transmission, substation

and distribution systems including the transmission rights-of-way maintenance. Attachment A is my resume, which includes a list of other projects I have managed.

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

A. No, I have not. However, I have been designated as an expert witness for a variety of legal and regulatory topics including: transmission siting and permitting, easement acquisitions, substation operations, distribution rate cases, storm performance and cost recovery, claims litigation, and system resiliency.

Q. What is your role in the Project?

A. As the Vice President of Engineering, I am the lead technical expert and am responsible for the Project.

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to provide an overview of the Project, summarize the construction plans, including plans to give hiring priority to local New Hampshire workers, explain post-construction operations and to describe the Applicants' technical and managerial capability to construct and operate the Project. I will also describe the property rights associated with the Project. Finally, I describe the measures that the Applicants will use to ensure that Project is constructed safely and operates in a safe manner and to ensure that there will be no adverse effects on public health during construction and operation of the Project.

Key Project Elements

Q. Please provide an overview of the proposed Project.

A. NPT proposes to construct a high voltage direct current ("HVDC") electric transmission line with a 1,090 MW transfer capability running from the international border between New Hampshire and Canada to Franklin, New Hampshire, where it will connect to a new station that will convert the energy from HVDC to alternating current ("AC"). From this station, a new 345 kV AC line will extend approximately 34 miles in order to interconnect with the existing transmission system at the existing substation located in Deerfield, New Hampshire. The Project will also require upgrades at the existing Deerfield substation and the Scobie Pond substation located in Londonderry, each of which is owned and operated by Public Service Company of New Hampshire d/b/a Eversource Energy ("PSNH"), a wholly-owned subsidiary of Eversource.

The northern HVDC converter terminal will be constructed by Hydro Québec at its Des Cantons Substation in the Province of Québec, Canada; it will be connected to an HVDC line that will run southward in Québec for approximately 49 miles,[1] where it will cross the U.S. and Canadian border into Pittsburg, New Hampshire. The New Hampshire segment of the HVDC line will continue southward for approximately 158.3 miles to the southern HVDC converter terminal. As part of the Project, the line will consist of three underground cable segments totaling approximately 60.5 miles.

NPT will lease approximately 99.5 miles of existing electric transmission right-of-way ("ROW") from PSNH in two segments. From Pittsburg, the line will extend southerly on land or in ROW belonging to entities other than PSNH for approximately 40 miles (approximately 8 miles of this segment would be installed underground in public roads). After reaching Dummer, the Project will travel overhead in ROWs owned by PSNH between Dummer and Bethlehem over a distance of approximately 40.5 miles (the "Northern Segment"). From Bethlehem, for a distance of approximately 52 miles through the White Mountain region and down to Bridgewater, Northern Pass will be located primarily underground in public roads. Thereafter, the Project will continue overhead in PSNH's ROWs from Bridgewater to a HVDC/AC converter terminal to be constructed by NPT in Franklin, New Hampshire. Once converted, Northern Pass will continue as a 345 kV AC line from Franklin along approximately 34 miles of ROWs owned by PSNH to an existing PSNH substation in Deerfield, New Hampshire (together with the Bridgewater to Franklin corridor, the "Southern Segment"). For additional information regarding the land rights associated with the Project, please see section (b)(6) of the Application. The Project map sheets can also be found in Appendix 1.

Once the Project is commissioned, and ready for commercial operation, ISO-NE will assume operational control pursuant to the terms of a FERC-approved Transmission Operating Agreement between NPT LLC and ISO-NE. The Project will enable the transmission of 1,090 MW of power between Québec and New England. Its objective is to provide clean, renewable, competitively-priced electricity for consumers in New Hampshire and the rest of New England.

[1] The original application indicated that this distance was 47 miles. However, the Canadian portion of the line will actually travel 49 miles from the Des Cantons Substation to the international border.

Q. What are the key physical features of the Project?

A. The key components of the Project, described below, are the HVDC line, the converter terminal and the 345 kV AC line. Other components of the Project that are required to support the interconnection to the regional transmission system are included in the Project Description, which is located in section (h)(1) of the Application.

The heart of the Project is the construction of the +/- 320 kV DC transmission line from the Québec border to Franklin NH. The HVDC line will be approximately 158.3 miles in length with 97.8 miles of overhead construction and approximately 60.5 miles of underground construction.

The overhead portions of the HVDC line will consist of a 32 mile section where new rights have been secured to locate the line. Twenty-four miles of the 32 mile section are within a working forest that is already frequently cleared. The remaining 65.8 miles of overhead will be installed in existing PSNH ROW that already has existing transmission and distribution lines. For the area where the HVDC line will be located within an existing ROW, where necessary, portions of the existing transmission and distribution lines will be relocated to allow room for the HVDC line construction.

The underground cables will be installed in three sections with a total Project length of 60.5 miles. The three areas are 1) a 0.7 mile segment in the towns of Pittsburg and Clarksville in the vicinity of the Route 3 bridge crossing of the Connecticut River, 2) a 7.5 mile segment in the towns of Clarksville and Stewartstown and 3) a 52.3 mile segment starting in the Town of Bethlehem at Route 302 and ending at the intersection of the transmission ROW and Route 3 in Bridgewater. The 52.3 mile segment would be constructed within Routes 302, 18, 116, 112 and 3. At the six locations (one at each end of the cable segment) where the overhead line transitions between the overhead line and cable, a transition station will be installed. The transition station will resemble a small substation and will be approximately 75’ by 130’. Equipment in the transition station will include a terminal structure, surge arresters, instrument transformers, cable terminators communications equipment and a small control enclosure.

