Interconnection Feasibility Study Report

GIP-157-FEAS-R2

System Interconnection Request #157

100.5 MW Wind Generating Facility

Guysborough County (L-6515)

2009 09 14

Control Centre Operations
Nova Scotia Power Inc.

Executive Summary

This Interconnection Request is for a proposed 100.5MW wind generation facility to be located near Guysborough in Guysborough County. The proposed facility will be interconnected to the NSPI 138kV transmission system via 25km of newly-constructed 138kV line from customer generation facilities to line L-6515. It is proposed that the Point of Interconnection (POI) should be near Mattie Settlement, approximately 37 km from the 4C-Lochaber Road substation.

With all lines in service, the power from this generator splits east and west along L-6515, and flow remains within the thermal range of the circuit in both winter and summer conditions. No concerns regarding short-circuit or voltage flicker were found for this project provided that the project design meets NSPI requirements for low-voltage ride-through, reactive power range and voltage control system.

With IR 157 in service, increased flow across the Onslow Import and Onslow South interfaces requires an additional 100 Mvar of switched capacitor banks at 120H-Brushy Hill which can be located on either the 138kV or the 230kV bus.

During winter conditions, the single contingency loss of lines L-8002 and L-8003 requires the installation of a 50MVAR SVC at the Onslow 230kV bus at a cost of $8,200,000. However, this contingency can be eliminated by splitting the Onslow 345kV bus, which would remove the requirement for the Onslow SVC. This alternative is more economic ($3,720,000) than that of the 50MVAR SVC and has therefore been included in the cost estimate.

There are a number of single contingency conditions that cause transmission line overloads during periods when summer line ratings are in effect:

- Loss of L-7005 & L-8004 (Strait Crossing) causes overloads of 144% on L-6511, 121% on L-6515, and 115% on L-7019.
- Loss of L-8004 causes an overload of 116% on L-6511.
- Loss of L6515 (East) between the IR 157 Point of Interconnection and Port Hastings causes an overload of 115% on L-6511.
- Loss of L-7003 & L-7004 (shared tower) causes overloads of 148% on L-6511 and 125% on L-6515.
- Loss of L-6511 between Trenton and IR 114 causes overloads of 116% on L-6515 between the IR 157 Point of Interconnection and Port Hastings.

These overloads can be dealt with by the addition of a new strait crossing to separate lines L-7005 & L-8004, and by upgrading lines L-6511 and L-6515.

IR #157 also requires the development of a 138kV substation with a three-breaker ring bus at the POI on L-6515. Approximately 25 km of 138kV transmission must be built from the POI to the Interconnection Customer's generation facility.

A non-binding estimate of the direct costs to interconnect this facility is $57,015,000.

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1 Introduction

The interconnection Customer submitted an Interconnection Request to NSPI for a proposed 100.5MW wind generation facility located near Guysborough in Guysborough County. The proposed facility will be interconnected to the NSPI 138kV transmission system via 25km of newly-constructed 138kV, 556 ACSR line from customer generation facilities to line L-6515. It is proposed that the Point of Interconnection (POI) should be near Mattie Settlement, approximately 37 km from the 4C-Lochaber Road substation.

The Interconnection Customer originally requested that the Point of Interconnection be the 100C substation. However, due to the congested substation layout, a new circuit breaker with a line tap can not be installed without extensive re-arrangement of the existing substation. Therefore a new switching substation with a differential protection scheme on L-6515 is recommended in this report.

The Interconnection Customer signed a Feasibility Study Agreement to study the connection of their proposed generation to the NSPI transmission system, dated 2008 07 28, and this report is the result of that Study Agreement. This project is listed as Interconnection Request #157 in the NSPI Interconnection Request Queue, and will be referred to as IR #157 throughout this report.

This Interconnection Request is for Network Resource Interconnection Service (NRIS).

2 Scope

The Interconnection Feasibility Study (FEAS) report shall provide the following information:

1. Preliminary identification of any circuit breaker short circuit capability limits exceeded as a result of the interconnection;
2. Preliminary identification of any thermal overload or voltage limit violations resulting from the interconnection;
3. Preliminary description and non-binding estimated cost of facilities required to interconnect the Generating Facility to the Transmission System, the time to construct such facilities, and to address the identified short circuit and power flow issues.

The Scope of this FEAS includes modeling the power system in normal state (with all transmission elements in service) under anticipated load and generation dispatch conditions.

