Interconnection Feasibility Study Report
GIP-IR570-FEAS-R0

Generator Interconnection Request 570

48 MW Wind Generating Facility

Pictou County, NS

2020-02-03

Control Centre Operations
Nova Scotia Power Inc.

Executive Summary

The Interconnection Customer submitted an Interconnection Request to NSPI for a proposed 48 MW wind generation facility interconnected to the NSPI 138kV transmission line L-6511 between 50N-Trenton and 93N-Glen Dhu, approximately 23km from 50N-Trenton near Piedmont, Pictou County.

The Interconnection Customer's substation is located approximately 2 km from the Point of Interconnection and the associated three breaker ring bus substation, and therefore the non-binding cost estimate includes the 138kV spur line that is required to supply the Interconnection Customer's substation.

No significant concerns regarding short-circuit level, or voltage control were found, provided that the project design meets NSPI requirements for low-voltage ride-through, reactive power range and voltage control system.

The study finds that IR#570 meets the requirement for voltage flicker level based on the wind turbine parameters provided.

The increased short circuit levels do not exceed the ratings of existing breakers in the system, hence there are no existing breakers that require upgrading to meet the necessary fault clearing capability.

The wind facility must meet the Total Harmonics Distortion provisions of IEEE 519.

For NRIS, the required Network Upgrades include a three breaker ring bus switching substation at the POI with L-6511 (near Piedmont) complete with control building and protection systems, control and communications between the POI switching station and NSPI SCADA system, and structures to turn L-6511 into the new switching station. In addition, replacement of the L-6503 138kV breaker, switch and instrument transformers at 50N-Trenton is required along with the uprating of 23km of 138kV line L-6511 between 50N-Trenton and IR-570 and 35km of 230kV line L-7004 between 3C-Port Hastings and 91N-Dalhousie Mountain. Finally, a 138 kV breaker and 24Mvar fixed capacitor bank will also be required at 50N-Trenton.

L-6511 and L-7004 will require a line survey to confirm that uprating the line is possible and to refine the associated cost estimates. The required Transmission Provider's Interconnection Facilities (TPIF) will consist of 2km of 138kV, 556 ACSR line between the new 138kV ring bus substation at the Point of Interconnection and the IR-570 Interconnection Customer substation.

The preliminary non-binding cost estimate for NRIS and TPIF facilities is $21,725,000.

For ERIS, the required Network Upgrades include the three breaker ring bus switching substation and associated communications facilities. The TPIF consists of the 2km spur line to the IR-570 substation. The preliminary non-binding cost estimate for ERIS is $7,865,000.

The above cost estimates do not account for any additional upgrades identified in the SIS stage of this project.

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1 Introduction

The Interconnection Customer (IC) submitted an Interconnection Request to Nova Scotia Power Inc. (NSPI) for a proposed 48 MW wind generation facility interconnected to the NSPI system via 138kV line L-6511 between 50N-Trenton and 93N-Glen Dhu, approximately 23 km from 50N-Trenton near Piedmont, Pictou County. The IC signed a Feasibility Study Agreement to study the connection of their proposed generation for Network Resource Interconnection Service (NRIS). This report is the result of that Study Agreement.

The project is listed as Interconnection Request (IR) 570 in the NSPI Interconnection Request Queue, and will be referred to as IR-570 throughout this report.

2 Scope

The objective of this Interconnection Feasibility Study (FEAS) is to provide a preliminary evaluation of the system impact and a high-level non-binding cost estimate of interconnecting the new 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 are applied.

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

- Preliminary identification of any circuit breaker short circuit capability limits exceeded as a result of the interconnection and identification of any Network Upgrades necessary to address short circuit issues associated with the IR.
- Preliminary identification of any thermal overload or voltage limit violations resulting from the interconnection and identification of the necessary Network Upgrades to allow full output of the proposed facility.
- Preliminary description and high level non-binding estimated cost of facilities required to interconnect the Generating Facility to the transmission system and the time to construct such facilities.

