Interconnection Feasibility Study Report

GIP-273-FEAS-R3

System Interconnection Request #273

100 MW Wind Generating Facility

Cumberland County (L-5550)

2011-11-10

Control Centre Operations
Nova Scotia Power Inc.

Executive Summary

The IC submitted an Interconnection Request (IR#273) for Energy Resource Interconnection Service (ERIS) to NSPI for a proposed 100 MW wind generation facility interconnected to the NSPI transmission system. The Point of Interconnection (POI) requested by the customer is on L-5550, approximately 25.7 km from 30N-Maccan substation.

This wind generating facility will be interconnected to L-5550 which feeds the 37N-Parrsboro substation from the 30N-Maccan substation. Line L-5550 is built to 138 kV standards with 556 ACSR Dove conductors and a maximum operating temperature of 50ºC, but it is currently operating at 69 kV with conductor thermal ratings of 54/82 MVA (summer/winter). With the addition of IR#273 the flow on L-5550 will exceed its 69 kV conductor thermal ratings; therefore L-5550 would have to be operated at 138 kV via a new 138 kV circuit breaker at the 30N-Maccan 138 kV bus. The 69-25 kV transformer at 37N-Parrsboro would also need to be replaced by a new 138-25 kV transformer (the same ratings) with associated fuses and surge arresters. IR#273 also requires the construction of approximately 100 m of 138kV transmission line tap with 556 ACSR Dove conductors and a maximum operating temperature of 100ºC.

In addition to the proposed generating facility, there is a Transmission Service Request (TSR100) that will have an impact on the transfer capability between Nova Scotia and New Brunswick and on the special protection systems (SPS) that has been installed to facilitate those transfers. While TSR100 is higher queued, it has an in-service date of 2016, whereas IR#273 has an in-service date of late 2013. Therefore the FEAS for this IR is performed twice – for 2013 without TSR100 in service and again for 2016 with TSR100 in-service.

Under the existing “Import Power Monitor” SPS arming level (without TSR100), the flow on L-6513 could be at its conductor thermal limit during summer when L-8001 trips due to the fault. With the addition of IR#273, loss of L-8001 could cause L-6513 to be overloaded up to 220% of its thermal ratings during periods when summer line ratings are in effect, assuming other generation in this area is concurrently generating at full output. Thermal overloads on L-6513 could also occur under the same contingency during winter. The overloads would depend on the real-time local load demands and other local generation output. Similarly, thermal violations on L-6513 could also occur under the contingency of 88S-721 breaker failure (resulting in the loss of two generator units at 88S-Lingan) with high NS imports (up to 300 MW) during periods when summer line ratings are in effect. For high NS export levels (up to 350 MW) during periods when summer line ratings are in effect, the addition of IR#273 could cause L-6536 to be overloaded up to 122% of its conductor thermal ratings after the loss of L-6535 between IR#45 and Memramcook NB. Therefore this study recommends that L-6513 should be re-built and L-6536 should be uprated to accommodate IR#273; otherwise operating restrictions must be established to curtail this wind facility and the curtailment could be significant which depends on NS Import/Export level and the real-time local generation output and load demands.

The “Import Power Monitor” SPS will be eliminated once the system upgrades associated with TSR100 are completed. IR#273 can operate without restrictions assuming that L-6513 would have been re-built in 2013.

No concern regarding short-circuit or voltage flicker was found for this project on its own, provided that the project design meets NSPI requirements for low-voltage ride-through, reactive power range and voltage control system. Harmonics must meet the Total Harmonics Distortion provisions of IEEE 519.

The preliminary value for the unit loss factor is calculated to be 4% (system losses increased by net 4 MW when IR #273 is operated at 100 MW).

The preliminary non-binding estimated cost of facilities required to interconnect 100 MW to L-5550 (operating at 138 kV) is $29.0 Million including a contingency of 10%. This estimate will be further refined in the System Impact Study and the Facility Study.