The converter station is located in Franklin, New Hampshire. The site was selected for three reasons. First, NPT was able to locate, and purchase from a willing landowner, a previously disturbed parcel that is large enough to accommodate the converter terminal. In addition, the use of this site facilitates the potential use and incorporation of the 345 kV by PSNH into a reliability

project should ISO-NE determine that the AC line, together with other system improvements, would provide transmission system reliability benefits in the future. Finally, the site is located close to the existing ROW.

The conversion of energy from HVDC to AC will be done at a Converter Terminal that has as its core operation feature a Voltage Source Converter ("VSC"). The converter terminal footprint is approximately 10 acres and will be located within a 118 acre parcel in Franklin, NH. The main components of the VSC include:

- A DC area where the line enters the terminal. Equipment in this area includes disconnect switches, circuit breakers, capacitors, reactors and instrument transformers.
- The conversion from HVDC to AC takes place in a valve hall. This is a building that is approximately 235' by 180'. The main electrical component that transforms the energy between AC and DC is the insulated gate bi-polar transistor ("IGBT"). An IGBT is an electronic device that essentially builds an AC voltage from the HVDC voltage. In addition to the IGBTs, HVDC reactors are located in the valve hall. A control room and unmanned office space will be located adjacent to the valve hall.
- The AC portion of the converter terminal includes the converter transformers, reactors, filters, capacitors, instrument transformers, disconnect switches and circuit breakers. The entire converter terminal will be located within a security fence.

Q. Please describe the steps being taken to allow NPT to utilize the existing PSNH transmission corridor.

A. Concurrently with the filing of the Application, NPT will submit to the New Hampshire Public Utilities Commission ("PUC") a Petition to Commence Business as a Public Utility in the State of New Hampshire. In addition, both PSNH and NPT will seek approval by the PUC of a lease that will allow NPT to use existing PSNH ROW.

Q. Please describe the ROW and any widening that will be required to construct the Project.

A. The transmission corridor in the new portion of the North Section where there is no preexisting transmission ROW, will be 120 feet wide. The line was redesigned to reduce the portion of the ROW that will be cleared. As described previously, much of this new corridor is a working forest and subject to routine timber harvesting. The 120 foot width was selected

because it will accommodate not only the operation of the transmission line, but also construction, maintenance and repair activities. It is designed to accommodate both steady state and extreme weather conditions, based on both NESC design requirements and good utility practice.

As previously described, for the Central and South Sections and a portion of the North Section, NPT intends to use existing transmission ROW under its lease with PSNH. The width of the existing ROW varies from 150 feet to 392.5 feet.

Q. Explain what upgrade work will be done at the Deerfield substation and why.

A. As discussed above, certain upgrades to the AC system are required to support the Project's interconnection with the regional electric grid. Additional work is necessary at the Deerfield substation in accordance with the requirements identified by the ISO-NE as part of its I.3.9 process.

Initially, the ISO-NE I.3.9 studies analyzed the impact of a new 1,200 MW transmission project and identified that the two 345 kV lines between Deerfield and Scobie Pond needed to be thermally uprated to ensure minimum clearance criteria are not violated. This involves replacement of certain structures along the path to allow the line to transmit a greater level of power.

Since the initial I.3.9 studies, the Project has altered its projected power flow from 1,200 MW to 1,090 MW. The Project is currently undergoing a new I.3.9 study, which is expected to provide substantially similar results.

The Northern Pass 345 kV AC line will terminate at the existing Deerfield Substation where the power will then flow to other New Hampshire substations and the New England electrical system. At Deerfield Substation, portions of the substation will be reconfigured to accommodate the Project. The work involves relocating certain 345 kV line terminals and adding 345 kV line positions to the substation. In addition to the line terminal work, an existing 345 kV line, the 391 line, that presently goes by the substation will be looped into and out of the Deerfield Substation (two line terminal positions will be added). The 345 kV line work and terminal additions will be constructed within the existing substation fenced area.

In a separate new substation area adjacent to the existing substation, a static VAR (volt-ampere reactive) compensator ("SVC") and 345 kV capacitor banks will be installed. These

devices, which were identified by the ISO-NE during its initial I.3.9 study, provide system voltage support during abnormal system events.

For the Deerfield upgrade, the equipment additions will include breakers, the SVC and transformer, capacitor banks, switches and bus, instrument transformers and arresters.

Q. Is work planned for any other substation locations?

A. Yes, a 345 kV capacitor bank addition is planned for an expansion of the Scobie Pond Substation along with the installation of 345 kV breakers in the existing substation bus.

Q. Explain why some existing lines need to be rebuilt and relocated.

A. Relocating some of the existing 115 kV transmission lines and 34.5 kV distribution lines is necessary to make room for the Project facilities. This allows NPT to lower structure heights to reduce potential visual impacts and to satisfy electrical code requirements. NPT has sought to utilize existing transmission ROW to the maximum extent feasible in order to minimize environmental and other impacts of the Project. NPT will bear the costs of all relocations and rebuilding of the PSNH lines.

In order to maximize the use of existing ROW and to reduce structure heights to reduce visual impacts in the HVDC portion of the line, NPT will relocate approximately 39.5 miles of existing 115 kV lines and 11.7 miles of 34.5 kV lines. For the 345 kV AC portion of the Project, approximately 22.8 miles of existing 115 kV lines and 6.5 miles of 34.5 kV lines must be relocated.