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

- NRIS Interconnection request
- A 48 MW wind farm with twelve (12) 4 MW Enercon E-126 EP3 FT inverter based wind turbines. The generator terminal voltage is 480V.
- The generation technology used must meet NSPI requirement for reactive power capability of 0.95 capacitive to 0.95 inductive at the high voltage terminals of the IC substation Generation Step-Up (GSU) transformer. It is also required to provide high-speed Automatic Voltage Regulation to maintain constant voltage at the high voltage terminals of the Interconnection Facilities.
- The IC identified their Point of Interconnection to the NSPI transmission system as the 138kV transmission line L-6511, approximately 23 km from the 50N-Trenton substation, near Piedmont. Line L-6511 is constructed with 556 kcm Dove ACSR conductor designed for maximum operating temperature of 60°C. The conductor has a thermal rating of 140 MVA summer and 185 MVA winter.
- The Interconnection Customer (IC) substation will be located approximately 2km south of the Point of Interconnection. As such, a separate 138kV transmission line connecting the wind farm substation to the POI three breaker ring bus substation is required.
- The IC substation will have one 138kV-34.5kV Y-Y-D transformer with a rating of 33/44/55 MVA; a positive sequence impedance of 6.5% on 33 MVA ONAN base; an X/R ratio of 27.3; a buried tertiary winding; and fixed taps between -10% and +10%. Collector voltage will be at 34.5kV.

This feasibility study is based on the assumption that the projects that are ahead of this project in the Advanced Stage Interconnection Request Queue (Queue) will proceed as listed in Section 4.

4 Project Queue Position

All in-service generation facilities are included in the FEAS

As of 03-Feb-2020, the following projects are higher queued in the Advanced Stage Interconnection Request Queue and are committed to the study base cases.

- IR #426 GIA Executed
- IR #516 GIA Executed
- IR #540 GIA Executed
- IR #542 GIA in Progress
- IR #557 SIS Complete
- IR #568 SIS in Progress
- IR #569 SIS in Progress

In addition, the following project has also been submitted in the Transmission Service Request Queue:

- TSR 409 Application Received

The application for this TSR is still in the review stage and as such it has not been included in this Feasibility Study.

If any of the higher-queued projects included in this FEAS are subsequently withdrawn from the Queue, the results of this FEAS may require updating or a re-study may be necessary.

5 Short Circuit Duty

The NSPI design criteria for maximum system fault capacity (three phase rms symmetrical) is 5,000 MVA at 138kV.

Short circuit analysis was performed using Aspen OneLiner V14.5, classical fault study, 3LG and flat voltage profile at 1 V(pu). The short-circuit levels in the area before and after this development are provided in Table 1.

The maximum short-circuit level at the POI is presently 1263.5 MVA. Although the actual increase in short-circuit levels will be dependent on the specific type of generator installed, the increase will bring the short-circuit level to not more than 1269 MVA at the POI. Under contingency operation, with the generator at Point Tupper off-line and wind farm only connected to 93N-Glen Dhu (L-6511 open at 50N-Trenton), the short-circuit level will be approximately 384.5 MVA at the POI.

Table 1: Short-Circuit Levels, Three-phase MVA[1]		
Location	**IR570 in service**	**IR570 not in service**
Maximum generation, all transmission facilities in service		
POI (IR570 tap on L6511)	1269	1264
50N-Trenton	2622	2618
93N-Glen Dhu	1115	1112
Minimum Conditions[2]		
POI (138KV Interconnection Point)	390	385

The interrupting capability of 138kV circuit breakers at 50N-Trenton and 93N-Glen Dhu is at least 3500 MVA. This will not be exceeded as a result of the addition of IR-570.

6 Voltage Flicker and Harmonics

The calculated voltage flicker value for IR-570 is 0.05, which is below the allowable P_{st} limit of 0.25, therefore voltage flicker is not a concern for this project.

The generators are required to meet IEEE Standard 519 limiting Total Harmonic Distortion (all frequencies) to a maximum of 5%, with no individual harmonic exceeding 1%. This FEAS cannot make this assessment. It is the responsibility of the generating facility to ensure that this requirement is met.

7 Thermal Limits

The load flow analysis was completed for a number of generation dispatches under system light load, summer peak load, and winter peak load conditions. Generation dispatch was also chosen to represent import and export scenarios that take into account expected flows from the existing transmission service reservation associated with the Maritime Link.

Transmission connected wind generation facilities were typically dispatched at approximately 40%, with some low wind and high wind scenarios included. For cases with winter peak load where the mainland transmission corridor flows were high (CBX and ONI) and Trenton thermal units 5 and 6 were both on-line, both the proposed IR-570 wind farm and the adjacent Glen Dhu wind farm were

[1] Classical fault study, flat voltage profile.
[2] L-6511 open between 50N-Trenton and Project #570 POI.

dispatched at full output to stress the local 138kV system under contingency operations. The cases and dispatch scenarios considered are shown in Table 7-1.

