THE NARRAGANSETT ELECTRIC COMPANY

RIPUC Dkt. No. 3732

Testimony of

David M. Campilii, P.E.

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PREFILED TESTIMONY OF DAVID M. CAMPILII, P.E.

INTRODUCTION

Q. Please state your name and business address.

A. My name is David M. Campilii. My business address is 55 Bearfoot Road, Northboro, Massachusetts 01532.

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

A. I am employed as a Consulting Engineer by National Grid in the Underground Engineering and Operations Department.

Q. What are your responsibilities as a Consulting Engineer in the Underground Engineering and Operations Department?

A. I am responsible for the design, licensing, and construction of underground transmission and distribution facilities.

Q. Please describe your education, training and engineering background.

A. I have a Bachelor of Science degree in electrical engineering from Northeastern University, and I am a registered Professional Engineer in the State of Rhode Island. I have been working on underground transmission and distribution projects for approximately 22 years.

Q. Have you testified before the Public Utilities Commission or Energy Facility Siting Board in previous cases?

A. Yes, I testified before the EFSB on both the Manchester Street Repowering Project and the E-183 Project and before the PUC on the E-183 Project.

Q. Are you familiar with Narragansett Electric's Southern Rhode Island Transmission Project (the "Project")?

A. Yes, I am. In addition to familiarity with the overall project, I oversaw development of the underground alternatives to the proposed extension of the L190 line.

Q. What is the scope of your testimony in this proceeding?

A. The purpose of my testimony is to describe the underground alternatives which were considered as part of this Project.

Q. Are you familiar with Narragansett's Energy Facility Siting Board Application, including the Environmental Report ("ER") prepared by Vanasse, Hangen, and Brustlin, Inc. (VHB) for the Project?

A. Yes, I prepared the analysis of underground alternatives in the ER.

UNDERGROUND ALTERNATIVES

Q. Please describe the underground alternatives that you examined for the Southern Rhode Island Transmission Project.

A. Figure 5-1 to the ER, entitled "Alternative Underground Routes," is a map of the Project area that identifies underground alternatives to the Project. As discussed in Section 5.4 of the ER, three underground routes were investigated, and one of these routes was developed as a project alternative. The three routes were:

Amtrak Railroad Corridor: The AMTRAK Northeast Corridor crosses the Old Baptist Road Tap, and passes close to the West Kingston Substation. As detailed in Section 5.4.1.1 of the ER, there are significant disadvantages with using this corridor for underground transmission. The most significant issues include severe restrictions that AMTRAK would place on construction hours, and limited physical space to install a cable. Additionally, the rail corridor does not pass near the site of the proposed Tower

Hill Substation, necessitating a significant cross country or roadway network detour to supply the substation. The constructability and access issues associated with this corridor caused us to reject this alternative on a screening level.

Existing Overhead ROW Route: Use of the existing overhead ROW for an underground transmission cable was evaluated. As detailed in Section 5.4.1.2 of the ER, there are significant disadvantages with using this corridor for underground transmission. The most significant issues include extensive wetlands, wetland buffer zones, and water bodies along the ROW route. While it is possible to span many of these features with the proposed overhead line construction, underground construction would require trenching or other construction techniques through the wetland areas. Initial construction and future maintenance would be difficult, and was expected to have greater long term and short term environmental impacts than the proposed Project.

The constructability and environmental issues associated with this corridor caused us to reject this alternative on a screening level.

Public Roadway Network: An underground route utilizing the public roadway network was developed. There are existing roadways that could be used to connect between the Old Baptist Road Tap and the West Kingston Substation, as well as provide a source into the proposed Tower Hill Substation. One such route was developed, as shown on Figure 5-1 of the ER.

While there would be significant temporary issues during construction, such as traffic maintenance, the roadway network appeared to be feasible, and did not have either the significant constructability issues associated with the AMTRAK corridor or the

significant environmental issues associated with the existing overhead ROW corridor. The roadway network alternative was developed as the most suitable underground alternative to the overhead extension of the L190 line.

Q. Please explain the underground technologies you considered for this Project.

A. As detailed in Section 5.4.2 of the ER, we evaluated High Pressure Fluid Filled (HPFF) pipe type cables and Solid Dielectric cables for the underground alternative.

