STATE OF VERMONT
PUBLIC SERVICE BOARD

Petition of Champlain VT, LLC d/b/a TDI New England for a Certificate of Public Good, pursuant to 30 V.S.A. §248, authorizing the installation and operation of a high voltage direct current (HVDC) underwater and underground electric transmission line with a capacity of 1,000 MW, a converter station, and other associated facilities, to be located in Lake Champlain and in the Counties of Grand Isle, Chittenden, Addison, Rutland, and Windsor, Vermont, and to be known as the New England Clean Power Link Project ("NECPL")	)))))))))	Docket No. _____

PREFILED DIRECT TESTIMONY OF LARRY ENG, P.E.

ON BEHALF OF CHAMPLAIN VT, LLC

December 8, 2014

Summary:

Mr. Eng describes the interconnection facilities contemplated for the NECPL, and the studies that are presently being conducted in consultation with ISO-NE and several regional electric transmission owners. Mr. Eng then discusses the NECPL in relation to 30 V.S.A. §§ 248(b)(3) (System Stability and Reliability) and 248(b)(10) (Existing or Planned Transmission Facilities).

Exhibit Number	Name of Exhibit
TDI-LE-1	Resume of Larry Eng
TDI-LE-2	One Line Electrical Diagram
TDI-LE-3	HVDC Product Description (ABB)
TDI-LE-4	HVDC Cable Design (ABB)
TDI-LE-5	Scope of Study for SISs (ISO-NE)

Q1. Please state your name, occupation, and business address.

A1. Response:

My name is Larry Eng. I am a Staff Consultant with Siemens Industry Inc., Power Technologies International ("Siemens PTI"). My office address is 400 State Street, Schenectady, New York 12301.

Q2. What is your connection to TDI New England and the New England Clean Power Link Project?

A2. Response: My employer, Siemens PTI, has been retained by Champlain, VT LLC d/b/a TDI New England ("TDI-NE") to review the potential system impacts on the New England and Vermont transmission system that may be associated with the construction and operation of the New England Clean Power Link Project ("NECPL"), and to perform an Elective Transmission Upgrade System Impact Study ("SIS"). The SIS is being conducted in consultation with ISO-NE and several regional transmission owners ("TOs"), including the Vermont Electric Power Company ("VELCO"). The SIS is examining the potential impacts on the bulk electric power system in Vermont and New England, and will identify the interconnection facilities and network upgrades that will be required to interconnect and operate the NECPL in compliance with applicable reliability criteria.

Q3. Please describe your qualifications and expertise.

A3. Response: I have more than 39 years of experience in power systems studies of high voltage power system (23 kV and above). I graduated from Rensselaer Polytechnic

Institute in 1973 with a Master of Engineering Degree in Electric Power Engineering and started my career in the power industry at Niagara Mohawk Power/National Grid in June 1973 and retired in 2005. Over the 32 years, I have performed or directed studies for the interconnection of over 4500 MW of generation and over 200 miles of 345 kV transmission lines. I have held the chairman's position the Northeast Power Coordinating Council's Task Force on System Studies and Task Force on Coordinated Planning. I have also worked on the proposed Champlain Hudson Power Express Project ("CHPE") on behalf of Transmission Developers, Inc. (an affiliate of TDI-NE). My educational background and business experience is summarized in ***Exhibit (Exh.) TDI-LE-1***.

Q4. Have you previously testified before the Public Service Board or in other judicial or administrative proceedings?

A4. Response: No I have not testified before the PSB. I have testified before the New York State Department Public Service in the following cases:

- Case 70126, Power Authority of the State of New York, Application for the Marcy South 345 kV Transmission Facilities.
- Case 91-T-1152, Selkirk Cogen Partners, L.P., Application for the 345 kV Electric Transmission Line in the Town of Bethlehem, Albany County.
- Case 92-T-0114, Niagara Mohawk Power Corporation, Application for the Independence Station-Clay 345 kV Transmission Line Project.
- Case 93-E-0912, Proceeding on Motion of the Commission to Review Long-Run Avoided Cost Estimation Policies and Methods.