In addition, to address specific visual impact concerns expressed by officials and residents in Concord, NPT agreed to modify its design to reduce structure heights for the 345 kV AC line in some areas. Specifically, six additional miles of 115 kV line will be relocated to allow use of H-frame structures. The H-frame has a standard design height of 80 feet, which is the lowest height of the AC structure design alternatives.

Underground Construction

Q. What technology is associated with constructing an underground transmission line of this magnitude?

A. Underground cables will be installed using a combination of construction techniques that include direct burial of the cable in trenches, installation of the cable in conduit or in a duct bank constructed in trenches or through the use of trenchless technology. The trenchless technology will include jack and bore and directional boring. The depth of the direct

buried cable will be approximately four feet below grade; the depth of the conduit or duct bank will vary based upon its configuration and will have at least 30 inches of cover over the duct bank; the depth of the jack and bore will be approximately 25 to 30 feet below grade; and the depth of the directional boring sections will be approximately 65 feet below grade at its maximum depth. The exact depth of the trenchless conduit installation, duct bank or direct buried cable may be adjusted based upon the final civil design. After the cable sections are installed, multiple segments of the line will be joined together in splice pits at locations along the route.

Project Construction

Q. Describe the process for selecting the contractors that will be involved in the construction of the Project.

A. Each contractor chosen to work on this Project was evaluated and selected based upon experience and previous performance on projects of similar size and scope in their respective fields and included the review of each contractor's safety and environmental record for comparison with industry standards. The procurement process was managed by Eversource's procurement group and included standard utility practices including, web-based bidding process, shortlisting qualified bidders detailed bid evaluations based on technical and commercial criteria and contract negotiation and award.

Q. Describe the qualifications and role of the contractors selected to construct the Project.

A. The Project will be managed and constructed by Quanta, a recognized leader in the construction of transmission facilities, and by ABB, an industry leader in HVDC systems, converters, and cables. For a detailed discussion of the qualifications of each company, please see Supplement #1 at Section 301.05(b)-(c).

The selected contractors have years of experience in managing and constructing high voltage transmission lines and substation facilities throughout the United States and here in New England. The major categories of work necessary to complete the Project include engineering and design services, project management and control services, construction management, converter terminal and underground cable supply, and transmission line and substation construction services.

Quanta, a Fortune 500 company headquartered in Houston, will manage the construction process of the Project as the general contractor. Quanta is a holding company made up of a team of specialty subsidiary companies that will oversee construction of various aspects of the Project. Quanta has a workforce of tens of thousands of people and has offices across North America and abroad; is the largest employer of certified electric power linemen in North America; is the owner of the largest specialized equipment fleet in the industry; has best-in-class safety leadership and performance while delivering exceptional value; and is an innovator of technologies and proprietary methodologies.

Quanta's primary subsidiary for the Project will be PAR Electric. PAR has been working with Eversource locally on projects for several years and has a permanent office in Bow, New Hampshire. PAR's responsibilities will be segmented in two categories, namely, a self-performing role and as an Owner's Agent. Quanta and its subsidiaries, including PAR, will be responsible for the overhead construction and foundations, substation construction, and underground construction. Some of Quanta's other subsidiaries expected to be involved in the Project include Longfellow Drilling, MJ Electric, Underground Construction ("UCC") and Crux Subsurface.

The preliminary design was developed by Burns and McDonnell ("BMcD"). BMcD has also been contracted to engineer the final design under a contract with Quanta. A blend of BMcD and Quanta resources will oversee the project management and the construction management roles.

ABB, a global leader in power and automation technologies, will supply the HVDC converter terminal in Franklin (and also in Des Cantons, QC) along with the HVDC cable and Deerfield SVC. ABB has directly contracted with Eversource to engineer, procure, and construct the converter terminal, the SVC at Deerfield, and the underground cable system.

Eversource has also contracted directly with specialty vendors for the supply of transmission structures and overhead conductor. PAR will oversee all aspects of the construction, including the construction of the converter terminal and SVC, installation of the underground cable, the manufacturing of the structures, and the overhead AC / DC conductor.

Q. Describe the qualifications and role of the Owner's Agent that will be involved in this Project.

A. PAR will manage the construction process. Working with BMcD, PAR will also be NPT's representative for engineering and design services, project management and controls services, and construction management. They will be responsible for monitoring, coordinating and reporting to the Project. Reports will include the quality and compliance of the work that the construction contractors and vendors perform on this Project. PAR will provide services including design, permitting, construction management, schedule, cost, construction coordination, materials management, safety oversight, environmental compliance oversight, communications, and project closeout.

Q. Describe the qualifications and role of the overhead line Construction Contractor that will be involved in this Project.

A. Quanta, through its subsidiary PAR, has the ability to manage a project of this size and has significant experience in the construction of high voltage switching stations and substations, underground or overhead transmission lines. Quanta and its subsidiaries have the demonstrated ability to construct the work within the allotted time frames and have the ability to supply adequate labor. Quanta has the necessary resources available to deliver the technical skill and physical capacity to respond safely, quickly and cost effectively and have an established track record of success with the ability to draw on field employees that are members of the International Brotherhood of Electrical Workers ("IBEW") and work closely with the National Electrical Contractors Association ("NECA"). This strong IBEW/NECA connection ensures trained, highly productive and safety-oriented personnel.

Q. Describe the qualifications and role of the converter terminal and Underground Cable supply vendor that will be involved in this Project.