Table of Contents

Page

1 Introduction

The Interconnection Customer submitted an Interconnection Request (IR) for Energy Resource Interconnection Service (ERIS) to NSPI for a proposed 100 MW wind generation facility interconnected to the NSPI transmission system. The Point of Interconnection (POI) requested by the customer is on line L-5550, approximately 25.7 km from 30N-Maccan substation. The line tap from the wind farm is assumed to be approximately 100 m.

The Interconnection Customer (IC) signed a Feasibility Study Agreement to study the connection of their proposed generating facility to the NSPI transmission system dated 2011-09-14, and this report is the result of that Study Agreement. This project is listed as Interconnection Request #273 in the NSPI Interconnection Request Queue, and will be referred to as IR#273 throughout this report.

2 Scope

This Interconnection Feasibility Study (FEAS) consists of a power flow and short circuit analysis. Based on this scope, the 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 limits violations resulting from the interconnection;
3. Preliminary description and high level non-bonding estimated cost of facilities required to interconnect the Generating Facility to the Transmission System 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.

In accordance with Section 3.2.1.2 of Revised Generation Interconnection Procedures (RGIP), the FEAS for ERIS consists of short circuit/fault duty, steady state (thermal and voltage) analyses. The short circuit/fault duty analysis would identify direct Interconnection Facilities required and the Network Upgrades necessary to address short circuit issues associated with the Interconnection Facilities. The steady state studies would identify necessary upgrades to allow full output of the proposed Generating Facility and would also identify the maximum allowed output, at the time the study is performed, of the interconnecting Generating Facility without requiring additional Network Upgrades. It is therefore assumed that transmission interfaces limits will not be exceeded to avoid system upgrades in an ERIS study.

A more detailed analysis of the technical implications of this development will be included in the System Impact Study (SIS) report. The SIS includes system stability

analysis, power flow analysis such as 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 and will include an assessment of the status of the Interconnection Facility as a Bulk Power System element. The SIS may identify and provide a non-binding estimate of any additional interconnection facilities and/or network upgrades that were not identified in this FEAS.

An Interconnection Facilities Study follows the SIS in order to ascertain the final cost estimate to interconnect the generating facility.

3 Assumptions

This FEAS is based on the technical information provided by the Interconnection Customer. The Point of Interconnection (POI) and configuration is studied as follows:

1. Energy Resource Interconnection Service type per section 3.2 of the RGIP.
2. 100 MW wind with 63 units of GE 1.6-100SLE Wind Turbines. Although manufactures data indicates that total generation output is rated at 100.8 MW, this study is conducted assuming this generating facility nameplate is restricted at 100 MW.
3. The generation technology used must meet NSPI requirement for reactive power capability of 0.95 capacitive to 0.95 inductive at the HV terminals of the IC Substation Step Up transformer. The generator is assumed to be specified for 34.5 kV at a rated power factor of 0.9 for both lagging and leading. It is also required to have high-speed Automatic Voltage Regulation to maintain constant voltage at the generator terminals during and following system disturbances as determined in the subsequent System Impact Study.
4. The Interconnection Customer indicated that the generation interconnection point is on line L-5550, approximately 25.7 km from the 30N-Maccan substation. The line tap to the wind facility is approximately 100 m.
5. Preliminary data was provided by the Interconnection Customer for the generator step-up and IC substation step-up transformers. Modeling was conducted with a 138kV-34.5kV 66/88/110 MVA Interconnection Facility transformer with a positive sequence impedance of 7.5% and an X/R ratio of 35. The Interconnection Customer indicated that this Interconnection Facility step-up transformer has a grounded wye-delta-wye winding configuration with +/-10% off-load tap changer. The generator step-up transformers are indicated with an impedance of 6% on 1.75 MVA.

6. The FEAS analysis is based on the assumption that IR's higher in the Generation Interconnection Queue and OATT Transmission Service Queue that have completed a System Impact Study, or that have a System Impact Study in progress will proceed. As such, IR#8, IR #45, IR#56, IR#151, TSR 100, IR#219, IR#227, IR#225 and IR#234 are included in this study.

4 Projects with Higher Queue Positions

All in-service generation is included in the FEAS.

As of 2011-11-10 the following projects are higher queued in the Interconnection Request Queue and OATT Transmission Service Queue, and have the status indicated.

