

FERC Technical Conference on Planning Models and Software

# ABB GridView Applications

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# Responses to Market Needs

- **Reliability Studies**

- Detailed models for transmission systems
- Forced outages of generators and transmission lines

- **Economic Studies**

- Detailed models for different new resources
- Better benchmark with market operation
- Co-optimization of ancillary service markets and energy market
- Concurrent with power flow studies
- Allow larger system simulation for interregional studies
- Better database management tools and automatic post processing
- Provide standard and customized reports
- Visualization of simulation results and debug capability
- Utilize parallel processing capability

# Challenges from Wind Integration

- Wind generation can be counter to load shape
- Need fast ramp generation with large operating range
- Unpredictable patterns – operators need to consider wind variability and prevent large imbalance from occurring
- Need additional regulation, ramping capability in system operation
- Need state-of-art forecasting tool to increase benefit from wind
- Need transmission upgrades to access to remote wind power
- May create over-generation conditions
- Wind has relatively low capacity factor at time of peak load
- Wind power with storage / battery
- Dispatchable demand and demand response programs

# High Renewable Energy Penetration

- **State Renewable Portfolio Standard (RPS) in next 10-20 years**
- **Forecast errors of renewable energy profiles (7-15% NMAE)**
- **Impacts on the traditional generation resources**
  - Gas plants, coal plants
  - Conventional hydro, pumped storage plants
- **Utilization of energy storage resources**
  - Concentrating Solar Power (CSP) with Thermal Storage
  - Compressed Air Energy Storage
- **Dispatchable Demand resources**
  - Plug-in Hybrid Electric Vehicle (PHEV)
- **Use of HVDC / HVAC for long distance energy delivery**

# Market Simulation Tool Requirements

- **Wind Model**
  - Wind generation forecast errors
  - Wind forecast for DAM, wind generation for RTM
  - Wind Curtailment report due to local congestion
- **Thermal Unit Model**
  - Ramping up / down model
- **Hydro Unit Model**
  - Schedule to accommodate wind generation
  - Response to price signals
- **Pumped Storage Unit Model**
  - Use price-driven logic
  - Consider energy efficiency and storage limits

# Market Simulation Tool Requirements

- **Energy Storage Unit Model**

- Concentrating Solar Power (CSP) with Thermal Storage
  - Dispatchable resource
  - Provides spinning reserve
- Compressed Air Energy Storage (CAES)
  - Pumping during off-peak and generating during on-peak
  - Provides spinning reserve

- **Dispatchable Demand Model**

- Plug-in Hybrid Electric Vehicle (PHEV) Dispatch
  - Charging during off-peak
  - Provides spinning reserve when charging

# GridView Features for Wind Integration

- **Monte Carlo Simulation to Assess System Reliability Impacts**
  - LOLE or ELCC (Effective Load Carrying Capability)
- **Detailed Generation and Transmission Modeling**
- **Economic Assessment for Transmission Upgrades**
- **Co-Optimization of Ancillary Service and Energy Markets**
- **Flexible Wind Model**
  - Commitment and Dispatch Curves
  - Forecast Error Model
- **Ramping Up/Down model**
- **Energy Storage Model**
- **Dispatchable Demand Model**
- **Quick Start Unit Commitment Logic**
- **Wind Curtailment Model and Report**
  - User specified curtailment price

