System Impact Study Report
Report GIP-IR131-SIS-R0

Generator Interconnection Request #131
10.25 MW Wind Generating Facility
Cape Breton, NS

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Executive Summary

This report presents the results of a System Impact Study (SIS) for the proposed expansion of the existing 109S-Lingan wind plant by 10.25 MW. This Interconnection Request is for Energy Resource Interconnection Service (ERIS) with an assigned Interconnection Request number IR#131.

IR#131 application has five Enercon E-82 wind turbines with each rated 2.05MW, 400V, 2.36 MVA and +/-0.87 power factor. The existing 69 kV to 25 kV transformer will be upgraded to 18/24/30 MVA, Wye-Wye with buried tertiary Delta, and +/-10% fixed tap changer in 1% step.

The SIS evaluates the impact of the proposed development on the NSPI power system with regard to the load flow, stability and short circuit. The SIS also includes the analysis of the facility's capability to meet NSPI's requirements for power factor, voltage flicker, under-frequency operation, low voltage ride through and an indication of the loss factor.

In accordance with the Generator Interconnection Procedure (GIP), ERIS allows the generating facility to generate using the existing transmission limits on an "as available" basis. ERIS does not convey any transmission service. Thus, this SIS is neither a transmission service study (TSR) nor a Network Resource Interconnection Service (NRIS).

Since IR#131 is located in Cape Breton and the Nova Scotia power system is constrained by Cape Breton Export (CBX) and Onslow Import (ONI) transmission limits, IR#131 is studied with the existing limits and with IR#131 displacing generation in Cape Breton when such non-renewable generation is available to be displaced. If there is a lack of non-renewable generation in Cape Breton for IR#131 to displace, then it may be curtailed when CBX is at its limit.

This study excludes TSR100 and TSR400 as TSR100 has been withdrawn and TSR400 has not been re-studied without TSR100. The IR#131 SIS may need updating following the completion of TSR400.

The study is conducted twice, once for the system in 2012 as per IR#131's indicated "in service" date of December 31, 2012 and once for the system in 2016 as the higher queued IR#225 and IR#234 will be in service in 2016. Even though IR#56 has an in service date of 2014, it is deemed to have no impact on IR#131 SIS and is included in 2016 system model, but not in the 2012 model.

In addition, In Cape Breton, there are approximately 11.8 MW of higher queued Distribution connected IRs, of which, only two IRs (IR#D215 and IR#D274) are explicitly modelled as they are in close proximity to IR#131. The remaining IRs are assumed to displace Cape Breton generation in a general way.

The study is based on the existing 109S-Lingan Wind Farm configuration being connected radially from 2S-Victoria Junction via L-5573. The existing L-5573 protection sends a transfer trip to 109S-Lingan Wind Farm to avoid the possibility of the wind farm being islanded with the local load at 15S-New Waterford. Although the existing 109S-Lingan Wind Farm is capable of generating more than 14 MW, this study will restrict the existing capacity to 14 MW per the terms of the Generator Interconnection and Operating Agreement (GIA).

The load flow analysis shows that IR#131 can generate at full 10.25 MW without overloading any local system elements. The stability analysis shows that the power system and IR#131 equivalent model generator are stable and well damped for all the contingencies studied. The short circuit analysis shows that the addition of IR#131 does not cause the short circuit levels to exceed the interrupting capability of any existing NSPI system equipment.

IR#131 remained in service and stable under "low voltage ride through" system condition. With the Nova Scotia system being islanded, IR#131 remained on line during and following the under-frequency load shedding in Nova Scotia. The calculated voltage flicker levels for IR#131 meet NSPI's voltage flicker requirement.

Based the data provided by the customer for the known elements such as transformers and generators, and using assumed values for the equivalent collector circuit, the preliminary analysis shows that the power factor requirement of +/-0.95 is met at the high voltage side of the 69kV to 25 kV transformer. However, this will require re-evaluation when the design of the collector circuit is complete and test values of the transformers are available to confirm that IR#131 will meet the power factor requirement.

The loss factor was calculated for light load, winter peak with a high transfer and a 2011/2012 sample system winter peak. It ranges from 5.7% to 12.3% at the Point of Interconnection. The Locational Transmission Loss Factor using the approach requested by the Renewable Energy Administrator was found to be 6.7% at the Point of Interconnection for IR #131.

IR#131 can operate a full 10.25 MW under ERIS without system upgrades provided that it displaces Cape Breton generation such that the existing CBX limit is not exceeded. Since IR#131 is an expansion of the existing 109S-Lingan wind farm, there are no changes on the 69 kV side from the POI back into NSPI's system, hence there is no cost identified regarding system upgrades.

It is assumed that the existing RTU, centralized voltage controller, and curtailment scheme could incorporate this expansion. In any case, the cost will be the responsibility of the customer. The NSPSO will use the voltage controller to remotely set the reactive output of this facility. It is normally set to control the 69 kV bus voltage and to provide fast or responsive dynamic reactive power during system disturbances. The application states that the 69 kV to 25 kV transformer has fixed taps. If this transformer has ULTC, then coordination among the voltage controller, this transformer, and 2S-VJ 69 kV transformer will need to be reviewed.