STATE OF CONNECTICUT

SITING COUNCIL

DOCKET NO. 468 - The Connecticut Light & Power Company d/b/a Eversource Energy application for a Certificate of Environmental Compatibility and Public Need for the Southwest Connecticut Reliability Project that traverses the municipalities of Bethel, Danbury, and Brookfield, which consists of (a) construction, maintenance and operation of a new 115-kV overhead electric transmission line entirely within existing Eversource right-of-way and associated facilities extending approximately 3.4 miles between Eversource's existing Plumtree Substation in the Town of Bethel to its existing Brookfield Junction in the Town of Brookfield; (b) reconfiguration of two existing 115-kV double-circuit electric transmission lines at Eversource's existing Stony Hill Substation in the Town of Brookfield; and (c) related substation modifications	**DOCKET NO. 468** September 15, 2016

DIRECT TESTIMONY OF JULIA FRAYER ON BEHALF OF THE CONNECTICUT LIGHT AND POWER COMPANY DOING BUSINESS AS EVERSOURCE ENERGY CONCERNING NON-TRANSMISSION ALTERNATIVES TO THE SOUTHWEST CONNECTICUT RELIABILITY PROJECT

Q. Please state your name, business affiliation and business address for the record.

A. My name is Julia Frayer. My firm's name is London Economics International LLC. My offices are located at 717 Atlantic Avenue in Boston, Massachusetts.

Q. What is your position with London Economics International?

A. I am a Managing Director at London Economics International and lead many of the firm's consulting engagements involving market analysis and infrastructure evaluation. This is the business area under which the subject matter of non-transmission alternatives ("NTAs") falls.

Q. What has been your role on the project?

A. I managed and oversaw an economic analysis of NTAs for the Southwest Connecticut Reliability Project ("Project"). The methodological approach for this analysis as well as study findings were documented in a report, entitled *Analysis of the Feasibility and Practicality of Non-Transmission Alternatives ("NTAs")*, dated March 11, 2016. A copy of the report is provided as Exhibit 4 in Volume 4 of Eversource's application in this Docket.

Q. Were all materials that bear your name prepared by you or under your supervision?

A. Yes.

Q. Do you have any additions or corrections to your report?

A. Yes, I have one correction and one clarification. Both footnote 4 on page 12 and Figure 15 on page 33 state that a capacitor bank is a more expensive option for generating reactive power, as compared to a synchronous condenser. Even though a synchronous condenser is in fact the more expensive option, this does not change the NTA analysis in

our report because, for purposes of our analysis, a synchronous condenser is needed to provide the ability to absorb and inject reactive compensation to control local area voltages.

The clarification concerns Figure 1, Row 5 on page 7, and Figure 8, Row 5 on page 20 of the report. Both of these line items refer to one of the transmission solution components for the Housatonic Valley sub-area identified in the *ISO-NE Solutions Report* as, "The substation fence will be expanded". The description of this work should have also referred to the installation of a synchronous condenser at Stony Hill Substation, which results in the need to expand the substation fence line.

Q. Can you describe the NTA analysis you performed?

A. As the starting point for LEI's analysis, Eversource system planners identified quantities of injections of power into the electrical system that would be required at particular electrical locations in the Housatonic Valley sub-area in order to eliminate the need for regulated transmission improvements in this sub-area. Eversource did not determine the types of resources and technology that could provide such injections or reductions of demand at each location; LEI made that determination. Such a determination requires consideration of the suitability of the available technologies for the particular application, including performance characteristics, cost, land requirements, and access to cooling water (if necessary), availability of fuel supplies, and other factors for developing and bringing to commercial operation a new demand reduction program or supply-side resource. Eversource planners also did not undertake to estimate the cost of the NTA solutions to be compared to the cost of the transmission solution. LEI performed all analyses regarding the suitability of available technologies and the cost of such

technologies.

Eversource planners also determined that demand-side resources alone could not properly address thermal overloads and voltage violations observed in the sub-area and, as such, could not be a technically viable alternative to the proposed transmission solution. Supply-side resources alone, however, could potentially qualify as technically feasible alternatives to the proposed solution.