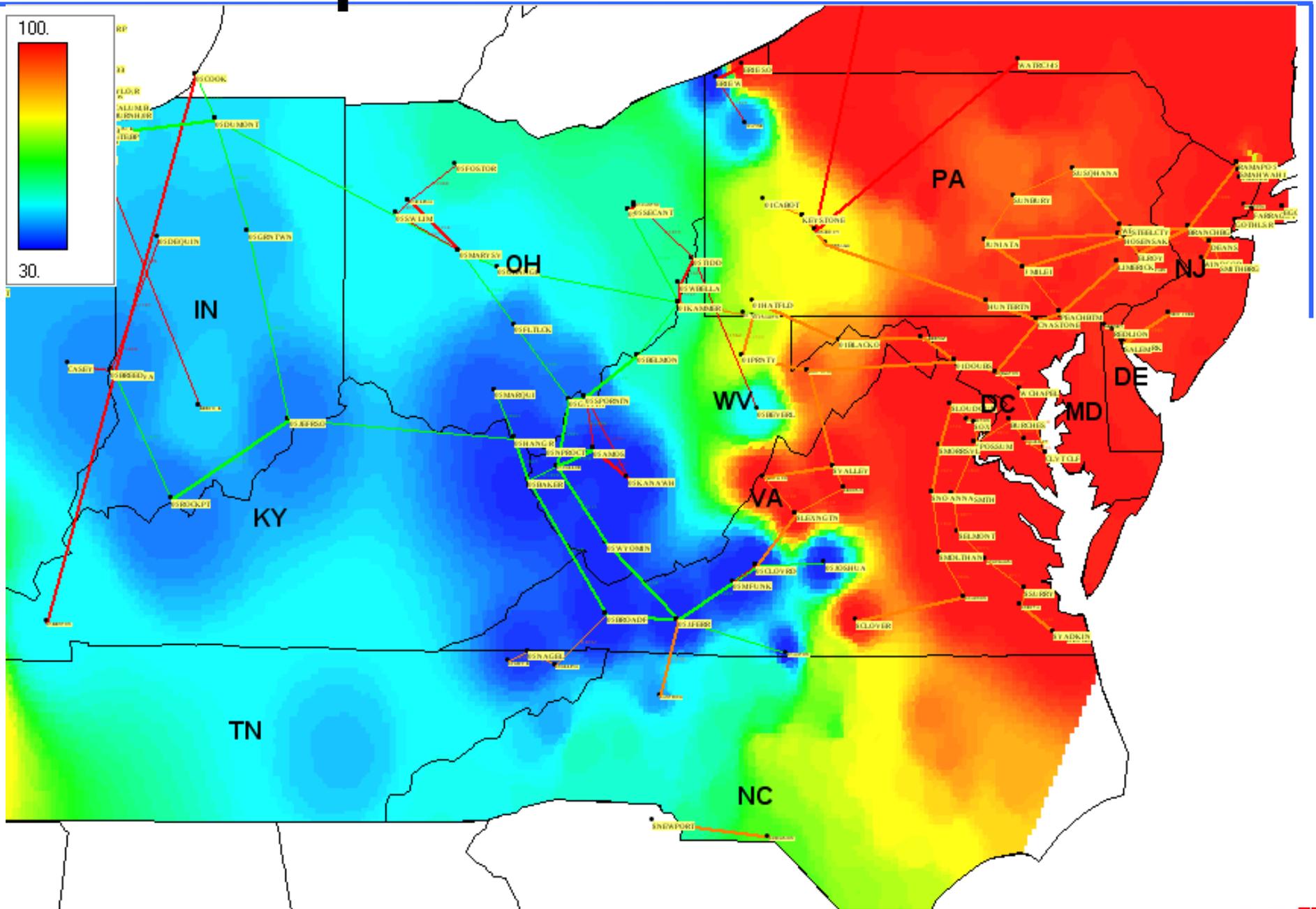
# Transmission Planning

- **Capacity mix and location have changed**
- **Need new transmission projects to access remote renewable energy**
- **Build HVAC / HVDC to increase transfer capability between regions**
- **Transmission planning process:**
  1. Build a generation expansion plan in the current transmission systems
  2. Run power flow studies to calculate the transmission limits
  3. Use Monte Carlo simulation to calculate system LOLE with current limits
  4. If  $LOLE < 0.1$  day/yr, Stop; Otherwise,
  5. Update system with transmission upgrade projects
  6. Adjust transmission limits based on power flow studies
  7. Rerun Monte Carlo simulation to make sure meet NERC rule
  8. Run economic study with transmission upgrades

# GridView Applications

- **Economic Benefit Study**
- **Wind / Renewable Integration Study**
- **Market Simulation**
  - Energy and Ancillary Services Co-Optimization
  - LMP Forecasting, CRR Valuation
- **Reliability Assessment**
  - Transmission and Generation Forced Outages
  - LOLE and EUE Calculations
- **Environmental Study**
  - RGGI Impacts
- **Hydro Thermal Co-Optimization**