For Network Resources Integration Service (NRIS), the FEAS will identify any transmission upgrades required as the result of thermal overload, voltage violation, or equipment rating. The FEAS will attempt to provide high level cost estimates for such upgrades and direct interconnection costs.

A more detailed analysis of the technical implications of this development will be included in the System Impact Study (SIS) report. This will include system stability analysis, single contingencies (including contingencies with more than one common element), off-nominal frequency operation, off-nominal voltage operation, low voltage ride through, harmonic current distortion, harmonic voltage distortion, system protection, special protection systems (SPS), automatic generation control (AGC) and islanded operation. The impacts on neighbouring power systems and the requirements set by reliability authorities such as Northeast Power Coordinating Council (NPCC), North American Electric Reliability Corporation (NERC), and NSPI will be addressed at that time. The SIS may identify additional costs and upgrades that were not identified in this FEAS.

A separate Facilities Study will follow the SIS in order to ascertain the final cost estimate for interconnection and any transmission upgrade requirements.

3 Assumptions

The Point of Interconnection (POI) and configuration studied is as follows:

1. 100.5 MW wind farm with 67 - 1.5MW GE sle Wind Turbines, with NRIS service.
2. The generation technology used must meet the NSPI requirement for reactive power capability of 0.95 capacitive to 0.95 inductive at the high voltage terminals of the Interconnection Facilities (Point of Interconnection). It is also a requirement to provide high-speed Automatic Voltage Regulation to maintain constant voltage at either the high voltage or the low voltage (selectable) terminals of the Interconnection Facilities.
3. The Generation Point of Interconnection is at L-6515, approximately 9km from the Cape Porcupine substation (100C) and 37km from the Lochaber Road substation (4C). The wind generating facility is located approximately 25 km from the Point of Interconnection.
4. No information was provided regarding the interconnection transformer; therefore it is assumed that there will be one 138kV transformer with a base rating of 60 MVA and a top rating of 100 MVA. The transformer impedance was assumed to be 8.5% (on a 60 MVA ONAN base) with the transformer having 5 fixed taps between -5% and +5%. The collector voltage will be at the discretion of the Interconnection Customer.
5. This Feasibility analysis is based on the assumption that IRs higher in the Generation Interconnection Queue will not proceed (with the exception of projects IR# 45, IR #82, IR #84, IR #114, IR #137/150 and IR #141 which have been included in this study in accordance with UARB Order P890).

4 Projects with Higher Queue Positions

As of September 3, 2009, the following projects can proceed ahead of this project, due to their position in the Generation Interconnection Request Queue, and have the status indicated.

In-service and committed generation projects

- Wind Generation - 30.5 MW - connected to L-5027 (in-service)
- Wind Generation – 15 MW – connected to L-5573 (in-service)
- Wind Generation – 25MW - distribution connected (in-service)
- IR #45 Wind – Cumberland County L-6535 30 MW – GIA Tendered
- IR #82 Wind – Colchester County L-5040 45 MW – GIA Executed
- IR #84 Wind – Pictou County L-7004 50 MW – GIA Executed
- IR #114 Wind – Pictou, L-6511, 60MW – FAC in Progress
- IR #137/150 Wind – Richmond, 1C, 22MW – FAC in Progress
- IR #141 Wind – Digby, 77V, 30MW – FAC in Progress

Generation projects with a higher Queue position, not yet committed:

- IR #8 Wind – Guysborough County L-5527B 15 MW – GIA Tendered
- IR #56 Wind – Cumberland County L-5058 34 MW – FAC in Progress
- IR #67 Wind – Annapolis County L-5026 40 MW – SIS in Progress
- IR #68 Wind – Digby County L-5533 35 MW – SIS in Progress
- IR #86 Wind – Pictou County L-7003 50MW – SIS in Progress
- IR #115 Wind – Pictou, L-7003, 120MW – SIS in Progress
- IR #117 Wind – Shelburne, L-5027, 10MW – SIS Agreement Complete
- IR #126 Wind – Cumberland, L-6513, 70MW – SIS Agreement Complete
- IR #128 Wind – Cumberland, L-6536, 40.5MW – SIS Agreement Complete
- IR #130 Wind /hydro pumped storage – Cape Breton, L-6516, 200MW – SIS Agreement Complete
- IR #131 Wind – Cape Breton, L-5580, 11.5MW – SIS Agreement Complete
- IR #140 Wind – Antigonish, L-7004, 30MW – SIS Agreement Complete
- IR #149 Wind – Cumberland, L-6536, 70MW – SIS Agreement Complete
- IR #151 Steam Turbine – Halifax, 91H, 50 MW – SIS Agreement Complete
- IR #156 Wind – Antigonish, L-6511, 49.5MW – Feasibility Study Complete

There are various congested interfaces that will be affected by this IR #157 and also other projects which have not yet been committed, but are ahead of IR #157 in the queue, as noted below.

