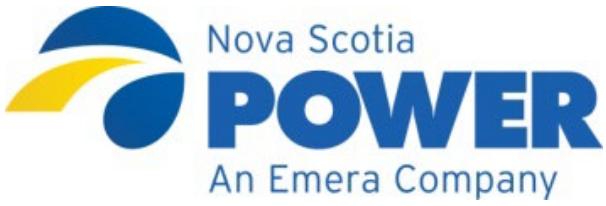

Interconnection Feasibility Study Report
GIP-IR725-FEAS-R0

Generator Interconnection Request 725
100 MW Wind Facility
Laconia, NS

2024-05-31

Control Centre Operations
Nova Scotia Power Inc.

Executive summary

This Feasibility Study report (FEAS) is based on the Feasibility Study Agreement, signed by the Interconnection Customer (IC) on October 17, 2023 and Nova Scotia Power Inc. (NSPI) on November 17, 2023 for connection of a 100 MW Wind power generating facility at PID 60311115 in Nova Scotia (NS).

The agreement states eighteen Vestas V162_6.2 wind turbines with each turbine rated 6.2 MW for a total of 111.6 MW, but the maximum generation will be 100 MW.

The agreement also includes two options, one for Network Resource Interconnection Service (NRIS) and one for Energy Resource Interconnection Service (ERIS). The Point of Interconnection (POI) will be on L-6025, an existing 138 kV line between 99W-Bridgewater and 50W-Milton substation. The agreement does not include an option for alternative POI.

The proposed Commercial Operation Date for IR725 is December 31, 2027.

L-6025 has another higher queued IR739 (ahead of IR725) to be connected prior to IR725. In addition, there are a total of 22 transmission projects across NS identified in the Combined T/D Advanced Stage Interconnection Request Queue with higher queue positions than IR725.

The power system base cases for the Feasibility Study include all transmission connected IRs in the GIP queue up to and including IR742 with the exception of IR686 which is considered electrically remote from IR725 and IR686 system impact study was not completed when IR725 was initiated.

L-6025 is presently not on NSPI's BPS list nor BES list. It has a line length of 42.05 km between 99W-Bridgewater substation to 50W-Milton substation. The IC's one-line shows the new 138 kV line extension from the POI to the IC's substation to be 3.5 km. Hence, connection to L-6025 would fall into the category of NSPI's TSIR Table 8 as "*Connected to non-Bulk Power System network lines at 138kV or 69kV. If new line length is >1km and <10% of length of main line being tapped to a maximum length of 5km"* will allow for *"Single breaker line tap with protection.*". However, it will depend upon how IR739 will be connected to L-6025, as the combination of IR739 and IR725 can result in a loss of 190 MW generation for a common contingency such as a fault on the line. This loss of generation will exceed the largest generator in NS and will require a different kind of interconnection than a single breaker line tap with protection (e.g. a three breaker ring may be required). This issue will be examined in IR725 SIS once the SIS for IR739 is completed.

Since the POI for IR725 will be on the 138 kV line L-6025 which is not on NSPI's present NPCC BPS list nor NERC BES list, therefore the POI substation and the 138 kV line extension to the IC substation are not expected to be BPS nor BES, however, due to a number of other wind farms in the vicinity, the SIS will determine if L-6025 and IR725 POI will be BPS and/or BES.

In this feasibility study, IR725 is assessed with the premise that it will displace thermal generation in Nova Scotia, with the order of units in Cape Breton to Central to Halifax, for the clean power initiative. In doing so, NSPI continues to maintain a minimum number of thermal units (synchronous generators) to maintain system strength and system stability, hence, when this level is reached, wind generation in NS, including IR725, will be curtailed accordingly.

The Transmission Service Reservation TSR-411for 550 MW from New Brunswick to Nova Scotia is not included as per the notice on NSPI's OASIS site.

Based on the short circuit technical bulletin provided by the IC for the wind turbines, the short circuit assessment shows that addition of IR725 does not necessitate any change out of transmission circuit breakers due to increased short circuit levels contributed by IR725. However, the estimated Short Circuit Ratio (SCR) under minimum generation and a line section out of service will be as low as 3.1, far less than the required value of 5 as per the wind turbine technical bulletin. In addition, there are a number of wind farms in the vicinity which will reduce the effective SCR further. The SCR value is just an estimate at this time and will very much depend on the design of the collector circuits and the impedances of the wind turbine generating transformers as well as the main substation transformer, hence the IC should carry out detailed short circuit modelling and discuss with the wind turbine supplier to ensure efficient operation of the wind turbines.

The IC will need to discuss with the wind turbine suppliers to ensure that the wind turbines can function at low short circuit levels via special designs or additional mitigating equipment. Section 7.4.15 of TSIR contains further information regarding SCR.

With reference to Inertia Response, section 7.6.7 of TSIR requires "WECS Generating Facilities shall support short-duration frequency deviations by providing inertia response equivalent to a Synchronous Generator with an inertia factor (H) of at least 3.0 MWs/MVA for a period of at least 10 seconds."

Based on the voltage flicker and harmonic technical bulletin provided by the IC for the wind turbines, the assessment shows that voltage flicker and harmonics are not expected to be an issue for IR725. However, if voltage flicker or harmonics become an issue during operation of IR725, IR725 will be responsible for mitigating the issue.

Based on the "Preliminary Datasheet of Power Quality" bulletin provide by the IC, IR725 will require to install power factor correction equipment to meet NSPI's power factor requirement o.95 or less when IR725 delivers MVAR to the power system. At this time, the information provided is not sufficient for this feasibility study to verify the power factor requirement at the full range of IR725 output from 0 MW to 100 MW. The IC will be required to provide this information for the SIS to evaluate and confirm that the facility meets the requirements of TSIR Section 7.6.2.

Based on the information provided by the IC for steady state modelling of the wind turbines and the generating facility, the assessment of thermal limit and voltage violations via steady state power flow analysis identified a list of system upgrades as shown below:

For NRIS:

1. Network Upgrades (NU):
   - Upgrade 99W-T71 (230/1138 kV transformer), 99W-T72 (230/1138 kV transformer), L-5003 (69kV line Akerley-Sackville), L-5535 (69kV line Tusket-Carleton-Sissiboo), L-6006 and L-6531 (138 kV lines Bridgewater-Milton), and L-7009 (230 kV Bridgewater-Brushy Hill).
   - Upgrade line full scale metering for L-5025, L-5532 and L-6009 at 11V-Paradise, 3W-Big Falls, 90H-Sackville substations respectively.
   - P&C modifications at both ends of the line L-6025 including in-line switches at the POI.
2. Transmission Provider's Interconnection Facilities (TPIF):
   - Single 138 kV tap substation at POI to L-6025 plus Protection and Control modifications at both terminals of the line.
   - New 3.5 km 138 kV line extension from POI to IC's 138 kV substation.
   - Protection and Control, Remote Terminal Unit, Tele-protection, and SCADA communications.

   The high level non-binding cost estimates for NU is $212.52 million and for TPIF is $8.31 million, for a total of $220.83 million.

For ERIS:

1. Network Upgrades (NU):
   - P&C modifications at both ends of the line L-6025 including in-line switches at the POI.
2. Transmission Provider's Interconnection Facilities (TPIF):
   - Single 138 kV tap substation at POI to L-6025 plus Protection and Control modifications at both terminals of the line.
   - New 3.5 km 138 kV line extension from POI to IC's 138 kV substation.
   - Protection and Control, Remote Terminal Unit, Tele-protection, and SCADA communications.

   The high level non-binding cost estimates for NU is $1.25 million and for TPIF is $8.31 million, for a total of $9.56 million.

The cost estimates are in 2024 Canadian dollars. They include a 25% contingency but exclude HST.

The system upgrades and cost estimates are subject to change as will be determined by the more in-depth subsequent system impact study (SIS) and the facility study (FAC).

For ERIS, when local higher queued IRs (ahead of IR725) operate at their full rated outputs then IR725 output will be restricted to as low as zero MW.

The cost of the Interconnection Customer's Interconnection Facilities (ICIF) is separate at the IC's own cost and is not included in this study. Its design must meet NSPI's Transmission System Interconnection Requirements (TSIR) and NERC's BES and possibly NPCC's BPS which will be determined by the SIS.

The IC will obtain Right Of Way (ROW) for the 3.5 km of 138 kV transmission line from the IC's substation to the POI and fund its construction, but NSPI will own and operate it. The IC will also obtain the ROW for the POI substation.

The estimated time to construct the NU and TPIF for NRIS is 24-36 months after the receipt of funds. It is expected that the time frame would be shorter for ERIS. The time frame will be further determined by the FAC study.

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1.0 Introduction

This Feasibility Study report (FEAS) is based on the Feasibility Study Agreement, signed by the Interconnection Customer (IC) on October 17, 2023 and Nova Scotia Power Inc. (NSPI) on November 17, 2023 for connection of a 100 MW wind power generating facility at PID 60311115 in Nova Scotia (NS).

The agreement states eighteen V162_6.2 wind turbines with each turbine rated 6.2 MW for a total of 111.6 MW but maximum generation will be 100 MW.

The agreement also includes two options, one for Network Resource Interconnection Service (NRIS) and one for Energy Resource Interconnection Service (ERIS). The Point of Interconnection (POI) will be on L-6025, an existing 138 kV line between 99W-Bridgewater and 50W-Milton substation. The agreement does not include an option for alternative POI.

L-6025 has another higher queued IR739 (ahead of IR725) to be connected prior to IR725. In addition, there are a total of 22 transmission and distribution projects across NS identified in the Combined T/D Advanced Stage Interconnection Request Queue with higher queue positions than IR725.

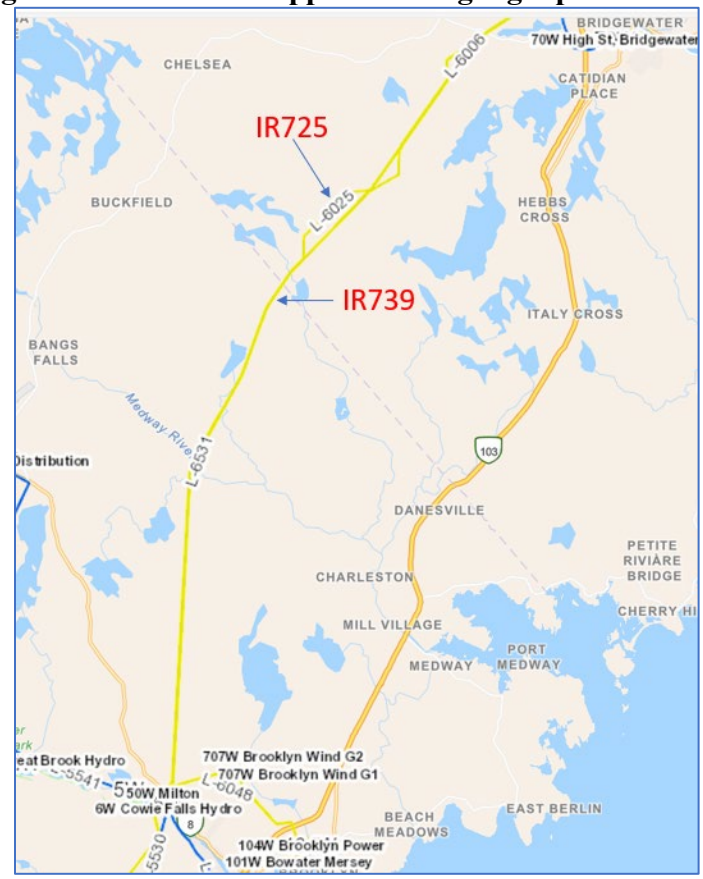
The power system base cases for the feasibility study include all transmission connected IRs in the GIP queue up to and including IR742 with the exception of IR686 which is considered electrically remote from IR725 and IR686 system impact study was not completed when IR725 was initiated.

