Interconnection Standards for Variable Energy Resources

NERC IVGTF Task 1-3 Report

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Executive Summary
1. Introduction
2. Reactive Power and Voltage
3. Performance During and After Disturbances
4. Active Power Control Capabilities
5. Harmonics and Subsynchronous Interaction
6. Models for Facility Interconnection Studies
7. Communications between Variable Generation Plants and Grid Operators

Appendix 1 – Disturbance Performance Requirements from International Standards and Grid Codes
Appendix 2 – Acronyms
Appendix 3 – Wind-Turbine Generation Technologies
Appendix 4 – Further Reading
Appendix 5 – Review of Utility Facility Connection Requirements or Grid Codes
Appendix 6 – Summary of Existing Reactive Power Standards
Appendix 7 – IVGTF Task 1-3 Roster

North American Electric Reliability Corporation Staff
Task Force Scope:

This task force was asked to make recommendations for how NERC Interconnection procedures and standards should be enhanced to address:

- Reactive and Real power control
- Voltage and Frequency ride-through
- Frequency/Inertial Response criteria

(in light of the evolving range of technical characteristics and physical capabilities of variable generation equipment)
Reactive Power & Voltage Control

Recommendations for Existing NERC Standards

- Add specificity regarding Static vs. Dynamic Requirements
- Make them applicable to different generating plant technologies

Recommendations for Standards Development

- Improve uniformity & Clarity
- Establish minimum reactive capability requirements
Reactive power capability requirement for AESO

Continuous Reactive Power Capability

Dynamic Reactive Power Capability

Absorbing MVARs p.u.

Producing MVARs p.u.

Where 1 p.u. is the Maximum Aggregated MW Capacity

- Minimum continuous reactive capability
- Minimum dynamic reactive capability
- Anticipated continuous reactive power capability within the shaded area.
- Anticipated dynamic reactive power capability within the shaded area.
Recommends broadening Scope of NERC Standard PRC-024-1

- Proposed 75 MVA will miss many variable generation facilities
  - 20 MW (Large Generator Interconnection Agreements?)
  - 10 MW (Plants not included under IEEE Standard 1547)?

- TPL-001-2 & PRC-024-1
  - What does remaining “connected” entails?
  - What about “repeated disturbances”?
Recommendations

- Require Curtailment Capability (avoid excessively fast response)
- Require ramp rate control capability
- Capability to provide increase of active power (for low frequencies)?
- Inertial Response/Governing capabilities?
Other Requirements

- Models for Interconnection Studies
- Communications between Plants & Grid Operators
Report available on NERC site