Interface	**Projects Influencing Interface (not yet committed)**
Onslow Import	IR #8, IR #86, IR #115, IR #130, IR #131, IR #140, IR #156
Onslow South	IR #8, IR #56, IR #86, IR #115, IR #126, IR #128, IR#130, IR#131, IR#140, IR #149, IR #156

If any of the projects ahead of IR #157 proceed, the results of this feasibility study must be updated to reflect the impact of increased interface flow on IR #157, and any transmission upgrades that might be required for this or other projects ahead in the queue.

The SIS[1] will be based on the assumption that all the projects that are ahead of this project in the Queue are in-service. Should any project that is ahead of this project be withdrawn, or changed, within the established procedures then the SIS for this project must be updated accordingly, at the Interconnection Customer's expense.

5 Objective

The objective of this feasibility study is to determine the primary physical requirements to interconnect 100.5 MW of generation at the designated location. The assessment will identify potential impacts on the loading of transmission elements, which must remain within their thermal limits. Any potential violations of voltage criteria will be identified and addressed. If the proposed new generation increases the short-circuit duty of any circuit breakers beyond their rated capacity, the circuit breakers must be upgraded. Single contingency criteria are applied for the Network Resource Interconnection Service assessment.

This FEAS does not produce a binding estimate of all costs and changes that may be required to interconnect the facility. These costs are limited to facility additions/changes that are in the immediate vicinity of the proposed generating facility and any other system costs that are foreseen at the time this report is completed.

This assessment does not include a complete determination of facility changes/additions required to increase system transfer capabilities that may be required to the Bulk Power System to meet the design and operating criteria established by the Northeast Power Coordinating Council (NPCC) and/or the North American Reliability Corporation (NERC) or required to maintain system stability. These requirements will be determined by the subsequent interconnection System Impact Study (SIS).

[1] This process could change depending on the decision of the UARB with regard to "NSPI Application to Amend the Generation Interconnection Procedures (GIP) - P890"

6 Short-Circuit Duty

The maximum (future) expected short-circuit level on 138kV systems is 5000 MVA. The short-circuit levels in the area before and after this development are provided in Table 6-1 below.

Table 6-1: Short-Circuit Levels. Three-phase MVA (1)		
Location	**IR #157 in service**	**IR #157 not in service**
All transmission facilities in service		
100C – Cape Porcupine	2416	2244
4C – Lochaber Road	1161	1122
POI on L-6515	1888	1681
IR #157 138kV Substation	1148	921
Minimum Conditions (2)		
POI on L-6515	561	355
IR #157 138kV Substation	530	302

(1) Classical fault study, flat voltage profile
(2) L-6515 open between POI and 2C-Port Hastings, one Trenton generator off line

In determining the maximum short-circuit levels with this generating facility in service the generators have been modeled as conventional machines with reactance comparable to induction machines regardless of the type of generators proposed, which provides a worst case scenario.

The maximum short-circuit level at the POI is presently 1681 MVA. After installing generating units the increase will bring the short-circuit level to not more than 1888 MVA at the POI. Under contingency operation, with one generator at Trenton off-line and the wind farm only connected to 4C-Lochaber Road (L-6515 open at 100C-Cape Porcupine), the short-circuit level will be approximately 355 MVA at the POI.

The interrupting capability of 138kV circuit breakers at 2C – Port Hastings and 4C-Lochaber Road is at least 3500 MVA which will not be exceeded by this development on its own.

7 Voltage Flicker and Harmonics

The voltage flicker at the POI using IEC Standard 61400-21, and based on GE published values for GE 1.5MW machines, is 0.034 under normal conditions and 0.16 under minimum generation conditions. These are both below NSPI's required limit of 0.25 for P_{st} and 0.35 for P_{lt} at the Point of Interconnection. Therefore voltage flicker should not be a concern for this project. The full System Impact Study will examine the requirements in detail.

The generator is expected to meet IEEE Standard 519 limiting Total Harmonic Distortion (all frequencies) to a maximum of 5%, with no individual harmonic exceeding 1%.

