Énergie NB Power

NB Power Transmission Planning Criteria

PREFACE

This document has been developed to describe New Brunswick Power Transmission Corporation's (NB Power Transmission) criteria for assessing the interconnected transmission system to ensure that it meets specified performance requirements.

DOCUMENT APPROVAL

This document was produced and reviewed by the Transmission Planning Department.

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1.0 INTRODUCTION

The function of the NB Power Transmission Planning Group is to ensure the co-ordinated development of a safe, reliable, efficient and economical transmission system for the benefit of the Province of New Brunswick.

The planning process involves the use of computer simulated power system studies to demonstrate that the power system meets certain planning criteria for the present and projected future uses of the system. Where the computer simulations indicate that the power system is not meeting the planning criteria, the transmission planning process involves developing cost effective transmission solutions for making the power system meet the planning criteria.

1.1 Purpose

This document presents the planning criteria which the NB Power Transmission Planning group adheres to in respect to doing power system studies. Where there are applicable planning criteria that exist in other documents, care has been taken not to reproduce those criteria in this document, but to reference the documents in which it appears.

This document is not intended to describe the planning process. Other NB Power Transmission guidance documents describe the methodologies of how studies are actually completed and documented. The latest approved versions of these documents are available electronically on the Transmission SharePoint site.

1.2 Document Control

This document is intended as a working document to be reviewed at a minimum once a year by the Planning Group to ensure that it contains current information.

Control of this document will follow the document control requirements as described in Procedure SU6-A00050-0002. No controlled hardcopy versions of the document will be maintained. A controlled version of the document will be maintained on the SharePoint site under “Planning”. Any copies (printed or digital) made of this document are considered to be “uncontrolled documents”.

2.0 COMPLIANCE REQUIREMENTS

2.1 North American Electric Reliability Corporation (NERC) Criteria

The NB Power Transmission Planning Group will ensure that the New Brunswick system meets all applicable criteria set out in the NERC Reliability Standards pertaining to transmission planning. These standards are applicable to all power system elements which are considered to be part of the Bulk Electrical System (BES). Information pertaining to these standards is available on the NERC website (www.nerc.com).

2.2 Northeast Power Coordinating Council (NPCC) Criteria

The NB Power Transmission Planning Group will ensure that the New Brunswick system meets the criteria set out in the NPCC Document Directory #1, entitled “Design and Operation of the Bulk Power System”. These criteria are applicable to all power system elements which are considered to be part of the Bulk Power System (BPS) by NPCC. The criteria for classifying which elements of the power system are BPS is set out in the NPCC Document A-10 entitled “Classification of Bulk Power System Elements”. This information is available on the NPCC website (www.npcc.org).

3.0 TRANSMISSION PLANNING CRITERIA

The applicable NERC Standards and NPCC Criteria set out general criteria that the power system must be designed to, in regard to study time-frames and acceptable pre- and post-contingency conditions, for certain defined study contingencies (for the portion of the power system to which they each apply, being BES or BPS).

This NB Power Transmission Planning Criteria sets out the specific acceptable pre- and post-contingency response of the power system for all elements of the power system, which includes all elements 69 kV and above.

3.1 Computer Power System Models

NB Power uses the Power System Simulator for Engineers (PSSE) program for doing planning studies.

The document entitled “Guide for Base Case Development” defines the methodology of how NB Power Transmission develops base cases for system studies.

3.2 Single Contingency Criteria (N-1)

From normal system conditions, the transmission system shall be able to withstand a single contingency. A single contingency is defined as an event with a single cause which leads to the loss of one or more system elements. The most common interpretation of this definition is the assumption of the loss of a:

- transformer
- transmission circuit
- generator
- bus section
- HVDC circuit

The New Brunswick transmission system is presently planned, designed and operated in accordance with this single contingency criterion. The “Single Contingency” criterion is also referred to as the “N-1” criteria.

To withstand a single contingency means that the contingency will not result in violation of the applicable voltage and MVA limits (which are the post-contingency limits in this case), or cause system instability, and that all firm load interrupted can be restored within a reasonable time by either switching actions, system reconfiguration, repair of equipment, or the installation of temporary equipment.

To demonstrate that the system is planned to meet the N-1 criteria, adequate studies will be completed which may include simulation of the loss of an element without a fault and the loss of an element with a 1-Phase to Ground or 3-Phase to Ground fault.

In certain circumstances, for example where customer reliability is a concern, NB Power Transmission Planning may design transmission supplies which exceed these criteria.

While failure of a circuit breaker is considered a design contingency by the NERC TPL Standards and the NPCC Directory #1 which apply to the BES and BPS portions of the power system, for non-BES and non-BPS portions of the system the application of the failure of a circuit breaker as a design contingency is not required by the NB Power planning criteria. However, it may be considered where warranted to meet desired system reliability.

3.3 Voltage and MVA Limits for Normal and N-1 Conditions

For planning purposes, NB Power Transmission Planning uses the terms “pre-contingency limits” and “post-contingency limits” which correspond to the terms “normal limits” and “emergency limits” respectively.

For planning purposes the pre-contingency limits cannot be exceeded under pre-contingency conditions. When studying a contingency, the post-contingency limits cannot be exceeded, and there must be flexibility in the system to reduce equipment loading following the contingency to within pre-contingency limits using a combination of:

- transformer tapchangers
- changes in generation dispatch
- changes in system configuration
- non-firm export reductions
- non-firm load reductions

These measures must be considered as reasonable within the timeframes involved in the operation of the power system.

Applicable Voltage and MVA Limits for NB Power equipment are described in the Transmission Planning Document entitled “Guide for Electrical Facility Rating”.