- Case 93-E-1075, Proceeding on Motion of the Commission to Establish a Process for Setting the Fuel Targets and Buy-Back Rates of all Electric Utilities on an Annual Basis.
- Case 94-E-0098, Niagara Mohawk Power Corporation 1995 Rate Case.
- Case 97-F-1563, Application by Athens Generating Company, L.P. for a Certificate of Environmental Compatibility and Public Need to Construct a 1080 MW natural gas-fired combined cycle combustion turbine generating plant, in the Town of Athens, Green County.
- Case 03-T-0644, Niagara Mohawk Power Corporation – BesiCorp 345 kV Transmission Line.
- Case 10-T-0139, Application of Champlain Hudson Power Express, for a Certificate of Environmental Compatibility and Public Need Pursuant to Article VII of the PSI, for the Construction, Operation and Maintenance of a High Voltage Direct Current Circuit from the Canadian Border to New York City.

Q5. What is the purpose of your testimony?

A5. Response: The purpose of my testimony is to discuss the electrical components of the NECPL and to describe the process by which the specific transmission upgrades required for the NECPL will be identified. My testimony discusses how the NECPL will be interconnected to the existing electric infrastructure in Vermont in a manner that does not adversely affect system stability and reliability. I then discuss the NECPL's compliance with 30 V.S.A. §§ 248(b)(3) (System Stability and Reliability) and 248(b)(10) (Transmission Facilities).

Q6. What work have you conducted in connection with the NECPL's electrical configuration and its interconnection to the existing electrical grid?

A6. Response: As noted below, I performed the initial screening studies that led to the identification of the Coolidge 345 kV substation as the optimal location at which the NECPL should interconnect to the Vermont transmission system. I have subsequently been working with ISO-NE and the TOs to perform the SIS. In accordance with the study agreement executed by TDI-NE in December 2013, the final report for the SIS will include the following:

- Identification of any circuit breaker or other facility short circuit capability limits exceeded as a result of the interconnection and operation of the NECPL;
- Identification of any thermal overload of any transmission facility or system voltage limit violations resulting from the interconnection and operation of the NECPL;
- Identification of any instability or inadequately damped response to system disturbances resulting from the interconnection and operation of the NECPL; and
- Specification of the upgrades to the New England transmission system that would be required to mitigate any reliability issues identified in the study.

A more detailed description of the SIS is provided in subsequent sections of my testimony.

Once completed and approved by ISO-NE, the results of the SIS will form the basis for the NECPL's specific interconnection requirements. Steady state and short circuit analysis completed to date have not indicted any reliability issues which cannot be adequately mitigated.

Additionally, I have reviewed the pre-filed direct testimony and exhibits of the TDI-NE overview panel (Jessome, Martin, and Bagnato) in this proceeding. I am familiar with all parameters of the NECPL that are relevant to its interconnection with the electric grid.

Q7. Has Siemens PTI performed System Impact Studies for ISO-NE in the past?

A7. Response: Yes. Siemens PTI has completed over 100 system impact or feasibility studies of proposed generation or transmission projects for ISO New England, from 2006 to the present. These have included power flow, steady state, short circuit and transient stability-analyses, as needed. Interconnection studies underway in July 2014 for ISO New England include six system impact or feasibility studies for proposed interconnections in Connecticut and Maine, for generation types including wind, hydro, combined cycle and combustion turbine. We have performed many other transmission planning studies as well for ISO New England over the years. In 2012, we provided services to update ISO New England's dynamic simulation database and train their engineers to do so themselves. ISO-NE engineers have attended numerous short courses at Siemens PTI's offices. In addition, Siemens PTI has also presented several short courses, at their request, at their facilities in Holyoke, MA.

Q8. Have you relied on the work of any other experts concerning the NECPL?

A8. Response: No. All of the work regarding my testimony has been either been performed by me personally or by other staff at Siemens PTI under my supervision.

