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Market Advisory Committee

Renewable Energy Generation Working Group

Second Meeting, 22 May 2008

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Capacity Credit

- Cover expected peak demand under an outage of the largest generator
- Maintain capacity to respond to frequency variations
- Remove need for high peak energy prices to provide price signals to invest in market

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Capacity Credits
Current Methodology

- Current methodology may not adequately address higher intermittent generation penetration rates
  - May provide greater recognition than generators contribute to system security as in 2006/07
  - Average annual generation may not reflect availability during peak
- Principles can be used to guide the certification of system capacity

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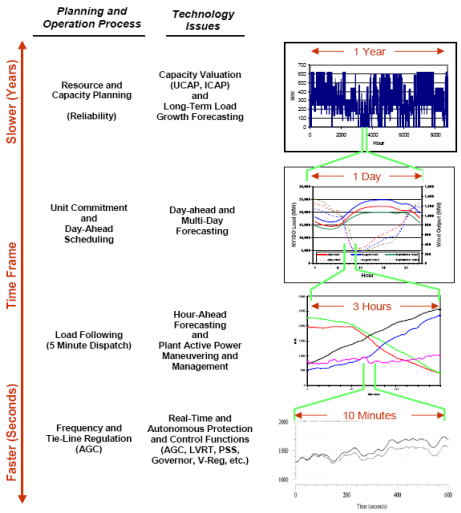
Capacity Credits
Impacts of Intermittency

- Intermittency causes issues on a number of timescales
- Different aspects of the market can be used to mitigate different impacts
- Poor management on one timescale can cascade into others



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Capacity Credits

- Impacts of inappropriately rewarding capacity contribution
  - Under recognising blunts price signals to:
    - Recognise geographic diversity
    - Manage volatility through plant design or operation
    - Balance gross output against peak optimisation
    - Increases reserve margin by default with cost borne by intermittent generators
  - Over recognising:
    - Risks under supply during peak operation – threat to system security
    - Also blunts price signals to manage volatility through plant design and operation

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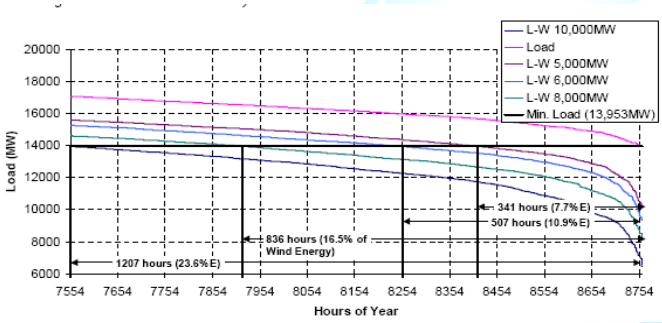
Capacity Credit Implications

- Appropriate capacity certification provides incentive to align with load profile
- Poor alignment of generation with load profile has implications for supply overhang in low load conditions
- Potential for negative prices under low load that may curtail generation
- Chart below from Ontario study showing impacts on intermittent generators
- In generators' long term interest to line up with peak to greatest extent possible



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Other Networks
PJM

- PJM Capacity Market
  - Capacity market not dissimilar to SWIS
  - Calculates 3 year mean over peak 3 hours during summer season
  - Default rate 20% if less than 3 years data
- SWIS context
  - Different wind resource to PJM
  - PJM methodology tends to filter low generation values and provide an elevated value in comparison to actual contribution to system capacity

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Other Networks
Ontario

- Undergoing Similar process to answer “How can we accommodate the impending boom in wind”
- Independent Electricity System Operator uses both probabilistic and deterministic sources to assign capacity credits
- Deterministic
  - 10 years of simulated output data
  - Post operation wind farm output
- Probabilistic
  - Median value from probability distribution of simulated and actual output

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Other Networks Ontario

- Previous method top 5 contiguous demand hours for winter, summer and shoulder months.
  - Probability distributions derived from limited sample
  - Did not account for new farms
- Default value 10%

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Other Networks Ontario

- Independent Electricity System Operator and wind peak body (CanWEA) engaged GE to examine issues
  - Capacity value defined as the average hourly wind power output during the periods when load is within 10% of its peak
  - The average capacity value during summer (peak load) is approximately 17%
  - Capacity factor 38% to 42% during the winter months and 16% to 19% during summer months
  - Overall yearly capacity value is approximately 20% - capacity value heavily weighted towards summer months (peak)
  - Geographic diversity and the scaling of wind data from the same groups to derive overall wind power output tend reduce sensitivity to penetration level

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Capacity Credits
Alternative Methodologies

- No over-arching principles exist to establish new methodologies
- Some things to consider
  - Availability - system security is paramount
  - Moderate price volatility
  - Appropriate investment incentives
  - Probabilistic - risk weighted but not overly risk averse
  - Equitable and technology neutral
  - Synoptic variability and impact on consumption patterns
  - Time frames
    - One year, three years or more years?
    - What intervals are of critical concerns?

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Capacity Credits
Alternative Methodologies

The objectives of the reserve capacity mechanism will shape the method used for calculating capacity from wind generators.

Two possible options:

- PJM Methodology Comparison - Peak 3 Weekday Summer Hours
- IRCR approach to identifying summer 'Peak Load Intervals'

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Analysis

- What we don't know
  - Probability distributions from wind farms
  - Extent to which 06/07 year is typical or atypical
  - Extent to which geographic diversity on SWIS can mitigate intermittency across different time scales
  - Sensitivity of accreditation methodologies to different parameters including
    - Time intervals
    - Probability of variability in output
    - Probability of availability

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Analysis
Existing Data Stocks

- Demand side existing data stocks include
  - Weather data
    - Temperature
    - Humidity
    - Wind speed and direction
  - Consumption data
- Supply side stocks more limited
  - Output from wind farms
  - Limited weather data for some but not all wind farms

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Analysis
Ideal Data Set

- Extend actual operating data with test mast data
- Detailed weather data from existing wind farms to develop more accurate generation curves
  - Wind speed
  - Wind direction
  - Temperature
  - Humidity
- Simulated output across different regions based on test mast data