A. The converter terminal, SVC and underground cable systems that are being proposed for this Project are unique in design and can only be manufactured by specialty companies. NPT issued a request for proposal ("RFP") for the supply of the converter terminal, SVC and cable system. ABB has been selected as the supplier for these facilities. ABB has extensive experience engineering and constructing underground HVDC projects and designing and constructing substations with power automation technology and HVDC converter terminals.

Q. Describe how the companies described above will work together.

A. The construction of Northern Pass will be a collaborative effort of NPT and Quanta. Each brings its unique skill sets to the table to create a strong and dynamic team. The converter terminal, SVC, and underground cable supply vendor, ABB, will provide equipment and construction services specific to the converter, SVC and underground cable.

NPT, as owner, will be responsible for all major management decisions. The Quanta lead will report directly to the Northern Pass Transmission Project Director. This reporting will include updates on cost, schedule, risk, compliance and other matters as it relates to the construction process. Regular meetings (weekly and monthly) will be held to provide Project updates.

Attachment B details the Construction Management Reporting Matrix and shows conceptually how the companies will integrate the distinct design and construction efforts. See also NPT Core Project Management Team.

In addition to the Eversource management structure, as depicted on the NPT Core Project Management Team chart, the Eversource team will also include additional project managers, a cost analyst, contract administrator, and field inspectors for QA/QC, safety, and the environment. The exact number of filed inspectors will vary depending on the magnitude of work being submitted.

Quanta, its subsidiaries, and ABB, will have direct lines of communication at all significant levels of operation (safety, community relations, environmental compliance, outage coordination, materials management, project controls and construction coordination). This direct communication allows for fast information exchange and processing and ensures that daily decisions are made in a timely manner. Quanta will provide the coordination and reporting that ensures that the Project is meeting all standard and compliance requirements.

Q. Please provide a general description of a Project Labor Agreement ("PLA").

A. A PLA is a set of terms and provisions agreed to between a construction project owner and a union regarding how work will be performed on a project. The owner includes PLA specifications in its bid requirements when it solicits contractors for its project. A contractor who accepts a contract award accepts the provisions of the PLA, and will apply the terms and provisions of the agreement with union and nonunion personnel who are hired to work on the contracted job.

Q. Describe how NPT expects to use a PLA.

A. NPT is firmly committed to hiring local, New Hampshire workers first, and to developing strong working relationships with both large and small contractors who are either union or non-union. In addition, NPT will be seeking contractors who have a track record of working safely and in an environmentally sensitive manner, and who are focused on competitive pricing and on-time service.

The PLA used for the Project was uniquely structured to promote local jobs to New Hampshire workers. That is the top priority. There are provisions to bring in non-union companies both where there are specialized skills or equipment not provided by tradesmen, and where there are simply not enough skilled craftsmen available to staff a job. Non-union companies can become signatories to the PLA.

The PLA specifically identifies non-union job opportunities that are not subject to the agreement, including logging, landscaping, land clearing, maintenance and warranty work on equipment, training, testing, and equipment installation.

Numerous "service vendors" providing such services as trash haulers, security, fuel delivery, and janitorial services, are also included in these non-union opportunities. Non-union job opportunities also include a number of "non-manual job categories" needed for Project support. These include inspectors, timekeepers, clerical and administrative workers, guards, emergency medical technicians, quality assurance/quality control staff, and engineering, real estate, survey, technical, and supervisory personnel.

The major engineering, construction, and equipment suppliers will generally hire trade personnel and/or subcontractors directly. The PLA requires that contractors hire NH labor first to ensure that local suppliers and businesses will be used.

As the Project construction start date draws closer, NPT will hold job fairs where Project contractors will meet with those interested in working on the Project. In addition, the IBEW, one of the major unions that will be working on the job, will be soliciting workers for its training and apprentice programs to ensure an adequate supply of labor for the Project in key skills areas.

Q. Please describe how NPT intends to address any violations of either state or federal requirements that were pre-existing on the land prior to the start of construction.

A. Any potential violations (e.g. environmental issues) will be identified and reported to the appropriate reporting agency. Wherever possible, these issues will be resolved

prior to when construction activities commence. Additionally, notification protocols will be created to assess any potential violations that could be identified once construction activities commence.

Project Operations

Q. After the Project is constructed, how will the Project operate?

A. Following completion of the Project construction phase, ISO-NE will assume operational control over the transmission facility pursuant to the terms of a FERC-approved Transmission Operating Agreement ("TOA") between NPT and ISO-NE.

Section 6.1(a) of the Transmission Service Agreement ("TSA") contemplates that the management committee comprised of Hydro Renewable Energy and NPT personnel will review the terms and conditions of the TOA to facilitate alignment of all interested parties. Under the TOA, NPT expects that ISO-NE will assume operational authority over the Project and all transactions over the line will be scheduled in accordance with the applicable New England market rules. ISO-NE will also have final approval authority over planned line outages. Therefore, Northern Pass effectively will operate in the same manner as all other facilities within the integrated ISO-NE system.

Section 6.2 of the TSA requires NPT to maintain the Project in accordance with good utility practice and in compliance with all applicable regulatory requirements, including applicable North American Electric Reliability Corporation ("NERC") and Northeast Power Coordinating Counsel ("NPCC") reliability standards, and to comply with all applicable operating instructions and manufacturers' warranties.

