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On Demand.

Renewable Resources and System Operations

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Presentation to the Asia-Pacific Energy Regulatory Forum

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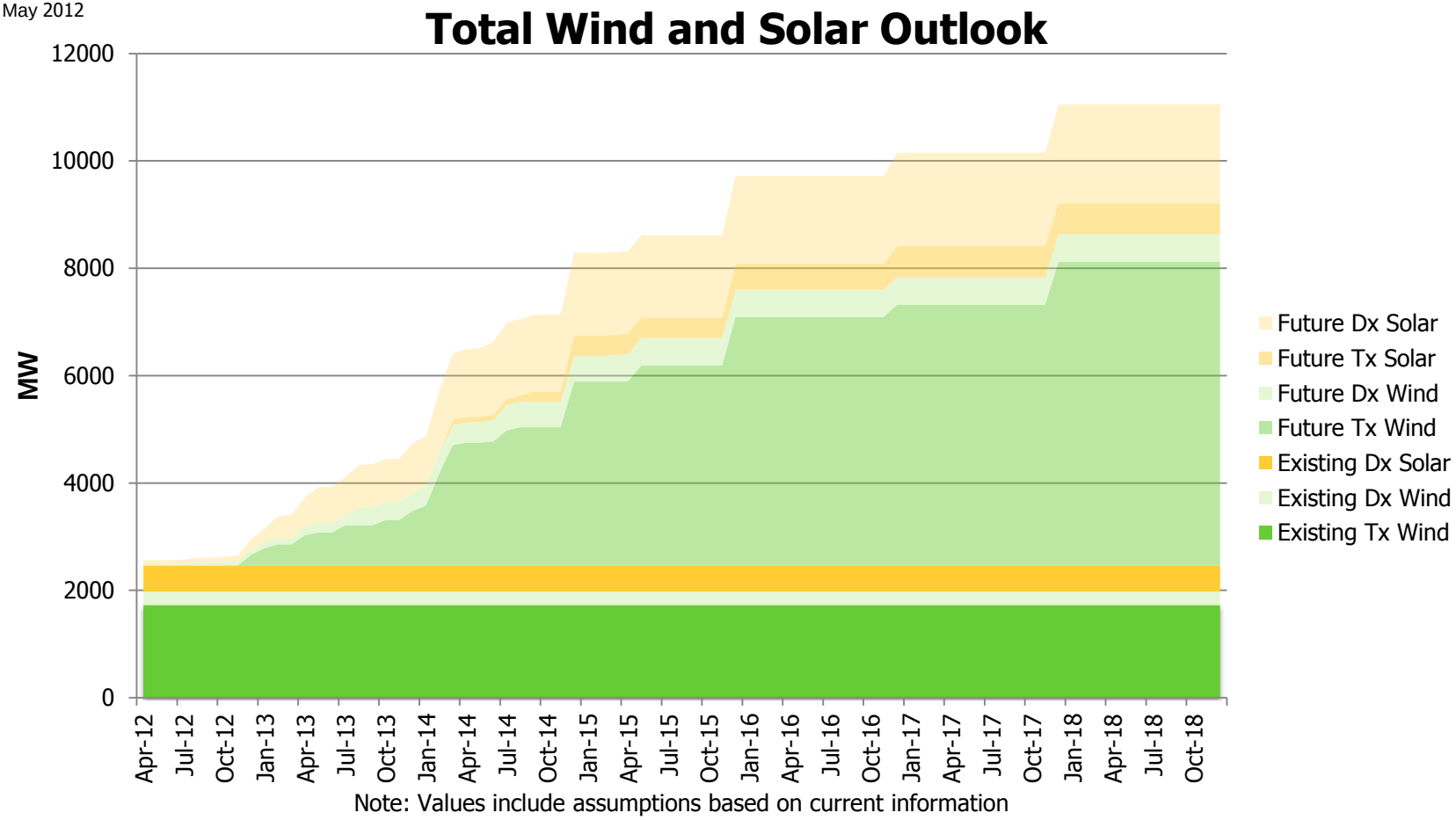
Renewable Generation: What the Future Holds