The proposed Commercial Operation Date for IR725 is December 31, 2027.

At the time of this feasibility study, the IC does not have a precise location for the POI and indicated, via email on January 23, 2024, to use an approximate location with coordinates 44.307, -64.677. Based on that, Figure 1 shows the approximate location of IR725 on L-6025. It also shows higher queued IR739 on the same line.

As for the IC substation, the IC provided a one-line diagram which shows the line length of 3.5 km of 138 kV line to the POI with conductors and impedances included for the study.

Figure 1: IR725 POI approximate geographic location.



2.0 Scope

This Interconnection Feasibility Study's (FEAS) objective is to provide a preliminary evaluation of system impact and a high-level non-binding cost estimate of interconnecting the new generation facility to the NSPI Transmission System at the designated location based on single contingency criteria.

This assessment will identify potential impacts on transmission element loading above their thermal limits and potential voltage criteria violations.

Circuit breakers must be upgraded if the proposed facility increases the short-circuit duty of any circuit breakers beyond their rated capacity.

The scope of the FEAS includes modelling the power system in normal state, with all transmission elements in service, under anticipated load and generation dispatch. A power flow and short circuit analysis will be performed to provide the following preliminary information:

- Identification of any circuit breaker short circuit capability limits exceeded because of the interconnection and any network upgrades necessary to address the short circuit issues associated with the IR.
- Identification of any thermal overload or voltage limit violations resulting from the interconnection and identify the necessary network upgrades.
- Description and high-level non-binding estimated cost of and time to construct the facilities required to interconnect the generating facility to the transmission system.

This FEAS does not include a complete determination of facility changes/additions required to increase the system transfer capabilities that may be required to the transmission system to meet the design and operating criteria established by NSPI, the Northeast Power Coordinating Council (NPCC), and the North American Electric Reliability Corporation (NERC). These requirements will be determined by a more detailed analysis in the subsequent interconnection System Impact Study *(SIS)*. An Interconnection Facilities Study (FAC) follows the SIS to ascertain the final cost estimate to the interconnect the generating facility.

3.0 Assumptions

The feasibility study uses the following information:

1. As per the signed Feasibility Study Agreement:
   1.1. Even though the signed Feasibility Agreement states 18 wind turbines with each being rated for 6.2 MW for a total of 111.6 MW, the Feasibility Agreement and the Interconnection Request application show the maximum MW of the facility to be 100 MW, hence this study will be conducted with IR725 having the maximum output of 100 MW.
   1.2. The equivalent impedances of the wind turbine generating transformers, the collector circuits, the main transformer, and the 138 kV line from the IC's substation to the POI substation are taken from the IC's supplied one-line for this study.
2. L-6025 is presently not on NSPI's BPS list nor BES list.
3. L-6025 is presently a 42.05 km 138 kV line between 99W-Bridgewater substation to 50W-Milton substation. The IC's one-line shows the new line length of the 138 kV line from the IC's substation to the POI on L-6025 to be 3.5 km. Hence, connection to L-6025 would fall into the category of Table 8 of NSPI's TSIR as "*Connected to non-Bulk Power System network lines at 138kV or 69kV. If new line length is >1km and <10% of length of main line being tapped to a maximum length of 5km"* will allow for *"Single breaker line tap with protection.*". However, it will depend upon how IR739 will be connected to L-6025, as the combination of IR739 and IR725 can result in a loss of 190 MW generation for a common contingency such as a fault on the line. This loss of generation will exceed the largest generator in NS and will require a different kind of interconnection than a single breaker line tap with protection. This issue will be examined in IR725 SIS once the SIS for IR739 is completed.
4. The single equivalent generator is based on eighteen Vestas V162_6.2 wind turbines with real and reactive power ranges as per Vestas technical bulletins.

5. The transmission line ratings are already in the power system cases using NSPI's latest "Transmission Line Ratings Summary", dated December 29, 2023.
6. The order of generation in NS to be displaced by IR725 is defined by NSPI as follows:

   - Trenton 5
   - Lingan 1
   - Lingan 4
   - Lingan 3
   - Pt Aconi
   - Pt Tupper
   - Trenton 6
   - Tufts Cove 1
   - Tufts Cove 2
   - Tufts Cove 3
   - Tufts Cove 4, 5, 6

   while maintaining a minimum of three thermal units on-line to provide short circuit level for NSPI's system operation and system stability: Trenton 6, Tufts Cove 3, and Point Tupper 2. These three generating units can be dispatched at minimum power output.

   In this feasibility study, it assumes that Lingan 2 is retired as per NSPI's generation plan.

7. This study is based on the following system upgrades already identified in local IRs ahead of IR725:

   - L-6006 re-termination to 99W-B62.
   - 9W-T63 upgrade to 60/80/100 MVA.
   - Previous 9W-T63 relocation to replace 30W-T2.
   - Replacement of switches 13V-516A&516B, 70V-503&504 and breaker 9W-563.
   - Addition of 8 MVAR capacitor bank at 30W 69 kV bus.
   - Expansion of 30W and addition of 138 kV bus for L-6020.
   - IR664 connected to 99W-B62.
   - IR597/IR675 connected to 50W-B4.
   - 9W-T2 upgrade to 60/80/100 MVA.
   - L-6054 (43V-IR673) and L-6004 (90H-IR671) upgrade to 100 degree C.

4.0 Project queue position

All in-service generation is included in this FEAS; except Lingan Unit 2, which is assumed to be retired.

As of 2024/02/15, the following projects are higher queued in the Advanced Stage Interconnection Request Queue and are committed to the study base cases:

- IR426: GIA Executed
- IR516: GIA Executed
- IR540: GIA Executed
- IR542: GIA Executed
- IR517: GIA in Progress
- IR574: GIA Executed
- IR598: GIA Executed
- IR597: GIA Executed
- IR647: GIA in Progress
- IR664: FAC Complete
- IR662: FAC Complete
- IR670: FAC Complete
- IR671: FAC in Progress
- IR669: FAC Complete
- IR668: FAC Complete
- IR618: FAC Complete
- IR673: FAC Complete
- IR675: FAC Complete
- IR677: SIS in Progress
- IR697: SIS in Progress
- IR739: SIS in Progress
- IR742: SIS in Progress

The power system base cases for the feasibility study includes all transmission connected IRs in the GIP queue up to and including IR742 with the exception of IR686, as the IR686 SIS was not completed when IR725 was initiated.

In addition, TSR-411 is included in the queue, which reflects the study of long-term firm Transmission Service Reservation (TSR) from New Brunswick to Nova Scotia. If approved by the NSUARB, the TSR is expected to be in service in 2028 and a system study is currently underway to determine the required updates to the Nova Scotia transmission system. This has not been included in the feasibility study and the following notice is posted to the OASIS site (at https://www.nspower.ca/oasis/generation-interconnection-procedures):

> ***Due to ongoing development discussions and engineering studies, the Transmission System Network Upgrades identified as part of Transmission Service Request #411 will not be included in the System Impact Study (SIS) Analysis for Generator Interconnection Procedures (GIP) Study Groups #32 to 35. GIP Study Group #32 to #35 analysis will be limited to the 2022 Transmission***

System configuration plus any material Network Upgrades identified in higher queued projects.

The Transmission Service Request (TSR) Queue is shown on Table 1.

Table 1: TSR queue

OATT Transmission Service
Queued System Impact Studies
Active December 11, 2023

Item	Project	Date & Time of Service Request	Project Type	Project Location	Requested In-Service Date	Project Size (MW)	Status
1	TSR 400	July 22, 2011	Point-to-point	NS-NB*	May 2019	330	System Upgrades in Progress
2	TSR 411	January 19, 2021	Point-to-point	NS-NB*	January 1, 2028	550	Facilities Study in Process

* Indicates project as being located near provincial border.

5.0 Short circuit

The short circuit analysis was performed using PSS/e 34.8.2 with classical fault option, flat voltage profile at 1.0 per unit voltage, and three phase to ground faults.

IR725 short circuit model is based on the technical bulletin (T09 0098-6814 VER 00) provided by the IC. The X"d and Xsource values of 0.26 per unit as per the technical bulletin for IR725 short circuit capability.

IR725 short circuit model was incorporated into NSPI short circuit system case and was simulated with IR725 off-line and with IR725 on-line and the results for relevant buses are shown in Table 2.

Table 2: Short-Circuit Levels, Three-phase MVA		
Location	**IR725 Off**	**IR725 On**
Maximum Generation System Normal (Magnitude in MVA / Angle in Degree)		
99W-Bridgewater 138 kV (Bus 199230)	2009/-84.66	2193/-84.27
50W-Milton 138 kV (Bus 199245)	1591/-84.05	17.16/-83.68
IR725 POI 138 kV (Bus 199535)	1442/-84.57	1668/-84.00
IR725 Main Sub Tx 138 kV (Bus 199536)	1423/-83.77	1649/-83.31
IR725 WEC Collector Term 34.5 kV (Bus 199538)	492/-84.85	822/-82.23
Minimum Generation (TC3, TR6, PT2 on) System Normal		
99W-Bridgewater 138 kV (Bus 199230)	977/-85.41	1189/-84.55
50W-Milton 138 kV (Bus 199245)	756/-84.19	906/-83.35
IR725 POI 138 kV (Bus 199535)	783/-84.97	1009/-83.93

Table 2: Short-Circuit Levels, Three-phase MVA		
Location	**IR725 Off**	**IR725 On**
IR725 Main Sub Tx 138 kV (Bus 199536)	778/-84.55	1004/-83.63
IR725 WEC Collector Term 34.5 kV (Bus 199538)	397/-85.07	727/-82.01
Minimum Generation + L-6025 (IR725-99W) Out		
99W-Bridgewater 138 kV (Bus 199230)	977/-85.42	1152/-84.74
50W-Milton 138 kV (Bus 199245)	680/-83.31	878/-82.75
IR725 POI 138 kV (Bus 199535)	476/-83.51	702/-82.49
IR725 Main Sub Tx 138 kV (Bus 199536)	474/-83.26	701/-82.35
IR725 WEC Collector Term 34.5 kV (Bus 199538)	**301**/-84.15	631/-81.10
Minimum Generation _ L-6025(IR725-IR739) Out		
99W-Bridgewater 138 kV (Bus 199230)	977/-85.42	1186/-84.57
50W-Milton 138 kV (Bus 199245)	681/-83.33	772/-82.53
IR725 POI 138 kV (Bus 199535)	734/-85.05	960/-83.94
IR725 Main Sub Tx 138 kV (Bus 199536)	729/-84.66	956/-83.67
IR725 WEC Collector Term 34.5 kV (Bus 199538)	384/-85.1	714/-81.97

All the 138 kV breakers in the vicinity of IR725 meet or exceed the short circuit interrupting capability of 3, 500 MVA and the three phase short circuit levels shown in Table 2 are well below 3, 500 MVA, hence IR725 does not incur any change out of the 138 kV breakers.

Table 2 shows that the lowest short circuit level at the collector circuit side at 34.5 kV of the wind turbine is 301 MVA, which give a Short Circuit Ratio (SCR) of 301/100 = 3.1, far less than the required value of 5 as per the technical bulletin provided by the wind turbine supplier. In addition, there are a number of wind farms in the vicinity which will reduce the effective SCR further. The SCR value is just an estimate at this time and will very much depend on the design of the collector circuits and the impedances of the wind turbine generating transformers as well as the main substation transformer, hence the IC should carry out detailed short circuit modelling and discuss with the wind turbine supplier to ensure efficient operation of the wind turbines.