8 Thermal Limits

There are a number of single contingency conditions that cause transmission line overloads during periods when summer line ratings are in effect:

- Loss of L-7005 & L-8004 (Strait Crossing) causes overloads of 144% on L-6511, 121% on L-6515, and 115% on L-7019.
- Loss of L-8004 causes an overload of 116% on L-6511.
- Loss of L6515 (East) between the IR 157 Point of Interconnection and Port Hastings causes an overload of 115% on L-6511
- Loss of L-7003 & L-7004 (shared tower) causes overloads of 148% on L-6511 and 125% on L-6515.
- Loss of L-6511 between Trenton and IR 114 causes overloads of 116% on L-6515 between the IR 157 Point of Interconnection and Port Hastings.

In order to deal with these contingencies, the following work will be necessary:

1. Up-rate L-6511 and L-6515
   The 138kV Lines L-6511 and L-6515 are constructed with 556 kcm Dove ACSR conductor designed for maximum operating temperature of 50°C. The conductors have a thermal rating of 110 MVA summer and 165 MVA winter. In order to avoid overloads on these two lines, they need to be up-rated to at least 165MVA and 140MVA respectively. In addition, the switch at the 4C-Lochaber Road end of L-6511 has a thermal rating of 143 MVA (summer or winter). This switch must be replaced with a device rated at least 165MVA.

2. Separate L-7005 & L-8004 by the addition of a new Strait Crossing
   Under certain conditions of high transfers across the Cape Breton Export interface, loss of the double-circuit transmission at the Strait of Canso Crossing can result in excessive loads on the section of L-7019 between 67N-Onslow and the IR 84 Wind Farm. The separation of these circuits by the addition of a new Strait Crossing is necessary to eliminate this contingency.

9 Voltage Limits

This project, like all new generating facilities must be capable of providing both lagging and leading power factor of 0.95, measured at the 138kV Point of Interconnection, at all production levels up to the full rated load of 100.5 MW. A centralized controller will be required which continuously adjusts individual generator reactive power output within the plant capability limits and regulates the voltage at the 138kV bus voltage. The voltage controls must be responsive to voltage deviations at the connection point, be equipped with a voltage set-point control, and also have facilities that will slowly adjust the set-point over several minutes (5-10) to maintain reactive power just within the individual generators capabilities. Details of the specific control features, control strategy and settings will be reviewed and addressed in the SIS.

The NSPI System Operator must have manual and remote control of the voltage set-point and the reactive set-point of this facility to coordinate reactive power dispatch requirements.

This facility must have low-voltage ride-through capability in accordance with FERC Order 661a[2]. The SIS will examine the generator/plant capabilities and controls in detail and will specify any options, controls and additional facilities that are required to achieve low-voltage ride-through.

The addition of IR 157 affects two NSPI transfer interfaces – the Onslow Import Interface, and the Onslow South Interface, both of which are stability and voltage limited. IR #157 will increase the flows across these interfaces and will cause the present limits to be exceeded. The Onslow South interface limit is a function of the reactive power (Mvar) dispatch and associated reactive power reserve in the Metro area. Higher transfer levels are possible if reactive power is kept in reserve to respond to contingencies. However, as power transfer increases across the Onslow South Interface, the resulting increase in steady-state reactive power requirements reduces the available reserve. It is recommended that 100 Mvar of switched reactive power be added in the Metro Area (i.e., Brushy Hill 138kV bus) to ensure that the existing reactive power remains available to respond to contingencies.

In addition, NPCC requires that systems remain stable and all bulk power transmission voltages remain within emergency limits following a single phase fault on a circuit breaker, or a single phase fault on a transmission line combined with the failure of a circuit breaker to operate. The 345kV transmission lines L-8003 and L-8002 share a common circuit breaker at 67N-Onslow (67N-812). Loss of these lines due to fault or failure of breaker 67N-812 is the most limiting fault for the Onslow Import and Onslow South interfaces, resulting in voltage collapse in Metro or instability in eastern NS. Two alternatives were examined for IR #157: addition of a 50 MVAR Static Var Compensator (SVC) at 67N-Onslow or the reconfiguration of the 345kV bus at 67N-Onslow to eliminate the contingency of most concern. If an SVC were to be installed at Onslow, it would need to be rated at 50 MVAR at an estimated cost of $8,200,000. However, the cost of a new 345kV circuit breaker at 67N-Onslow and the reconfiguration of the 345kV bus such that no two lines share a common breaker is estimated to be $3,720,000. Therefore, this second alternative is the recommended action.

