

Status Update on Renewables Integration

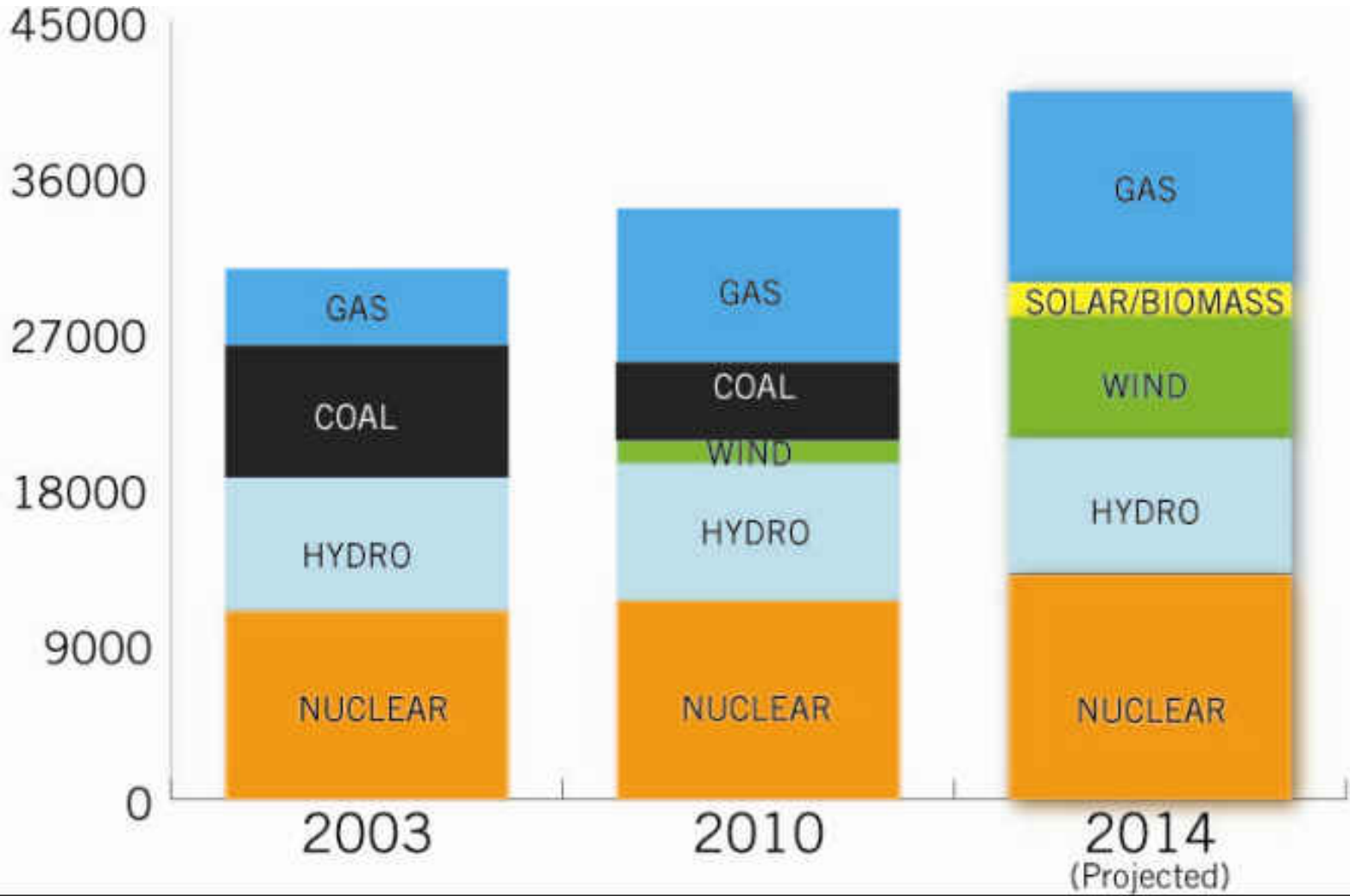
Wind Power Standing Committee
September 23, 2010 - Revised