6.0 Voltage flicker & harmonics

Based on the technical bulletin, provided by the IC, for voltage flicker parameters for the eighteen wind turbines having nominal power of 6.784 MVA, flicker coefficient c of 1.25 and flicker factor k of 0.05 at 85 degree short circuit angle, the voltage flicker calculation results in Pst = Plt = 0.0269 at the 138 kV POI bus. This value is well below NSPI's

required values of Pst < 0.25 and Plt < 0.35, hence it is not expected that voltage flicker will be an issue.

The same technical bulletin provided by the IC shows that individual harmonics are less than NSPI's requirement (<1.5 % for 138 kV) and total harmonics of 0.92 % is less than NSPI's requirement (<2.5 % for 138 kV), hence it is not expected that harmonics will be an issue.

In any case, if voltage flicker or harmonics become an issue during operation of IR725, IR725 will be responsible for mitigating the issue.

7.0 Thermal limit and voltage limit assessment

For the steady state thermal and voltage assessment, a total of 32 power flow cases were developed and 406 transmission contingencies were simulated for each case.

Half of the cases have IR725 off-line (cases with suffix a) and the other half have IR725 on-line (cases with suffix b) for determining any new system issues that can be attributed to IR725.

The cases reflect a number of system dispatches:

- Maritime Link HVDC at maximum and minimum.
- NS wind at capacity value of 17% and at 100% when the power system can allow.
- High levels of CBX and ONI.
- NB delivers 10 minute operating reserve to NS for loss of 1 pole of Maritime Link HVDC.
- NS delivers 10 minute operating reserve to NB for loss of Point Lepreau nuclear power plant.
- Seasons: winter peak (WIN), summer peak (SUM), summer light load (SML), summer shoulder (SSH).

In nonpeak cases, with the Maritime Link HVDC at zero and depending upon NS to be able to export to NB, the nonpeak cases may not be dispatched at 100% NS wind, hence it is expected that IR703 will be curtailed along with other wind facilities in NS under these system conditions.

The contingencies in NS include:

- Loss of a single transmission system element.
- Breaker failure to operate (BBU).
- Loss of double circuit towers (DCT).
- Loss of load (LOL).
- Loss of source (LOS).

The criteria for assessment are as follows:

- Under system normal, all elements in service, system voltages are no less than 0.95 per unit and element loading must be within nominal rating (Rate A).
- Post contingency steady state, system voltages are no less than 0.9 per unit and element loading is within short time rating (Rate B). For NS, the element loading must also be within rate D (short time rating for the element auxiliary equipment).

There are some existing system conditions observed in the power system cases used in this feasibility study that are not attributed to IR725 and for NSPI to mitigate:

- 22W remote 69 kV bus slightly below 0.95 per unit in system normal.
- Transformer at 58H, 137H, 75W have loading above rating in system normal.

Table 6, Table 7, and Table 8 of Section 13 show the detailed dispatch of the power flow cases and Table 9 and Table 10 of Section 14 show the contingencies in NS and NB that were simulated in steady state power flow.

The power flow simulations for the above mentioned contingencies for the thirty two power flow cases show the following for NRIS:

- 99W-T71 (230 kV/138 kV transformer, 120/160/200 MVA) at 99W-Bridgewater substation is thermally loaded up to 242.2 MVA (100.9% of Rate B and Rate D) for 99W-B62 contingency for case C63a, pre IR725. However, IR725 will load this transformer further to 324.9 MVA (135.4% of Rate B and Rate D). Both Rate B and Rate D for this transformer are 240 MVA in the power system cases. With IR725 addition, this transformer will be overloaded for contingencies 120H-715, 120H-716, 99W-B62, 99W-T72, and L-7008 and for cases C03b, C23b, C43b, and C63b. It is expected that the higher queued IR will upgrade the transformer to resolve pre-IR725 overload and IR725 will require to upgrade the transformer to resolve the additional overload.
- 99W-T72 (230 kV/138 kV transformer, 120/160/200 MVA) at 99W-Bridgewater substation is thermally loaded up to 313.3 MVA (130.5% of Rate B and Rate D) with the addition of IR725. Both Rate B and Rate D for this transformer are 240 MVA. This transformer is overloaded for contingencies 120H-712, 120H-713, 99W-501, 99W-B61, 99W-T71, L-7009, and L-8002/L-7009 (double circuit tower) for cases C03b, C23b, C43b, and C63b. This transformer will require replacement with a larger unit.
- L-5003 69 kV line section between 124H-Akeley substation and 90H-Sackville substation (Rated 55 MVA summer) is thermally loaded to 61.7 MVA (100.1 % of Rate B and Rate D). Both Rate B and Rate D for this line section are 60.5 MVA. This line section is overloaded for contingency L6003/L6009 (double circuit tower) for case C23b. This line section will require upgrade.
- L-5025 69 kV line section from 11V-Paradise substation to 65V-Middleton Tap onto 10V-Nictaux substation has full scale metering rated 42 MVA (Rate D at Paradise substation) and is loaded up to 49 MVA (117.7 % of Rate D). This line metering at 11V-Paradise substation is overloaded for contingencies 99W-B62,

99W-B61, and 99W-501 for cases C23b and C43b. The full scale metering for L-5025 at 11V-Paradise substation will require upgrade.

- L-5532 69 kV line section between 91W-Middlefield and 3W-Big Fall substation has full scale metering rated 28 MVA (Rate D at 3W-Big Fall substation) and is loaded up to 29.3 MVA (104.1 % of Rate D). This line metering at 3W-Big Fall substation is overloaded for contingency 99W-B62 for case C03b. The full scale metering at Big Fall substation for L-5532 will require upgrade.
- L-5535 69 kV line (section 1) between 92W-Carleton Tap and 15V-Sissiboo substation (Rated 23 MVA summer) is thermally loaded up to 33.9 MVA (131 % of Rate B and Rate D). Both Rate B and Rate D for this line section are 25.3 MVA. This line section is overloaded for contingencies 99W-B62, 99W-B61, 99W-50, 50W-B4, and 120H-716 for cases C23a, C23b, C63a, and C63b. This line section is overloaded pre-IR725, up to 27.3 MVA (104.5 % of Rate B and Rate D) for case C23a and C63a due to a higher queued IR on the line. However, IR725 will render the line section even more overloaded, up to 33.9 MVA (131 % of Rate B and Rate D). This line section will require upgrade. It is expected that that the higher queued IR will upgrade the line section to the level that it will require and IR725 will upgrade the line section to 33.9 MVA.
- L-5535 69 kV line (section 2) between 9W-Tusket substation and 92W-Carleton Tap (Rated 23 MVA summer) is thermally loaded up to 35.1 MVA (133.8 % of Rate B and Rate D). Both Rate B and Rate D for this line section are 25.3 MVA. This line section is overloaded for contingencies 120H-713, 120H-715, 50W-B4, 99W-501, 99W-B61, 99W-B62, 99W-T72, L-7008, and L-8002/L-7009 (double circuit tower) for cases C23a, C23b, C63a, and C63b. This line section is overloaded pre-IR725, up to 28 MVA (106.7 % of Rate B and Rate D) for case C23a and C63a due to a higher queued IR on the line. However, IR725 will render the line section even more overloaded, up to 35.1 MVA (133.8 % of Rate B and Rate D). This line section will require upgrade. It is expected that that the higher queued IR will upgrade the line section to the level that it will require and IR725 will upgrade the line section to 35.1 MVA.
- L-6006 138 kV line between 99W-Bridgewater substation and 50W-Milton substation (Rated 135 MVA summer) is thermally loaded up to 183.8 MVA (122.5 % of Rate B and Rate D). Both Rate B and Rate D for this line are 148.5 MVA. This line is overloaded for contingencies L-6025 section between Bridgewater substation and IR725 substation, 99W-B61, and 99W-501 for cases C23b and C63b. This line section will require upgrade.
- L-6009 138 kV line section between 90H-Sackville substation and 101H-Cobequid substation has full scale metering rated 231 MVA at 90H-Sackville substation (Rate D of 231 MVA) and is loaded up to 238.1 MVA (101.4 % of Rate D). This line metering is overloaded for contingency 90H-606 and L-6003 for case C03b. The full scale metering at Sackville substation for L-6009 will require upgrade.
- L-6016 138 kV line between 103H-Lakeside substation and 120H-Brushy Hill substation (with a line tap at 137H-Hammond Plain substation) has full scale metering rated 231 MVA at 103H-Lakeside substation and 346 MVA at 120H-Brushy Hill substation, so the Rate D for the line is 231 MVA. The load flow result shows the full scale metering is loaded up to 244.1 MVA (103.3 % of Rate D) for

the line section between 120H-Brushy Hill substation and 137H-Hammond Plain substation for contingency L-6005/L-6010 (double circuit tower) and 90H-608 for case C03b. However, this loading is below the full scale metering at 120H-Brushy Hill substation, hence this message from the load flow can be ignored and the full scale metering for L-6016 will not require upgrade.

- L-6531 138 kV line between 99W-Bridgewater substation and 50W-Milton substation (Rated 110 MVA summer) is thermally loaded up to 225 MVA (183.5 % of Rate B and Rate D). Both Rate B and Rate D for this line are 121 MVA. This line is overloaded for contingencies 50W-B4, 99W-501, 99W-B61, IR725 BBU (breaker failure), L-6025 (section IR725-99W and section IR739-IR725) for cases C23a, C23b, C43b, C63a, and C63b. This line is overloaded pre-IR725, up to 138.3 MVA (111.5 % of Rate B and Rate D) for case C23a and C63a due to a higher queued IR on the line. However, IR725 will render the line section even more overloaded, up to 225 MVA (183.5 % of Rate B and Rate D). This line section will require upgrade. It is expected that that the higher queued IR will upgrade the line section to the level that it will require and IR725 will upgrade the line section to 225 MVA.
- L-7009 230 kV line between Bridgewater substation and Brushy Hill substation (Rated 223 MVA summer) is thermally loaded up to 242.2 MVA (103.6 % of Rate B and Rate D) for 99W-B62 contingencies for case C63a, pre IR725. However, IR725 will load this line further to 325 MVA (145.9 % of Rate B and Rate D). Both Rate B and Rate D for this line are 245.3 MVA. With IR725 addition, this line is overloaded for contingencies 99W-B62, L-7008, 120H-715, 99W-T72, for cases C23b, C43b, and C63b. It is expected that the higher queued IR will take mitigation measure to avoid the resolve the pre-IR725 overload and IR725 will upgrade the line to resolve the new overload.

Please note that for transmission lines, even though the ratings are in nominal MVA, the power system simulation software, PSSE, is set to convert the MVA to Amperes taking into account the system bus voltages post contingencies. The percentage of transmission line overload is calculated based on amperes current flow in the lines as output by PSSE.

Table 11 in Section 15 shows the summary of power flow results.

The power flow analysis shows that when the local higher queued IRs (ahead of IR725) operate at their full rated outputs then IR725 output will be restricted to as low as zero MW for ERIS.

8.0 Reactive power & voltage control

The IC provided “Preliminary Datasheet of Power Quality” bulletin which indicates that the nominal reactive power per wind turbine is +2.753 MVAR, -2.053 MVAR at 6.2 MW output and 1 p.u. voltage and 7.5 MVA.

IR725 has 18 wind turbines, so the range of reactive power for IR725 is nominally modelled as +49.554 MVAR, -36.954 MVAR.

For Qmax analysis, Figure 2 shows the power flow when IR725 delivers rated MVAR at 100 MW output.

Figure 2: Power Flow for Qmax.