Table 7-1: Base Case Dispatch (MW)

Case	NL-NS	NS-NB	ONI	CBX	ONS	M at H	Wind
LL01	475	500	670	492	151	190	223
LL02	330	0	341	238	291	81	108
LL03	-200	500	299	85	-221	41	223
LL04	-150	-150	114	-16	247	4	233
S01	475	500	1121	688	529	312	253
S02	475	0	793	585	708	262	223
S03	475	-300	451	468	626	192	132
S04	-100	-300	457	280	673	162	223
S05	475	500	1313	1013	721	463	242
W01	475	350	1262	852	764	386	371
W02	475	0	1103	885	958	407	316
W03	475	-300	809	638	964	295	353
W04	-100	-300	692	416	846	226	353
W05	475	350	1308	1034	810	484	371

LL - Light Load S - Summer Peak W - Winter Peak

For NRIS analysis, this FEAS increased the ONI interface above the existing limits by displacing generation south of Onslow. Single contingencies were applied at the 345 kV, 230 kV, and 138 kV voltage levels for these system conditions with IR-570 interconnected to line L-6511.

The load flow results for the majority of these cases with IR-570 operating at full output show all system elements either operating within 110% of their posted seasonal equipment ratings or operating within documented maximum equipment ratings if greater than 110% of the posted seasonal ratings. However, load flow cases S01, S05, W01, W02, and W05 represent the system with generation dispatched at or near the ONI corridor limits, with IR-570 generation then added to displace generation south of Onslow. In these cases, the addition of IR-570 generation resulted in the overload and under-voltage conditions shown in Table 7-2.

Table 7-2: Criteria Violations			
Case	Contingency	SPS	Violation
S01	67N, 67N-811, G5	G5 ONI Lo	L-6503 between 49N-Michelin Granton and 50N-Trenton Overload to 112%
	67N, 67N-816, G5		
	79N, L-8003, G5		
	79N, 79N-601	-	L-7004 between 3C-Port Hastings and 91N-Dalhouside Mtn Overload to 117% plus L-6503 to 115%
	79N, 79N-606		
	79N, 79N-803, G0		
	79N, 79N-810, G0		
	79N, 79N-T81, G0		
S05	101S, 101S-812, G6	G6 CBX Hi	L-6511 between IR-570 and 50N-Trenton Overload to 130%
	101S, 101S-813, G6		
	101S, L-8004, G6		
	79N, 79N-601	G6 CBX Hi	L-7004 between 3C-Port Hastings and 93N-Dalhouside Mtn Overload to 117% plus L-6503 Overload to 115%
	79N, 79N-606		
	79N, 79N-803, G0		
	79N, 79N-810, G0		
	79N, 79N-T81, G0		
W01	79N, 79N-601, G6	G6 CBX Hi	L-6503 between 49N-Michelin Granton and 50N-Trenton Overload to 112%
	79N, 79N-606, G6		
	79N, 79N-803, G6		
	79N, 79N-810, G6		
	79N, 79N-T81, G6		
W02	101S, 101S-813, G0	-	L-6511 between IR-570 and 50N-Trenton Overload to 130%
	101S, L-8004, G0		
	79N, 79N-601	-	Low Voltage < 0.9 pu at 62N-Bridge Ave and 88H-Musquodoboit Hbr
	79N, 79N-606		
	79N, 79N-803, G0		
	79N, 79N-810, G0		
	79N, 79N-T81, G0		
W05	79N, 79N-601, G5	G5 CBX Lo	Low Voltage < 0.9 pu at 50N-Trenton, 62N-Bridge Ave, 49N-Michelin Granton, 55N-Pictou Town, and 88H-Musquodoboit Hbr
	79N, 79N-606, G5		
	79N, 79N-803, G5		
	79N, 79N-810, G5		
	79N, 79N-T81, G5		
	101S, 101S-813, G5	G5 CBX Lo	L-6515 between 2C-Port Hastings, 100C- Cape Porcupine, and 4C-Antigonish Overloaded to 113% plus L-6503 Overload to 115%
	101S, L-8004, G5		

In order to retain the existing corridor flows and accommodate the new IR-570 NRIS generation, the system would require the following Network Upgrades:

- Upgrade the 138kV breaker, switch and instrument transformers at the 50N-Trenton end of line L-6503a to increase the line rating from 287 MVA to 320 MVA summer / 363 MVA winter.
- Uprate 23km of 138kV line L-6511 between 50N-Trenton and IR-570 from 60C maximum operating temperature to 100C maximum operating temperature to increase the line rating from 140 MVA summer / 184 MVA winter to 215 MVA summer / 242 MVA winter.
- Uprate 35km of wood pole section of 230kV line L-7004 between 3C-Port Hastings and 91N-Dalhousie Mountain from 60C maximum operating temperature to 70C maximum operating temperature to increase the line rating from 233 MVA summer / 307 MVA winter to 273 MVA summer / 345 MVA winter.
- Install a 24Mvar fixed capacitor bank on the 138kV bus at 50N-Trenton