Interconnection Requests -Included in FEAS

- IR #8 GIA Executed
- IR #45 GIA Executed
- IR #56 GIA Executed
- IR #151 GIA Executed
- IR #219 GIA Executed
- IR #227 FAC Complete
- IR #225 FAC Complete
- IR #234 SIS completed

OATT Transmission Service Queue– Included in FEAS

- TSR 100 SIS in progress

Interconnection Requests - Not Included in FEAS

The following IRs either have SIS Agreements complete (but have not yet met the RGIP SIS progression milestones), or have Feasibility Study agreements complete. As such, they are not included in this FEAS.

IR #67	IR #68	IR #86	IR #115	IR #117	IR #126
IR #128	IR #130	IR #131	IR #149	IR #163	IR #213
IR #222	IR #235	IR #238	IR #241	IR#242	

OATT Transmission Service Queue– Not Included in FEAS

- TSR 400 SIS Agreement Completed

If any of the higher-queued projects included in this FEAS are subsequently withdrawn from the Queue, the results of this SIS may require updating or a re-study may be necessary. The re-study cost incurred as a result of the withdrawal of the higher-queued project shall be the responsibility of the Interconnection Customer that withdraws the higher queued project.

In addition to IR#273, TSR-100 will also have an impact on the transfer capability between Nova Scotia and New Brunswick and on the special protection systems (SPS) that has been installed to facilitate those transfers. While TSR-100 is higher queued, it has an in-service date of 2016, whereas IR#273 has an in-service date of late 2013. Therefore the FEAS for this IR will be performed twice – for 2013 without TSR-100 in service and again for 2016 with TSR-100 in-service.

An additional Transmission Service Request, TSR-400 in higher queued than IR#273 and a SIS is in progress. However, the results of this SIS are not sufficiently defined to be included in the FEAS for IR#273.

5 Objective

The objective of this FEAS is to provide a preliminary evaluation of the system impact and the high-level non-binding cost estimate of interconnecting the 100 MW generating facility to the NSPI transmission system 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[1] are applied for the ERIS assessments.

This FEAS is based on a power flow and short circuit analysis and 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 NPCC and NERC or required to maintain system stability. These requirements will be determined by the subsequent interconnection System Impact Study (SIS).

6 Short-Circuit Duty

The maximum (design) expected short-circuit level is 5000 MVA on 138kV systems and 3500 MVA on 69 kV systems. The short-circuit levels in the area before and after this development (including TSR#100) are provided below in Table 6-1.

[1] The Single Contingency Criteria is defined by NPCC in its A-7 Document, and may involve more than one transmission element.

Table 6-1: Short-Circuit Levels. Three-phase MVA [1]		
Location	**IR #273 in service**	**IR #273 not in service**
All transmission facilities in service		
Interconnection Facility (POI)	1093	644
30N-Maccan 138 kV	1452	1102
74N-Springhill 138 kV	1449	1229
1N-Onslow 138 kV	2553	2495
30N-Maccan 69 kV	400	368
74N-Springhill 69 kV	430	409
Minimum Conditions		
Interconnection Facility (POI)	913	465

[1] Classical fault study, flat voltage profile

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 SIS will refine the fault level based on the actual machine characteristics.

The maximum short-circuit level at the POI on L-5550 is presently 644 MVA. After installing IR # 273 the increase will bring the short-circuit level to 1093 MVA at the POI. Similarly, under summer light load conditions with certain generation units offline and certain lines out-of-service, the minimum short-circuit level will be approximately 465 MVA at the POI. This translates into maximum equivalent system impedance at the POI of 0.215 per unit on 100 MVA base.

The interrupting capability of the 138kV circuit breakers at 1N-Onslow is at least 3500 MVA, and the interrupting capability of the 138kV circuit breakers at 30N-Maccan is at least 3000 MVA and all 69 kV circuit breakers at that substation are rated at least 1000 MVA, As such, the interrupting ratings will not be exceeded by this development on its own. At 74N-Springhill the breaker ratings are at least 5000 MVA (138kV breakers) and 3500 MVA (69kV breakers); therefore IR#273 will not impact the circuit breakers at these stations.