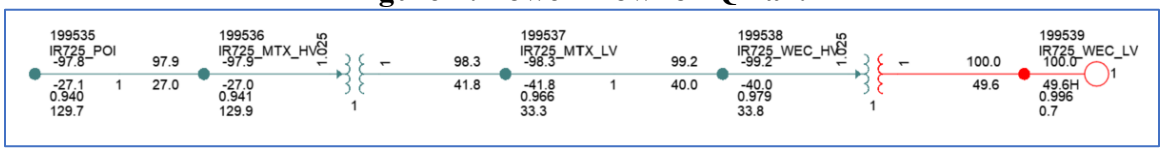


Figure 2 shows that the high side of the main substation transformer delivers 97.9 MW and 27 MVAR, equating to a power factor of 0.96 which is higher than NSPI's requirement of 0.95 or less, hence IR725 will require to install power factor correction equipment to meet NSPI's power factor requirement for delivering MVAR.

For Qmin analysis, Figure 3 shows the power flow when IR725 absorbs MVAR required to meet NSPI's power factor requirement as it delivers 100 MW output.

Figure 3: Power Flow for Qmin.

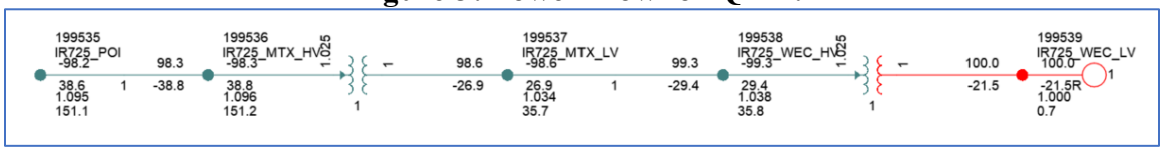


Figure 3 shows that the high side of the main substation transformer delivers 98.3 MW and absorbs 38.8 MVAR, equating to a power factor of 0.93 which meets NSPI's requirement of 0.95 or less, hence IR725 will not require to install power factor correction equipment to meet NSPI's power factor requirement for MVAR absorption.

At this time, the information provided is not sufficient for this feasibility study to verify the power factor requirement at the full range of IR725 output from 0 MW to 100 MW. The IC will be required to provide this information for the SIS to evaluate and confirm that the facility meets the requirements of TSIR Section 7.6.2.

A centralized controller will be required, which continuously adjusts the individual generator reactive power output within the plant capability limits and regulates the voltage at the low voltage terminal of the two main transformers. The voltage controls must be responsive to voltage deviations, be equipped with a voltage setpoint control, and have facilities that will slowly adjust the setpoint over several (5-10) minutes to maintain reactive power within the individual wind turbine' 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 setpoint and the reactive setpoint of this facility to coordinate reactive power dispatch requirements.

This facility must have voltage ride-through capability as detailed in the NS Power Transmission System Interconnection Requirements (TSIR)[1]. The SIS will examine the plant capabilities and controls in detail to specify options, controls, and additional facilities that are required to achieve low voltage ride through.

NS Power notes that NERC standard PRC-029-1 is currently in development. As proposed, this standard will impose performance requirements for voltage and frequency ride through behaviour on inverter-based generating resources. It is anticipated that this standard will be applicable to the project currently under study. The Interconnection Customer is advised to consider the requirements of PRC-029-1 in their project design to ensure that their project can conform to these requirements. Conformance will be validated at the System Impact Study stage.

9.0 NPCC and NERC requirements

In NS, certain transmission system elements are required to meet NPCC[2] BPS (Bulk Power System) or NERC[3] BES (Bulk Electric System) requirements or both.

Since the POI for IR725 will be on the 138 kV line L-6025 which is not on NSPI's present NPCC BPS list nor NERC BES list, therefore the POI substation and the 138 kV line extension to the IC substation are not expected to be BPS nor BES, however, due to a number of other wind farms in the vicinity, the SIS will determine if L-6025 and IR725 POI will be BPS and/or BES.

IR725 generating facility will be BES as its aggregate generation of 100 MW will be above the BES generation threshold of 75 MW.

10.0 Loss factor

Loss factor is calculated by running the winter peak load flow case with and without the new facility in service, while keeping 91H-Tufts Cove as the NS Area Interchange bus. This methodology reflects the load centre in and around 91H-Tufts Cove and how effectively the new facility can displace generation at Tufts Cove. Generally, a negative loss factor reflects a reduction in system losses.

The loss factor for IR725 is shown in Table 3.

[1] NS Power Transmission System Interconnection Requirements; https://www.nspower.ca/oasis/generation-interconnection-procedures
[2] Northeastern Power Coordination Council.
[3] North American Electric Reliability Corporation.

Table 3: IR725 Loss Factor

Component	at IR725 Terminal	at POI
IR725 on at 100 MW	100	98.2
TC3 MW with IR725 on	56.3	56.3
TC3 MW with IR725 off	153	153
IR725 Loss Factor	3.3%	1.5%

The loss factor at POI is lower because it does not include the losses from POI to IR725 facility.

11.0 Expected facilities required for interconnection.

The following facilities are required to interconnect IR725 to the NSPI system via the POI on L-6025:

1) Network Upgrades (NU):

Table 4 and Table 5 show NU required for NRIS and ERIS respectively.

2) Transmission Provider's Interconnection Facilities (TPIF):

Table 4 and Table 5 also show TPIF required for NRIS and ERIS respectively.

The single breaker line tap with protection is included in the cost estimate at this time, but this will depend upon how IR739 (ahead in queue position than IR725) will be connected to L-6025, a three breaker ring may be required to connect IR725 to the same line to avoid generation loss larger than the present largest generator in NS. This issue is discussed in detail in the Executive Summary.

3) Interconnection Customer's Interconnection Facilities (ICIF*)*:

a) Facilities to limit plant output to 100 MW.

b) Facilities to provide ±0.95 power factor when delivering rated output (100MW) at the 138 kV bus when voltage is operating between ±5% of nominal. Rated reactive power shall be available through the full range of real power output, from zero to full power.

c) Centralized controls for voltage setpoint control for the low side of the ICIF transformers. Fast acting control is required and will include a curtailment scheme, which will limit/reduce total output from the facility, upon receipt of a telemetered signal from NSPI's SCADA system.

d) NSPI to have supervisory and control of this facility, via the centralized controller. This will permit the NSPI System Operator to raise/lower the voltage setpoint, change the status of reactive power controls, change the real/reactive power

remotely. NSPI will also have remote manual control of the load curtailment scheme.

e) When curtailed, the facility shall offer over-frequency and under-frequency control with ±0.2 Hz dead band and 4% droop characteristic. The active power controls shall also react to continuous control signals from the NSPI SCADA system's Automatic Generation Control (AGC) system to control tie-line fluctuations as required.

f) Real-time telemetry will include MW, MVAR, bus voltages, and curtailment state.

g) Meet the requirements detailed in the NS Power Transmission System Interconnection Requirements (TSIR)[4]. Among them is voltage ride-through capability per section 7.4.1 and frequency ride-through per section 7.4.2.

h) Facilities for NSPI to execute high speed rejection of generation and load (transfer trip), if determined in the SIS. The plant may be incorporated in SPS runback or load reject schemes.

i) The facility must use equipment capable of closing a circuit breaker with minimal transient impact on system voltage and frequency (matching voltage within ±0.05 PU and a phase angle within ±15°).

j) Operation at ambient temperatures as low as -30ºC.

12.0 NSPI Interconnection Facilities & Network Upgrades cost estimate.

The high level, non-binding, cost estimate, excluding HST, for IR725's NRIS and ERIS are shown in Table 4 and Table 5 respectively.

Table 4: Non-Binding Cost Estimate for *NRIS*

Item	Network Upgrades (NU)	Estimate ($M CAN)
1	Upgrade 99W-T71 230 kV/138 kV transformer from 120/160/200 MVA to 325 MVA min (235/314//392 MVA)	7.45
2	Upgrade 99W-T72 230 kV/138 kV transformer from 120/160/200 MVA to 315 MVA min (235/314//392 MVA)	7.45
3	Upgrade L-5003, 69 kV line section between 124H-Akeley substation and 90H-Sackville substation, thermal rating from 55 MVA summer to 61 MVA	5.28

[4] NS Power Transmission System Interconnection Requirements; https://www.nspower.ca/oasis/generation-interconnection-procedures

Item	Network Upgrades (NU)	Estimate ($M CAN)
4	Upgrade line full scale metering for L-5025, L-5532 and L-6009 at 11V-Paradise, 3W-Big Falls, 90H-Sackville substations respectively	0.10
5	Upgrade L-5535 69 kV line section 1, between 92W-Carleton Tap and 15V-Sissiboo substation, which is thermally rated 23 MVA, from 27.3 MVA summer (post local IR upgrade) to 34 MVA	41.10
6	Upgrade L-5535 69 kV line section 2, between 9W-Tusket substation and 92W-Carleton Tap which is thermally rated 23 MVA, from 28 MVA summer (post local IR upgrade) to 36 MVA	10.85
7	Upgrade L-6006 138 kV line between 99W-Bridgewater substation and 50W-Milton substation thermal rating from 135 MVA summer to 184 MVA	16.84
8	Upgrade L-6531 138 kV line, between 99W-Bridgewater substation and 50W-Milton substation, which is rated 110 MVA summer, from 138 MVA summer (post local IR upgrade) to 225 MVA	16.62
9	Upgrade L-7009 230 kV line, between 99W-Bridgewater substation and 90H-Brushy Hill substation, which is thermally rated 223 MVA summer, from 223 summer to 325 MVA	63.33
10	P&C modifications at 50W-Milton substation (if IR739 does not proceed) or at IR739 substation (if IR739 is built ahead of IR725) and 99W-Bridgewater substation on L-6025 including in-line switches at the POI	1.00
	Contingency (25%)	42.50
	Network Upgrade Sub-total	***212.52***
Item	**Transmission Provider's Interconnection Facilities (TPIF)**	
1	Single breaker line tap with protection at 138 kV to L-6025	2.00
2	New 3.5 km of wood pole H-frame, Dove 556 ACSR, 100 deg C, 138 kV line from POI substation to IC substation.	3.50
3	P&C relaying equipment	0.30
4	NSPI supplied RTU	0.10
5	Tele-protection and SCADA communications	0.75
	Contingency (25%)	1.66
	TPIF Upgrade Sub-total	***8.31***
	Total NU and TPIF Upgrades (*excluding HST*)	**220.83**

Table 5: Non-Binding Cost Estimate for ERIS

Item	Network Upgrades (NU)	Estimate ($M CAN)
1	P&C modifications at 50W-Milton substation (if IR739 does not proceed) or at IR739 substation (if IR739 is built ahead of IR725) and 99W-Bridgewater substation on line L-6025 including in-line switches at the POI	1.00
	Contingency (25%)	0.25
	Network Upgrade Sub-total	***1.25***
Item	**Transmission Provider's Interconnection Facilities (TPIF)**	
1	Single breaker line tap with protection at 138 kV to L-6025	2.00
2	New 3.5 km of wood pole H-frame, Dove 556 ACSR, 100 deg C, 138 kV line from POI substation to IC substation.	3.50
3	P&C relaying equipment	0.30
4	NSPI supplied RTU	0.10
5	Tele-protection and SCADA communications	0.75
	Contingency (25%)	1.66
	TPIF Upgrade Sub-total	***8.31***
	Total NU and TPIF Upgrades (*excluding HST*)	**9.56**

The cost estimates in Table 4 and Table 5 are subject to change as will be determined by the SIS and FAC study.

For ERIS, when local higher queue IRs (ahead of IR725) operate at their full rated outputs then IR725 output will be restricted to as low as zero MW.

The estimated time to construct the NU and TPIF for NRIS is 24-36 months after the receipt of funds. It is expected that the time frame would be shorter for ERIS. The time frame will be further determined by the FAC study.