HPFF cables consist of three paper insulated cables installed in a steel pipe. The pipe is filled with a synthetic dielectric (insulating) fluid, which is pressurized to 200 psi. Pressurizing equipment, consisting of pumps, reservoirs, and controls are required at one or both ends of the cables.

Solid Dielectric cables are insulated with an extruded "solid" material. At 115 kV, there are two insulations used: Cross-Linked Polyethylene (XLPE) and Ethylene Propylene Rubber (EPR). This type of cable is typically installed in concrete encased conduits.

For the L190 extension underground alternative, the cable technology selected was solid dielectric. Major reasons for this included

a) The ability to match the needed cable capacity with one solid dielectric circuit, as opposed to two pipe type cables.

b) Pipe type cables would require approximately 250,000 gallons of dielectric fluid, pressurized to 200 psi, with possible environmental issues.

c) Cost and complexity were greater for the two cable pipe type system than for the single solid dielectric system.

Q. Are there operational and maintenance issues related to underground transmission lines compared to overhead lines?

A. Yes, there are several.

(a) Outage Duration: One of the biggest operational issues associated with an underground transmission line is lengthy repair times. Repair times for underground transmission lines are anywhere from 100 to 300 hours or longer. By contrast, with an overhead transmission line, failures or outages are usually corrected within 24 to 48 hours, or are only momentary in nature.

(b) Line Ratings: It can be difficult to match the power rating of an overhead line with underground cables. In this case, a very large cable would be required to match the overhead line rating. Future capacity upgrades are typically more difficult with underground lines than overhead lines.

(c) Cable Charging: Underground cables have a disadvantage of being significantly more capacitive than overhead lines. This capacitance tends to raise the voltage on the transmission system, particularly during periods of light load. If there is too much cable capacitance, voltages can reach unacceptable levels. This may require installation of additional equipment to compensate for the line charging.

Simulations of the transmission system indicate that it could absorb the 27 MVAR of line charging from the proposed cable, but that voltage regulation would be near the outer limit of the acceptable range. Additional equipment, in the form of shunt reactors, might be necessary if voltage performance became unacceptable.

(d) Reclosing: Many faults on an overhead line are temporary in nature. It is often

possible to "reclose" (re-energize) an overhead line, resulting in only a momentary outage. Faults on underground lines are almost never temporary in nature, so reclosing is not available for underground lines.

(e) Load Sharing: Underground cables have different impedance characteristics than overhead lines. If a cable is put in parallel with an overhead line, as would be the case with the L190 extension, the cable will tend to "hog" the load, resulting in possible power flow control issues. This could trigger the need for additional transmission equipment to better balance line flows.

These operational issues collectively make it more difficult and costly to incorporate underground cables into the transmission grid.

Q. Please explain the process you used to estimate the Project cost.

A. The underground transmission estimate involved several components, including overhead transmission reconductoring along the Old Baptist Road Tap, installation of a transition station along the Old Baptist Road Tap, installation of underground transmission cable from the Old Baptist Road transition station through Tower Hill Substation to West Kingston Substation, and modifications at Tower Hill Substation and West Kingston Substation to accept the underground transmission cables. Estimates for the various components were performed using a combination of historic project costs from similar projects, estimating quotations from manufacturers and installers, and visual and "literature search" assessment of route features.

The costs are study grade estimates which are expected to have an accuracy of +/- 25% and are based on a conceptual design of a project. Some costs are not included in

any of these estimates, including land acquisition costs for a transition station site along the Old Baptist Road Tap, and Allowance for Funds Used During Construction ("AFUDC").

Q. What would the estimated Project cost be if the L-190 extension were constructed Underground?

A. Table 5-4 of the ER details overall costs for the proposed Project, and also details overall costs for the Project with an underground alternative for the L190 extension. In the case of the proposed Project, the overall cost is estimated to be $25.1 million. If an underground alternative is used for the L190 extension between the Old Baptist Road tap and the West Kingston Substation, the overall project cost is estimated to be $91.4 million, an increase of approximately $66.3 million.

Q. Does this complete your testimony?

A. Yes, it does.