Accommodating High Levels of Variable Generation

EPRI
Managing Complexity for Safety and Reliability
September 14-15, 2009
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 today’s report 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
- 145,000 MW of wind proposed in coming 10 years
- Increases seen in solar (i.e. 30,000 MW in California ISO queue)

![Projected Summer Wind On-Peak: Total Nameplate Capacity](chart)

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Legend:
- Existing
- Planned
- Proposed
Bulk Power System Designed to Meet Demand in Real Time

Typical Daily Demand Curve

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

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 Where Available

- Variable generation often located in areas remote from demand centers and existing transmission infrastructure.
Keeping Reliability in the Balance

- 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.
Next Steps

- Specific Activities Outlined
  - Three-year plan
  - Assignments
    - Reports
    - Standards Review/Creation
    - Industry Coordination
  - Industry Reference Manual to be completed by March, 2010
IVGTF Operating Committee Activities

- **2nd Qtr. 2009**  
  **End Date: 2nd Qtr. 2010**
  - Forecasting techniques must be incorporated into day-to-day operational planning and real-time operations routines/practices including unit commitment and dispatch

- **2nd Qtr. 2009**  
  **End Date: 1st Qtr. 2010**
  - Balancing areas must have sufficient communications for monitoring and sending dispatch instructions to variable resources.
IVGTF Operating Committee Activities

- **2nd Qtr. 2009**  End Date: **1st Qtr. 2010**
  - Impact of securing ancillary services through larger balancing areas or participation in wider-area balancing management on bulk power system reliability must be investigated

- **1st Qtr. 2010**  End Date: **2nd Qtr. 2011**
  - Operating practices, procedures and tools will need to be enhanced and modified
TVGTF Operating Committee Activities

- 2nd Qtr. 2009
  End Date: 1st Qtr. 2010
  - Operators would benefit from a reference manual which describes the changes required to plan and operate the bulk power and distribution systems to accommodate large amounts of variable generation
Question & Answer

Contact:
Mark Lauby
Director of Reliability Assessments & Performance Analysis
mark.lauby@nerc.net
609.524.7077