Q. Please provide the final design criteria for the Labrador Island Link project.

A. Please refer to PUB-NLH-221 Attachment 1.

LIL PROJECT DESCRIPTION

SCHEDULE 1
LIL PROJECT DESCRIPTION

Section 1 Labrador - Island Link (LIL)

Overall HVdc system consists of a 900 MW HVdc Island Link between Labrador and Newfoundland.

Section 2 Construction Power

The following power supply sources will be used for construction power:

- Muskrat Falls: A 25 kV tap from the construction power system for the Muskrat Falls Generating Facility.
- Forteau Point: A 25 kV tap from an existing distribution system located approximately 2.5 km away.
- Shoal Cove: A 25 kV tap from an existing distribution system located approximately 700m away.
- L'Anse Au Diable: A 14.4 kV tap from an existing distribution system located approximately 400 m away.
- Dowden's Point: A 14.4 kV tap from an existing distribution system located approximately 1.5 km away.
- Soldiers Pond: A 25 kV tap from an existing distribution system located approximately 4 km away.

Section 3 Construction Telecommunication Systems - Labrador-Island Link

Provision of telecommunications services and infrastructure during the construction phase to the end of the Project along the 315 kV HVac and the ±350 kV HVdc transmission lines and associated construction camps, including the CF Extension Switchyard construction camp.

- Services along the transmission line rights-of-way
- Land Mobile Radio System (LMRS)
- Services available at the various remote campsites
- Data (corporate and personal)
- Telephony (corporate and personal)
- Network Management System (NMS)
- Closed Circuit Television (CCTV) and
- Security and Access Control System (SACS)

Section 4 Labrador Converter Station

- 900 MW, ±350 kV bi-pole, LCC converter station capable of operating in mono-polar mode.
- Each pole rated at 450 MW with 100% overload capacity for ten minutes and 50% overload capacity for continuous operation.
- Situated on the south side of the Churchill River on a level fenced site.

- Concrete foundations and galvanized steel structures to support the electrical equipment and switchgear.
- Mono-polar operation shall be supported by an electrode.

Section 5 Electrode Line - Labrador

- An electrode line carrying two conductors with the first 370 km to be supported on the HVdc lattice steel towers from Muskrat Falls to Forteau Point and the remaining section from Forteau Point to L'Anse au Diable to be supported on a wood pole line.
- 50-year Reliability Level Return Period of loads.
- Electrode line will have provision for arcing horns.

Section 6 Electrode Labrador

- A shoreline pond electrode to be located at L'Anse au Diable on the Labrador side of the Strait of Belle Isla (SOBI).
- Nominal monopolar rating of 450 MW with 100% overload capacity for ten minutes and 50% overload capacity for continuous operation.

Section 7 Labrador - Island Overland HVdc Transmission

- An HVdc overhead transmission line, ±350 kV bi-pole, to connect the Muskrat Falls Converter Station to the Labrador Transition Compound at the Strait of Belle Isle and then to connect the Northern Peninsula Transition Compound at SOBI to the Soldiers Pond Converter Station.
- Transmission line to carry both poles (single conductor per pole) and one OPGW. The Labrador section is to carry two electrode conductors from the Muskrat Falls Converter Station to Forteau Point
- The HVdc transmission line is to have a designed nominal power capacity of 900 MW; however, given the mono-polar operation criteria, each pole is to have a nominal rating of 450 MW with 100% overload capacity for ten minutes and 50% overload capacity for continuous operation.
- Counterpoise installed from station-to-station.
- Towers are to be galvanized lattice steel, with self-supported angles and dead ends, and guyed suspension towers.
- Climatic line loadings base on 50 years actual load data along all line segments with the design loading on each segment approximately equivalent to climatic loadings calculated assuming Canadian Electrical Association (CSA) 1:500 year-return period

Section 8 Transition Compound - Labrador

- Situated on a level fenced site at Forteau Point.
- Enclosed building and provision for submarine cable termination system and associated switching requirements.
- Concrete pads and steel structures to support the electrical equipment and switchgear.

- Overhead line to cable transition equipment.
- High-speed switching, control, protection, monitoring and communication equipment.

Section 9 Marine Crossing - SOBI - General

- ±350 kV, 900 MW submarine cable system to transmit power across the SOBI in bipolar mode for 50-year design life, with capabilities to allow configuration in monopolar mode.
- Each cable to have a nominal rating of 1286 A (one pu per pole) and a transient rating of 2572 A (two pu per pole) for five minutes in mono-pole mode.
- Consists of three mass impregnated submarine cables and associated components, inclusive of one spare submarine cable.
- Land cables shall connect submarine cables to cable termination system within the transition compound.
- The route for the submarine cable(s) crossing shall be designed to meet the transmission, protection, reliability, and design life requirements, and give consideration to technical and economic optimization.
- Cables shall be adequately protected along the entire length of the crossing as required. Cable protection methodology will employ proven technologies only, and may include rock placement, trenching, horizontal directional drilling (HDD) and concrete mattresses.
- Where discrete protection application is required, protection measures shall be designed to meet the transmission and reliability requirements.