13.0 Cases

Table 6: Steady State Power Flow Cases (Part 1)

Case Name	IR725	Total Wind	NS Load	Motor Load	CBX	ONI	ONS
C02_2027WIN_GCP_MMWG_a.sav	0	261	2340	0	1008	1037	851
C02_2027WIN_GCP_MMWG_b.sav	100	361	2331	0	902	937	751
C03_2027WIN_GCP_MMWG_a.sav	0	1389	2297	0	210	593	552
C03_2027WIN_GCP_MMWG_b.sav	100	1489	2297	0	183	535	494
C04_2027WIN_GCP_MMWG_a.sav	0	261	2331	0	791	819	776
C04_2027WIN_GCP_MMWG_b.sav	100	361	2322	0	686	719	676
C05_2027WIN_GCP_MMWG_a.sav	0	528	2340	0	1010	1145	607
C05_2027WIN_GCP_MMWG_b.sav	100	628	2331	0	905	1047	509
C22_2027SUM_GCP_MMWG_a.sav	0	236	1545	135	549	650	401
C22_2027SUM_GCP_MMWG_b.sav	100	336	1545	135	447	552	303
C23_2027SUM_GCP_MMWG_a.sav	0	1389	1587	197	-144	268	150
C23_2027SUM_GCP_MMWG_b.sav	100	1489	1578	197	-226	184	60
C24_2027SUM_GCP_MMWG_a.sav	0	236	1541	135	467	571	615
C24_2027SUM_GCP_MMWG_b.sav	100	336	1541	135	365	471	516
C25_2027SUM_GCP_MMWG_a.sav	0	236	1563	135	911	995	389
C25_2027SUM_GCP_MMWG_b.sav	99	335	1563	135	807	896	291
C42_2027SML_GCP_MMWG_a.sav	0	236	743	165	39	210	47
C42_2027SML_GCP_MMWG_b.sav	100	336	743	165	12	114	-48
C43_2027SML_GCP_MMWG_a.sav	0	776	743	165	-143	134	-141
C43_2027SML_GCP_MMWG_b.sav	100	876	743	165	-143	133	-229
C44_2027SML_GCP_MMWG_a.sav	0	236	775	197	-104	-9	121
C44_2027SML_GCP_MMWG_b.sav	100	336	775	197	-104	-9	25
C45_2027SML_GCP_MMWG_a.sav	0	776	743	165	-83	194	-255
C45_2027SML_GCP_MMWG_b.sav	6	782	743	165	-83	193	-255
C46_2027SML_GCP_MMWG_a.sav	0	574	775	197	-199	219	141
C46_2027SML_GCP_MMWG_b.sav	100	674	775	197	-199	219	44
C62_2027SSH_GCP_MMWG_a.sav	0	236	1172	135	291	369	163
C62_2027SSH_GCP_MMWG_b.sav	100	336	1172	135	289	345	139
C63_2027SSH_GCP_MMWG_a.sav	0	1389	1218	197	-181	259	-73
C63_2027SSH_GCP_MMWG_b.sav	100	1489	1214	197	-183	256	-119
C72_2027SUM_GCP_MMWG_a.sav	0	236	1545	135	549	650	401
C72_2027SUM_GCP_MMWG_b.sav	100	336	1545	135	447	552	303

Table 7: Steady State Power Flow Cases (Part 2)

Case Name	NL to NS	NB to NS	NB to PEI	NB to NE	NB to HQ	NB to MPS	Pt Lepreau
C02_2027WIN_GCP_MMWG_a.sav	475	0	289	0	-960	70	715
C02_2027WIN_GCP_MMWG_b.sav	475	-1	289	1	-960	70	715

Case Name	NL to NS	NB to NS	NB to PEI	NB to NE	NB to HQ	NB to MPS	Pt Lepreau
C03_2027WIN_GCP_MMWG_a.sav	86	0	288	0	-960	70	715
C03_2027WIN_GCP_MMWG_b.sav	86	0	288	0	-960	70	715
C04_2027WIN_GCP_MMWG_a.sav	237	142	259	0	-960	70	715
C04_2027WIN_GCP_MMWG_b.sav	237	142	258	1	-960	70	715
C05_2027WIN_GCP_MMWG_a.sav	475	-381	289	10	-960	70	0
C05_2027WIN_GCP_MMWG_b.sav	475	-381	289	10	-960	70	0
C22_2027SUM_GCP_MMWG_a.sav	330	-150	228	800	-845	64	715
C22_2027SUM_GCP_MMWG_b.sav	330	-150	228	800	-845	64	715
C23_2027SUM_GCP_MMWG_a.sav	0	-163	228	813	-845	64	715
C23_2027SUM_GCP_MMWG_b.sav	0	-170	228	821	-845	64	715
C24_2027SUM_GCP_MMWG_a.sav	237	142	228	800	-845	64	715
C24_2027SUM_GCP_MMWG_b.sav	237	142	228	800	-845	64	715
C25_2027SUM_GCP_MMWG_a.sav	340	-500	228	800	-845	64	0
C25_2027SUM_GCP_MMWG_b.sav	340	-500	229	799	-845	64	0
C42_2027SML_GCP_MMWG_a.sav	170	-150	55	450	-460	27	600
C42_2027SML_GCP_MMWG_b.sav	170	-150	55	450	-460	27	600
C43_2027SML_GCP_MMWG_a.sav	0	-330	55	448	-460	27	419
C43_2027SML_GCP_MMWG_b.sav	0	-415	55	530	-460	27	419
C44_2027SML_GCP_MMWG_a.sav	85	142	55	444	-460	27	715
C44_2027SML_GCP_MMWG_b.sav	85	45	55	542	-460	27	715
C45_2027SML_GCP_MMWG_a.sav	0	-500	55	440	-460	27	0
C45_2027SML_GCP_MMWG_b.sav	0	-500	55	440	-460	27	0
C46_2027SML_GCP_MMWG_a.sav	0	-66	55	466	-460	27	600
C46_2027SML_GCP_MMWG_b.sav	0	-162	55	561	-460	27	600
C62_2027SSH_GCP_MMWG_a.sav	330	-151	162	801	-813	47	715
C62_2027SSH_GCP_MMWG_b.sav	330	-152	162	802	-813	47	715
C63_2027SSH_GCP_MMWG_a.sav	0	-418	162	812	-813	47	600
C63_2027SSH_GCP_MMWG_b.sav	0	-460	162	852	-813	47	600
C72_2027SUM_GCP_MMWG_a.sav	330	-150	228	800	-845	64	715
C72_2027SUM_GCP_MMWG_b.sav	330	-150	228	800	-845	64	715

Table 8: Steady State Power Flow Cases (Part 3)

Case Name	TC	TR	PT2	LG	PA	BS	VJ	TUS	WC
C02_2027WIN_GCP_MMWG_a.sav	389	165	155	250	184	0	66	30	190
C02_2027WIN_GCP_MMWG_b.sav	389	165	155	132	184	0	66	30	190
C03_2027WIN_GCP_MMWG_a.sav	213	110	100	0	0	0	66	30	190
C03_2027WIN_GCP_MMWG_b.sav	177	78	73	0	0	0	66	30	190
C04_2027WIN_GCP_MMWG_a.sav	389	151	156	258	184	72	66	30	190
C04_2027WIN_GCP_MMWG_b.sav	389	151	156	141	184	72	66	30	190
C05_2027WIN_GCP_MMWG_a.sav	390	165	155	245	184	100	66	30	190
C05_2027WIN_GCP_MMWG_b.sav	390	165	155	128	184	100	66	30	190

Case Name	TC	TR	PT2	LG	PA	BS	VJ	TUS	WC
C22_2027SUM_GCP_MMWG_a.sav	386	160	150	110	174	0	0	0	80
C22_2027SUM_GCP_MMWG_b.sav	386	160	141	63	126	0	0	0	80
C23_2027SUM_GCP_MMWG_a.sav	70	80	83	80	0	0	0	10	0
C23_2027SUM_GCP_MMWG_b.sav	68	78	73	0	0	0	0	10	0
C24_2027SUM_GCP_MMWG_a.sav	168	160	150	110	184	0	0	0	80
C24_2027SUM_GCP_MMWG_b.sav	168	160	150	63	126	0	0	0	80
C25_2027SUM_GCP_MMWG_a.sav	314	160	150	480	184	80	0	0	80
C25_2027SUM_GCP_MMWG_b.sav	314	160	150	371	184	80	0	0	80
C42_2027SML_GCP_MMWG_a.sav	141	154	100	0	0	0	0	0	0
C42_2027SML_GCP_MMWG_b.sav	141	83	73	0	0	0	0	0	0
C43_2027SML_GCP_MMWG_a.sav	74	79	73	0	0	0	0	0	0
C43_2027SML_GCP_MMWG_b.sav	68	78	73	0	0	0	0	0	0
C44_2027SML_GCP_MMWG_a.sav	68	78	73	0	0	0	0	0	0
C44_2027SML_GCP_MMWG_b.sav	68	78	73	0	0	0	0	0	0
C45_2027SML_GCP_MMWG_a.sav	74	79	73	0	0	100	60	16	0
C45_2027SML_GCP_MMWG_b.sav	68	78	73	0	0	100	60	16	0
C46_2027SML_GCP_MMWG_a.sav	68	78	73	0	0	0	0	0	0
C46_2027SML_GCP_MMWG_b.sav	68	78	73	0	0	0	0	0	0
C62_2027SSH_GCP_MMWG_a.sav	366	100	75	0	126	0	0	0	0
C62_2027SSH_GCP_MMWG_b.sav	292	78	73	0	126	0	0	0	0
C63_2027SSH_GCP_MMWG_a.sav	118	78	75	0	0	0	0	10	0
C63_2027SSH_GCP_MMWG_b.sav	68	78	73	0	0	0	0	10	0
C72_2027SUM_GCP_MMWG_a.sav	311	160	150	110	174	0	0	25	80
C72_2027SUM_GCP_MMWG_b.sav	312	160	141	63	126	0	0	25	80

14.0 Contingencies

Table 9: Steady State Contingencies (Part 1)					
101S_701	120H_627	1N_B52	43V_T62**	67N_710	90H_605
101S_702	120H_628	1N_B61	47C_T63	67N_713	90H_606
101S_703	120H_629	1N_B62	47C_T64	67N_811*	90H_608
101S_704	120H_710	1N_C61	47C_T65	67N_812	90H_609
101S_705	120H_711	1N_T1	47C_T67	67N_813	90H_611
101S_706	120H_712	1N_T4	49N_600	67N_814*	90H_612
101S_711	120H_713	1V_B51	4C_620BBU	67N_T71	90H_T1
101S_712	120H_714	20V_B51	4C_621BBU	67N_T81	91H_511
101S_713	120H_715	2CB61*	4C_622BBU	67N_T82	91H_513
101S_811	120H_716	2CB62*	4C_623BBU	67N711*	91H_516
101S_812*	120H_720	2S_600	4C_T2	67N712*	91H_521
101S_813*	120H_SVC	2S_B64	4C_T63	7003a_4*	91H_523
101S_814	120H_T71	2S_B65	50N_604	7003c_4*	91H_603