Q9. Please describe the major categories of the NECPL's electrical components, including those elements required for reliable interconnection and operation, and how interconnection will be accomplished.

A9. Response: Within New England, three categories of transmission facilities are required to reliably interconnect and operate the NECPL for delivering energy from Quebec to loads within New England.

The first category of transmission facilities is the set of electrical components that comprise the NECPL itself, including:

- The HVDC cable system that will extend from the Quebec/Vermont border to the Vermont HVDC Converter Station to be located in Ludlow, Vermont. HVDC energy will be transmitted from the Quebec/Vermont border to the Vermont HVDC Converter Station over this cable system;
- The Vermont HVDC Converter Station to be located in Ludlow Vermont, at which the HVDC energy received from Quebec will be converted into HVAC energy that can be injected into the New England transmission system; and

- A buried HVAC electrical cable that will connect the Vermont HVDC Converter Station to VELCO's 345 kV Coolidge substation in Cavendish, Vermont and will deliver the HVAC energy to the New England grid.

These transmission facilities (the "Project Facilities") will be directly designed, engineered, procured, constructed, financed, owned, and maintained by TDI-NE or its contractor(s). ISO-NE will have operational control of the Project Facilities.

More detailed information on the HVDC Project Facilities can be found in the prefiled testimony and exhibits of Jessome/Martin/Bagnato and Alan Wironen.

The second category of transmission facilities is the modifications at VELCO's Coolidge substation that will be required to reliably interconnect the NECPL to the Vermont transmission system. These transmission facilities will be designed, constructed, owned, operated and maintained by VELCO or its contractor(s), pursuant to an interconnection agreement that will be executed between VELCO and TDI-NE. Under that agreement, TDI-NE will fund all of the capital and operating costs of these "Direct Interconnection Facilities."

The third category of transmission facilities are any upgrades to other portions of the Vermont or New England transmission system that are required to reliably interconnect and operate the NECPL. These transmission facilities will be designed, constructed, owned, operated and maintained by the transmission owner whose facilities would otherwise be impacted by the interconnection and operation of the NECPL. TDI-NE will fund the capital and operating costs of these "Network Upgrades" pursuant to interconnection agreements that will be executed with the relevant transmission owners.

Below, I provide a high-level overview of each category of transmission facilities, and describe the process by which the required Direct Interconnection Facilities and the Network Upgrades will be determined.

Finally, within the Province of Quebec, additional transmission facilities will be developed in conjunction with the NECPL. Those Canadian transmission facilities will include:

- The Quebec HVDC Converter Station, at which HVAC energy is withdrawn from the Quebec transmission system and converted into HVDC energy;
- HVDC electrical conductor (in the form of overhead transmission lines, buried cable, or some combination thereof) that will transmit the DC energy from the sending Converter Station to the Quebec/Vermont border; and
- Any network upgrades required in Quebec to reliably interconnect and operate the Canadian HVDC facilities.

The full extent and design of these Canadian transmission facilities will be determined by an interconnection study that is currently being performed by TransEnergie, the transmission division of Hydro-Quebec, pursuant to an interconnection request that TDI-NE submitted to TransEnergie on October 3, 2013. None of the costs of the Canadian transmission facilities will be included in transmission rates within New England. See page 14 of the HQT Impact Study Queue, items 171T and 177T. http://www.oatioasis.com/HQT/HQTdocs/List_Impact_Studies.pdf.

Q10. Please describe the Project Facilities.