Q. Please describe the maintenance and inspection activities associated with Project operations.

A. For the Project route where there are already transmission lines, many of the maintenance and inspection activities will be performed for the Project as the crews traverse the ROW. In these locations, NPT will pay its allocated share of the costs associated with such maintenance and inspection activities. For example, under the lease arrangement with PSNH, NPT will pay a proportionate share of the vegetation management costs. With respect to other forms of maintenance and inspection work that would address both NPT and PSNH needs, such as aerial inspections, NPT and PSNH could contract directly with third party vendors for the performance of such work, with each of NPT and Eversource (NH) paying for its proportionate

share of the work. In addition, Eversource Energy Service Company employees engaged in such work would allocate their time directly to NPT or PSNH as appropriate.

Where the Project is not located with existing transmission lines, maintenance and inspection activities will be paid for by NPT, and performed consistent with the Eversource Energy maintenance policies and procedures which are documented in the Eversource Energy Transmission Maintenance Program Manual ("TMPM"). The TMPM is based upon the following key attributes:

- Best practices for preventive maintenance;
- Assuring compliance with regulatory and power coordination authority standards and guidelines;
- Establishing maintenance practices that are practical and cost effective;
- Establishing maintenance practices that monitor equipment operating conditions and provide trend data; and
- Written descriptions of the maintenance program.

During operation, NPT and its contractors will follow all Eversource Energy company policies and procedures, including a well-established set of transmission procedures mandated for all Eversource Energy employees and contractors. Those policies and procedures include all OSHA regulations, all State and federal regulations and other guidance documents. In accordance with maintenance procedures, Eversource Energy inspects high voltage transmission lines (including Northern Pass) on the following basis:

- Aerial patrol of the line each year for inspection of structures and conductors;
- Foot patrol of the line each year to visually inspect the facilities;
- Thermographic inspection of the line two times per year;
- Patrol of lines after every interruption if the specific cause cannot be identified;
- Aerial patrol of lines each year for vegetation management inspection; and
- Three year vegetation maintenance within cleared areas, ten year side trimming and tree removal as required.

With regard to the stationary buildings, including maintenance for transition stations, converter terminal, underground sections, and the substations, NPT will undertake the following:

- Monitoring, testing and maintaining, civil, electrical, protection and communication equipment including visual inspection, sampling, trending, testing, maintenance and time based equipment replacement;
- Monitoring on-line key electrical devices to determine equipment status, load levels, and temperature and to identify any abnormal conditions; and
- Spare parts will also always be kept on site.

In addition to the TMPM, the Protection System Maintenance Program ("PSMP") provides the basis for performing maintenance on Protection System components across the three-state Eversource Energy system. The PSMP provides the basis to verify regulatory compliance for protective systems. The requirements of the Federal Energy Regulatory Commission ("FERC"), NERC, NPCC and ISO-NE form the basis for the PSMP.

Q. Please describe the vegetation maintenance work that will be required once the Project is in operation.

A. PSNH will be responsible for vegetation maintenance work where NPT facilities are collocated with PSNH facilities, and NPT will pay to PSNH its proportionate share of the costs of such vegetation management pursuant to Section 5.2 of the Lease Agreement between PSNH and NPT. NPT will contract directly with third party vendors for the performance of vegetation management activities in the newly developed transmission corridor where only NPT facilities will be located. Maintenance activities in the ROW, depending on the natural features and accessibility of the ROW, can be carried out on foot, or by line truck, track mounted vehicle, all-terrain vehicle or snowmobile. Any of these activities can have an impact on the environment if not performed in a sensitive manner. All vegetation management and line maintenance activities associated with the Project's new lines will be performed in accordance with the New Hampshire Division of Forest and Lands Best Management Practice for Utility Maintenance. The Best Management Practice publication provides guidance for identifying appropriate means and methods for vegetation management and maintenance in or within the vicinity of jurisdictional wetlands. The company will provide a field manual summarizing the Best Management Practice to all contractors performing maintenance work in the ROW.

Q. Please describe the security measures associated with Project operations.

A. NPT also will implement security measures consistent with industry practices and Eversource Energy policies, including the use of security cameras at stations. With regard to the stationary buildings, transition stations, converter terminal, underground sections, and the substations, NPT will maintain the facilities in accordance with the TMPM, the PSMP and manufacturer recommendations. Maintenance activities for those facilities will include:

- Monitoring, testing and maintaining civil, electrical, protection and communication equipment including visual inspection, sampling, trending, testing, maintenance and time based equipment replacement;
- Monitoring on-line key electrical devices to determine equipment status, load levels, and temperature and to identify any abnormal conditions; and
- Maintaining an adequate supply of spare parts on site.

Q. Please describe how NPT will manage Project operations.

A. NPT will rely on Eversource Energy's transmission maintenance and work management department to support the operating and maintenance requirements of the new facilities associated with the Project. NPT will pay for the cost of these services. To the extent appropriate or required (including for emergency repair efforts resulting from storms or system events), Eversource Energy supplements its transmission maintenance and work management department with contractors having crews with the necessary skills and experience. The collective staff available to NPT will ensure that all maintenance and operational activities are performed in accordance the TMPM and PSMP.

Q. Describe all measures that will be employed to ensure the Project operates safely.

A. During Project operations, NPT and its contractors will follow all Eversource Energy policies and procedures, including a well-established set of transmission procedures which contractors are required to follow. These policies and procedures necessarily include all Occupational Safety and Health Administration ("OSHA") regulations, all State and federal regulations and other guidance documents. NPT will also adhere to the National Fire Protection Association ("NFPA") 850 Recommended Practices for Electric Generating Plants and High Voltage Direct Current Converter Stations.