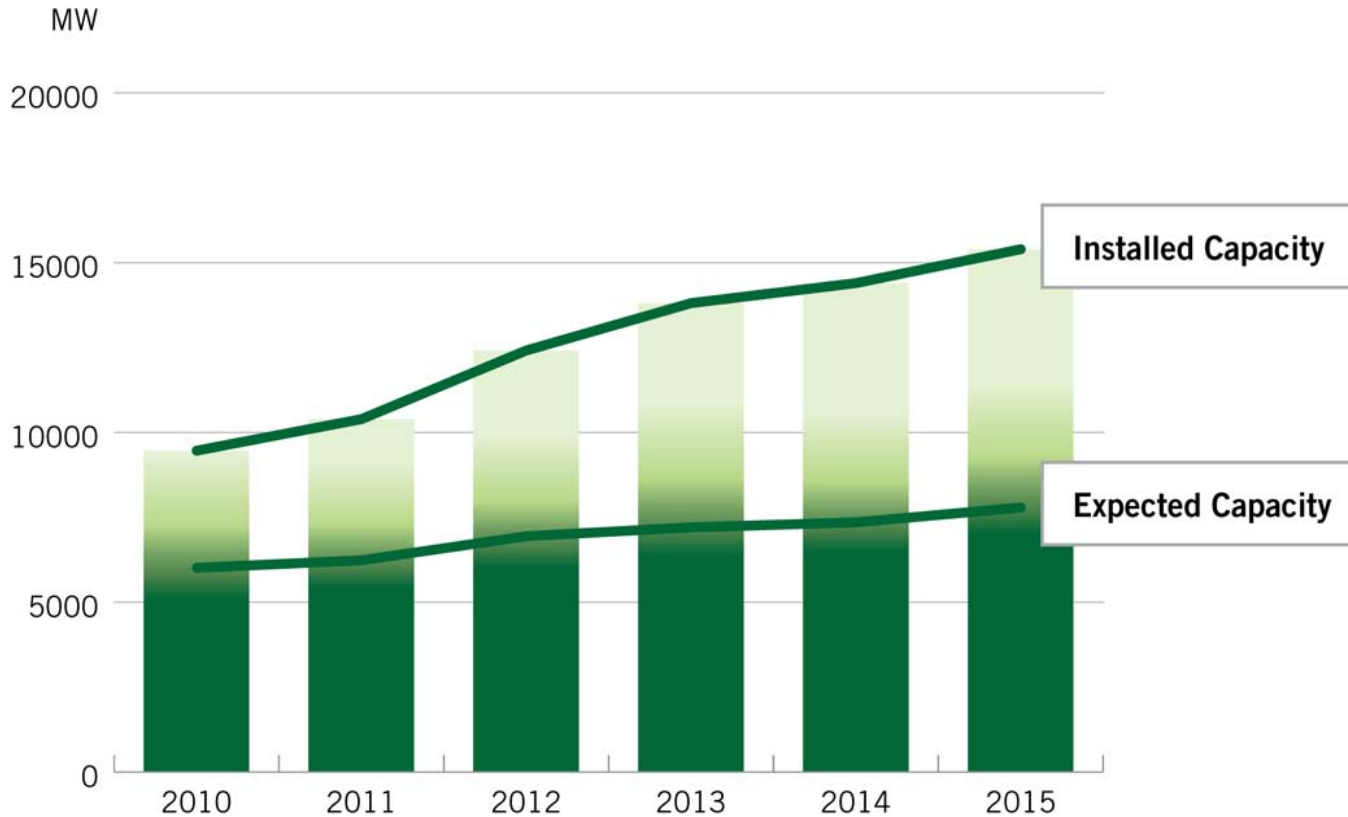


What once was a minor contributor to meeting Ontario's generation needs, variable resources will soon represent a significant portion of the province's baseload fleet.