A10. Response: As noted above, the Project Facilities will consist of a buried HVDC cable system, the Vermont HVDC Converter Station and a buried HVAC cable that will connect the Vermont HVDC Converter Station to VELCO's 345 kV Coolidge substation. The Project Facilities are described below, with references to Exhibits that provide additional information:

- General electrical configuration. The Project Facilities will consist of two buried 320 kV HVDC cables, approximately 150 miles which connects to a 1000 MW HVDC Converter Station in Ludlow, Vermont, and a 425/345 kV converter transformer 1150MVA which connects to the Coolidge 345 kV substation. See the One Line Diagram, ***Exh. TDI-LE-2***.
- HVDC technology. The Project will utilize HVDC Light technology developed by ABB, or similar technology by another entity, based on voltage source converters (VSC). The HVDC Light technology utilizes two-level converter valve with custom designed series connected press-pack insulated-gate bipolar transistors (IGBTs) which would allow the semiconductor control to turn on and turn off. This capability allow the VCS to control not only active power but also reactive power. The HVDC Classic utilizes Thyristors which only allow semiconductor control to turn on and can only control active power. The HVDC cable is a submarine cable rated at +/- 320 kV with a 2,500mm^2 cross-section cooper conductor and semi-conductive polymer insulation. ***See Exhs. TDI-LE-3 (ABB Overview) and LE-4 (ABB Cable Design).***

- Converter Station equipment. See the prefiled direct testimony of Jessome/Martin/Bagnato and ***Exh. TDI-JMB-9***.

While the information on the Project Facilities that I have provide above and in the referenced exhibits is being reviewed and refined by TDI-NE, ISO-NE and others, I do not expect that the final design of these facilities will materially change.

Q11. Are there specific benefits or advantages that arise from the NECPL's use of HVDC technology?

A11. Response: Yes. Using HVDC technology to transmit power from Quebec to New England has several advantages over high-voltage alternating current ("HVAC") technology. Those benefits include:

- The ability to bury the electric cable for the entire 154 mile distance from the Vermont-Quebec border to the Converter Station utilizing HVDC technology instead of HVAC transmission lines has significant advantages regarding transmission losses. With respect to real (I^2R) losses the HVDC transmission line would have only two cables instead of three. With respect to reactive (I^2X) losses, the HVDC (I^2X) line losses would be zero. In contrast, if the Project was constructed with HVAC cables, the HVAC (I^2X) line losses would approach the capability of the transmission line and the net transfer capability through the HVAC cable would be reduced to zero.
- The ability to precisely and continuously control the flow of energy over the NECPL by directly controlling the power electronics at the HVDC Converter Station, thus allowing the NECPL to be fully dispatchable by ISO-NE in

accordance with the regional transmission tariff and market rules. In contrast, energy over an HVAC transmission line will flow in response to the regional pattern of generation and load and the unchanging characteristics of the HVAC transmission line. Thus, energy flow over an HVAC line cannot be directly controlled, thereby creating the potential for unplanned flows on that particular facility in response to changes in load and generation;

- The ability of the NECPL to provide or absorb up to +579 and -220 MVArs of reactive power, even when delivering 1000 MWs of real power to New England; and
- The ability of the NECPL to significantly assist ISO-NE in recovery from a major regional power outage (a "blackout"), by providing "black start" capability in Vermont. After a major regional power outage, ISO-NE would implement a system restoration plan that relies upon generators or other energy sources that are capable of resuming operation without drawing "startup electricity" (*e.g.,* electric power needed to operate control and cooling systems). Not all generating units are capable of such "black start" operation, whereas the NECPL will include the equipment necessary to "self energize" after a blackout. Thus, the NECPL can materially contribute to the restoration of electric service to New England following a regional power outage. TDI-NE will work with ISO-NE to try and incorporate the NECPL's capabilities into ISO-NE's system restoration plan.

Q12. Are you familiar with the CHPE Project?

A12. Response: Yes, Siemens PTI has performed the same role for the CHPE as we are currently performing for the NECPL. CHPE is a proposed HVDC transmission line that will begin at the Canadian border and terminate in New York City. It will run underwater in Lake Champlain and in other water bodies, and underground elsewhere, and eventually terminate at a converter station in New York City.

Q13. Are there any electrical transmission system reliability issues which would preclude the installation of the CHPE and the NECPL cables in a single trench in Lake Champlain?

