NPCC, Inc.

NORTHEAST POWER COORDINATING COUNCIL, INC.
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September 14, 2007

Subject: Posting of NPCC Document A-14, *Verification of Generator Gross and Net Reactive Power Capability* for Open Process Review

Dear Sir/Madam:

The CO-7 Operational Review Team Working Group has developed the A-14, *Verification of Generator Gross and Net Reactive Power Capability,* document. The Task Force on Coordination of Operation has reviewed and approved the document and the document draft is now posted to receive your comments through the NPCC, Inc. Open Process. A copy of this document is attached for your use in this review.

The NPCC Open Process may be accessed through:

http://www.npcc.org/Open_Process.htm

The draft of NPCC Document A-14 submitted for comment may be viewed and / or downloaded by clicking on the link "document." Comments may be posted on the NPCC Web Site by clicking on the link "add" and following the prompts provided.

All comments must be submitted electronically through the NPCC Web site. Comments will be received for forty-five days through Monday, October 29, 2007, and they will be addressed by both the CO-7 Operational Review Team Working Group and the Task Force on Coordination of Operation.

Sincerely,

Paul A. Roman

Paul A. Roman

cc: Members, NPCC Task Force on Coordination of Operation
Members, CO-07 Operational Review Team Working Group

Document A-14

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Draft Posted for Comment Through the NPCC, Inc. Open Process

September 14, 2007

Verification of Generator Gross and Net Reactive Power Capability

Adopted by the Members of the Northeast Power Coordinating Council on mm dd, yyyy, based on recommendation by the Reliability Coordinating Committee.

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1.0 Introduction

This Document establishes the minimum criteria to verify the **Gross Reactive Power** and **Net Reactive Power Capability** of generators to ensure accuracy of information used in the steady-state models to assess the reliability of the NPCC bulk power system. These criteria have been developed to ensure that the requirements specified in **NERC** Standard MOD-025-1, "Verification of Generator Gross and Net Reactive Power Capability", are met by NPCC and its applicable members that are required to comply with the **NERC** standards.

The **Gross Reactive Power Capability** of a generator or generation facility for the purpose of this Document is defined as the maximum lagging and leading reactive capability at the generator terminals and at the **Area**'s specified Gross Real Power output during the seasonal capability period. In the event that a generator or generation facility cannot achieve a leading megavar output because of unit or system limitation, then the **Area** may require the generator to verify its minimum lagging reactive capability.

The **Net Reactive Power Capability** of a generator or generation facility for the purpose of this Document is defined as **Gross Reactive Power Capability** adjusted for any applicable losses and auxiliary loads incurred up to the point of interconnection.

A "Generator Owner's Declared Reactive Power Capability", for the purpose of this Document is defined as the reactive power lagging and leading capability values submitted by the Generator Owner to the respective **Area**.

A "Generator Owner's Verified Reactive Power Capability", for the purpose of this Document is defined as the reactive power lagging and leading capability as demonstrated by the methods specified herein.

A "Generation Facility" for the purpose of this Document is defined as multiple generating units, which are modeled as a single entity by the **Area**.

2.0 General Requirements

2.1 Each **Area** shall identify generators and generation facilities that are subject to seasonal **Gross Reactive Power** and **Net Reactive Power Capability** verification and apply these criteria to all identified generators and generation facilities. The verified data shall be used as the maximum gross and net reactive power capability of generators and generation facilities for steady state models and may also be used for other reliability assessments.

2.2 For those identified generator or generation facilities each **Area** shall maintain as a minimum the following documentation:

2.2.1 Listing of generators or generation facilities and their declared **Gross Reactive Power** and **Net Reactive Power Capability** and seasonal auxiliary reactive power requirements. (Reference Appendix B for recommended generator or generation facility's information to be provided by the generator owner.)

2.2.2 Listing of generators or generation facilities verified **Gross Reactive Power** and **Net Reactive Power Capability**, verification date and method of verification.

2.2.3 Listing of discrepancies between system modeling, declared and verified **Gross Reactive Power** and **Net Reactive Power Capability** and the reason for such discrepancies.

2.2.4 Listing of generators and generation facilities exempted from the verification testing requirements and basis for their exemption (see section 3.7).

2.3 Each **Area** shall establish and maintain a program in accordance with the criteria outlined in this Document to periodically verify the **Gross Reactive Power** and **Net Reactive Power Capability** of all generators and generation facilities subject to periodic seasonal **Gross Reactive Power** and **Net Reactive Power Capability** verification. Any change made to the program after it has been established shall be reported to NPCC and the Generator Owners within 30 days.

