Weather Forecasting and Power System Operation

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Outline of Topics
♦ Background
♦ Recent Grid Integration Studies
♦ Role of Transmission
♦ Market Evolution
♦ Conclusions

Variable Generation Forecasting – Why Is it Important
♦ Economics
  – Better forecasts mean lower operating reserves
  – Lower operating reserves mean lower operating costs
  – Avoid penalties for bad forecasts
♦ Reliability
  – Situational awareness for operators
  – System positioning for ramping events
  – Preparation for extreme events
♦ Market Operation
  – Understand need for and provide incentives for the right market products with high VG penetration
  – Align market rules with forecasting capabilities

Reserve Requirement Summary
Source: IEA Task 25

Balancing Cost - Summary of Results

Capacity Credit Summary
Source: McElroy, 2011
Transmission and Interconnection Policy in the US

- Major activities covered under transmission policy include:
  - Planning
  - Permitting
  - Paying (cost allocation and recovery)
- Many political and regulatory jurisdictions now explicitly recognize that significant amounts of VG cannot be delivered to load without a corresponding expansion of the transmission
- This realization has been enshrined in policy through FERC Order 1000, which requires joint and coordinated transmission planning between neighboring transmission entities, transmission operators and RTOs/ISOs

Transmission Adequacy

- Transmission planning for energy sources
  - Planning driven by LMP differences
  - Look at 8760 hours instead of peak load hour
  - New contingencies likely around times of minimum load and minimum conventional generation
  - Need wind integration study to determine ancillary service requirements
  - LOLE and ELCC calculations likely to modify planning reserve margins
- HVDC system design, use and justification across synchronous zones for aggregation, diversity and control benefits

Market Design

- Today’s markets not all designed with VG in mind
  - Energy markets
  - Capacity markets
  - Ancillary service markets
  - Price responsive load markets
- Market shortcomings must be identified and corrected
  - Capacity/flexibility adequacy concerns
  - Energy market price volatility
  - Negative prices

A New Paradigm for Future Capacity and Flexibility Adequacy?

Revenue mix will change, but paths and values are uncertain
- Capacity markets vs. long-term contracts vs. rate-based plants…
- Ample supplies of services may lead to low values
- New sources of services and flexibility are likely

Conclusions

- Deploy more flexible generation and load technologies
- Improve wind plant output forecasting tools
- Aggregate wind plant output over large regions
- Improve balancing area cooperation/ACE Sharing
- Recognize wind contributions to capacity value
- Develop well-functioning day-ahead, hour-ahead, and real-time energy and price responsive load markets
- Adequate transmission capacity and comprehensive regional planning processes are critical

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