A13. Response: Yes. The installation of the CHPE and NECPL cables in a single trench would significantly increase the probability of a single common mode that could cause the outage of both cables. The loss of the two cables would result in the loss of 2000 MW of energy resources to Eastern New York and New England. The reliability impact of such a contingency was first studied with the proposal to construct a 2000 MW HVDC from Raddison, Quebec to Sandy Pond, New Hampshire, commonly called the New England Phase II HVDC transmission line. Extensive studies[1] were conducted by three Regional Reliability councils -- Mid Atlantic Area Council, East Central Area Reliability, and Northeast Power Coordinating Council (MEN) -- because of the potential that the loss of 2000 MW in Eastern New York and New England would cause a major blackout to the three Reliability Regions. The results of the studies led to an

[1] *See* Overall Reliability Review of the Hydro-Québec/NEPOOL Phase II Interconnection, NPCC Task Force on System Studies, SS-32 Working Group on Reliability Review, Steering Committee Study No. 6, Final Report, June 3, 1988; 1990 Summer Interregional System Performance – Part 2 Dynamic Analysis, MAAC-ECAR-NPCC (MEN) Study Committee, April 1988; New York ISO, "Analysis of Hydro- Québec Transfers Above 1,200 MW", June 2000.

inter-Area (PJM, NY, NE) operating procedure which limits the transfer on the Phase II HVDC line (ISO-NE Attachment G – Procedure to Protect for the Loss of Phase II Imports). Thus, in my opinion the CHPE cables and NECPL cables should be constructed in separate trenches with sufficient separation to preclude the single common mode outage of both sets of cables.

Q14. Who will be responsible for operating and maintaining the Project Facilities?

A14. <u>Response:</u> TDI-NE will maintain all of the Project Facilities, and will recover the costs associated with the Project Facilities through the sale of transmission capacity to willing buyers.

ISO-NE will have day-to-day operational control of the Project Facilities. Because ISO-NE is responsible for the reliable and economical operation of the integrated New England bulk power system, this arrangement will ensure that the day-to-day operation of the Project Facilities complies with all applicable reliability criteria, and that the Project Facilities will be operated in accordance with the transmission tariff and market rules that are administered by ISO-NE.

Q15. Please describe the Direct Interconnection Facilities.

A15. <u>Response</u>: The Direct Interconnection Facilities are anticipated to include the following:

- Reconfiguration of Coolidge substation to add a new 345kV circuit breaker in the breaker bay of the existing Coolidge-Newfane 345kV line or add a new breaker bay with two new 345 kV circuit breakers; and

- Upgrade the Coolidge 345 kV system protection for the station and line protection equipment.

TDI-NE will fund, via the interconnection agreement with VELCO, the cost of modifying the Coolidge substation and equipment therein to reliably interconnect and operate the NECPL.

While the information on the Direct Interconnection Facilities that I have provide above and in the referenced exhibits is being reviewed and refined by TDI-NE, ISO-NE and others, I do not expect that the final design of these facilities will significantly change. However, as described below, the Direct Interconnection Facilities will only be definitively determined when the SIS has been completed and approved. Since the SIS is still being completed and reviewed, the final configuration of the Direct Interconnection Facilities may vary somewhat from the description provided above.

Q16. Who will be financially responsible for the Direct Interconnection Facilities?

A16. Response: As stated in the prefiled direct testimony of Jessome/Martin/Bagnato, while the Direct Interconnection Facilities will be designed, constructed, owned, operated and maintained by VELCO, TDI-NE acknowledges that it will be financially responsible for all of the capital and operating costs associated with the Direct Interconnection Facilities, pursuant to the contemplated interconnection agreement between TDI-NE and VELCO.

Q17. What is the purpose of the Network Upgrades?

A17. Response: As discussed in the section describing the Direct Interconnection Facilities, the interconnection of a new large source of electrical energy to the Vermont transmission system (such as the NECPL) will require new and/or upgraded transmission facilities at the point of interconnection, in order to allow energy to be reliably injected into the Vermont transmission system. However, the potential effects of large amounts of energy injections may not be geographically limited to the point of interconnection.

