STATE OF VERMONT
PUBLIC SERVICE BOARD

Docket No.	
	)
Petition of Vermont Transco LLC and Vermont	)
Electric Power Company, Inc., requesting a	)
certificate of public good, pursuant to 30 V.S.A.	)
§ 248, authorizing the construction of the PV20	)
Cable Replacement Project	)

PREFILED TESTIMONY AND EXHIBITS OF
EDWARD MCGANN
ON BEHALF OF
VERMONT TRANSCO LLC & VERMONT ELECTRIC POWER COMPANY, INC.

September 8, 2015

Mr. McGann's testimony describes the proposed submarine cable, its termination station, and the design plans for the connecting overhead transmission line associated with the PV20 Cable Replacement Project.

Table of Contents

EXHIBITS

Introduction

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

A1. My name is Edward McGann. I am the Manager of Engineering for Vermont Electric Power Company, Inc. and Vermont Transco LLC (collectively referred to as "VELCO") and I am responsible for the overall technical design of VELCO's transmission facilities. I have served in an engineering capacity for VELCO since 2004 and have recently assumed the role of Manager of Engineering. My business address is 366 Pinnacle Ridge Road, Rutland, Vermont 05701.

Q2. Please describe your educational background and professional experience.

A2. I received my Bachelor of Science degree in Electromechanical Engineering Technology from Vermont Technical College in 1999. I have been employed by VELCO since 2004. Specific information regarding my work experience is detailed in my resume, attached as Exhibit Petitioner EM-1.

Q3. Do you hold any professional licenses or certifications?

A3. Yes, I am registered as a Professional Engineer in the State of Vermont.

Testimony Overview

Q4. What is the purpose of your testimony?

A4. My testimony describes the design for the proposed PV20 Project.

Project Engineering and Design

Q5. Please describe the existing submarine cable.

A5. The existing submarine cable system consists of four (4), 115 kV, 500 kcmil cables (made up of three (3) phase cables and one (1) spare cable) installed in 1958, and three (3), 1,000 kcmil cables installed in 1970. The cables are terminated in stations located in Grand Isle VT and Plattsburgh, NY. One of the original 500 kcmil cables failed in 1969 as a result of thermal overload. The failed cable was removed from service and a forty (40) foot section of the failed cable was cut and removed for factory failure analysis. The remaining portions of the cable were capped and the cable remains in place today. In 1970 the three (3) 1000 kcmil cables were installed to attain an increased circuit capacity rating. The submarine portion of the PV20 circuit is currently made up of one (1) 500 kcmil and one (1) 1000 kcmil cable per phase.

Each cable is a low-pressure fluid-filled cable design with oil-permeated insulating paper. Cable pressurization is achieved with gravity fed oil-filled reservoirs connected to each cable located at each terminal station. The existing 500 kcmil cables are trenched approximately 2 feet below grade and spaced approximately 6 feet on center from each terminal station out to approximately 200 feet past the lake shore while the existing 1000 kcmil cables are spaced approximately 50 feet on center out approximately 500 feet past the lake shore.

The submarine portion of the cables were originally laid on the lake bottom where they sank into the mud and were covered with up to approximately two (2) feet of silt. Since installation portions of the cables have varying depths of silt coverage with instances exceeding four (4) feet. Mr. Mallory's testimony details the age and condition of the existing cables and related termination station equipment, and the need for them to be replaced.

Q6. Please describe the proposed replacement submarine cable system.

A6. The proposed submarine cable system will consist of four (4) 3,553 kcmil XLPE cables (three (3), single phase cables and one (1), single spare cable), rated at 230 kV and operated at 115 kV. Mr. Mallory's testimony provides further details on the choice for using cable with a 230 kV rating.

The proposed cable size is designed to meet a 300 MVA continuous rating. The 300 MVA criteria meets the existing 262 MVA rating with additional margin for load growth uncertainty and compatibility with VELCO's standard 115 kV overhead line design. The submarine cables will transition to overhead transmission conductors at the terminal stations at each end of the cable system. The proposed terminal stations will be designed and rated for 230 kV with the exception of the lightning arresters and instrument voltage transformers which must be rated according to the proposed operating voltage of 115 kV . Within

Lake Champlain the new cables are to be placed approximately 30 feet to the north of the existing cables. The proposed cable separation arrangement requires 300 foot spacing between the two inner cables and 50 foot spacing between the outer cables as per the replacement submarine cable plan and profile drawings, see attached Exhibit Petitioner EM-2. The proposed 50 feet cable spacing is required for the submarine jet plowed portion of the cable lay and this spacing is retained for the remaining submarine line segment routed at depths greater than 100 feet. The 300-foot spacing allows room to install a repair segment to a failed cable and maintain the desired 50 feet cable spacing to an adjacent cable when the cable is laid back into the lake. Fiber optic cable used for submarine cable temperature monitoring and protective relaying will be lashed to each of the four submarine cables, terminated at the New York termination station and connected to the VELCO fiber network at the Vermont termination station.