# Contour Map of LMP

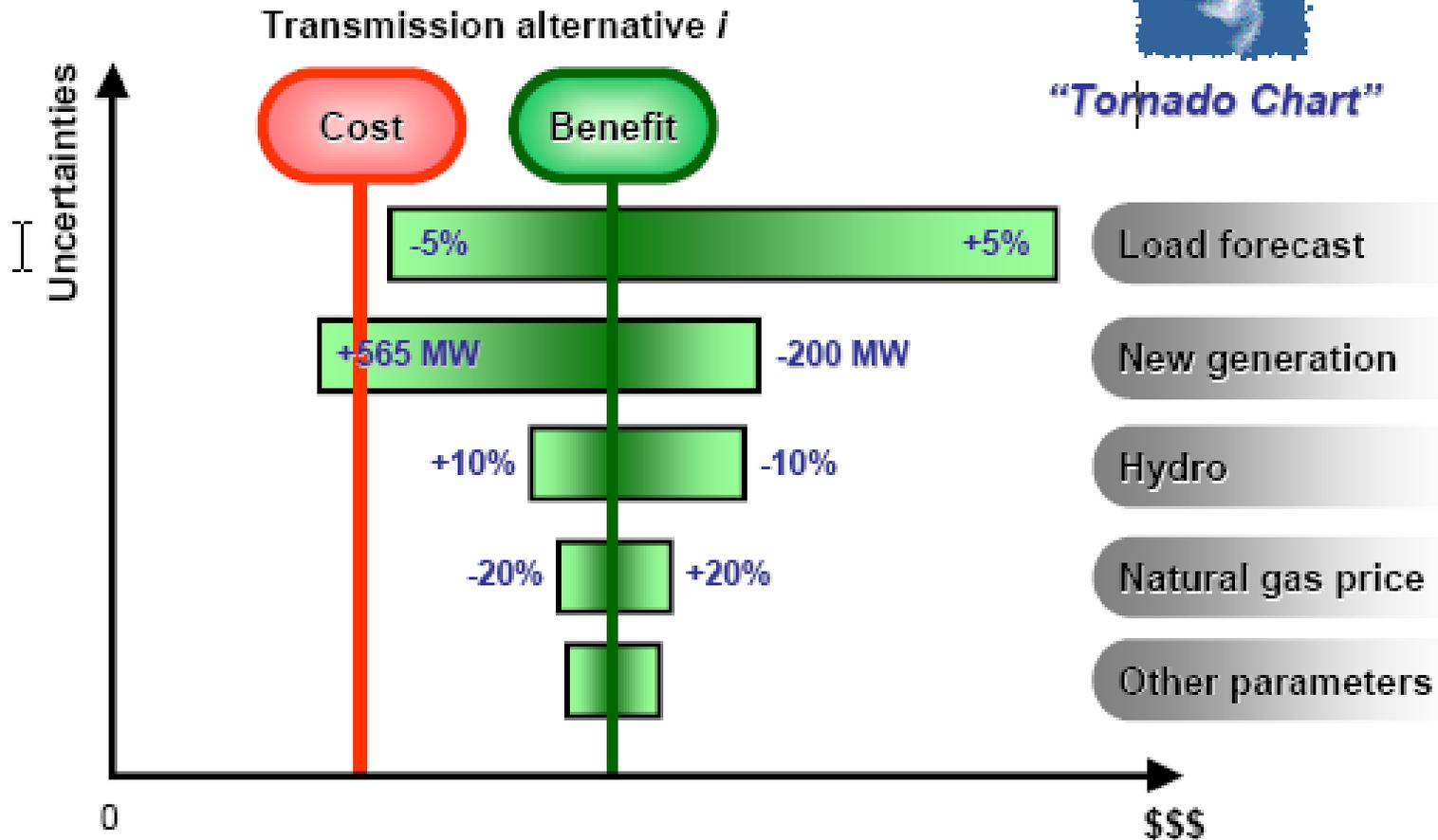


# Account for Uncertainties

## Sensitivity Analysis



*"Tornado Chart"*



In this study, sensitivity analysis will be performed for two selected alternatives.

Note: This slide is just an illustration of study deliverables. Nothing shown in this example are actual study results.

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