



**System Impact Study Report
Report GIP-IR379-SIS-R2**

**Generator Interconnection Request #379
78 MW Wind Generating Facility
Lunenburg County, NS**

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Transmission Planning
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Executive Summary

This report presents the results of a System Impact Study (SIS) for a proposed 78 MW wind turbine generating facility interconnected to the NS Power transmission system. Network Resource Interconnection Service (NRIS) and Energy Resource Interconnection Service (ERIS) are studied concurrently. The study performed analysis on the impact of the proposed development on the NS Power grid. System studies, including short circuit, power factor, voltage flicker, steady state, stability, Bulk Power System analysis, under-frequency operation, low voltage ride through and loss factor was performed. NS Power and NPCC planning criteria were applied.

This wind facility will be interconnected to the 138 kV line L-6004 at a Point of Interconnection (POI) which is approximately 25.5 km from 43V-Canaan Rd. and 47.4 km from 90H-Sackville via a three breaker ring bus and a new 17 km spur line from the POI to the wind farm substation. A circuit switcher at each of the high side of Interconnection Customer's (IC) power transformers and protection systems acceptable to NS Power are required at the IC's Interconnection Substation. Although IR#379 is related to IR#372, this study only includes the impact of IR#379, although IR#372 is assumed to be in-service. The impact of IR#372 on its own is the subject of a separate System Impact Study.

This study shows that low system short circuit level could be an issue with L-6004 open at 90H-Sackville end concurrent with low Valley generation. It is possible that the Short Circuit Ratio is below the minimum value recommended by the generator vendor for the model proposed. There are a number of uncertainties associated with transformer rating and control setting options to determine if IR#379 will be required to be restricted when the short circuit level is too low at the local Valley area under certain system configurations. It is critical that the central voltage controller is properly tuned for system strength, and the generator manufacturer must be made aware of this condition. It is recommended that the Interconnection Facility transformers be specified with a maximum impedance of 8.4 percent (0.084 per unit) on a base rating of 30 MVA.

The voltage flicker P_{st} for continuous operation and for start-up is within NS Power's required limit, however flicker test data for the North American version of the generator was not available for this SIS, therefore calculated data was used.

As long as the western valley transmission system is operated within historical limits, the addition of IR#379 does not adversely impact the thermal capacity of the NS Power transmission system. With the exception of conditions of low Short Circuit Ratio, no issues were identified in either the steady-state or stability analysis attributable to IR#379. It is therefore concluded that the incorporation of the proposed 78 MW facility into the NS Power transmission system at the specified location has no negative impacts on the reliability of the NS Power grid provided the recommendations given in this report are implemented.

IR#379 was not found to cause issues with the stability of the interconnected system. IR#379 was found to comply with the Low Voltage Ride Through requirements, and remained on-line though simulated under frequency islanding events. IR#379 and its interconnection facilities are not classified as part of the NPCC Bulk Power System, however, they are classified as NERC Bulk Electric System.

The Acciona AW3000 generators do not have sufficient reactive power capability to meet system requirements and will require supplementary sources. Based on the transformer data provided, it is estimated that approximately 10 Mvar of switchable capacitor banks are needed if they are installed on the 34.5 kV buses (five Mvar on each bus). If capacitors are used to provide the auxiliary reactive power, it is recommended that a separate harmonics and grounding study be conducted using EMTP.

There is no difference between NRIS and ERIS.

The total high level estimated cost for Interconnection Costs and Network Upgrades is \$10,817,500, shared with IR#372. The details of financial arrangements for sharing these costs are outside the scope of this SIS. If for any reason IR#372 does not proceed, these costs would be the responsibility of IR#379. The Facility Study will provide a more detailed cost estimate. All cost of associated facilities required at the Interconnection Customer's substation and generating facility are in addition to this estimate.