The existing ratings of the above lines are as follows in Table 7.3

Table 7-3: Transmission Line Ratings

NSPI Transmission Line Ratings — Last Updated: 2019-10-16

LINE	STATION	CONDUCTOR				BREAKER	SWITCH	CURRENT TRANSFORMER						TRIP MVA
								RELAYING			FULL SCALE METERING			
		Type	Maximum Operating Temp. (Celsius)	SUMMER RATING 25 DEG (MVA)	WINTER RATING 5 DEG (MVA)	100% Name-plate	100% Name-plate	Ratio	R.F.	MVA	Ratio	R.F.	MVA	
L-6511	93N Glen Dhu	ACSR 556.5 Dove	60	140	184	478	478	800	2	382	800	2	441	895
	50N Trenton					287	287	600	2	287	800	1	231	895
L-6503a	50N Trenton	ACSR 1113 Beaumont	100	320	363	287	287	1000	2	287	1000	1	554	589
	49N/51N Michelin Granton						404				NA			
L-7004	3C Pt. Hastings EHV	ACSR 556 Dove	60	233	307	797	797	500	2	398	1000	1	462	533
	91N Dalhousie Mountain					797	797	800	2	600	800	1	368	600

For ERIS analysis, this FEAS displaced generation east of Onslow while complying with the existing ONI limit of 1275MW and the seasonal CBX limits.

No voltage criteria violations or overload violations were found for ERIS generation for IR-570.

8 Voltage Control

This project, like all new generating facilities must be capable of providing both lagging and leading power factor of 0.95, measured at the 138kV terminals of the Interconnection Facility substation, at all production levels up to the full rated load of 48 MW.

Based on the data provided by the IC for +/-0.889 power factor for the wind turbines, the transformer impedances, and the assumed collector impedances, the load flow analysis shows that IR-570 is able to meet the power factor requirement for absorbing and delivering vars at the 138 kV side of the GSU transformer. When the wind turbines deliver their maximum vars, the power factor at the 138 kV side of the GSU is +0.94. As such, additional Power factor correction at the 138 kV side of the GSU will not be required.

A centralized controller will be required which continuously adjusts individual generator reactive power output within the plant capability limits and regulates the voltage at the 138kV bus of the Interconnection Facility. The voltage controls must be responsive to voltage deviations at the connection point, be equipped with a voltage set-point control, and also have facilities that will slowly adjust the set-point over several (5-10) minutes to maintain reactive power just within the individual generators capabilities. Details of the specific control features, control strategy and settings will be reviewed and addressed in the SIS.

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

This facility must have low-voltage ride-through capability in accordance with FERC Order 661a[3]. The SIS will examine the generator/plant capabilities and controls in detail specify any options, controls and additional facilities that are required to achieve low-voltage ride-through.

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

9 System Security

The NSPI transmission system has limited east to west transfer capability. Transmission corridors between Sydney and Halifax are often operated to security limits. This project increases flow across the Onslow Import interface. Generation rejection Special Protection Systems[4] (SPS's) are utilized to increase system stability limits to maximize east to west power transfers. Depending on the impact of other generation additions ahead of this project in the Interconnection Request Queue, the additional generating capacity that this facility provides may not be integrated into the NSPI system under all dispatch conditions without system upgrades.

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

10 Expected Facilities Required for Interconnection

The following facility changes will be required to connect IR-570 to the NSPI transmission system:

10.1 NRIS:

a. Required Network Upgrades

1. Develop a three breaker ring bus switching substation at the POI with L-6511 (near Piedmont) consisting of:

    - Three 138kV circuit breakers and associated switches in a ring-bus arrangement,
    - Control building and protection systems,
    - Control and communications between the POI switching station and NSPI SCADA system,
    - Structures to turn L-6511 into new switching station

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

- Any conductors needed to connect the wind farm to POI will use 556 Dove ACSR conductor rated 100°C conductor temperature.

2. Replace the L-6503 138kV breaker, switch and instrument transformers at 50N-Trenton.

3. Uprate 23km of 138kV line L-6511 between 50N-Trenton and IR-570 from 60C maximum operating temperature to 100C maximum operating temperature.

4. Uprate the 35km 556ACSR section of 230kV line L-7004 between 3C-Port Hastings and 91N-Dalhousie Mountain from 60C max. operating temperature to 70C max operating temperature.