Where planning studies indicate that pre-contingency or post-contingency voltage limits are violated, plans must be developed to mitigate the violations. These plans must mitigate violations at terminals at all voltage levels. However, plans for mitigation of violations at customer substations may include acceptance of a voltage outside of the pre-contingency or post-contingency limit given the customer has voltage boosting capability (transformer tap changers or regulators) at there substation. Likewise, plans for mitigation of violations at Terminal Busses may include acceptance of a voltage outside of the pre-contingency or post-contingency limit given the violation, has a low probability of occurrence, can be mitigated operationally in a reasonable time frame, and will not result in violations of criteria on any BES elements.

Where planning studies indicate that pre-contingency or post-contingency MVA limits are violated, plans must be developed to mitigate the violations. These plans must mitigate violations on all NERC BES elements. However, plans for mitigation of violations on non BES elements may include acceptance of an MVA loading above the pre-contingency or post-contingency limit, given the violation has a low probability of occurrence, can be mitigated operationally in a reasonable time frame, and will not result in violations of criteria on any BES elements.

3.4 Acceptable Voltage Change for Switching Reactive Elements

Discrete reactive devices (inductors and capacitors) should be sized to ensure that the voltage change associated with switching the device either in or out of service will not result in a voltage change exceeding 5% (before transformer tapping) in the load flow using a constant MVA load model.

3.5 Loss of Load

To limit power swings to within acceptable limits on the New Brunswick to New England interface and within the New England system itself, no single contingency within New Brunswick should result in a loss of more than 250 MW of load. However, the probability of the loss of load occurring when the resultant swing may not result in unacceptable conditions, such as times of low exports to New England, may be considered.

3.6 Contingencies of Study

The NERC TPL Standards and the NPCC A-2 Criteria outline which design contingencies must be studied to be compliant with each. The methodology for defining contingencies requiring study for compliance with NERC and NPCC is contained in the NB Power Transmission Planning document entitled “Guide for Selecting Study Contingencies”.

3.7 Transformer Contingencies

The power system must be designed with sufficient back-up capability such that all firm loads can be supplied on system peak following the loss of any single tie transformer.

Outages to all transmission equipment other than transformers are considered to be repairable within a short time frame and can be considered to be mitigated through the use of operational measures. However, transformer outages must be treated differently due to the long time frames which can be associated with repairing transformers. Therefore, transformer contingency studies must be completed as necessary. The conclusion of these studies must suggest reasonable mitigating measures to supply all loads during peak conditions.

3.8 Dynamic Stability

Stability of the interconnected power system shall be maintained in normal pre-contingency operation as well as during and following all applicable planning contingencies, with due regard to reclosing and any automatic control actions which may occur.

Care must be taken to model events with the proper timing sequences which would occur based on protection settings and telecommunication propagation times. In some cases, the outcome of dynamic stability analysis may result in recommendations for the time delays associated with protection settings in order to enhance the stability of the power system.

The stability of the interconnected power system will be considered acceptable if all oscillations (voltage, current, angle) are adequately damped so as not to cause any equipment damage and any unplanned equipment tripping. Pole slipping of generators is considered unacceptable.

3.9 Short Circuit Levels

Planned maximum short circuit fault levels shall not exceed the interrupting capability of any associated breakers.

3.10 Special Protection Systems

Special Protection Schemes (SPS) are designed for specific foreseen events and switch transmission elements and shed load or generation to preserve system integrity. They may be used when the cost of additional facilities are not warranted on a cost versus benefit evaluation, when facilities can not be built in required time-frames, to shed opportunity loads or transactions, to increase operating limits beyond planning limits of system capacity, or when the frequency of the triggering event is very low. The consequence of SPS failure and inadvertent operation must also be considered.

3.11 Generator MVA Capability

New generators connecting to the transmission system must have adequate reactive power capabilities so they can operate within the voltage limits described in the NBP Transmission Planning Document entitled “Guide for Electrical Facility Rating” for pre-contingency and post-contingency operation.

3.12 Point Lepreau Nuclear Plant Interface Requirements

The NB Power Transmission Planning group will ensure that the NB Power system meets the applicable Point Lepreau nuclear plant interface requirements as described in the document entitled “Point Lepreau Nuclear Plant Interface Requirements”.

4.0 REFERENCES

Directory 1 Design and Operation of the Bulk Power System, Northeast Power Coordinating Council. December 1, 2009

Document A-10 Classification of Bulk Power System Elements. Northeast Power Coordinating Council. December 1, 2009

New Brunswick Power Corporation, Transmission Guide for Electrical Facility Ratings. September 2012.

New Brunswick Power Corporation, Transmission Guide for Base Case Development. September 2013.

New Brunswick Power Corporation, Transmission Guide for Selecting Study Contingencies. September 2013

New Brunswick Power Transmission Corporation, Point Lepreau Nuclear Plant Interface Requirements Agreement.

Standard *TPL-001 System Performance Under Normal Conditions*, North American Electric Reliability Corporation, Effective Date: May 13, 2009

Standard *TPL-002 System Performance Following Loss of a Single BES Element*, North American Electric Reliability Corporation, Effective Date: April 23, 2010

Standard *TPL-003 System Performance Following the Loss of Two or More BES Elements*, North American Electric Reliability Corporation, Effective Date: April 23, 2010

Standard *TPL-004 System Performance Following Extreme BES Events*, North American Electric Reliability Corporation, Effective Date: April 1, 2005

5.0 REVISION HISTORY

Revision Number	Revised Section(s)	Revision Summary	Prepared / Revised By	Effective Date (yyyy/mm/dd)
00	-----	New document issued.	Andrew Wilcox	2013/09/25
01	----	Edits	A. Wilcox	2014/01/15