- 7 of top 10 hourly wind outputs took place on September 4th, 2010. Max output achieved was 1,019MW (92% capacity factor)
- wind output reached as high as 7.5% of the hourly Ontario demand and 6.5% for the day
- 6,600MW of new renewable resources expected for 2013. (4,200MW of wind, 1,800MW of solar and 600MW of water)

A Changing Fuel Mix

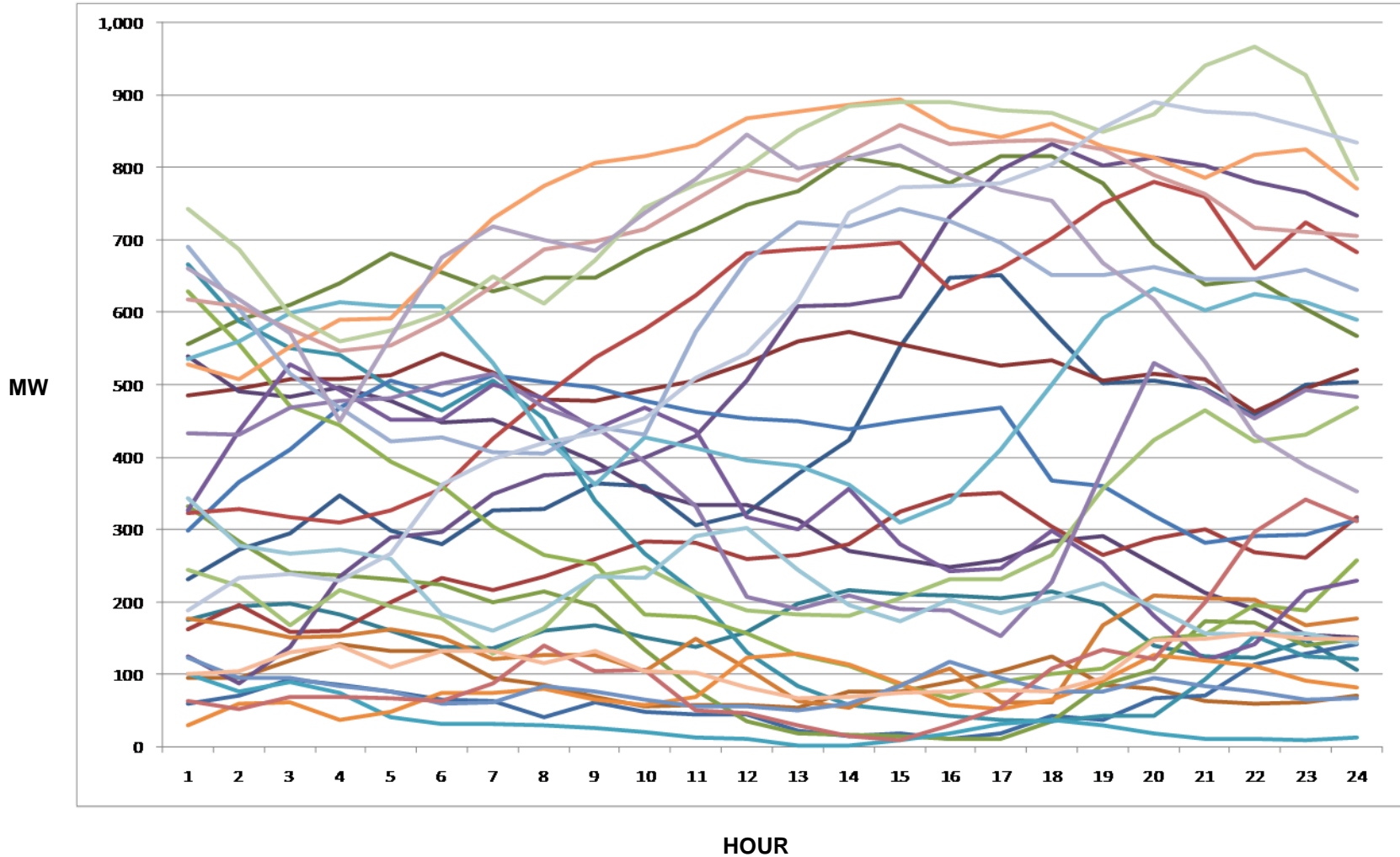


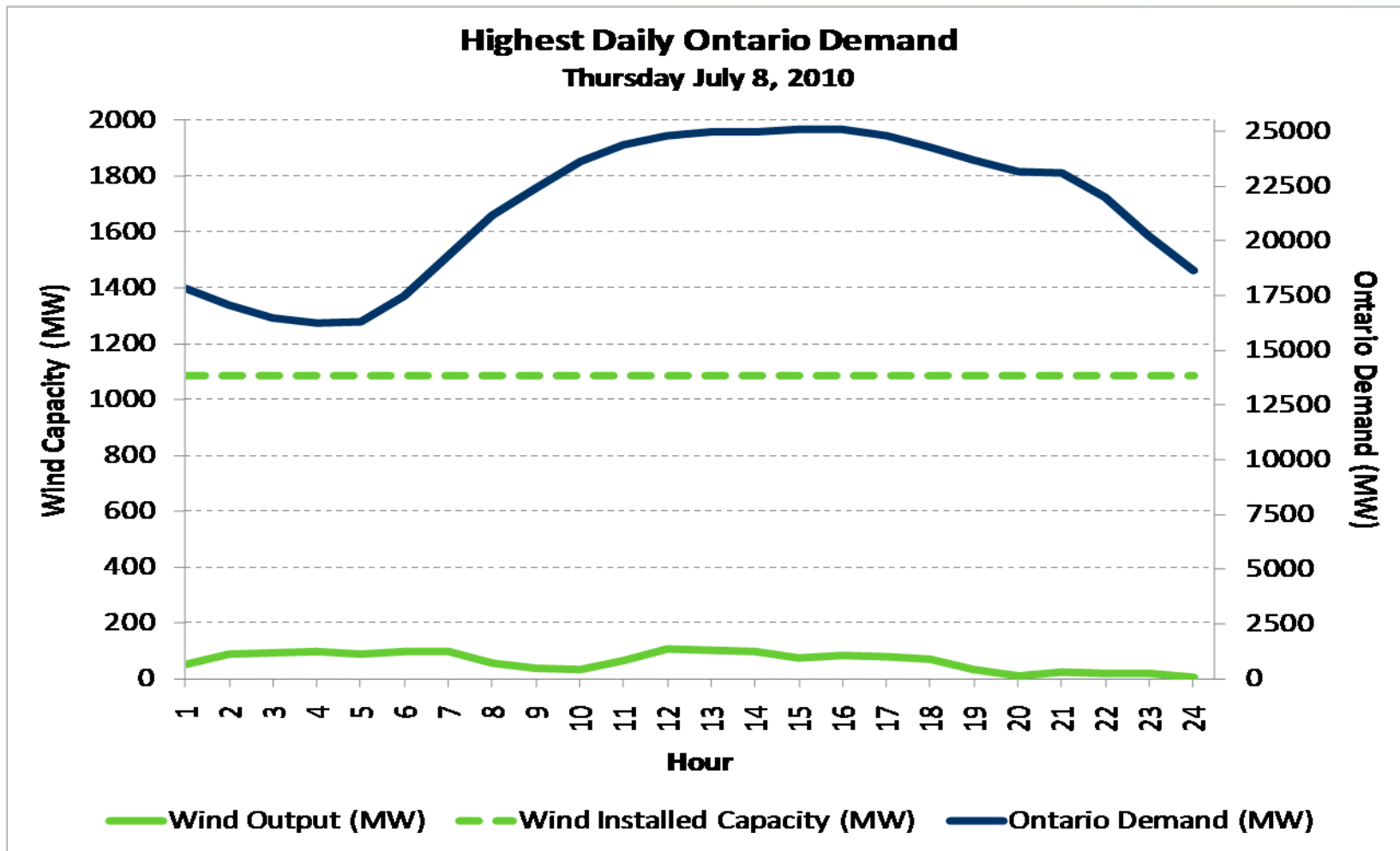


Note: Installed and expected capacity are based on what is existing, committed and directed as of September 16, 2010

Wind Variability: A System Operator's Challenge

Ontario Hourly Wind Output: January 2010





Wind Production Hour - Low: 7 MW, High: 106 MW, Daily Peak Demand: 25,075 MW 6

Forecasting

Ability to predict output from variable resources is essential for maintaining system reliability and market efficiency

Visibility

New processes such as direct telemetry and reporting may be needed to ensure visibility of large-scale embedded wind and solar generators