5. Install a 138 kV breaker and 24Mvar fixed capacitor bank at 50N-Trenton

b. Required Transmission Provider's Interconnection Facilities (TPIF):

1. Construct 2km of 138kV, 556 ACSR line between the new 138kV ring bus substation at the Point of Interconnection and the IR-570 Interconnection Customer substation.

c. Required Interconnection Customer's Interconnection Facilities (ICIF)

1. Facilities to provide 0.95 leading and lagging power factor when delivering rated output (48 MW) all at the 138kV bus when the voltage at that point is operating between 95 and 105 % of nominal.

2. Centralized controls. These will provide centralized voltage set-point controls and reactive power set-point controls acting to control the voltage on the 138kV system and the reactive output of the machines. Responsive (fast-acting) controls are required. The controls will also include a curtailment scheme which will limit or reduce total output from the facility, upon receipt of a telemetered signal from NSPI's SCADA system. The controller will also limit the load ramp rate of the facility to within limits set by NSPI and/or telemetered from NSPI's SCADA system.

3. NSPI to have control and monitoring of reactive output of this facility, via the centralized controller. This will permit the NSPI Operator to raise or lower the voltage set-point and change the status of any reactive power controls, remotely. NSPI will also have remote manual control of the load curtailment scheme.

4. Low voltage ride-through capability in accordance with FERC Order 661a.

5. Real-time monitoring (RTU's) of the interconnection substation and facilities for NSPI to execute high speed rejection of generation (transfer trip) if determined by SIS.

10.2 ERIS:

a. ERIS: Required Network Upgrades

1. For ERIS generation, the three breaker ring bus switching station described in Section 10.1.a.1 is required.

b. Required Transmission Provider's Interconnection Facilities (TPIF):

1. The TPIF for ERIS generation is the same as for the NRIS generation in Section 10.1.b.

c. Required Interconnection Customer's Interconnection Facilities (ICIF)

1. The ICIF for ERIS generation is the same as for the NRIS generation in Section 10.1.c.

11 NSPI Interconnection Facilities Cost Estimate

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

Table 12-1: NRIS Cost Estimates		
	Network Upgrades	**Estimate**
i	138kV ring bus with three circuit breakers	$5,750,000
ii	L-6503 Breaker /switch replacement	$1,000,000
iii	Uprate 35km of L-7004	$6,400,000
iv	Uprate 23km of L-6511	$3,500,000
v	24 Mvar Fixed Capacitor Bank c/w breaker & switch	$1,700,000
vi	Communications Systems	$500,000
	TPIF	**Estimate**
vii	2 km 138kV, 556ACSR Spur line	$900,000
	Contingency (10%)	$1,975,000
	Total of Determined Cost Items	$21,725,000
	To be Determined Costs	
vi	System additions to increase east-west transfer capability	TBD (SIS)

NSPI estimates the time required to construct the above facilities at 18-30 months assuming all easements and permits are provided and complete.

Table 12-2: ERIS Cost Estimates		
	Network Upgrades	**Estimate**
i	138kV ring bus with three circuit breakers	$5,750,000
ii	Communications Systems	$500,000
	TPIF	**Estimate**
vii	2 km 138kV, 556ACSR Spur line	$900,000
	Contingency (10%)	$715,000
	Total of Determined Cost Items	$7,865,000
	To be Determined Costs	
vi	System additions to increase east-west transfer capability	TBD (SIS)

NSPI estimates the time required to construct the above facilities at 12-24 months assuming all easements and permits are provided and complete.

12 Issues to be addressed in SIS

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

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

i. Cape Breton Export
ii. Onslow Import
iii. Onslow South
iv. Metro reactive reserve requirements
v. NS – NB export/import

12.1 Steady-state post-contingency analysis

All elements within acceptable voltage and thermal limits under the following single contingencies, in accordance with NPCC[5] and NERC[6] criteria.

i. L-8004
ii. Hopewell transformer 79N-T81
iii. L-8003

12.2 System stability for the following faults

Loss of any element without a fault

i. L-8004
ii. Hopewell transformer 79N-T81
iii. L-8003

Three-phase fault cleared in normal time:

i. L-8003 at Onslow end
ii. L-8003 at Hopewell end
iii. L-8001 at import and export limits

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

i. L-8004 plus L-7009 at Canso Crossing
ii. L-7003 plus section of L-6511 at Trenton

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

[5] NPCC criteria are set forth in its A-2 Document *Basic Criteria for Design and Operation of Interconnected Power Systems*
[6] NERC transmission criteria are set forth in *NERC Reliability Standards TPL-001, TPL-002, TPL-003*