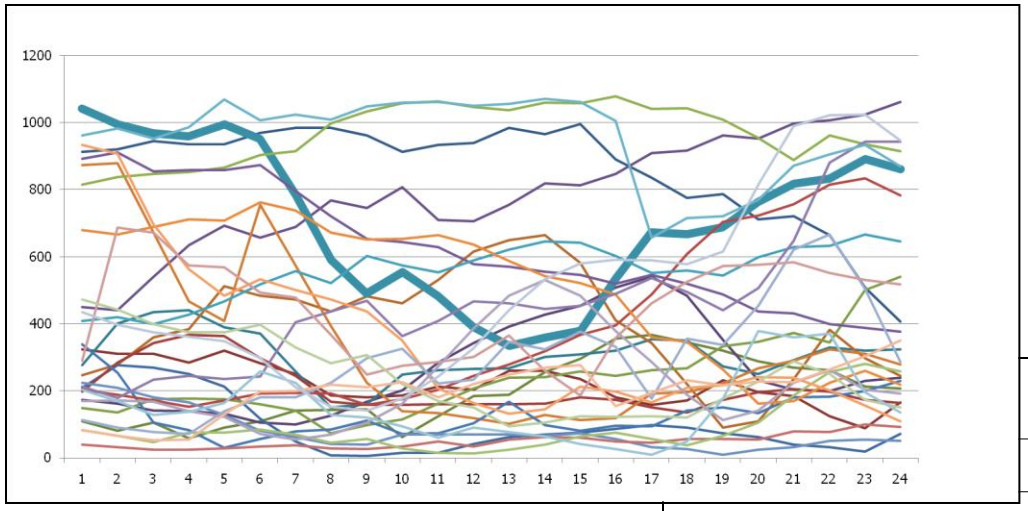
May 2012



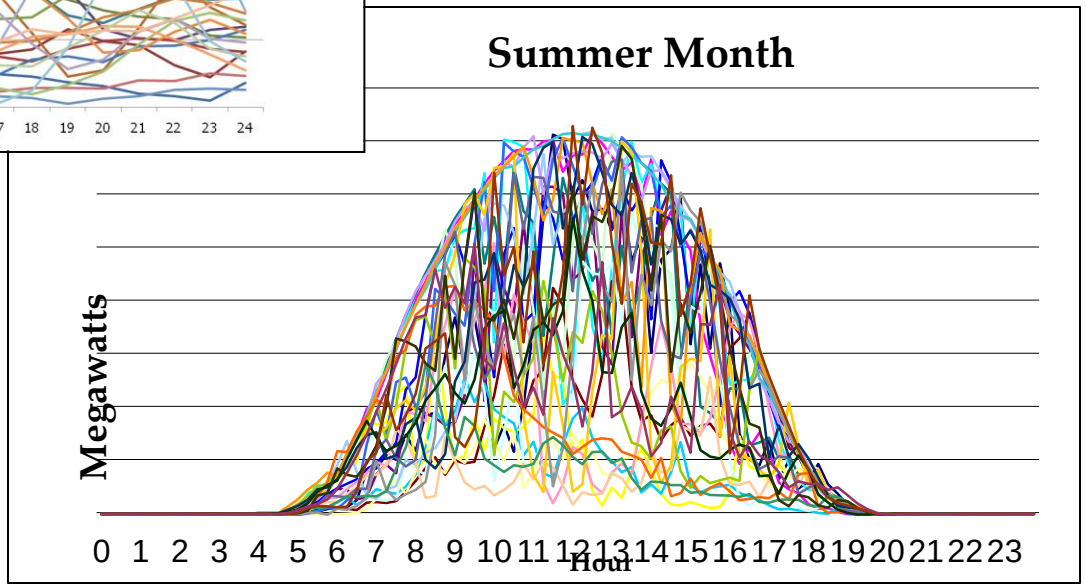
Note: Values include assumptions based on current information