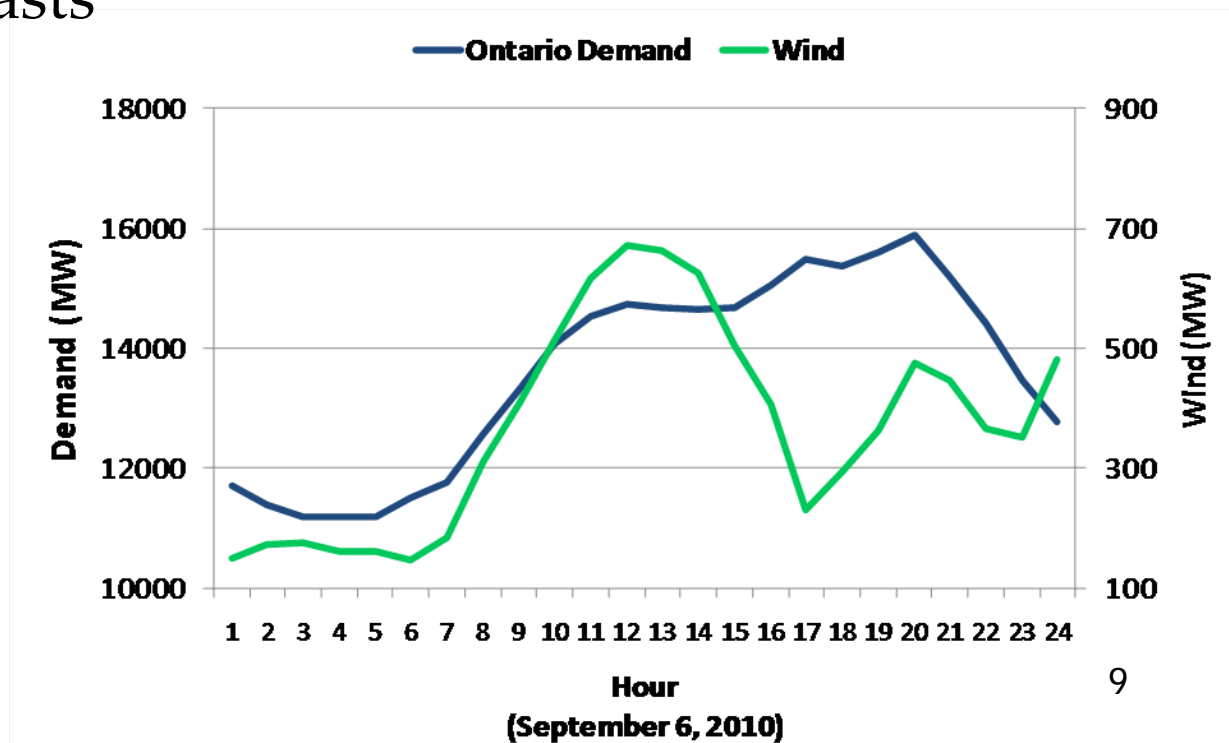
Dispatch

Integration of renewables into economic dispatch model should help resolve issues like surplus baseload generation

- Improved forecasting tools and techniques
- Centralized approach
- Multiple time frames
- Best practices from other jurisdictions
- Data requirements – static and dynamic
- Reporting obligations
- Funding model
- Need for market rule changes



- Next hour and day ahead forecasts (CWF project)
- Real-time forecasts for dispatched down units
- Weather situational awareness
- Probabilistic forecasts
- Ramp forecasts
- Foregone energy