Since electrical energy flows freely over the integrated bulk power system in accordance with the physical characteristics of the transmission system, energy injections at any single point may have reliability implications at other points on the interconnected transmission system, including points that are relatively distant from the point of injection. A key objective of the interconnection studies that are performed before any new facility is added to the transmission system is to ensure that all elements of the bulk power system are expected to operate within their allowable ratings, both under normal and unexpected ("contingency") system conditions. If the addition of a new generator or a new transmission element has the potential to cause any "distant" component of the transmission system to exceed its applicable rating during either normal or contingency system conditions, then an appropriate solution to that potential "overload" must be identified. Whether the appropriate solution is to either add new transmission facilities (*e.g.,* a series reactor to address potential voltage concerns) or upgrade existing transmission facilities (*e.g.,* replacing the electrical conductor on an existing transmission line with a new conductor with a higher capacity), those modifications (or "Network

Upgrades") must be completed and placed into service before the new generator or new transmission facility can be reliably operated.

Thus, Network Upgrades are those modifications to the New England transmission system that (a) are required to meet the interconnection and reliability criteria enforced by ISO-NE and (b) are not Direct Interconnection Facilities that are geographically proximate to the point of interconnection.

Q18. What are some examples of Network Upgrades?

A18. <u>Response:</u> Network Upgrades could include any of the following types of upgrades or modifications:

- Modifying the equipment at electrical substations other than the Coolidge substation (*e.g.,* replacing a circuit breaker at a distant substation with a higher capacity circuit breaker);
- Modifying the control and protection settings for specific facilities;
- Repairing or refurbishing an existing transmission line to allow a higher operating rating (*e.g.,* increasing the clearance between the live transmission conductor and potential grounding points by "retensioning" the conductor);
- Replacing the electrical conductor on an existing transmission line with electrical conductor of a higher capacity (known as "reconductoring a line");
- Adding specific bulk power facilities such as reactors, capacitors or regulating transformers at specific locations on the transmission system; and
- Other modifications to the transmission system that may be necessary to meet applicable reliability criteria.

Q19. How are the Network Upgrades required to interconnect a new generator or new transmission facility to the New England bulk power system identified?

A19. <u>Response:</u> The process of identifying all of the upgrades required to interconnect a new generator or a new transmission facility such as the NECPL begins with the submission of an Interconnection Request to ISO-NE. That request describes the facilities that would be interconnected to the New England transmission system, the location of the interconnection, and the anticipated date of initial commercial operation. The interconnection request also provides detailed information regarding the specific equipment that would be interconnected to the system. All of this information is required to perform the SIS that will specify the Direct Interconnection Facilities and the Network Upgrades required to reliably interconnect and operate the new facility.

Q20. Has TDI-NE submitted an interconnection request for the NECPL to ISO-NE?

A20. <u>Response:</u> Yes. On September 23, 2013, TDI-NE submitted an interconnection request to ISO-NE for the interconnection of the NECPL at the Coolidge substation. ISO-NE assigned a "queue number" of 425 to that interconnection request, and TDI-NE has executed an Elective Transmission Upgrade System Impact Study Agreement with ISO-NE, under which TDI-NE is funding the development of the SIS. Siemens PTI has been engaged by TDI-NE since October 2013 to perform the SIS, under the direction of ISO-NE, in consultation with ISO-NE and the Transmission Owners.

Q21. Please describe the SIS in more detail.

A21. Response: The SIS includes several individual studies that examine the performance of the New England bulk power system under normal and contingency conditions. Those individual studies include:

- A steady state analysis thermal and voltage study;
- A dynamic stability study;
- A short circuit study; and
- Other studies that may be specific to the individual project under consideration (*e.g.,* system protection and relaying studies).

I and other staff at Siemens PTI that are under my direct supervision are performing these studies for the NECPL, under the direction of ISO-NE and in consultation with ISO-NE and the Transmission Owners.