Table 9: Steady State Contingencies (Part 1)					
101S_816	120H_T72	2S_T1	50N_G6	70087009sep	91H_604
101S_T81	132H_602	2S_T2	50N_T12	74N_B61	91H_605
101S_T82	132H_603	30N_B61	50N_T8	74NT61	91H_606
101V_601	132H_605	30NT61	50NB61	79N-T81	91H_607
101V_602	132H_606	30W_B51	50NB62*	82V_B61	91H_608
101V_603	13V_B51	30W_B61	50W_501**	85S_B61	91H_609
103H_600	15V_B51	3C_711	50W_600SEP	85S_G1	91H_611
103H_608	17V_512	3C_712*	50W_B2	88S_710	91H_613
103H_681	17V_563	3C_713	50W_B3**	88S_711	91H_621
103H_881	17V_611	3C_714	50W_B4	88S_712	91H_T11
103H_B61	17V_B1	3C_715*	51V_500**	88S_713	91H_T62
103H_B62	17V_B2	3C_716	51V_601	88S_714	91H_TC3
103H_T81	17V_B63	3C_T71	51V_602	88S_715	91N_701
108H_600	17V_T1	3C_T72	51V_603	88S_720	91N_Dal_WF
108H_B1	17V_T2	3C710*	51V_B51**	88S_721	92V_B51
108H_B3	17V_T63	3C720*	51V_B52	88S_722	99W_501
110W	1C_689	3S_T1	51V_T61**	88S_723*	99W_600***
113H_600	1C_B61	3W_B53	51V_T62	88S_G4	99W_B51
11V_B51**	1C_B62	43V_503	67N_701	88S_T71	99W_B61
120H_621	1C_G2	43V_562	67N_702	88S_T72	99W_B62
120H_622	1N_600	43V_B51	67N_703	89S_G1	99W_T61
120H_623	1N_601	43V_B61**	67N_704	90H_503	99W_T71
120H_624	1N_613	43V_B62	67N_705	90H_602	99W_T72
120H_626	1N_B51	43V_T61**	67N_706	90H_603	9W_500

Table 10: Steady State Contingencies (Part 2)				
9W_B52	L5049	L-5564L5576	L6035	L6552
9W_B53	L-5053	L-5571	L6038	L6613
IR618	L-5054	L-5573L5575	L6040	L7001
IR618_BBU	L-5058	L-5580	L60406042	L7002
IR668	L-5060	L6001	L6042	L7003a
IR668_BBU	L-5500	L6002_90H	L6043	L7003b
IR670	L-5501	L6002_99W	L6044	L7003c
IR670_BBU	L-5502	L6003	L6047	L7004
IR725	L-5505	L60036007	L6048	L7005Has*
IR725_BBU	L-5506	L60036009	L6051_IR574	L7005Ons*
IR739	L-5507L5508	L6004_IR671	L6051a	L7008
IR739_BBU	L-5511	L6004a	L6051b	L7009
L-5003	L-5512	L6004b	L6052	L7011
L-5011	L-5521	L6005	L6053	L7012
L5012	L-5524	L60056010	L6054_IR673	L7014

Table 10: Steady State Contingencies (Part 2)				
L-5014	L-5530	L60056016	L6054a	L7015
L-5015	L-5531	L6006	L6054b	L7019
L-5016	L-5532	L6007	L6055	L7021
L-5017	L-5533L5581	L6008	L6503	L70216534
L5019_L5035	L-5534	L6009	L6507	L7022
L-5020	L-5535	L6010	L65076508	L8001*
L-5021	L-5536	L60106011	L6508	L8002
L-5022	L-5537	L6011	L6510	L80027009
L-5024	L-5538	L6012	L6511	L8003*
L-5025**	L-5539	L6013	L6514	L8004*
L-5026**	L-5540	L6014	L6515	ML_2Poles
L-5027	L-5541	L6015	L6516	ML_Pole1
L-5028	L-5545	L6016	L6517	ML_Pole2
L-5029L5030	L-5546	L6020	L6518	Lepreau
L-5032L5004	L-5547L5551	L6021	L6523	104H600
L-5033	L-5548	L6024	L6531	1H
L-5036	L-5549	L6025_50W-IR739	L6535	2S_513
L-5037L3031	L-5550L5582	L6025_IR725-99W	L6536	47C_602
L-5039	L-5559L5579	L6025_IR739-IR725	L6537*	47C_603
L-5040	L-5560	L6033	L6538	47C_674
L5041	L-5561L5565	L60335039	L6539	PHP
L-5042	L-5563	L60336035	L6551	

Contingencies with * means it is equipped with Remedial Action Scheme (RAS) or Special Protection Scheme (SPS).

Contingencies with ** means it is equipped with Automatic Action Scheme (AAS).

Contingencies with *** means that this contingency can separate the local western area of NS.

15.0 Contingency Power Flow Results

Table 11: Contingency Power Flow Results

Case and Rate	Contingency	Rating	MW	MVAR	MVA	% Loading	Line Number
C63b_Rate D	99W_B62_____	240	313.1	-86.8	324.9	135.4	99W-T71
C63b_Rate B	99W_B62_____	240	313.1	-86.8	324.9	135.4	99W-T71
C23b_RateD	99W_B62_____	240	293.9	-83.3	305.5	127.3	99W-T71
C23b_RateB	99W_B62_____	240	293.9	-83.3	305.5	127.3	99W-T71

Case and Rate	Contingency	Rating	MW	MVAR	MVA	% Loading	Line Number
C23b_RateD	99W_T72_____	240	282.4	-62.2	289.1	120.5	99W-T71
C23b_RateB	99W_T72_____	240	282.4	-62.2	289.1	120.5	99W-T71
C23b_RateD	L7008_____	240	282.3	-61.2	288.9	120.4	99W-T71
C23b_RateB	L7008_____	240	282.3	-61.2	288.9	120.4	99W-T71
C23b_RateD	120H_715_____	240	282.2	-59.6	288.4	120.2	99W-T71
C23b_RateB	120H_715_____	240	282.2	-59.6	288.4	120.2	99W-T71
C23b_RateD	120H_716_____	240	280.8	-60.5	287.3	119.7	99W-T71
C23b_RateB	120H_716_____	240	280.8	-60.5	287.3	119.7	99W-T71
C63b_Rate D	99W_T72_____	240	266.5	-64.7	274.2	114.3	99W-T71
C63b_Rate B	99W_T72_____	240	266.5	-64.7	274.2	114.3	99W-T71
C63b_Rate D	L7008_____	240	266.4	-63.7	273.9	114.1	99W-T71
C63b_Rate B	L7008_____	240	266.4	-63.7	273.9	114.1	99W-T71
C63b_Rate D	120H_715_____	240	266.2	-62.2	273.4	113.9	99W-T71
C63b_Rate B	120H_715_____	240	266.2	-62.2	273.4	113.9	99W-T71
C63b_Rate D	120H_716_____	240	265.5	-62.8	272.9	113.7	99W-T71
C63b_Rate B	120H_716_____	240	265.5	-62.8	272.9	113.7	99W-T71
C03b_RateD	99W_B62_____	240	248.7	-75.6	259.9	108.3	99W-T71
C03b_RateB	99W_B62_____	240	248.7	-75.6	259.9	108.3	99W-T71
C43b_RateD	99W_B62_____	240	254.9	-46.1	259	107.9	99W-T71
C43b_RateB	99W_B62_____	240	254.9	-46.1	259	107.9	99W-T71
C43b_RateD	99W_T72_____	240	253.6	-29.9	255.3	106.4	99W-T71
C43b_RateB	99W_T72_____	240	253.6	-29.9	255.3	106.4	99W-T71
C43b_RateD	L7008_____	240	253.5	-28.9	255.2	106.3	99W-T71
C43b_RateB	L7008_____	240	253.5	-28.9	255.2	106.3	99W-T71
C43b_RateD	120H_715_____	240	253.4	-27.9	254.9	106.2	99W-T71
C43b_RateD	120H_716_____	240	253.2	-28.7	254.8	106.2	99W-T71
C43b_RateB	120H_715_____	240	253.4	-27.9	254.9	106.2	99W-T71
C43b_RateB	120H_716_____	240	253.2	-28.7	254.8	106.2	99W-T71
C63a_RateD	99W_B62_____	240	231.2	-72.1	242.2	100.9	99W-T71
C63a_RateB	99W_B62_____	240	231.2	-72.1	242.2	100.9	99W-T71
C23b_RateD	99W_B61_____	240	304	-75.4	313.3	130.5	99W-T72
C23b_RateD	99W_501_____	240	304	-75.4	313.3	130.5	99W-T72
C23b_RateB	99W_B61_____	240	304	-75.4	313.3	130.5	99W-T72
C23b_RateB	99W_501_____	240	304	-75.4	313.3	130.5	99W-T72
C23b_RateD	99W_T71_____	240	283.8	-63.6	290.8	121.2	99W-T72
C23b_RateB	99W_T71_____	240	283.8	-63.6	290.8	121.2	99W-T72
C23b_RateD	L7009_____	240	283.7	-62.6	290.5	121.1	99W-T72
C23b_RateB	L7009_____	240	283.7	-62.6	290.5	121.1	99W-T72
C23b_RateD	120H_712_____	240	283.6	-60.9	290.1	120.9	99W-T72
C23b_RateB	120H_712_____	240	283.6	-60.9	290.1	120.9	99W-T72
C23b_RateD	L80027009_____	240	283	-62.1	289.8	120.7	99W-T72

Case and Rate	Contingency	Rating	MW	MVAR	MVA	% Loading	Line Number
C23b_RateB	L80027009_____	240	283	-62.1	289.8	120.7	99W-T72
C23b_RateD	120H_713_____	240	282.2	-62	289	120.4	99W-T72
C23b_RateB	120H_713_____	240	282.2	-62	289	120.4	99W-T72
C63b_Rate D	99W_B61_____	240	275.7	-77.8	286.5	119.4	99W-T72
C63b_Rate D	99W_501_____	240	275.7	-77.8	286.5	119.4	99W-T72
C63b_Rate B	99W_B61_____	240	275.7	-77.8	286.5	119.4	99W-T72
C63b_Rate B	99W_501_____	240	275.7	-77.8	286.5	119.4	99W-T72
C03b_RateD	99W_B61_____	240	275.9	-56.2	281.5	117.3	99W-T72
C03b_RateD	99W_501_____	240	275.9	-56.2	281.5	117.3	99W-T72
C03b_RateB	99W_B61_____	240	275.9	-56.2	281.5	117.3	99W-T72
C03b_RateB	99W_501_____	240	275.9	-56.2	281.5	117.3	99W-T72
C63b_Rate D	99W_T71_____	240	267.8	-66.3	275.9	115	99W-T72
C63b_Rate B	99W_T71_____	240	267.8	-66.3	275.9	115	99W-T72
C63b_Rate D	L7009_____	240	267.8	-65.3	275.6	114.8	99W-T72
C63b_Rate D	L80027009_____	240	267.8	-65	275.6	114.8	99W-T72
C63b_Rate B	L7009_____	240	267.8	-65.3	275.6	114.8	99W-T72
C63b_Rate B	L80027009_____	240	267.8	-65	275.6	114.8	99W-T72
C63b_Rate D	120H_712_____	240	267.6	-63.7	275.1	114.6	99W-T72
C63b_Rate B	120H_712_____	240	267.6	-63.7	275.1	114.6	99W-T72
C63b_Rate D	120H_713_____	240	266.9	-64.5	274.6	114.4	99W-T72
C63b_Rate B	120H_713_____	240	266.9	-64.5	274.6	114.4	99W-T72
C43b_RateD	99W_B61_____	240	256.7	-38.6	259.6	108.1	99W-T72
C43b_RateD	99W_501_____	240	256.7	-38.6	259.6	108.1	99W-T72
C43b_RateB	99W_B61_____	240	256.7	-38.6	259.6	108.1	99W-T72
C43b_RateB	99W_501_____	240	256.7	-38.6	259.6	108.1	99W-T72
C43b_RateD	L80027009_____	240	254.9	-27.6	256.4	106.8	99W-T72
C43b_RateD	99W_T71_____	240	254.6	-29.1	256.3	106.8	99W-T72
C43b_RateB	L80027009_____	240	254.9	-27.6	256.4	106.8	99W-T72
C43b_RateB	99W_T71_____	240	254.6	-29.1	256.3	106.8	99W-T72
C43b_RateD	L7009_____	240	254.6	-28	256.1	106.7	99W-T72
C43b_RateB	L7009_____	240	254.6	-28	256.1	106.7	99W-T72
C43b_RateD	120H_712_____	240	254.4	-27	255.9	106.6	99W-T72
C43b_RateB	120H_712_____	240	254.4	-27	255.9	106.6	99W-T72
C43b_RateD	120H_713_____	240	254.2	-28	255.7	106.5	99W-T72
C43b_RateB	120H_713_____	240	254.2	-28	255.7	106.5	99W-T72
C23b_RateD	L60036009_____	60.5	-61.7	-3	61.7	100.1	L-5003-2 Akerley - Sackville
C23b_RateB	L60036009_____	60.5	-61.7	-3	61.7	100.1	L-5003-2 Akerley - Sackville
C63b_Rate D	99W_B62_____	42	46.4	-15.6	49	117.7	L-5025-1 Paradise - Middleton
C23b_RateD	99W_B62_____	42	44.9	-16.3	47.8	115.4	L-5025-1 Paradise - Middleton
C03b_RateD	99W_B62_____	42	40.7	-22.1	46.3	112.9	L-5025-1 Paradise - Middleton
C03b_RateD	99W_B61_____	42	38.4	-20.1	43.3	104.7	L-5025-1 Paradise - Middleton