2.4 Each Generator Owner shall comply with the **Area's** requests for periodic verification of **Gross Reactive Power** and **Net Reactive Power Capability** of their generators or generation facilities' as outlined in this Document.

2.5 Each Generator Owner shall determine and report to the **Area** the generator or generation facility's seasonal **Gross Reactive Power** and **Net Reactive Power Capabilities** and seasonal reactive auxiliary load requirements.

2.6 Generator Owner shall retain **Gross Reactive Power** and **Net Reactive Power Capability** testing, commissioning or performance tracking data with any supplemental engineering analysis as specified by the **Area** for the most current and prior verification period.

2.7 Each **Area** shall establish notification requirements for a Generator Owner to notify its **Area** within a specified time period when its generator and generation facility cannot achieve the previously verified reactive power capability because of any equipment limitation.

2.8 The **NPCC Task Force on Coordination of Operations** and **Task Force on Coordination of Planning** shall annually review the **Area's Gross Reactive**

Power and **Net Reactive Power Capability** verification program to ensure the program is meeting the intent of these criteria.

3.0 Specific Criteria

3.1 Each **Area** shall verify the seasonal **Gross Reactive Power** and **Net Reactive Power Capability** of all generators and generation facilities subject to seasonal **Gross Reactive Power** and **Net Reactive Power Capability** verification as specified in this Document and applicable NERC Standards. The two (2) capability seasons are defined as summer and winter as specified by the **Area**.

3.1.1 If an **Area** determines that only one seasonal generating capability value will suffice for NPCC Bulk Power System reliability analysis, then periodic verification will be required only for that particular season.

3.1.2 If an **Area** determines that the difference between **Gross Reactive Power** and **Net Reactive Power Capability** of a generator or generation facility is insignificant for NPCC Bulk Power System reliability analysis, then periodic verification will be required for only one numerical value.

3.1.3 If an **Area** determines that only lagging or leading **Gross Reactive Power** and **Net Reactive Power Capability** of a generator or generation facility is required for NPCC Bulk Power System reliability analysis, then periodic verification will be required for that specific reactive power capability value.

3.1.4 Verification of a single unit is acceptable as a representative for multiple generators of same type and design at a common location for intermittent or small units as specified by an Area.

3.2 Verification of a generator's lagging and leading reactive capabilities can be demonstrated for that seasonal capability verification period at a real power level equivalent to that specified in sections 3.3 and 3.4 by:

- testing,
- use of performance tracking with any required supplemental engineering analysis, or,
- commissioning data (for new generators only) acquired.

3.3 Lagging Reactive Power Capability testing will normally be performed during on-peak hours. Lagging Reactive Power capability testing shall be performed at a real power level as specified by the **Area**.

Leading Reactive Power Capability testing will normally be performed during off-peak hours. Leading Reactive Power Capability testing shall be performed at a real power level as specified by the **Area**.

3.4 The following criteria shall apply for verification of a generator's **Gross Reactive Power** and **Net Reactive Power Capability**, as applicable to the types of generators and for the required verification periods as described in sections below:

3.4.1 Thermal Generators, Internal Combustion Generators, Gas Turbine Generators, Combined Cycle and Hydro Generators

The verification of **Gross Reactive Power** and **Net Reactive Power Capability** of a generator shall be determined from the average leading reactive power output for at least a 15 consecutive minute period and average lagging reactive power output for a 60 consecutive minute period.

3.4.2 Intermittent Power Resources

For intermittent power resources (wind, tidal or geo-thermal generators) the manufacturers' or commissioning data can be used until sufficient performance tracking data is available to verify generator or generation facilities lagging and leading reactive capabilities.

3.4.3 Generators Operating as Synchronous Condensers

The verification of **Gross Reactive Power and Net Reactive Power Capability** of a generator that has the capability of being used as a synchronous condenser (this testing shall be conducted at zero MW output) shall be determined from the average leading and reactive power output for at least 15 consecutive minute period and average lagging reactive power output for a 60 consecutive minute period.

3.5 Determination of **Gross Reactive Power** and **Net Reactive Power Capability** for a generation facility when limited by common elements shall be based on the reactive power capability of the generation facility and not the sum of the capabilities of the individual generators.

3.6 If the generator or generator facility is unable to reach its declared lagging or leading seasonal **Gross Reactive Power** and **Net Reactive Power Capability** during testing or by use of performance data, the **Area** and Generator Owner shall evaluate the cause of the limitation. The **Area** shall document the reasons that prevented the generator or generation facility from achieving its declared capability and determine if retesting is required during that seasonal period.