7 Voltage Flicker and Harmonics

Due to the lack of flicker coefficient information on the GE 1.6-100SLE machine, this study assumes the same flicker data as for the GE 1.5SLE machine. The calculated voltage flicker at the POI on line L-5550 (operating at 138 kV) using IEC Standard 61400-21 and the published values for GE 1.5 SLE machines is 0.027 under normal conditions and 0.032 under minimum generation conditions. These are both below

NSPI's required limit of 0.35 for P_{st}. Therefore voltage flicker should not be a concern for this project.

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

This wind generating facility will be interconnected to L-5550 which feeds the 37N-Parrsboro substation from the 30N-Maccan substation. Line L-5550 is built to 138 kV standards with 556 ACSR Dove conductors and a maximum operating temperature of 50ºC, but it is currently operating at 69 kV with conductor thermal ratings of 54/82 MVA (summer/winter). With the addition of IR#273 the flow on L-5550 will exceed its 69 kV conductor thermal ratings; therefore L-5550 would have to be operated at 138 kV and a new 138 kV circuit breaker associated with switches will be required at the 30N-Maccan 138 kV bus. The 69-25 kV transformer at 37N-Parrsboro would also be replaced by a 138-25 kV transformer (the same ratings) complete with associated 138 kV fuses and surge arresters. IR#273 also requires the construction of approximately 100 m of 138kV transmission line utilizing 556 ACSR Dove conductors and a maximum operating temperature of 100ºC.

Any new generating facilities added to the system in northern Nova Scotia (between Truro and New Brunswick) could have an impact on the transfer capability between Nova Scotia and New Brunswick and on the associated SPSs. The NSPI transmission line ratings records show that L-6513 between 74N-Springhill and 1N-Onslow substation is built with 556 ACSR Dove conductors with a maximum operating temperature of 50ºC and a Summer/Winter line rating of 110/165 MVA limited by conductor size. Under the existing "Import Power Monitor" SPS arming level, the flow on L-6513 could be at its conductor thermal limit during summer when 345 kV line L-8001 trips due to a fault. With the addition of IR#273 loss of L-8001 could cause L-6513 to be overloaded up to 220% of its conductor thermal ratings during periods when summer line ratings are in effect, assuming other generation in this area is concurrently generating at full output. Thermal overloads on L-6513 could also occur under the same contingency during winter. The overloads would also depend on the real-time local load demands and other local generation output. Similarly, thermal violations on L-6513 could also occur under the contingency of 88S-721 breaker failure (resulting in the loss of two generator units at 88S-Lingan) with high NS imports (up to 300 MW) during periods when summer line ratings are in effect. For high NS export levels (up to 350 MW) during periods when summer line ratings are in effect, the addition of IR#273 could cause L-6536 to be overloaded up to 122% of its conductor thermal ratings after the loss of L-6535 between IR#45 and Memramcook NB. Therefore this study recommends that L-6513 should be re-built and L-6536 should be uprated to accommodate IR#273; otherwise operating restrictions must be established to curtail this wind facility and the curtailment could be significant which depends on NS Import/Export level and the real-time local generation output and load demands.

TSR-100 involves a request for a NS import from New Brunswick of 320 MW (firm) plus 400 MW (non-firm) with an in-service date of 2016. System network upgrades associated with TSR-100 include:

- New 345 kV transmission line from Coleson Cove, NB to Salisbury, NB
- New 345 kV transmission line from Salisbury NB to Memramcook, NB
- New 345 kV transmission line from Memramcook, NB to Onslow NS
- Switched capacitor banks in NB at Memramcook, Salisbury and Norton
- Static Var Compensators (SVC) in NB at Salisbury and Memramcook

Once these upgrades are completed, the "Import Power Monitor" SPS will be eliminated. IR#273 can operate without restrictions assuming that L-6513 would have been re-built in 2013.

The SIS will determine the detailed system requirements to accommodate IR#273. The requirement for restrictions or curtailments of this facility when operating with an element (transmission line, transformer etc) out of service (N-1 operation) will be further assessed in the SIS.