Section 10 Transition Compound - Northern Peninsula

- Situated on a level fenced site at Shoal Cove.
- Enclosed building and provision for submarine cable termination system and associated switching requirements.
- Concrete pads and steel structures to support the electrical equipment and switchgear.
- Cable to overhead line transition equipment.
- High-speed switching, control, protection, monitoring and communication equipment.

Section 11 Soldiers Pond Converter Station

- 900 MW, ±350 kV bi-pole, LCC converter station capable of operating in mono-polar mode.
- Each pole rated at 450 MW with 100% overload protection for ten minutes and 50% overload protection for continuous operation.
- Situated next to the Soldiers Pond switchyard on the Avalon Peninsula on a level fenced site.
- Concrete foundations and galvanized steel structures to support the electrical equipment and switchgear.
- Mono-polar operation shall be supported by an electrode.

Section 12 Electrode Line - Newfoundland East

- An electrode line carrying two conductors generally follows the existing transmission ROW from Soldiers Pond to Conception Bay.

- Wood pole construction.
- 50-year Reliability Level Return Period of loads.
- Electrode line will have provision for arcing horns.

Section 13 Electrode Newfoundland East

- A shoreline pond electrode to be located at Dowden's Point on the east side of Conception Bay.
- Nominal rating of 450 MW with 100% overload protection for ten minutes and 50% overload protection for continuous operation.

Section 14 Soldiers Pond Switchyard

- Situated on the north-east side of Soldiers Pond on a level, fenced site.
- Concrete foundations and galvanized steel structures to support the electrical equipment and switchgear.
- Electrical layout of the switchyard is to be in accordance with the proposed SLD.
- Switchyard to interconnect six 230 kV HVac transmission lines (three existing transmission lines looped in), the synchronous condensers and the Soldiers Pond Converter Station.

Section 15 Island System Upgrades East

- Three 175 MVAR high-inertia synchronous condensers at Soldiers Pond.
- 230 kV circuit breaker replacements including Holyrood, B1B11, B1L17, B12L17, B2B11, B2L42, B12L42, B2L18, B3B13 and B12B15 and Bay d'Espoir B4B5.
- 66 kV circuit breaker replacements including Hardwoods B7T1, B7T5 and B7B8 230 kV and 138 kV circuit breaker replacements.
- Replacement of conductors, 230 kV transmission line - Bay d'Espoir to Sunnyside.
- Splitting and Re-termination of three existing 230 kV transmission lines (TL201, TL217 and TL242) into the new Soldier's Pond Terminal Station forming six 230 kV line terminations. This requires construction of 6 x 1.6 km of 230 kV transmission line complete with overhead ground wire to provide lightening protection for the six new transmission line terminations.
- Upgrade of the protection and control systems at Hardwoods, Oxen Pond, Holyrood and Western Avalon Terminal Stations.

Section 16 Operations Telecommunications System - Island Link

- Telecommunication System shall be comprised of three separate layers: Optical Transport Network (OTN), Convergence, and Access Layers.
- OTN Layer shall be the telecommunications backbone and utilize the OPGW, All Dielectric Self Supporting (ADSS) or equivalent fibre optic infrastructure. The OTN Layer equipment nodes shall be designed based upon the least total cost of ownership alternative.
- Convergence Layer shall be based on the Synchronous Optical Network (SONET) international standard. It shall be used to create logical point-to-point telecommunication

links between all Muskrat Falls (MF) locations. It will multiplex and de-multiplex the Access Layer subsystems for transmission on the OTN.

- Access Layer shall be based on the Ethernet (IEEE 802.3) standard. It shall be comprised of a minimum of three separate telecommunication systems: Protection and Control, SCADA, and Administrative systems. The Administrative system may include the following subsystems: telephony, corporate data, security access control system, and video surveillance.

The Island Transmission Link Telecommunication Assets specifically includes the following:

- HVdc OPGW fibre optics connecting
    - Muskrat Falls Converter Station to Forteau Point Transition Compound
    - Shoal Cove Transition Compound to Soldiers Pond Converter Station
- ADSS fibre optics connecting
    - Forteau Point Transition Compound to the L'Anse au Diable Electrode
    - Soldiers Pond Converter Station to Dowden's Point Electrode
- Fibre optic infrastructure shall also be used to connect
    - Forteau Point Transition Compound to Shoal Cove Transition Compound by optic fibres embedded in each power cable being installed across the SOBI
    - Soldiers Pond Converter Station to the Newfoundland and Labrador Hydro (NLH) Energy Control Centre (ECC) in St. John's
    - Soldiers Pond Converter Station to the NLH Backup Control Centre (BCC)
- OTN Layer optical-electronics associated with the above referenced HVdc OPGW fibre optic interconnections.
- Convergence and Access Layers telecommunication systems associated with all of the above referenced fibre optic interconnections, except these telecommunication layers at MF.
- NLH ECC and BCC SCADA system upgrades