Q. What information did Eversource provide to LEI regarding the quantity and locations of NTAs that would be needed?

Eversource identified the quantity and locations of NTAs that would alleviate both thermal system overloads and voltage violations in the sub-area. Specifically, Eversource planners determined that a total injection of 247 MW of power over four locations (50 MW at Stony Hill Substation; 47 MW at West Brookfield Substation in Brookfield; 50 MW at Triangle Substation in Danbury; and 100 MW at Peaceable Substation in Redding) would be required to alleviate reliability needs in the sub-area in lieu of the planned transmission upgrades. In addition to the active power requirements (MW), Eversource planners determined that these locations also require reactive power regulation of up to 16 MVAR (Stony Hill and Triangle substations), 15 MVAR (West Brookfield substation), and 33 MVAR (Peaceable substation).

Using these assumptions provided by Eversource, we examined what actual supply-side resources – whether alone or in combination with demand-side resources - could provide these energy injection amounts, and selected hypothetical technically feasible NTA technologies for cost analysis, based on performance relative to planning criteria and size. "Technically feasible technologies" are those technologies that could hypothetically be

implemented based on planning criteria and technology-specific operating profiles. A technically feasible NTA technology therefore meets the reliability issues being addressed by the proposed transmission components and is then a candidate for cost analysis. A technically feasible NTA solution may still not be practical and may face numerous challenges in commercialization which we discuss in our report. The results of our studies, as well as a detailed description of their analyses, are contained in our report.

Q. Please summarize the analysis and findings in your report.

A. Using the assumptions provided by Eversource, we considered two "cases" in our analysis: (i) an NTA solution solely based on supply-side resources ("Supply Case") and (ii) an NTA solution combining both demand and supply-side resources ("Combination Case"). In light of the determination by Eversource planners that demand-side resources alone would not be sufficient to address reliability concerns, we decided to include a Combination Case in the alternative analysis to determine whether combining both demand and supply-side resources would lower the costs associated with an NTA solution.

In both the Supply Case and the Combination Case, we identified supply-side resources, including slow discharge batteries, peaker aeroderivatives, and fuel cells, as technically feasible NTA technologies at all four substations serving as the injection points. The assessment of technical feasibility included the ability to provide reactive power instantaneously. In the Combination Case, energy efficiency resources (limited to load availability and load reduction capability) were assumed by default to be part of the NTA solution, and as such would cover a portion of the megawatt requirement, while a supply-side resource would address the remainder of the energy requirement, as well as provide

reactive power to ameliorate voltage issues. Some technologies, such as gas-fired aeroderivative peakers feature this capability by design; however, providing reactive power instantaneously would require the plant to be constantly running. We assumed that all the considered technologies (including engine-based technologies such as gas-fired generation) would need to be accompanied by a synchronous condenser to address the instantaneous nature of the voltage requirement. Although we explored the technical feasibility of solar photovoltaic (PV) as a NTA at the considered locations, such technology was excluded from the analysis due to cost, the volume of nameplate capacity needed, and the associated land requirements.

We then assessed whether the technically feasible NTAs could be cost-effective and practical, employing industry-standard levelized costing principles to select the least-cost NTA technology for each location from the group of technically feasible NTA technologies. Since no merchant sponsor has proposed to build the NTAs, and the NTAs would not generate a return that would attract private investors, we assumed that they would be built only if their net costs were paid for by electric ratepayers. We estimated the net direct cost of the NTAs to Connecticut ratepayers by deducting expected average annual market-related revenues from levelized annual gross costs of investment (including capital and operating costs).

The tables below summarize the total requirements and technically feasible NTA technologies, by substation:

Supply Case - List of Qualified Technologies and Requirements for Each Substation

Substations	Stony Hill	West Brookfield	Triangle	Peaceable
Requirements at substation (MW)	50	47	50	100
Requirements at substation (MVAR)	16	15	16	33
NTA Technologies (nameplate rating):				
Aeroderivative Peaker (MW)	59	55	59	118
Synchronous Condenser (MVAR)	25	25	25	50

Note: Capacity of NTA technologies were sized to reflect requirements and performance of the selected NTA technology as well as minimum scale constraints if any.