10 System Security / Stability Limits

The NSPI transmission system has limited east to west transfer capability and transmission corridors between Sydney and Halifax are often operated to security limits. This project increases flow across the Onslow Import interface. Generation rejection

[2] Post-transition Period LVRT Standard; "Interconnection for Wind Energy", Federal Energy Regulatory Commission, Docket RM05-4-001; Order No. 661-A December 12, 2005.

Special Protection Systems[3] (SPS's) are utilized to increase system stability limits to maximize east to west power transfers. Depending on the impact of other generation additions ahead of this project in the Interconnection Request Queue, the additional generating capacity that this facility provides may not be able to be integrated into the NSPI system under all dispatch conditions without additional system upgrades.

Under some dispatch conditions with certain contingencies, transmission corridors become overstressed, which may require transmission system upgrades. Section 8 demonstrated the issues associated with thermal overload of transmission for the loss of the double circuit tower at the Strait of Canso, for which it is recommended that the circuits be separated. The SIS will determine if this action solves the stability issues associated with the congested interfaces.

Section 9 recommended the addition of a switched capacitor bank at 120H-Brushy Hill and the reconfiguration of the 67N-Onslow 345kV bus to increase the Onslow Import and Onslow South interface flow limits. The SIS will examine the stability aspects of these changes, and any change in setting of SPS's that might be affected.

The SIS will determine the facility changes that are required to permit higher transmission loadings while maintaining compliance with NERC/NPCC standards and in keeping with good utility practices.

11 Expected Facilities Required for Interconnection

We expect the following facilities will be required assuming that the projects ahead of this project in the Interconnection Request queue (except IR# 45, IR #82, IR #84, IR #114, IR #137/150 and IR #141) do not proceed.

Additions/Changes to NSPI systems

1. Develop a switching substation at the POI with L-6515 consisting of:
    - Three 138kV circuit breakers and associated switches in a ring-bus arrangement,
    - Control building and protection systems,
    - Control and communications between the POI switching station and NSPI SCADA system,
    - Structures to detour L-6515 into the new switching station,
    - Any conductors needed to connect the wind farm to the POI will use 556 Dove ACSR conductor rated 100°C conductor temperature.
    - Control and Communications between the POI and NSPI SCADA system (to be specified)

[3] Also known as Remedial Action Schemes, SPS's are defined by NPCC as "A protection system designed to detect abnormal system conditions, and take corrective action other than the isolation of faulted elements." *NPCC Document A7 - Glossary of Terms*.

2. Construct 25km of 556 ACSR (Dove) 138kV line with 100^{o}C conductor temperature rating from POI to wind farm facilities,
3. Construct new transmission structures across the Strait of Canso, and relocate L-7005 to the new structures.
4. Add 100 Mvar capacitor bank at the 120H-Brushy Hill 138kV bus with associated switchgear and protection.
5. Add a new 345kV circuit breaker and associate switches at 67N-Onslow, at the node between breaker 67N-815 and bus 67N-B82. Complete breaker node swap at 67N-Onslow for L-8003 and 67N-T82, with associated protection and SPS modifications.
6. Up-rate 138kV lines L-6511 and L-6515 to 166MVA and 140MVA respectively

Requirements for the Generating Facility

1. 138 kV substation. This will include 138 kV circuit breaker and protection systems as acceptable to NSPI, a Remote Terminal Unit (RTU) to interface with NSPI's SCADA with telemetry and controls as required by NSPI.
2. Facilities to provide 0.95 leading and lagging power factor when delivering rated output (100.5 MW) at the 138kV Point of Interconnection when the voltage at that point is operating between 95% and 105 % of nominal.
3. Centralized controls. These will provide centralized voltage set-point controls and reactive power set-point controls acting to control the voltage on the 138kV system and the reactive output of the machines. Responsive (fast-acting) controls are required. The controls will also include a curtailment scheme which will limit or reduce total output from the facility, upon receipt of a telemetered signal from NSPI's SCADA system. The controller will also limit the load ramp rate of the facility to within limits set by NSPI and/or telemetered from NSPI's SCADA system.
4. NSPI to have control and monitoring of reactive output of this facility, via the centralized controller. This will permit the NSPI Operator to raise or lower the voltage set-point and change the status of any reactive power controls, remotely. NSPI will also have remote manual control of the load curtailment scheme.
5. Low voltage ride-through capability in accordance with FERC Order 661a.
6. Real-time monitoring (RTU's) of the interconnection substation and facilities for NSPI to execute high speed rejection of generation (transfer trip) if determined by SIS.