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 HV terminals of the IC Substation Step Up Transformer, at all production levels up to the full rated load of 100 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 34.5 kV bus voltage. The voltage controls must be responsive to voltage deviations at the terminals of the Interconnection Facility substation, be equipped with a voltage set-point control, and also have the ability to slowly adjust the set-point over several (5-10) minutes to maintain reactive power within the individual generators capabilities. The details of the specific control features, control strategy and settings will be reviewed and addressed in the SIS, as will the dynamic performance of the generator and its excitation.

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 also have low voltage ride-through capability as per Appendix G to the Standard Generator Interconnection and Operating Agreement (GIA). The SIS will state specific options, controls and additional facilities that are required to achieve this.

10 System Security / Stability Limits (Transfer Capability)

There are a number of proposed generation additions in New Brunswick that may have an impact on projects in northern NS and vice versa. Their POI, size and relative position of

the NS and NB interconnection Queues will determine the impact. This will be resolved through collaboration with NBSO at the SIS stage.

This generating facility will also increase loading on the Onslow South corridor (Truro to Halifax) by replacing generation located south and west of Truro. This may require increased reactive support requirements in the Halifax area or invoke facility additions that can reduce the reactive support requirements. This will be evaluated in the SIS.

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

11 Expected Facilities Required for Interconnection

The following facility changes are required to interconnect IR #273 to the line L-5550:

Additions/Changes for POI on line L-5550:

1. Convert L-5550 to 138 kV
2. Add a direct line tap to L-5550 (Transfer trip protection required at the generation side via a circuit breaker)
3. Add 100 m of new 138kV line from the POI to the customer substation consisting of 556 Dove ACSR conductor rated at 100°C conductor temperature
4. Install a new 138 kV circuit breaker and associated switches for the new termination of L-5550 into 30N-Maccan substation
5. Add a new 138-25 kV transformer at 37N-Parrsboro
6. Add control and communications between the Generating Facility and NSPI SCADA system including transfer trip signals to the Generating Facility from 30N-Maccan
7. Protection upgrades at 30N-Maccan
8. Re-build L-6513 (65 km)
9. Up-rate L-6536 (32 km)

Requirements for the Generating Facility

1. 138 kV Interconnection Substation. This will include a circuit breaker at high side of customer power transformer and protections as acceptable to NSPI. An 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 at the HV terminals of the IC Substation Step Up Transformer 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 are known as Farm Control Units (FCU). The FCU will control the 34.5 kV bus voltage 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.
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 remotely.
5. Low voltage ride-through capability as per Appendix G to the Standard Generator Interconnection and Operating Agreement (GIA).
6. Real-time monitoring (including a Remote Terminal Unit) of the interconnection facilities.
7. Facilities for NSPI to execute high speed rejection of generation (transfer trip) if determined in SIS.

12 NSPI Interconnection Facilities and Network Upgrades Cost Estimate

Estimates for NSPI Interconnections Facilities and Network Upgrades for interconnecting 100 MW wind energy onto the 138 kV systems are included in Table 12-1.

Table 12-1: Cost Estimates identified from FEAS scope

	Determined Cost Items	Estimate
NSPI Interconnection Facilities		
i	Build 100 m 138kV single circuit line and line tap off L-5550	$ 100,000
ii	Protection, control, communication	$ 700,000
Network Upgrades		
iii	138 kV circuit breakers and associated switches plus line L-5550 new terminal (138 kV) at 30N-Maccan	$ 1,180,000
iv	37N-Parrsboro substation upgrades	$1,186,000
v	Re-build L-6513 (65 km) & upgrades at 1N-Onslow end	$19,200,000
vi	Uprate L-6536 (32 km)	$4,000,000
Totals		
vii	Contingency (10%)	$2,636,600
viii	Total of Determined Cost Items	$29,002,600
	To be Determined Costs	
iv	System additions to address potential stability limits	TBD (SIS)

The preliminary non-binding cost estimate for interconnecting 100 MW onto L-5550 (operating at 138 kV) would be $29,002,600 including a contingency of 10%. The Interconnection Customer is also required to fund the Item iii), iv), v) and vi) costs, but would be eligible for repayment in accordance with the terms of the GIA.