Q. Describe what measures will be taken to ensure the security of the Project once constructed.

A. The Project will meet all requirements identified by the Federal Energy Regulatory Commission in CIP-014-1, the security Reliability Standards for critical Bulk Power System facilities. Features of the Eversource Energy security plan include the following:

- Inspection of the converter terminal, transition stations and substations in accordance with the Eversource maintenance procedures
- Inspection of transmission lines (foot patrols and aerial inspections) in accordance with Eversource maintenance procedures
- Security gates at converter terminal, transition stations and substations
- Transmission line ROW gates to restrict access to the ROW at certain locations. Perimeter fencing at all station facilities
- Security cameras – to be used at converter and substations
- Control House security system

Technical and Managerial Capability

Q. Please summarize why the Applicants have the technical and managerial capability to construct and operate the project.

A. As discussed in the pre-filed testimony of James A. Muntz, Eversource has extensive experience siting large transmission projects in New England. Eversource owns and operates approximately 4,270 miles of transmission lines in the Northeast and serves approximately 3.6 million electric and natural gas customers in the region. The Eversource Transmission Business is a procedure-driven organization that has been structured for the specific purpose of constructing, operating and maintaining transmission assets in the states of CT, MA and NH. Eversource Transmission utilizes procedures for all key functions including Project Management, Engineering, Maintenance and Operations, and Quality Control, to name a few. Eversource has a significant ongoing transmission capital construction program in New Hampshire, of which this project is only a small part. Over the past decade, Eversource has a proven track record of constructing many complex transmission projects.

Eversource and its contractors have an extensive staff of in-house siting, engineering, environmental, legal project management and construction professionals, skilled in the

development of large transmission projects. Eversource has numerous relationships with many major engineering firms, environmental and other related consultants and contractors which we will rely on to execute projects in a safe, efficient and cost effective manner.

Based on the information contained in the Application, coupled with the relevant pre-filed testimony, the Applicants have the requisite technical and managerial capability to construct and operate the Project.

Property Rights

Q. Please describe whether the Applicants have a current right, an option, or other legal basis to acquire the right, to construct, operate, and maintain the facility on, over, or under the site.

A. NPT has option agreements for a leasehold interest in three segments of a new right of way ("ROW") totaling approximately 32 miles extending from the Canadian border in Pittsburg, NH to the existing PSNH ROW in Dummer, NH. Specifically, NPT entered into an "Option to Lease Agreement" dated October 14, 2015 with its affiliate, Renewable Properties, Inc. (the "Lease Option Agreement"), that encompasses two of these segments and a portion of the third (as well as the transition station, converter terminal and other ROW properties described below). The Lease Option Agreement is based on RPI's fee and easement ownership interests in the subject properties, which ownership is a matter of public record. The portion of the new ROW covered by the Lease Option Agreement extends from the U.S.-Canada border in Pittsburg, New Hampshire to the Stewartstown-Dixville town boundary.

NPT entered into a separate "Option for Partial Assignment and Assumption of Lease Agreement" dated October 14, 2015 with RPI (the "Assignment Option Agreement") that covers the remaining portion of the third segment of new ROW. The Assignment Option Agreement is for the approximately 24 mile long portion of the new ROW extending across property owned by Bayroot LLC (and managed by Wagner Forest Management, LLC) from the Stewartstown/Dixville town boundary to the existing PSNH ROW in Dummer, NH. The Assignment Option Agreement is based on the lease between RPI and Bayroot dated October 1, 2012 and recorded at Book 1364, Page 0456 of the Coos County Registry of Deeds. Uniting these three leased segments are two sections of public highway, totaling approximately eight miles in the towns of Pittsburg, Clarksville, and Stewartstown, where NPT will install underground transmission facilities pursuant to authority provided under RSA 231:160, et seq.

NPT has executed an agreement with PSNH to lease approximately 100 miles of existing electric transmission ROW from PSNH pursuant to RSA 374:30 in three segments: Dummer to Bethlehem—approximately 41 miles; Bridgewater to Franklin—approximately 25 miles; and, Franklin to Deerfield—approximately 34 miles. PSNH has submitted the lease to the New Hampshire Public Utilities Commission ("NHPUC") for approval pursuant to RSA 374:30. See NHPUC Docket DE 15-464.

Northern Pass will be installed under public highways, pursuant to authority provided under RSA 231:160, et seq., for a distance of approximately 60 miles consisting of an approximately half mile long segment in Route 3 located Pittsburg and Clarkesville, an 7.5 mile long segment in Clarkesville and Stewartstown, and an approximately 52 mile long segment beginning in Bethlehem and continuing through Sugar Hill, Franconia, Easton, Woodstock, Thornton, Campton, and Plymouth, and ending in Bridgewater. Northern Pass, as well as relocated PSNH transmission and distribution facilities, will also cross over highways at various locations pursuant to RSA 231:160, et seq. The Project lines will cross over or under public waters and lands owned by the State pursuant to authority provided under RSA 371:17. Crossings of land owned by the state that is State-owned railroad property will be crossed consistent with the New Hampshire Department of Transportation ("NHDOT") Utility Accommodation Manual, Section XX, Railroads, as well. In addition, the Project lines will cross a privately-owned railroad in Stark pursuant to agreements with the St. Lawrence and Atlantic Railroad. The Project will also cross federal land in Franklin, Hill, and New Hampton pursuant to an easement to be issued by the U.S. Army Corps of Engineers ("USACE") in connection with the review of the Clean Water Act Section 404 Permit application.