Combination Case - List of Qualified Technologies and Requirements for Each Substation

Substations	Stony Hill	West Brookfield	Triangle	Peaceable
Requirements at substation (MW)	50	47	50	100
Requirements at substation (MVAR)	16	15	16	33
NTA Technologies:				
Energy Efficiency (MW)	8	7	10	5
Aeroderivative Peaker (MW)	49	47	48	111
Synchronous Condenser (MVAR)	25	25	25	50

We determined that the least-cost NTA solution was the Supply Case, which would entail the development of 291 MW of gas-fired peakers (using aeroderivative technology) across four locations (and each of the peaking facilities would include a synchronous condenser for voltage regulation) at a direct cost to electric ratepayers totaling $53 million per year. By comparison, the direct cost to electric ratepayers for the Combination Case (combining 31 MW of incremental energy efficiency resources and 255 MW of supply-side NTA technologies) was estimated at $82 million per year.

The direct cost to electric ratepayers under both the Supply Case and the Combination Case would be significantly more than the $2.1 million per year estimated by Eversource as the Connecticut electric ratepayers allocated share of the annual revenue requirement

associated with the transmission solution for the Housatonic Valley sub-area, as identified in the *SWCT Solutions Report*. This enormous cost differential compelled the conclusion that an NTA – neither the Supply Case nor the Combined Case - would not provide a practical alternative to the transmission solution.

Q. Did you consider other issues associated with the development of the Supply Case and Combined Case?

A. Yes, as noted in our report, we considered that additional costs would be associated with the development of these NTAs. For example, for any new NTA involving a gas-fired generator, new natural gas pipeline laterals would have to be constructed between the existing gas pipelines and the four substations[1] where gas-fired generation units would be needed. Similarly, the NTA estimates above do not include the cost of any electric transmission system upgrades that may be required to interconnect the NTA technologies.

Such further studies would have to evaluate the costs of interconnection and refine the estimated amount of power required (and design of the NTA) and would also have to consider a full range of the non-economic costs and benefits of the NTAs, compared to those of the transmission solution. For instance, the environmental effects of the NTAs (e.g., noise impacts and air emissions from the aeroderivative and combined cycle gas turbine [CCGT] plants) would have to be specifically determined and subsequently compared to those of the transmission alternative, which are extensively described in the Application (refer to Section 6). In addition, forward-looking simulation modeling would have to be performed to assess the relative longevity of both the transmission solution and

[1] Although Stony Hill Substation is located comparatively near a natural gas pipeline (less than 0.1 mile), the West Brookfield Substation is about 1.3 miles from the nearest gas pipeline, while Triangle Substation and Peaceable Substation are located 1.5 miles and 8.2 miles, respectively, from the nearest gas pipelines.

the potential NTA technologies, and to compare the various services and other benefits that each could provide.

In fact, the least cost technically feasible NTA solution was estimated to cost Connecticut ratepayers significantly more than the portion of the annual cost of the transmission solution payable by Connecticut end-use customers. Furthermore, there are a host of practical impediments to developing and bringing to fruition an NTA solution. There are also questions related to the development process itself, as no private developer to date has shown interest in bringing to market an NTA that would fit the technological requirements and geographical requirements of the necessary NTA solution. Based on these findings, I could not conclude that there was a viable, cost effective alternative to the Project.

Q. Has there been any new information that could possibly change any inputs or assumptions in your analysis?

A. Markets are constantly evolving. Although we had considered market information from FCA 10, and information from state filings regarding cost of energy efficiency from December 2015, other inputs into our analysis have not been updated since 2015. However, I don't believe this will materially impact the report's overall findings regarding the big differential between the levelized costs of a potential NTA solution relative to the transmission solution or otherwise reduce the practical challenges of bringing forth an NTA.

Q. Does that conclude your testimony?

A. Yes