13 Issues to be addressed in SIS

The following provides a preliminary scope of work for the subsequent SIS for IR#273. The SIS will include a more comprehensive assessment of the technical issues and requirements to interconnect generation as requested. It will include contingency analysis, system stability and ride through and operation following a contingency (N-1 operation). The SIS must determine the facilities required to operate this facility at full capacity, withstand any contingencies (as defined by the criteria appropriate to the location) and identify any restrictions that must be placed on the system following a first contingency loss. The SIS will confirm the options and ancillary equipment that the customer must install to control flicker, voltage and ensure that the facility has the required ride-through capability. The SIS will be conducted in accordance with the GIP with the assumption that all appropriate higher-queued projects will proceed and the facilities associated with those projects are installed.

The following outline provides the minimum scope that must be complete in order to assess the impacts. It is recognized the actual scope may deviate, to achieve the primary objectives.

The assessment will consider but not be limited to the following.

i. Facilities that the customer must install to meet the requirements of the GIP
ii. The minimum transmission additions/upgrades that are necessary to permit operation of this Generating Facility, under all dispatch conditions, catering to the first contingencies listed.
iii. Guidelines and restrictions applicable to first contingency operation(curtailments etc)
iv. System loss impacts
v. Under-frequency load shedding impacts

To complete this assessment the following first contingencies, as a minimum, will be assessed:

- L-8001/3025
- L-3006 – with and without NBPT SPS operation
- Memramcook 345/138 kV transformer
- L-6513
- L-6514
- L-6535/L-1159

- L-6536/L-1160
- L-8003
- L-8002 & L-8003 (common circuit breaker)
- L-8003 & L-8004 (common circuit breaker
- L-8001 & 67N-T81 TX (common circuit breaker)
- L-8002 & 67N-T81 TX (common circuit breaker)
- L-3006 & L-3025 & Memramcook 345/138 kV Tx (common breaker)
- L-3006 & L3017 (common breaker)
- 1N-B61
- L-1108/1190 Common 138kV structure
- Loss of 180 MW of load under peak load conditions and 250 MW under light load conditions
- Loss of largest generation – Pt. Aconi 174MW net
- Loss of two generating units at Lingan – 312 Net
- Loss of the Trenton Bus (Two units with load)

To complete this assessment the dynamics of the following first contingencies, as a minimum, will be assessed:

- 3 phase fault L-8001/3025 at 67N-Onslow, NS Import SPS operation (islanding)
- 3 phase fault L-3006 at Memramcook, NB SPS/UVLS operation (islanding)
- 3 phase fault L-3006 at Salisbury, NB SPS/UVLS operation (islanding)
- 3 phase fault L-8003 at 67N-Onslow
- 3 phase fault L-8002 at 67N-Onslow
- Slg L-3017, drops L-3017&L-3006 (common CB), NB SPS/UVLS operation,
- Slg Memramcook T3, drops L-3006 (common CB), NB SPS/UVLS operation
- Slg L-8002 at Onslow, drops L-8003, Grp5 SPS Operation
- 3 phase fault at 79N-Hopewell, drops L-8003, 8004, bus, SPS operation
- 3 phase fault 1N-Onslow 138 kV bus B61
- 3 phase fault 74N-Springhill 138 kV bus

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[2] and NPCC[3] criteria as well as NSPI guidelines and good utility practice. The SIS will also determine the contingencies for which this facility must be curtailed.

The SIS will calculate the unit loss factor, which is a measure of the percentage of the net output of IR #273 which is lost through the transmission system. Preliminary value is

[2] NPCC criteria are set forth in it's Reliability Reference Directory #1 *Design and Operation of the Bulk Power System*
[3] NERC transmission criteria are set forth in *NERC Reliability Standards TPL-001, TPL-002, TPL-003*

calculated to be 4.0% (system losses increased by net 4.0 MW when IR #273 is operated at 100 MW).

Nova Scotia Power
2011-11-10