NPT will construct six transition stations on land that is the subject of the first lease option agreement described above and that is located in Pittsburg, Clarksville, Stewartstown, Bethlehem, and Bridgewater, and will also construct a converter terminal on such land in Franklin, in order to HVDC power to AC power. The lease option agreement also includes the necessary land rights needed to expand the existing PSNH easement in Pembroke to meet FAA requirements by keeping NPT's proposed structure heights at or below those of existing transmission structures in that segment.

PSNH owns the sites of AC system upgrades required by the Independent System Operator-New England ("ISO-NE"), each of which will be located at the site of an existing PSNH substation or ROW.

Q. Please address the requirement in recently adopted Site 301.03 (c) (7) that the Application contains evidence that the Applicants have a current or conditional right of access to private property within the boundaries of the proposed energy facility site sufficient to accommodate a site visit by the Committee.

A. The direct ownership and leasehold interests of PSNH and NPT and their affiliate RPI of the privately owned properties and easements that are the basis for this Application, and that are described above, are sufficient to accommodate SEC site visits.

Q. Does this conclude your testimony?

A. Yes, it does.

BIOGRAPHICAL INFORMATION

Kenneth B. Bowes

Kenneth B. Bowes is Vice President – Engineering for Eversource Energy ("the Company"). Mr. Bowes is responsible for engineering activities for the electric transmission and distribution system including: distribution planning, distribution engineering and design, substation engineering, protection and control engineering, and the geographic information systems for electric and gas operations. Mr. Bowes establishes the reliability, asset management and system resiliency strategies for the annual program development and the five year capital program. He also manages the distributed generation, micro-grid, new technology and R&D activities for the Company. Additionally, he executes the System Resiliency Program and Single Pole Administration functions. Mr. Bowes serves as the lead witness for regulatory proceedings and serves as the Connecticut Incident Commander for system restoration activities.

A native of New Hampshire, Bowes joined Eversource in July 1984 in the System Test department. He has held several engineering and management positions in the Energy Delivery organizations becoming the Director – Transmission and Distribution Maintenance in 1999, Director – Transmission Construction, Test, and Maintenance in 2002, Director – Transmission Projects in 2004, Vice President – Customer Operations in 2008, and Vice President of Energy Delivery in 2010.

Bowes earned a Bachelor of Electrical Engineering degree from the University of New Hampshire and a Master's Degree in Electrical Engineering from Rensselaer Polytechnic Institute. Bowes is the past Chairman of the Edison Electric Institute's Transmission Committee and presently serves on the EEI Transmission and EEI Security Committees.

PUBLICATIONS AND PREVIOUS TESTIMONY

Kenneth B. Bowes

Publications:

- Bowes K., Beehler M., “Defining the Value of the Grid”, IEEE, The Sixth Annual IEEE PES Conference on Innovative Smart Grid Technology, February, 2015
- Bowes K., Hogan J., “CL&P Explores Sustainable Solutions”, Transmission & Distribution World Magazine, January 2012, Volume 64, Number 1, pp. 24-31.
- IEEE Working Group on Nonsinusoidal Situations, "Practical Definitions for Powers in Systems with Nonsinusoidal Waveforms and Unbalanced Loads: A Discussion", 95 WM 040-6 PWRD, 1995
- IEEE Working Group on Nonsinusoidal Situations, "A Survey of North American Electric Utility Concerns Regarding Nonsinusoidal Waveforms", 95 WM 036-4 PWRD, 1995
- Bowes, K. B., "The Effects of Temporary Overvoltage (TOV) on Consumer Products", POWER QUALITY '91 USA, Official Proceedings of the Third International Power Quality Conference, Universal City, CA, September 22-27, 1991
- Bowes, K. B., Lorusso, A., "Harmonic and Power Characteristics of Electronic Ballasts for Fluorescent Lighting Applications", POWER QUALITY '90 USA, Official Proceedings of the Second International Power Quality ASD Conference, Philadelphia, PA, October 21, 29, 1990
- Anderson, L.M., Bowes, K.B., "The Effects of Power-line Disturbances on Consumer Electronic Equipment", IEEE Transactions on Power Delivery, Volume 5, Number 2, pp. 1062-65, April 1990
- Bowes, K. B., "The Effects of Power-line Disturbances on Electronic Products", POWER QUALITY '89 USA, Official Proceedings of the First International Power Quality Conference, Long Beach, CA, October 15-20-1989 (Also edited and reprinted in Power Quality Magazine - Premier V Issue)

Mr. Bowes has testified extensively in many cases in a variety of forums, including;

- Connecticut Siting Council Docket No. 292 – The Connecticut Light & Power Company application for a Certificate of Environmental Compatibility and Public Need for the construction and operation of 8.7 miles of new underground 115-kilovolt electric transmission cables extending from CL&P’s existing Glenbrook Substation in the City of Stamford, through the Town of Darien, to CL&P’s existing Norwalk Substation in the City of Norwalk;
- Connecticut Siting Council Docket No. 302 – Northeast Utilities Service Company, on behalf of The Connecticut Light and Power Company (CL&P) application for a Certificate of Environmental Compatibility and Public Need for the construction, maintenance and operation of the proposed Killingly 2G Substation at 193 Tracy Road and 227-257 Park

Road in the Towns of Killingly and Putnam, and the proposed connections to the existing #347 345-kV line and the existing #1607 and #1505 115-kV lines;