3.7 If prior to performing the verification testing it is determined that the generator or generation facilities cannot perform the verification testing for the required seasonal verification period, the **Area** may exempt the generator from testing for one or more of the following reasons:

3.7.1 Adverse impact on transmission system reliability

3.7.2 Potential damage to transmission system, or generator equipment

3.7.3 Governmental regulatory or operating license limitations

The generator or generation facility exempted from seasonal capability testing shall submit certified generator performance tracking, manufacturer's or commissioning data (for new generators only) from the previous applicable seasonal verification period as required by the **Area.** Engineering analysis may be used in conjunction with performance tracking data to justify any difference between a generator's or generation facility's declared capability and previous seasonal performance data.

The generator or generation facility and the **Area** shall coordinate the rescheduling of verification testing for the next seasonal verification period or as mutually agreed upon.

3.8 The Generator Owner shall identify and notify the **Area** of any equipment, system or other factors that will limit the capability of the generator or generation facility to meet its declared **Gross Reactive Power** and **Net Reactive Power Capability**.

3.9 Upon notification of a discrepancy between verified and declared **Gross Reactive Power** and **Net Reactive Power Capability**, the Generator Owner shall provide the **Area** a plan to resolve any discrepancy or revise its declared reactive power capability**.**

4.0 Responsibilities

4.1 NPCC INC

4.1.1 Shall annually validate that each **Area** has implemented the **Gross Reactive Power** and **Net Reactive Power Capability** verification program.

4.1.2 Shall, through periodic compliance audits, review the effectiveness of the **Areas**' **Gross Reactive Power** and **Net Reactive Power Capability** verification program.

4.1.3 Shall ensure compliance to the criteria in this Document.

4.1.4 Shall ensure that any disagreements among the parties are addressed in accordance with the Area Dispute Resolution Process.

4.1.5 The **NPCC Task Force on Coordination of Operations** and **Task Force on Coordination of Planning** shall annually review each **Area's Gross Reactive Power** and **Net Reactive Power Capability** verification program to ensure the program is meeting the intent of these criteria

4.1.6 Shall retain both the current and previous versions of this Document.

4.2 Area

4.2.1 Shall develop, implement and review the **Gross Reactive Power** and **Net Reactive Power Capability** verification program within its **Area.** The program shall be reviewed on a 3-year cycle.

4.2.2 Shall ensure that any discrepancy between a Generator Owner's declared and verified **Gross Reactive Power** and **Net Reactive Power Capability** is addressed in a time frame as specified by the **Area**.

4.2.3 Shall ensure that any disagreements among the parties are addressed in accordance with the applicable Dispute Resolution Process.

4.2.4 Shall maintain documentation on exempted and verified generators and generation facilities.

4.2.5 Shall notify the Generator Owners, Generator Operators, Transmission Operators, Planning Authorities, Transmission Planners and **NPCC Task Forces on Coordination of Operations and Task Force on Coordination of Planning** within 30 days of issue of any changes to the **Area's Gross Reactive Power** and **Net Reactive Power Capability** verification program.

4.3 Generator Owner

4.3.1 Shall determine and report the generator or generation facility's declared **Gross Reactive Power** and **Net Reactive Power Capability** as required by the **Area**.

4.3.2 Shall address any discrepancies between declared and verified **Gross Reactive Power** and **Net Reactive Power Capability** within a time frame specified by the **Area.**

4.3.3 Shall retain **Gross Reactive Power** and **Net Reactive Power Capability** testing, commissioning data or performance tracking data with any supplemental engineering analysis as specified by the **Area** for the current and most recent prior verification period.

5.0 Verification Schedule

5.1 Generator and generation facility's **Gross Reactive Power** and **Net Reactive Power Capability** shall be re-verified at least every five years.