Q22. **What criteria are being used for the SIS?**

A22. Response: The study is being performed in accordance with the following standards:

- Northeast Power Coordinating Council (NPCC) Directory #1 "Design and Operation of Interconnected Power Systems";
- ISO-NE Planning Procedure No. 3, "Reliability Standards for the New England Area Bulk Power System";
- ISO-NE Planning Procedure No. 5-3, "Guidelines for Conducting and Evaluating Proposed Plan Application Analyses";

- ISO-NE Planning Procedure No. 5-6, "Scope of Study for System Impact Studies under the Generation Interconnection Procedures"; see ***Exh. TDI-LE-5;*** and
- ISO-NE Operating Documents.

Q23. Has the SIS been finalized?

A23. Response: No. While much of the analyses have been completed and discussed with ISO-NE and the Transmission Owners and a draft version of the final SIS report is being reviewed by those parties, the SIS has not yet been finalized. Since the specific Network Upgrades that are required to reliably interconnect and operate the NECPL are only identified when the SIS is completed and approved by ISO-NE, the specific list of the Network Upgrades (and the confirmation of the anticipated Direct Interconnection Facilities) will not be known until that time.

Q24. When do you anticipate that the SIS be finalized and approved by ISO-NE?

A24. Response: Based on the significant amount of work that has been accomplished to date, I anticipate that the SIS will be finalized and approved by ISO-NE sometime in the first quarter of 2015. The exact date will depend on whether any revisions to the draft report are required, and on when the relevant committee meetings occur.

Q25. Once the SIS is finalized and approved, how will the specific list of Network Upgrades and the confirmation of anticipated Direction Interconnection Facilities be communicated to the PSB?

A25. Response: Once the SIS has been finalized and approved, I will submit supplemental testimony that will:

- Discuss any changes to the Project Facilities or the Direct Interconnection Facilities from the information provided in this testimony; and
- Describe the Network Upgrades that are required.

I anticipate being able to submit that supplemental testimony shortly after the final SIS is approved.

Q26. Who will be financially responsible for any Network Upgrades, whether located within the VELCO transmission system or elsewhere?

A26. Response: As stated in the prefiled direct testimony of Jessome/Martin/Bagnato, while the Network Upgrades will be designed, constructed, owned, operated and maintained by VELCO or another Transmission Owner, TDI-NE acknowledges that it will be financially responsible for all of the capital and operating costs associated with the Network Upgrades, to the extent required by ISO-NE rules, pursuant to the contemplated interconnection agreement between TDI-NE and the applicable Transmission Owner.

Q27. What alternatives to interconnection at the VELCO Coolidge station were considered from an electrical system perspective and how was this interconnection point ultimately chosen for the NECPL?

A27. Response: Coolidge substation is the closest point to Lake Champlain with two 345 kV transmission circuits (needed to transmit 1000 MWs of energy to loads in Vermont and New England). In addition, interconnection at any 345 kV substation closer to Lake Champlain would have required the construction of new 345 kV overhead transmission from that interior point of interconnection to Coolidge substation. See also the prefiled direct testimony of Jessome/Martin/Bagnato.

30 V.S.A. § 248(b)(3) – System Stability and Reliability

Q28. In light of the information available to date, in your opinion can the NECPL be constructed and operated so as not to adversely affect system stability and reliability?

A28. Response: Yes. In my professional opinion, interconnection and operation of the NECPL should not result in an adverse impact on the transmission system stability or reliability because mitigation measures can be developed to relieve overloads on critical transmission facilities or the NECPL output could be modified by ISO-NE if necessary to ensure the New England transmission system is operated in accordance with applicable reliability criteria.

30 V.S.A. § 248(b)(10) – Transmission Facilities

Q29. In light of the information available to date, in your opinion can the NECPL be served economically by existing or planned transmission facilities without undue adverse effect on Vermont utilities or customers?

A29. Response: Yes. In my professional opinion, the NECPL can be economically served by the combination of existing transmission facilities and the upgrades that will be determined by the SIS, without undue adverse effect on Vermont utilities or customers.

Q30. Does this conclude your testimony at this time?

A30. Response: Yes