- Connecticut Siting Council Docket No. 311 – Northeast Utilities Service Company, on behalf of The Connecticut Light and Power Company (CL&P) Application for a Certificate of Environmental Compatibility and Public Need for the construction, maintenance and operation of the proposed Wilton 35A Substation at 53 Old Danbury Road in the Town of Wilton;
- Connecticut Siting Council Docket No. 326 – The Connecticut Light and Power Company application for a Certificate of Environmental Compatibility and Public Need for the construction, maintenance, and operation of a proposed substation located at Stepstone Hill Road, Guilford, Connecticut; and
- Connecticut Siting Council Docket No. 327 – The Connecticut Light and Power Company application for a Certificate of Environmental Compatibility and Public Need for the construction, maintenance, and operation of a proposed substation located off Commerce Drive, Oxford, Connecticut.
- Connecticut Siting Council Docket No. 352 – The Connecticut Light and Power Company application for a Certificate of Environmental Compatibility and Public Need for the construction, maintenance, and operation of a proposed substation located at 264 Rood Avenue and 25 Shelley Avenue, Windsor, Connecticut;
- Connecticut Siting Council Docket No. 461 - Eversource Energy application for a Certificate of Environmental Compatibility and Public Need for the construction, maintenance, and operation of a 115-kilovolt (kV) bulk substation located at 290 Railroad Avenue, Greenwich, Connecticut, and two 115-kV underground transmission circuits extending approximately 2.3 miles between the proposed substation and the existing Cos Cob Substation, Greenwich, Connecticut, and related substation improvements.

- Commonwealth of Massachusetts, Energy Facilities Siting Board, EFSB 07-4/D.P.U. 07-35/07-36, Petition of Russell Biomass, LLC. and Western Massachusetts Electric Company for a proposed project consisting of (1) an approximately 5.3-mile, 115 kilovolt transmission line from the proposed Russell Biomass generating facility in Russell to Western Massachusetts Electric Company's ("WMECo") transmission system in Westfield, and (2) a new switching station facility in Westfield.
- Connecticut Superior Court, Allyn vs. CL&P, CV-96-0109273-S;
- Connecticut Superior Court, Scanlon vs. CL&P, CV-96-0536911S;
- Connecticut Superior Court, Segalla vs. CL&P, X-04-CV-98-0117225S;
- DSV MR. SONNY: Damage to submarine electric cables in Long Island Sound. Complex, multi-party limitation of liability proceeding in U.S. District Court for the Eastern District of New York. Settled at mediation;
- Connecticut DPUC Docket No. 94-05-35 - DPUC Investigation Into Stray Voltage On Dairy Farms;
- Connecticut DPUC Docket No. 08-02-06, DPUC Investigation into The Connecticut Light and Power Company's Billing Issues;

- Connecticut DPUC Docket No. 09-12-05 - Application of The Connecticut Light and Power Company to Amend Its Rate Schedules;
- Connecticut DPUC Docket No. 10-03-08 – Investigation of the Service Response and Communications of The Connecticut Light and Power Company (CL&P) and The United Illuminating Company (UI) Following the Outages from the Severe Weather over the Period of March 12 through March 14, 2010;
- Connecticut DPUC Docket No. 10-05-09 - DPUC Investigation of the Safety of the Connecticut Light and Power Company Underground Electric Distribution System in Waterbury;
- Connecticut PURA Docket No. 11-03-07, PURA Investigation Into The Appointment Of A Third Party Statewide Utility Telephone Pole Administrator For The State Of Connecticut; and,
- Connecticut PURA Docket No. 11-09-09 - PURA Investigation of Public Service Companies' Response to 2011 Storms;
- Connecticut PURA Docket No. 12-01-07 – Application for Approval of Holding Company Transaction Involving Northeast Utilities and NSTAR;
- Connecticut PURA Docket No. 12-01-10 - Investigation into the Tree Trimming Practices of CT Utility Companies;
- Connecticut PURA Docket No. 12-06-09 - PURA Establishment of Industry Performance Standards for Electric and Gas Companies;
- Connecticut PURA Docket No. 12-07-06RE01 – Application of the Connecticut Light and Power Company For Approval of its System Resiliency Plan – Expanded Plan;
- Connecticut PURA Docket No. 12-06-12 – PURA Investigation of the Feasibility of the Establishment of a Program to Reimburse Residential Customers for Spoilage Loss of Food items or Refrigerated Medications Caused by a Lack of Refrigeration During Electric Service Outages;
- Connecticut PURA Docket No. 12-09-13 – PURA Investigation of the Best Practices of Other State Public Utility Commissions, Public Utility Companies and Municipal Utilities' Emergency Management Best Practices;
- Connecticut PURA Docket No. 12-11-07, PURA Investigation into the Performance of Connecticut's Electric Distribution Companies and Gas Companies in Restoring Service Following Storm Sandy;
- Connecticut PURA Docket No. 13-03-23, Petition of the Connecticut Light and Power Company for Approval to Recover its 2011-2012 Major Storm Costs;
- Connecticut PURA Docket No. 14-05-06 – Application of the Connecticut Light and Power Company To Amend Rate Schedules;
- Connecticut PURA Docket No. 14-07-18 – PURA Report to the General Assembly Concerning its Review of Each Electric Distribution Company’s Vegetation Management Practices;
- Connecticut PURA Docket No. 15-01-27 - Attorney General and Office of Consumer Counsel Request for Investigation of Northeast Utilities Facilities Closures in Connecticut