Variability – Output Volatility

Daily Wind Output for One Month

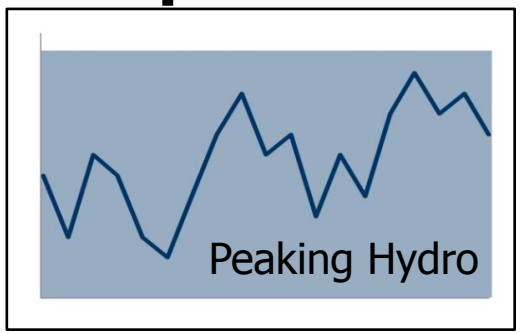


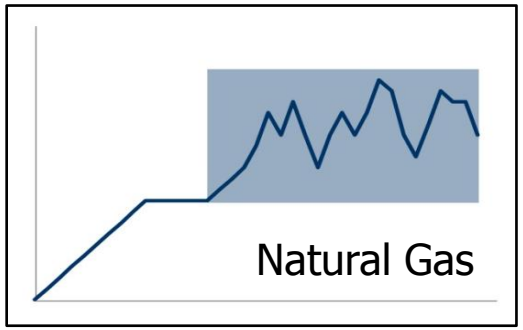
Daily Solar Output



Managing Supply

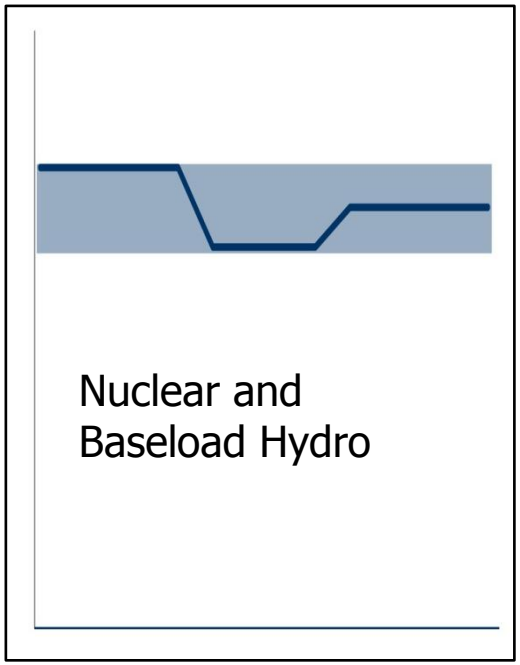
Dispatchable





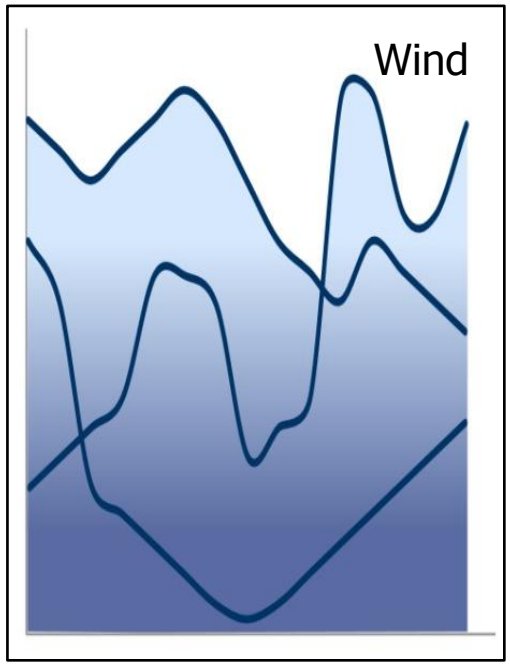
- Hydro: highly flexible when there's water
- Gas: highly flexible, if min. loading point is met

Baseload



- Limited flexibility to manoeuvre
- Can't "follow" demand

Variable



- Output varies depending on conditions
- Can be highly flexible within those max. outputs

Flexibility - Gains and Losses with a Changing Supply Mix

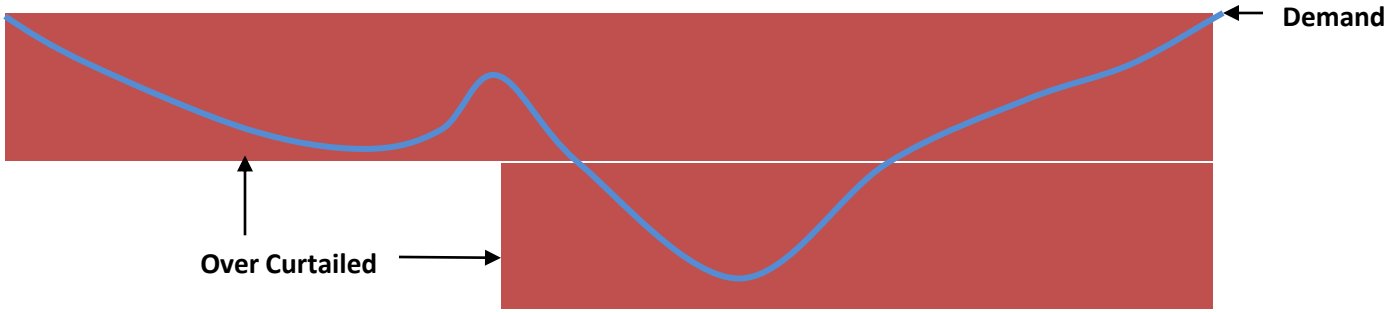
- More than 6,500 MW of coal retiring by end of 2014
- More than 10,000 MW of gas a primary source of flexibility
- Growth to 10,700 MW of renewables, primarily wind and solar, increasing the need for flexibility
- Nuclear refurbishment increasing baseload nuclear by ~1,500 MW to nearly 13,000 MW

Renewable Integration Initiative: Areas of Focus

Forecasting	Visibility	Dispatch
Ability to predict output from variable resources is essential for maintaining system reliability and market efficiency	New processes such as direct telemetry and reporting are needed to ensure visibility of large-scale embedded wind and solar generators	Integration of renewables into the economic dispatch is required to resolve surplus baseload generation, ramping and transmission constraints