Case and Rate	Contingency	Rating	MW	MVAR	MVA	% Loading	Line Number
C03b_RateD	99W_501_____	42	38.4	-20.1	43.3	104.7	L-5025-1 Paradise - Middleton
C23b_RateD	99W_B61_____	42	41	-14	43.3	103.4	L-5025-1 Paradise - Middleton
C23b_RateD	99W_501_____	42	41	-14	43.3	103.4	L-5025-1 Paradise - Middleton
C43b_RateD	99W_B62_____	42	42.3	-9.3	43.3	101.7	L-5025-1 Paradise - Middleton
C63b_Rate D	99W_B62_____	42	37.9	-21.5	43.6	103.3	L-5025-2 Middleton - Nictaux
C03b_RateD	99W_B62_____	28	28.8	-5.5	29.3	104.1	L-5532-6 Middlefield - Big Fall
C63b_Rate D	99W_B62_____	25.3	28.6	-18.2	33.9	131	L-5535-1 Carleton-Sissiboo
C63b_Rate B	99W_B62_____	25.3	28.6	-18.2	33.9	131	L-5535-1 Carleton-Sissiboo
C23b_RateD	99W_B62_____	25.3	28.1	-16.4	32.5	126.2	L-5535-1 Carleton-Sissiboo
C23b_RateB	99W_B62_____	25.3	28.1	-16.4	32.5	126.2	L-5535-1 Carleton-Sissiboo
C23b_RateD	99W_B61_____	25.3	24.9	-16	29.6	114.5	L-5535-1 Carleton-Sissiboo
C23b_RateD	99W_501_____	25.3	24.9	-16	29.6	114.5	L-5535-1 Carleton-Sissiboo
C23b_RateB	99W_B61_____	25.3	24.9	-16	29.6	114.5	L-5535-1 Carleton-Sissiboo
C23b_RateB	99W_501_____	25.3	24.9	-16	29.6	114.5	L-5535-1 Carleton-Sissiboo
C63b_Rate D	50W_B4_____	25.3	21.9	-18.1	28.4	109.8	L-5535-1 Carleton-Sissiboo
C63b_Rate B	50W_B4_____	25.3	21.9	-18.1	28.4	109.8	L-5535-1 Carleton-Sissiboo
C63b_Rate D	99W_B61_____	25.3	22.2	-16.5	27.6	105.9	L-5535-1 Carleton-Sissiboo
C63b_Rate D	99W_501_____	25.3	22.2	-16.5	27.6	105.9	L-5535-1 Carleton-Sissiboo
C63b_Rate B	99W_B61_____	25.3	22.2	-16.5	27.6	105.9	L-5535-1 Carleton-Sissiboo
C63b_Rate B	99W_501_____	25.3	22.2	-16.5	27.6	105.9	L-5535-1 Carleton-Sissiboo
C63a_RateD	99W_B62_____	25.3	22	-16.2	27.3	104.5	L-5535-1 Carleton-Sissiboo
C63a_RateB	99W_B62_____	25.3	22	-16.2	27.3	104.5	L-5535-1 Carleton-Sissiboo
C23b_RateD	50W_B4_____	25.3	21.1	-16.7	26.9	104.3	L-5535-1 Carleton-Sissiboo
C23b_RateB	50W_B4_____	25.3	21.1	-16.7	26.9	104.3	L-5535-1 Carleton-Sissiboo
C23a_RateD	99W_B62_____	25.3	22.2	-15	26.7	102.8	L-5535-1 Carleton-Sissiboo
C23a_RateB	99W_B62_____	25.3	22.2	-15	26.7	102.8	L-5535-1 Carleton-Sissiboo
C23b_RateD	120H_716_____	25.3	22	-14.7	26.5	101.6	L-5535-1 Carleton-Sissiboo
C23b_RateB	120H_716_____	25.3	22	-14.7	26.5	101.6	L-5535-1 Carleton-Sissiboo
C63b_Rate D	99W_B62_____	25.3	31.2	-16.1	35.1	133.8	L-5535-2 Tusket-Carleton
C63b_Rate B	99W_B62_____	25.3	31.2	-16.1	35.1	133.8	L-5535-2 Tusket-Carleton
C23b_RateD	99W_B62_____	25.3	31.1	-14.2	34.2	130.5	L-5535-2 Tusket-Carleton
C23b_RateB	99W_B62_____	25.3	31.1	-14.2	34.2	130.5	L-5535-2 Tusket-Carleton
C23b_RateD	99W_B61_____	25.3	27.7	-14	31	118.5	L-5535-2 Tusket-Carleton
C23b_RateD	99W_501_____	25.3	27.7	-14	31	118.5	L-5535-2 Tusket-Carleton
C23b_RateB	99W_B61_____	25.3	27.7	-14	31	118.5	L-5535-2 Tusket-Carleton
C23b_RateB	99W_501_____	25.3	27.7	-14	31	118.5	L-5535-2 Tusket-Carleton
C63b_Rate D	50W_B4_____	25.3	23.9	-16.4	28.9	111.3	L-5535-2 Tusket-Carleton
C63b_Rate B	50W_B4_____	25.3	23.9	-16.4	28.9	111.3	L-5535-2 Tusket-Carleton
C23b_RateD	50W_B4_____	25.3	23.7	-14.9	28	107.7	L-5535-2 Tusket-Carleton
C23b_RateB	50W_B4_____	25.3	23.7	-14.9	28	107.7	L-5535-2 Tusket-Carleton
C63b_Rate D	99W_B61_____	25.3	24.1	-14.8	28.3	107.6	L-5535-2 Tusket-Carleton

Case and Rate	Contingency	Rating	MW	MVAR	MVA	% Loading	Line Number
C63b_Rate D	99W_501_____	25.3	24.1	-14.8	28.3	107.6	L-5535-2 Tusket-Carleton
C63b_Rate B	99W_B61_____	25.3	24.1	-14.8	28.3	107.6	L-5535-2 Tusket-Carleton
C63b_Rate B	99W_501_____	25.3	24.1	-14.8	28.3	107.6	L-5535-2 Tusket-Carleton
C23a_RateD	99W_B62_____	25.3	24.7	-13.2	28	106.7	L-5535-2 Tusket-Carleton
C23a_RateB	99W_B62_____	25.3	24.7	-13.2	28	106.7	L-5535-2 Tusket-Carleton
C63a_RateD	99W_B62_____	25.3	23.8	-14.6	27.9	106.2	L-5535-2 Tusket-Carleton
C63a_RateB	99W_B62_____	25.3	23.8	-14.6	27.9	106.2	L-5535-2 Tusket-Carleton
C23b_RateD	120H_716_____	25.3	24.6	-13	27.8	105.4	L-5535-2 Tusket-Carleton
C23b_RateB	120H_716_____	25.3	24.6	-13	27.8	105.4	L-5535-2 Tusket-Carleton
C23b_RateD	120H_715_____	25.3	23.8	-12.8	27	102.6	L-5535-2 Tusket-Carleton
C23b_RateB	120H_715_____	25.3	23.8	-12.8	27	102.6	L-5535-2 Tusket-Carleton
C23b_RateD	L7008_____	25.3	23.7	-12.8	27	102.4	L-5535-2 Tusket-Carleton
C23b_RateB	L7008_____	25.3	23.7	-12.8	27	102.4	L-5535-2 Tusket-Carleton
C23b_RateD	99W_T72_____	25.3	23.7	-12.8	26.9	102.2	L-5535-2 Tusket-Carleton
C23b_RateB	99W_T72_____	25.3	23.7	-12.8	26.9	102.2	L-5535-2 Tusket-Carleton
C23b_RateD	120H_713_____	25.3	23.6	-12.7	26.8	101.7	L-5535-2 Tusket-Carleton
C23b_RateB	120H_713_____	25.3	23.6	-12.7	26.8	101.7	L-5535-2 Tusket-Carleton
C23b_RateD	L80027009_____	25.3	23.1	-12.6	26.3	100	L-5535-2 Tusket-Carleton
C23b_RateB	L80027009_____	25.3	23.1	-12.6	26.3	100	L-5535-2 Tusket-Carleton
C63b_Rate D	L6025_IR725-99W	148.5	-183.5	8.9	183.8	122.5	L-6006
C63b_Rate B	L6025_IR725-99W	148.5	-183.5	8.9	183.8	122.5	L-6006
C63b_Rate D	99W_B61_____	148.5	-176.4	-5.7	176.5	119	L-6006
C63b_Rate D	99W_501_____	148.5	-176.4	-5.7	176.5	119	L-6006
C63b_Rate B	99W_B61_____	148.5	-176.4	-5.7	176.5	119	L-6006
C63b_Rate B	99W_501_____	148.5	-176.4	-5.7	176.5	119	L-6006
C23b_RateD	L6025_IR725-99W	148.5	-177.7	5.5	177.8	118.1	L-6006
C23b_RateB	L6025_IR725-99W	148.5	-177.7	5.5	177.8	118.1	L-6006
C23b_RateD	99W_B61_____	148.5	-169.7	-9.2	169.9	114.3	L-6006
C23b_RateD	99W_501_____	148.5	-169.7	-9.2	169.9	114.3	L-6006
C23b_RateB	99W_B61_____	148.5	-169.7	-9.2	169.9	114.3	L-6006
C23b_RateB	99W_501_____	148.5	-169.7	-9.2	169.9	114.3	L-6006
C03b_RateD	90H_606_____	231	237.8	-11.5	238.1	101.4	L-6009-1 Sackville-Cobequid
C03b_RateD	L6003_____	231	238.1	-2.2	238.1	100.8	L-6009-1 Sackville-Cobequid
C03b_RateD	L60056010_____	231	244.1	0.5	244.1	103.3	L-6016A Brushy H. – Ham.Plain
C03b_RateD	90H_608_____	231	244.1	0.5	244.1	103.3	L-6016A Brushy H – Ham.Plain
C63b_Rate B	99W_B62_____	266.2	-340.4	18.1	340.9	134.6	L-6025a (99W-IR725)
C23b_RateB	99W_B62_____	266.2	-334	19.8	334.6	130.8	L-6025a (99W-IR725)
C63b_Rate D	99W_B62_____	287	-340.4	18.1	340.9	124.9	L-6025a (99W-IR725)
C23b_RateD	99W_B62_____	287	-334	19.8	334.6	121.4	L-6025a (99W-IR725)
C03b_RateD	99W_B62_____	287	-318.7	16.4	319.1	115.9	L-6025a (99W-IR725)
C03b_RateB	99W_B62_____	315.7	-318.7	16.4	319.1	105.4	L-6025a (99W-IR725)

