

 - Canso

System Impact Study

Nova Scotia Power Inc.
Control Centre Operations
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1. Summary

This assessment was undertaken to determine the requirements and conditions for the interconnection of a 22.5MW wind generating facility proposed by [REDACTED] at 19C-Canso Point. The proposed development includes a maximum fifteen 1.5MW wind turbines interconnected through the 69kV system (NSPI transmission line L5527) via 69/25kV dedicated interconnection substation.

The objectives of this report were to determine the impacts of this development on the local system and NSPI transmission system. It was also to define the changes required on both NSPIs system and to [REDACTED] s facilities to permit interconnection and on-going operations.

As this assessment progressed it became apparent that major transmission expenditures would be required to permit the interconnection of 22.5MW of wind energy at 19C-Canso. The preliminary findings were discussed with [REDACTED] and the objectives of this assessment were accordingly altered to determine the minimum transmission reinforcements to facilitate the connection of 12 and 15MW of wind generation at 19C-Canso by [REDACTED] using 1.5MW GE DFIG (General Electric, double-fed induction generators).

The key findings of this assessment are as follows:

- *A capacity of 9MW (6-1.5MW WTGs) can be interconnected with minimal upgrades to NSPIs transmission systems. The upgrades involve protection and communications equipment. The requirements are listed in section 5.1*
- *To interconnect 12MW (8-1.5MW WTGs) the short-circuit level at NSPIs 4C-Locaber Rd substation must be increased in addition to the upgrades required for a capacity of 9MW. This can be done by replacing the existing transformer with a unit that has a lower impedance. This is discussed in section 5.2*
- *To interconnect 15MW (11-1.5MW WTGs) a portion of the 69kV transmission line (L5527) between 19C-Canso and 24C- Dickie Brook must be re-conducted in addition to the upgrades required for a capacity of 12MW . This can be done by re-conducting the line section with at 336MCM ACSR or larger. This is discussed in section 5.3*

A summary of the general requirements of [REDACTED] s facilities are discussed in this report, for installed capacities 9, 12 or 15MW are as follows:

- [REDACTED] *must have centralized control of the wind generators that will include real and reactive power*
- *The real-power controller must have facilities to limit the total output from [REDACTED]'s facility to 0, 1/3, and 2/3 of the total capacity. This facility will interface with NSPI's automatic generation controls (AGC) in real-time. It may be used by NSPI to regulate NSPI's inter-provincial ties following system upsets or to curtail generation and facilitate switching operations local to 19C-Canso. This facility may be operated manually by NSPI's energy dispatcher or engaged automatically by NSPI's energy management systems (EMS). Under normal operation the real-power controller will attempt to raise and lower generation at ramp rates not exceeding 2MW/min.*
- *The reactive-power controller must control voltage at the 69kV 19C-Canso bus. The 19C-Canso 69kV bus will serve as the point of common coupling (PCC). This will likely require a load drop compensation (LDC) feature. The voltage set-point of this controller must be adjusted by a slow-Q controller which is coordinated with NSPI's transformer tap-changers. This controller must also ensure that at all operating points the WTGs have sufficient reactive margins to respond to all normal variations without reaching generator limits. It is advisable to ensure that the facilities installed can be modified (software) and permit a field fit with the participation of NSPI.*
- [REDACTED] *must ensure that the flicker emissions from their operation are within the limits provided in section 4.1.2.*
- [REDACTED] *must take care in the selection of taps and tap-changing equipment for the interconnection transformer and the WTG step-up transformers such that the facility overall will have sufficient reactive capability to control voltage at the PCC over the range of NSPI and [REDACTED] operating conditions to provide adequate flicker and voltage control.*
- *High-speed generation rejection facilities must also be included to facilitate generation rejection of [REDACTED] by NSPI. This facility will be used to directly trip the low voltage (25kV) or high-voltage (69kV) switchgear. The generation rejection scheme is a requirement of all significant generating facilities and may be placed into service at any time by NSPI to cater to any number of events to enhance the capability or security of transmission systems. Rejection schemes are currently in service on several generators in Nova Scotia. This is discussed in section 4.4.*

Requirements for interconnection facilities are provided in section 5. This contains a functional specification of the facilities to be added by NSPI and [REDACTED].

The completion of this draft report was delayed pending receipt of information from the WTG manufacturer (GE) regarding flicker and dynamics models from Power Technologies Inc (PTI) and GE. At the time of this writing neither had been received. Rather than conduct the assessments, requirements for flicker and ride-through have been stated in this document.