Accommodating High Levels of Variable Generation

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Agenda

- About NERC
- About the Integration of Variable Generation Task Force (IVGTF)
- “Variable” Resources
- Recommendations
- Next Steps
Variable resources are types of electric power generation that rely on an uncontrolled, “variable” fuel (e.g. wind, sunlight, waves, tidal forces, and some types of rivers) to generate electricity. Most renewables fall into this category.

Reliably integrating these resources into the bulk power system will require significant changes to traditional methods used for system planning and operation.

Ongoing efforts brought together by NERC and its stakeholders have the potential to fundamentally change how the system is planned, operated, and used – from the grid operator to the average customer.
About NERC

International regulatory authority for electric reliability in North America

- Develop & enforce reliability standards
- Analyze system outages and near-misses & recommend improved practices
- Assess current and future reliability
Integration of Variable Generation Task Force

- Formed by NERC’s Planning & Operating Committees in December 2007
- 47 participants, 23 official “members”
  - Utilities, ISO / RTO’s, wind and solar manufacturers, associations, government
  - Strong cross-border collaboration (U.S. & Canada)
- Focus on reliability
Significant Growth Expected

- New policies & environmental priorities driving growth
- 200,000 MW of wind proposed in coming 10 years
- Increases seen in solar (i.e. 15,000 MW in California ISO queue)
Bulk Power System Designed to Meet Demand in Real Time

Typical Daily Demand Curve

- **Base Load**
- **Intermediate Load**
- **Peak Load**

**Operating Reserves**

**Capacity:** Instantaneous measure of electricity available at peak

**Energy:** Electricity Produced over Time
Variable Fuels Must Be Used When Available

- Variable generation often does not positively correlate with electricity demand

Only 8 – 26% of wind’s “nameplate” capacity is available at times of peak demand for electricity.

“Ramps” in availability can challenge grid operators.

Wind & Solar Electricity Production Appears Complementary

While variable generation differs from traditional generation in important ways, properly integrated variable resources do not reduce reliability or otherwise negatively affect the grid.
Variable Fuels Must Be Used When Available

This does not mean that the wind does not blow during peak periods. However, for resource adequacy purposes, planners must derate wind capacity to an expected value—typically between 8-26% of the nameplate value.
Variable Fuels Must Be Used Where Available

- Variable generation often located in areas remote from demand centers and existing transmission infrastructure.
Bulk power system reliability must be maintained, regardless of the generation mix;

All generation must contribute to system reliability within their physical capabilities; and

Industry standards and criteria must be fair, transparent and performance-based.
Areas of Further Study & Effort

- High levels of variable generation will require **significant transmission additions** and reinforcements. Barriers to transmission development should be addressed.

- **Additional flexible resources**, such as demand response, plug-in hybrid electric vehicles, and energy storage may help balance steep “ramps”

- **Improved measurement**, forecasting, and modeling of variable generation output is needed.
Areas of Further Study & Effort

- More comprehensive planning approaches and operational practices are needed, including probabilistic planning approaches.

- In aggregate, variable generation connected at the distribution level (i.e. local wind generation and rooftop solar panels) may impact bulk power system reliability.

- Deploying complementary types of variable generation (e.g. wind and solar), leveraging fuel diversity over large geographic regions, and advanced control technologies show promise in managing unique operating characteristics.

- Greater access to larger pools of generation and demand may facilitate the large-scale integration of variable resources.
Status of Work Plan Activities – Completed

- **Probabilistic Techniques**
  - Flexibility Requirements and Metrics for Variable Generation
  - Final on 9/15/2010

- **Planning**
  - MOD Standards Models of VG
  - Final on 5/18/2010

- **Interconnection**
  - Variable Generation Power Forecasting for Operations
  - Final on 2/23/2010

- **Operations**

- **Reference Manual**

Preliminary Results – NOT FOR CITATION
Status of Work Plan Activities – Under Review

Probabilistic Techniques
Accurate Methods to Model and Calculate Capacity of Variable Generation
Review 12/15/2010

Planning
Potential Reliability Impacts of Emerging Flexible Resources
For Approval on 12/15/10

Interconnection

Operations
Ancillary Services and BA Solutions
Review 12/15/2010

Regional Diversity VG
Review 12/15/2010

Reference Manual

Preliminary Results – NOT FOR CITATION
Status of Work Plan Activities – Under Development

- **Probabilistic Techniques and Planning Approaches**
  - Targeted for 2012

- **Planning**
  - Reliability Impacts of Distributed Resource Review 12/15/2010

- **Interconnection**
  - Interconnection Requirements Targeted for 2011
  - Low Voltage Ride-through Targeted for 2011

- **Operations**
  - BA Communication Targeted for 2011

- **Reference Manual**
  - Reference Manual Targeted for 2011

Preliminary Results – NOT FOR CITATION
Spawning by governmental policy drivers and societal benefits, renewable energy is growing at an unprecedented rate. The electric power industry must be prepared to reliability accommodate the expansion.

Reliably integrating these resources into the bulk power system will require significant changes to traditional methods used for system planning and operation.

While variable generation differs from traditional generation in important ways, properly integrated variable resources do not reduce reliability or otherwise negatively affect the grid.
Question & Answer