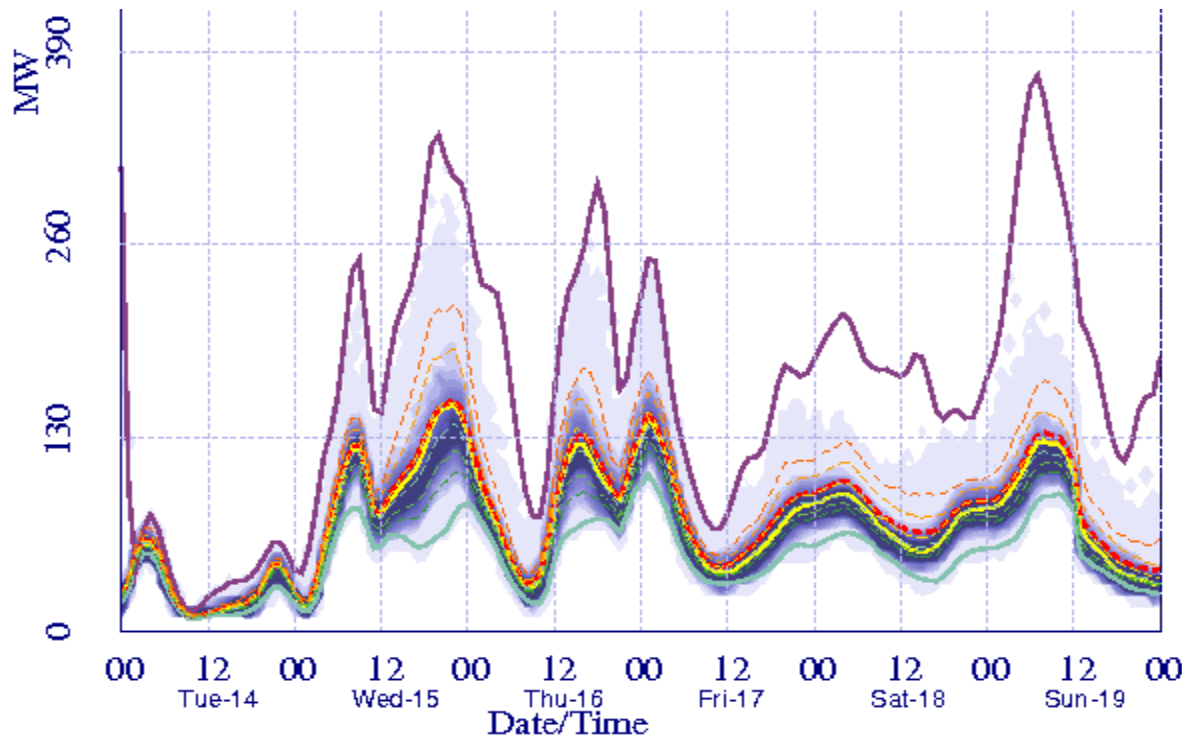
Applicable to all wind generators directly connected to ICG and for all wind generators with an installed capacity of 5MW or greater connected to a distribution system.

- Static Plant Data
- Dynamic Data



All meteorological data and forecasts will be publicly available.

Alberta 6 day wind power forecast updated at
2010/09/14 00:00 MDT [2010/09/14 06 UTC]



The Centralized Wind Forecasting project will forego a trial and move directly to a RFP.

- Limited time horizon for implementation
- Trial is not considered necessary to achieve the project's objectives
- Performance expectations will be managed in RFP

Next steps are to issue wind facility data requirements document and RFP in 2011.

- Blurring of lines between transmission and distribution systems
- Need for direct telemetry and reporting from embedded resources
- Real-time tools for situational awareness



- Visibility of embedded resources
 - allow control room operators to identify those resources that could be used for curtailment to address a reliability issue.
- New modeling and visibility in IESO SCADA tools.
- Real-time data
 - 3 second frequency





- Changing role of variable resources
- Significant component of Ontario's baseload fleet
- Optimization
- Technological and operational limitations
- Compliance rules
- Dispatch merit order
- Contract implications

- Integrating renewable resources into real-time market.
- Actively dispatch all grid connected variable resources on a five minute economic basis.
- Will require new dispatch modeling
 - Variable fuel
 - Technology specific operating characteristics
 - Real-time forecasting
- Resource specific compliance rules

Applicable whenever demand (locally or globally) in at least one future hour is expected to be so low the only remaining resources available for dispatch are baseload generators.

Offers may not reflect marginal cost leading to counterintuitive outcomes. The IESO is considering whether it is appropriate to adopt a dispatch merit order policy as seen in other jurisdictions.

- FIT Contract Settlement
 - Two part settlement
 - Foregone energy calculation
- CMSC Payments
- OR Market Participation