Q7. Please describe the new terminal stations.

A7. New, replacement terminal stations will be built at each end of the submarine cables to transition the submarine cable to the existing overhead transmission lines. The new Grand Isle terminal station is proposed to be located adjacent to the existing terminal station and will have a footprint of approximately 110' x 119'. The terminal station will contain structures for the submarine cable termination, disconnect switches, lightning arresters, instrument current and

voltage transformers, and the termination of the existing, rerouted 115 kV overhead transmission line. The station will also include a building measuring approximately 12'(W) x 16'(L) x 16'(H) to house equipment for cable fault targeting relays, optical cable temperature measurement equipment, metering, remote monitoring (SCADA), station security, fiber optic communications, and associated ancillary systems. Yard lights will be installed at the station to provide for safe access and operation of yard equipment. The yard lights mounted to the building, perimeter fence and steel structures will be high efficiency Light Emitting Diode (LED) down-lights. The light mounted to the building will be controlled via a photocell while lights mounted to the perimeter fence and steel structures will be manually switched remotely by SCADA or by on-site personnel only during emergency and security response events. Exhibit Petitioner EM-3.

Q8. Does VELCO plan to make any changes to the grading of the terminal station site?

A8. Yes, VELCO will make minor grading changes to the site to accommodate the terminal station and its driveway. VELCO will construct an approximately 840-foot long access drive (generally 16-feet wide) off of Vermont Route 314. The site grading plan is offered within Exhibit Petitioner EM-3. The Vermont Agency of Transportation has already approved the access (permit ID# 39045).

Q9. Please describe the proposed changes to the existing overhead section of the PV20 transmission line, otherwise known as the "K20" line.

A9. Two existing 115 kV structures will be rebuilt to connect the existing transmission line to the new terminal station. Structure 283 will be relocated from the existing terminal station to a location just east of the new Grand Isle terminal, and it will be rebuilt as a guyed dead-end structure. Structure 282 will be relocated slightly east within the existing VELCO right-of-way, and it will be rebuilt as an angle structure. These changes are driven by the need to relocate the terminal station while allowing for the most efficient use of VELCO's existing right-of-way. The existing conductor and shield wire will be reused.

The relocated structures will be horizontally configured 115 kV wood pole designs, similar to the existing overhead section of the line, with the following changes (by structure):

Structure No.	Existing Structure	New Structure
282	2-pole unguyed tangent 47.5′ above ground level	3-pole guyed angle 52′ above ground level
283	3-pole guyed dead-end 43′ above ground level	3-pole guyed angle dead-end 52′ above ground level

The heights of the two, proposed replacement structures will be increased to meet VELCO's current design criteria for conductor ground clearance and structure shielding (lightning protection). The average, above-grade height of the two replacement structures will increase from approximately 45' to 52'. Exhibit Petitioner EM-4.

Q10. Please explain how the fourth (spare) submarine cable will be connected.

A10. The proposed spare cable will be connected and energized from the Vermont end only at the new Grand Isle terminal station. Energizing the spare allows for continuous monitoring of the cable's health and availability without incurring load losses. Details of this can be seen on the electrical one-line diagram, Exhibit Petitioner EM-5, which is provided under seal pursuant to the FERC's Critical Energy Infrastructure Information protocols.

Q11. What design standards were used to design the submarine cables, transition station, and connecting overhead line?

A11. VELCO and NYPA design standards were factored into in the preliminary design of the terminal stations and overhead transmission line. VELCO's engineering design standards are based on industry standards, including the National Electrical Safety Code (NESC), Institute of Electrical and Electronic Engineers (IEEE), American National Standards Institute (ANSI) and National

Electrical Manufacturer's Association (NEMA). VELCO and NYPA utilized specialized consulting engineering services to design and develop submarine cable equipment specifications that comply with pertinent national and international cable manufacturing, testing and installation standards, including standards established by American National Standards Institute (ANSI), Association of Edison Illuminating Companies (AEIC), Insulated cable Engineers Association (ICEA), International Electrotechnical Commission (IEC), CIGRE and Institute of Electrical and Electronic Engineers (IEEE).

Q12. Which project elements depicted in your exhibits have reached a design level of detail?

A12. The overhead transmission line plans and elevations that have been included as exhibits to my testimony have reached a design level of detail showing the locations and structures types proposed for construction. (See Exhibit Petitioner EM-6 for the pole structure elevation drawings.) The below-grade and submarine transmission line plans and profiles are also at a design level of detail. The termination station drawings have reached an issued-for-bid level of design, but final elements of the station are dependent on the cable manufacturer's final design of the cable system. The detailed design of the cable system is within the scope of work for the cable manufacturer/installer and remains pending. Depending on the final cable system design following selection of the cable

manufacturer and final engineering, the terminal station drawings may require minor modifications. We expect the final design to be complete by Spring of 2016 and will submit these to the Board if there are any substantive changes compared to the current exhibits.

Q13. Does this conclude your testimony?

A13. Yes.