12 NSPI Interconnection Facilities Cost Estimate

It is anticipated that the high level cost estimates (non-binding), excluding HST taxes, for the items identified above will be in the range:

Table 12-1: Cost Estimates		
	Determined Cost Items	**Estimate**
i	Transmission reinforcement on Dbl Cct Towers (separate Strait Crossing)	$20,974,000
ii	Up-rate L-6515 to 140MVA rating (49km)	$6,125,000
iii	Up-rate L-6511 between Trenton and IR 114 to 166MVA rating (36km)	$4,500,000
v	Develop 138kV Three Breaker Ring Bus Substation at POI	$4,629,000
v	Build 25km 138kV spur line (556 ACSR Dove) from POI to IR #157 138kV Substation	$8,625,000
Vi	Split Onslow 345kV Bus	$3,720,000
vii	Add 100MVAR reactive support at Brushy Hill	$2,760,000
viii	Protection, control, communication	$500,000
ix	Contingency (10%)	$5,183,000
	Total of Determined Cost Items	$57,015,000
	To be Determined Costs	
viii	System additions to address potential stability limits	TBD (SIS)

The above estimate includes the additions/changes to NSPI systems with the exception of changes to NSPI SPS's which will not be known until the SIS is complete. All costs associated with facilities required at interconnection substation and generating facility are in addition to the above estimate.

13 Issues to be Addressed in SIS

The SIS must determine the facilities required to operate this facility at full capacity, withstand the contingencies as defined by NPCC/NERC and identify any restrictions that must be placed on the system following a first contingency loss. The SIS will be conducted with the assumption that all projects higher-queued will proceed and the facilities associated with those projects are installed.

The assessment will consider but not be limited to the following. The facility additions/changes required to increase NSPI east to west transfers under system normal conditions (all transmission in) over the range of NSPI loads and with interruptible loads on or off.

Some of the interfaces that may be constrained and should be included in the assessment are as follows.

1. Cape Breton Export
2. Onslow Import
3. Onslow South
4. Metro reactive reserve requirements
5. NS – NB export/import

Steady-State Post-contingency Analysis

All elements within acceptable voltage and thermal limits under the following single contingencies, in accordance with NPCC[4] and NERC[5] criteria

1. Hopewell transformer 79N-T81
2. Trenton Bus 50N-B62
3. L-8003
4. L-6515 (either side of Interconnection Point)
5. Operation with Breaker 50N-604 open
6. Loss of Double-circuit tower L-7003+L-7004 near Trenton
7. Loss of double-circuit tower line L-8004 +L-7005 at Strait of Canso.

System stability for the following faults

Loss of any element without a fault

1. L-8003
2. L-8004
3. Hopewell transformer 79N-T81
4. L-6515

Three-phase fault cleared in normal time:

1. L-8003 at Hopewell end
2. L-8003 at Onslow end
3. High voltage side of 79N-T81
4. L-6515 at Trenton
5. L-6515 at Onslow
6. L-8001 at import and export limits

[4] NPCC criteria are set forth in it's A-2 Document *Basic Criteria for Design and Operation of Interconnected Power Systems*

[5] NERC transmission criteria are set forth in *NERC Reliability Standards TPL-001, TPL-002, TPL-003*

7. Low voltage side of 67N-T71
8. Onslow Bus 1N-B61
9. Onslow Bus 1N-B62

Single-phase to ground fault cleared in backup time (Breaker Failure)

1. L-8003 at Onslow with failure of 67N-812 (lose L-8002)
2. L-6515 at Onslow with failure of 1N-600
3. L-6515 at Trenton with failure of 50N-604

Single-phase to ground fault on separated circuits of double-circuit tower:

1. L-8004 + L-7005 at Canso Crossing
2. L-7003 + L-7004 at Trenton

Verify Bulk Power Status of Interconnection Facility

1. Three-phase fault on IR#157 138kV bus cleared remotely in backup time.

Any changes to SPS schemes required for operation of this generating facility, in addition to existing generation and facilities that can proceed before this project, will be determined by the SIS as well as any required additional transmission facilities. The determination will be based on NERC and NPCC criteria as well as NSPI guidelines and good utility practice. The SIS will also determine the contingencies for which this facility must be curtailed.

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