Case and Rate	Contingency	Rating	MW	MVAR	MVA	% Loading	Line Number
C43b_RateB	99W_B62_____	266.2	-268.8	5.2	268.8	102.4	L-6025a (99W-IR725)
C63b_Rate D	50W_B4_____	121	-222.4	34.5	225	183.5	L-6531
C63b_Rate B	50W_B4_____	121	-222.4	34.5	225	183.5	L-6531
C23b_RateD	50W_B4_____	121	-195.4	31.8	197.9	161	L-6531
C23b_RateB	50W_B4_____	121	-195.4	31.8	197.9	161	L-6531
C63b_Rate D	L6025_IR725-99W	121	-189.2	22.2	190.5	155.9	L-6531
C63b_Rate B	L6025_IR725-99W	121	-189.2	22.2	190.5	155.9	L-6531
C63b_Rate D	99W_B61_____	121	-182.8	6.6	182.9	151.4	L-6531
C63b_Rate D	99W_501_____	121	-182.8	6.6	182.9	151.4	L-6531
C63b_Rate B	99W_B61_____	121	-182.8	6.6	182.9	151.4	L-6531
C63b_Rate B	99W_501_____	121	-182.8	6.6	182.9	151.4	L-6531
C23b_RateD	L6025_IR725-99W	121	-183.4	18.3	184.3	150.3	L-6531
C23b_RateB	L6025_IR725-99W	121	-183.4	18.3	184.3	150.3	L-6531
C43b_RateD	50W_B4_____	121	-183	15.7	183.7	148.5	L-6531
C43b_RateB	50W_B4_____	121	-183	15.7	183.7	148.5	L-6531
C23b_RateD	99W_B61_____	121	-176.1	2.4	176.2	145.4	L-6531
C23b_RateD	99W_501_____	121	-176.1	2.4	176.2	145.4	L-6531
C23b_RateB	99W_B61_____	121	-176.1	2.4	176.2	145.4	L-6531
C23b_RateB	99W_501_____	121	-176.1	2.4	176.2	145.4	L-6531
C63a_RateD	IR725_BBU_____	121	-143.9	23.5	145.8	118.3	L-6531
C63a_RateD	L6025 IR739-IR725	121	-143.9	24.3	145.9	118.3	L-6531
C63a_RateB	IR725_BBU_____	121	-143.9	23.5	145.8	118.3	L-6531
C63a_RateB	L6025 IR739-IR725	121	-143.9	24.3	145.9	118.3	L-6531
C63a_RateD	L6025_IR725-99W	121	-143.9	23	145.8	118.2	L-6531
C63a_RateB	L6025_IR725-99W	121	-143.9	23	145.8	118.2	L-6531
C63b_Rate D	IR725_BBU_____	121	-143.6	25.9	145.9	118.1	L-6531
C63b_Rate B	IR725_BBU_____	121	-143.6	25.9	145.9	118.1	L-6531
C43b_RateD	L6025_IR725-99W	121	-146.2	7.8	146.4	117.9	L-6531
C43b_RateB	L6025_IR725-99W	121	-146.2	7.8	146.4	117.9	L-6531
C63b_Rate D	L6025 IR739-IR725	121	-141.5	22.7	143.3	116.3	L-6531
C63b_Rate B	L6025 IR739-IR725	121	-141.5	22.7	143.3	116.3	L-6531
C63a_RateD	99W_B61_____	121	-139.7	13.6	140.4	114.6	L-6531
C63a_RateD	99W_501_____	121	-139.7	13.6	140.4	114.6	L-6531
C63a_RateB	99W_B61_____	121	-139.7	13.6	140.4	114.6	L-6531
C63a_RateB	99W_501_____	121	-139.7	13.6	140.4	114.6	L-6531
C43b_RateD	99W_B61_____	121	-141.1	-1.1	141.1	114.2	L-6531
C43b_RateD	99W_501_____	121	-141.1	-1.1	141.1	114.2	L-6531
C43b_RateB	99W_B61_____	121	-141.1	-1.1	141.1	114.2	L-6531
C43b_RateB	99W_501_____	121	-141.1	-1.1	141.1	114.2	L-6531
C23b_RateD	IR725_BBU_____	121	-137.8	21.5	139.5	112.6	L-6531
C23b_RateB	IR725_BBU_____	121	-137.8	21.5	139.5	112.6	L-6531

Case and Rate	Contingency	Rating	MW	MVAR	MVA	% Loading	Line Number
C23a_RateD	IR725_BBU_____	121	-137.9	18.5	139.2	112.6	L-6531
C23a_RateD	L6025 IR739-IR725	121	-137.9	19.4	139.3	112.6	L-6531
C23a_RateB	IR725_BBU_____	121	-137.9	18.5	139.2	112.6	L-6531
C23a_RateB	L6025 IR739-IR725	121	-137.9	19.4	139.3	112.6	L-6531
C23a_RateD	L6025_IR725-99W	121	-138	18.1	139.1	112.5	L-6531
C23a_RateB	L6025_IR725-99W	121	-138	18.1	139.1	112.5	L-6531
C63a_RateD	50W_B4_____	121	-135	30.3	138.3	111.5	L-6531
C63a_RateB	50W_B4_____	121	-135	30.3	138.3	111.5	L-6531
C23b_RateD	L6025 IR739-IR725	121	-135.7	18.3	137	110.8	L-6531
C23b_RateB	L6025 IR739-IR725	121	-135.7	18.3	137	110.8	L-6531
C63b_Rate D	L6006_____	121	-134.7	19.5	136.1	110.2	L-6531
C63b_Rate B	L6006_____	121	-134.7	19.5	136.1	110.2	L-6531
C23a_RateD	99W_B61_____	121	-132.8	8.9	133.1	108.3	L-6531
C23a_RateD	99W_501_____	121	-132.8	8.9	133.1	108.3	L-6531
C23a_RateB	99W_B61_____	121	-132.8	8.9	133.1	108.3	L-6531
C23a_RateB	99W_501_____	121	-132.8	8.9	133.1	108.3	L-6531
C23b_RateD	L6006_____	121	-129.2	15	130	105	L-6531
C23b_RateB	L6006_____	121	-129.2	15	130	105	L-6531
C63b_Rate D	99W_B62_____	245.3	-313.2	86.8	325	145.9	L-7009
C63b_Rate B	99W_B62_____	245.3	-313.2	86.8	325	145.9	L-7009
C23b_RateD	99W_B62_____	245.3	-293.9	83.3	305.5	133.1	L-7009
C23b_RateB	99W_B62_____	245.3	-293.9	83.3	305.5	133.1	L-7009
C23b_RateD	L7008_____	245.3	-282.3	61.2	288.9	122.3	L-7009
C23b_RateD	120H_715_____	245.3	-282.2	59.6	288.4	122.3	L-7009
C23b_RateD	99W_T72_____	245.3	-282.4	62.2	289.1	122.3	L-7009
C23b_RateB	L7008_____	245.3	-282.3	61.2	288.9	122.3	L-7009
C23b_RateB	120H_715_____	245.3	-282.2	59.6	288.4	122.3	L-7009
C23b_RateB	99W_T72_____	245.3	-282.4	62.2	289.1	122.3	L-7009
C23b_RateD	120H_716_____	245.3	-280.8	60.5	287.3	121.7	L-7009
C23b_RateB	120H_716_____	245.3	-280.8	60.5	287.3	121.7	L-7009
C63b_Rate D	L7008_____	245.3	-266.4	63.7	273.9	118	L-7009
C63b_Rate D	99W_T72_____	245.3	-266.5	64.7	274.2	118	L-7009
C63b_Rate B	L7008_____	245.3	-266.4	63.7	273.9	118	L-7009
C63b_Rate B	99W_T72_____	245.3	-266.5	64.7	274.2	118	L-7009
C63b_Rate D	120H_715_____	245.3	-266.2	62.2	273.4	117.9	L-7009
C63b_Rate B	120H_715_____	245.3	-266.2	62.2	273.4	117.9	L-7009
C63b_Rate D	120H_716_____	245.3	-265.5	62.8	272.9	117.6	L-7009
C63b_Rate B	120H_716_____	245.3	-265.5	62.8	272.9	117.6	L-7009
C43b_RateD	99W_B62_____	245.3	-254.9	46.1	259	106.2	L-7009
C43b_RateB	99W_B62_____	245.3	-254.9	46.1	259	106.2	L-7009
C63a_RateD	99W_B62_____	245.3	-231.2	72.1	242.2	103.6	L-7009

Case and Rate	Contingency	Rating	MW	MVAR	MVA	% Loading	Line Number
C63a_RateB	99W_B62_____	245.3	-231.2	72.1	242.2	103.6	L-7009
C43b_RateD	L7008_____	245.3	-253.5	28.9	255.2	102.9	L-7009
C43b_RateD	120H_715_____	245.3	-253.4	27.9	254.9	102.9	L-7009
C43b_RateD	99W_T72_____	245.3	-253.5	29.9	255.3	102.9	L-7009
C43b_RateB	L7008_____	245.3	-253.5	28.9	255.2	102.9	L-7009
C43b_RateB	120H_715_____	245.3	-253.4	27.9	254.9	102.9	L-7009
C43b_RateB	99W_T72_____	245.3	-253.5	29.9	255.3	102.9	L-7009
C43b_RateD	120H_716_____	245.3	-253.2	28.7	254.8	102.8	L-7009
C43b_RateB	120H_716_____	245.3	-253.2	28.7	254.8	102.8	L-7009

16.0 Preliminary Scope of Subsequent SIS

The following provides a preliminary scope of work for the subsequent SIS for IR#725.

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, transient stability, ride through capability, 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 response, frequency response, control interactions with other IBR facilities, active power 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 proceed, and the facilities associated with those projects are installed.

The following notice on OASIS provides additional clarification on the SIS model requirements:

NSPI-TPR-015-2: PSSE and PSCAD Model Requirements and NSPI-TPR-014-1: Model Quality Testing will undergo revision as the grid evolves and performance criteria changes. The most up to date version will be provided as they become available.
To be eligible for inclusion in the Interconnection System Impact Study stage, and thereby advance the Interconnection Request's initial Queue Position, the Interconnection Customer must meet the progression milestone requirements of Section 7.2 of the GIP at least ten (10) Business Days prior to the Interconnection System Impact Study commencement date. For clarity, item 7.2 (i) – provision of a detailed stability model for the generator(s) shall mean:

- ***Provision of PSSE and PSCAD models in compliance with documents NSPI-TPR-015-2: PSSE and PSCAD Model Requirements, and***

- ***Provision of test data demonstrating model testing in compliance with NERC, NPCC and NSPI criteria. NSPI-TPR-014-1: Model Quality Testing lists the minimum requirements that will be performed by NSPI. Additional testing may be performed to assess compliance with all applicable criteria. Any test not meeting the minimum NSPI requirements will be documented in the MQT report to the IC.***

The following outline provides the minimum scope that must be complete 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.

- Facilities that the customer must install to meet the requirements of the GIP and the TSIR.
- 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.
- Guidelines and restrictions applicable to first contingency operation (curtailments etc.).
- Under-frequency load shedding impacts.

The SIS will assess system contingencies such that the system performance will meet the following criteria:

- Table 1 "Planning Design Criteria" of NPCC Directory 1.
- Table 1 "Steady State & Stability Performance Planning Events" of NERC TPL001-4.
- NSPI System Design Criteria, report number NSPI-TPR-003-4.

Any changes to RAS 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 NPCC[5] and NERC[6] criteria as well as NSPI guidelines and good utility practice. The SIS will also determine the contingencies for which this facility must be curtailed.

[5] NPCC criteria are set forth in its Reliability Reference Directory #1 *Design and Operation of the Bulk Power System*

[6] NERC transmission criteria are set forth in *NERC Reliability Standard TPL-001-4*