5.2 Re-verification of a generator or generation facility that did not meet its declared capability shall be scheduled within a time frame as required by the **Area.**

Lead Task Forces:	Task Force on Coordination of Planning/ Task Force on Coordination of Operation
Reviewed for concurrence by:	TFCO, TFSP, TFSS and TFIST Chairman
Review frequency:	3 years

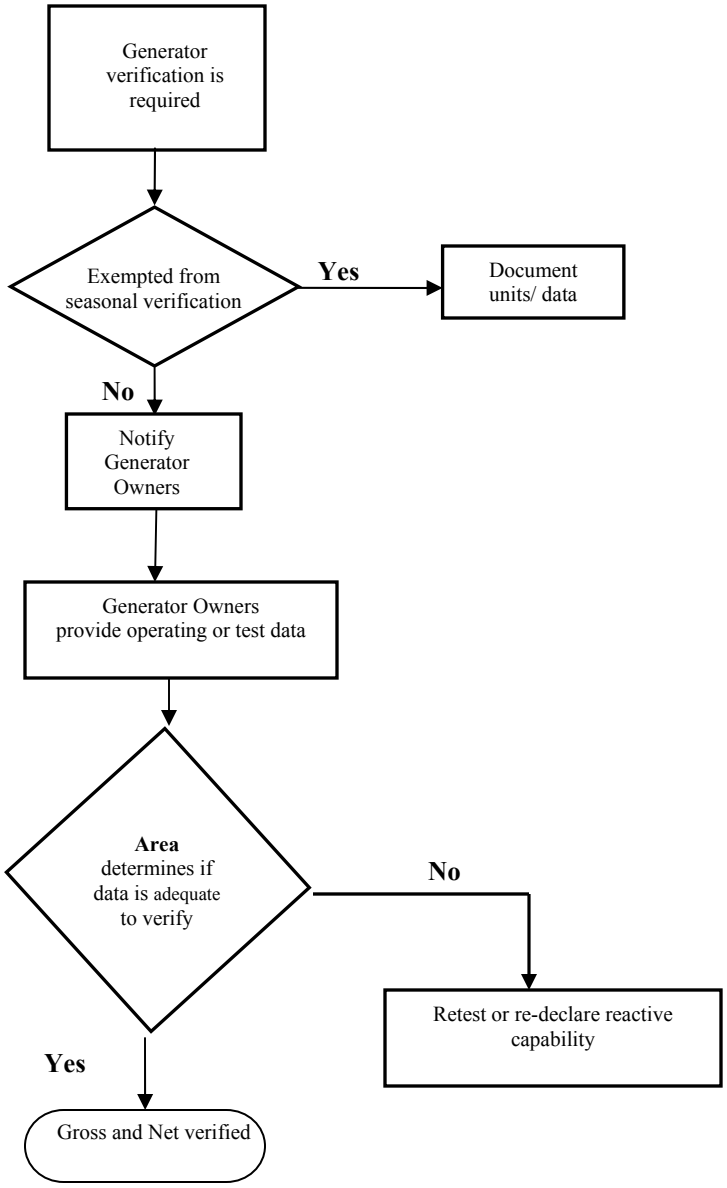
References:

- NERC Standard MOD-025-1, "Verification of Generator Gross and Net Reactive Power Capability"
- NERC Standard TOP-002-1, "Normal Operations Planning"
- NPCC Document A-07, "NPCC Glossary of Terms"

Appendix: A - Basic Flow Chart for Verification of Generator Gross and Net Reactive Power Capability

Appendix: B - Generator Reactive Capability Data Form

APPENDIX A
Basic Flow Chart for Verification of Generator Gross and Net Reactive Power Capability



GENERATOR REACTIVE CAPABILITY DATA FORM

1. Data Preparation Documentation*

Generator Facility Name	Unit No.	Facility ID	Generator Owner	Primary Contact
Big Generator Station	1	12234	Big Power	Jim Smith
Prepared By	**Date prepared:**	**Effective Date**	**Contact Tel**	**Contact e-mail**
John Doe	01/05/2007	01/10/2007	XXX-XXX-XXXX	john@bigpower.com

Auxiliary Reactive Power Requirements	Summer MVAR	Winter MVAR
	20	15

Reactive Data*

Seasonal Data	Declared Real and Reactive Capability						Verified Reactive Capability and Season			Verification Method (T, P,C** as applicable)	Date Verified
	Summer			Winter			Winter				Date
	Gross MW	Gross MVAR	Net MVAR	Gross MW	Gross MVAR	Net MVAR	Gross MW	Gross MVAR	Net MVAR		
Lagging Capability	500	120	120	525	100	100	520	110	110	P	03/15/2007
Leading Capability	500	250	230	525	240	225	525	200 (1)	185(1)	T	01/25/2007

Data inputted for illustration purposes,
***** T- Testing; P- Performance Tracking; C-Commissioning data***

Notes and Limitations:	(1) Full MVAR capability could not be achieved because of system voltage restriction. Engineering analysis was provided to demonstrate unit was capable of declared values.

Generating unit capability curve. *Please attach a .jpg image from the generating unit capability D curve*