Maximizing the Value of the Greener Fleet

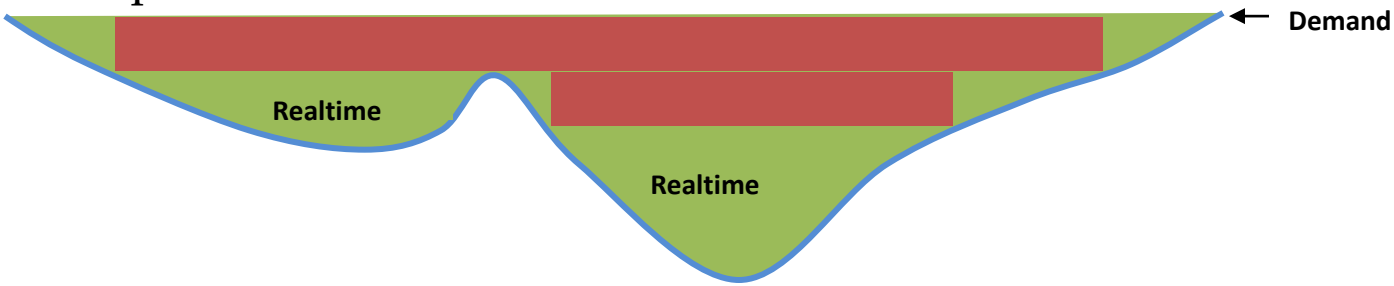
- Without Renewable Dispatch (current situation)



Nuclear Today

Over curtailed nuclear often requires costly carbon emitting replacement energy.

- With Renewable Dispatch

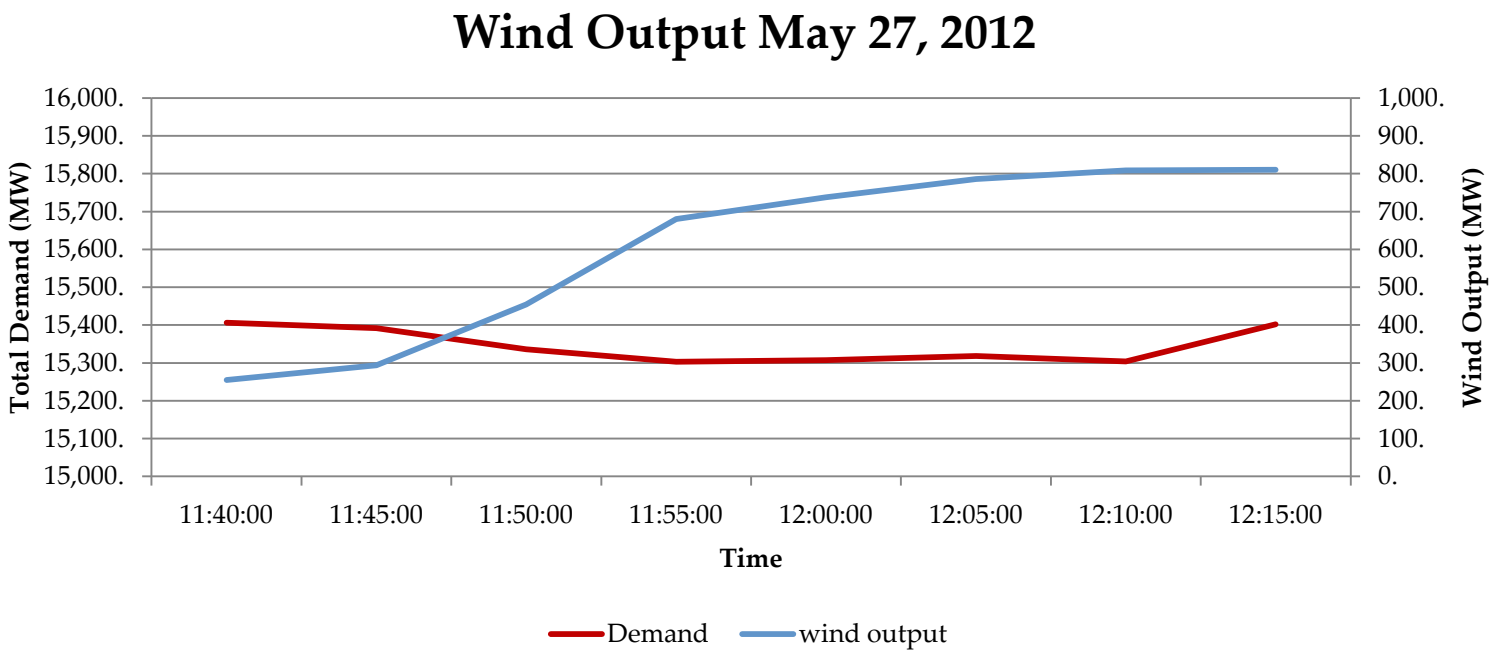


Flexible Nuclear

Wind & Solar

Using flexible renewables minimizes over curtailment and its associated economic and environmental impacts.

Managing Variability



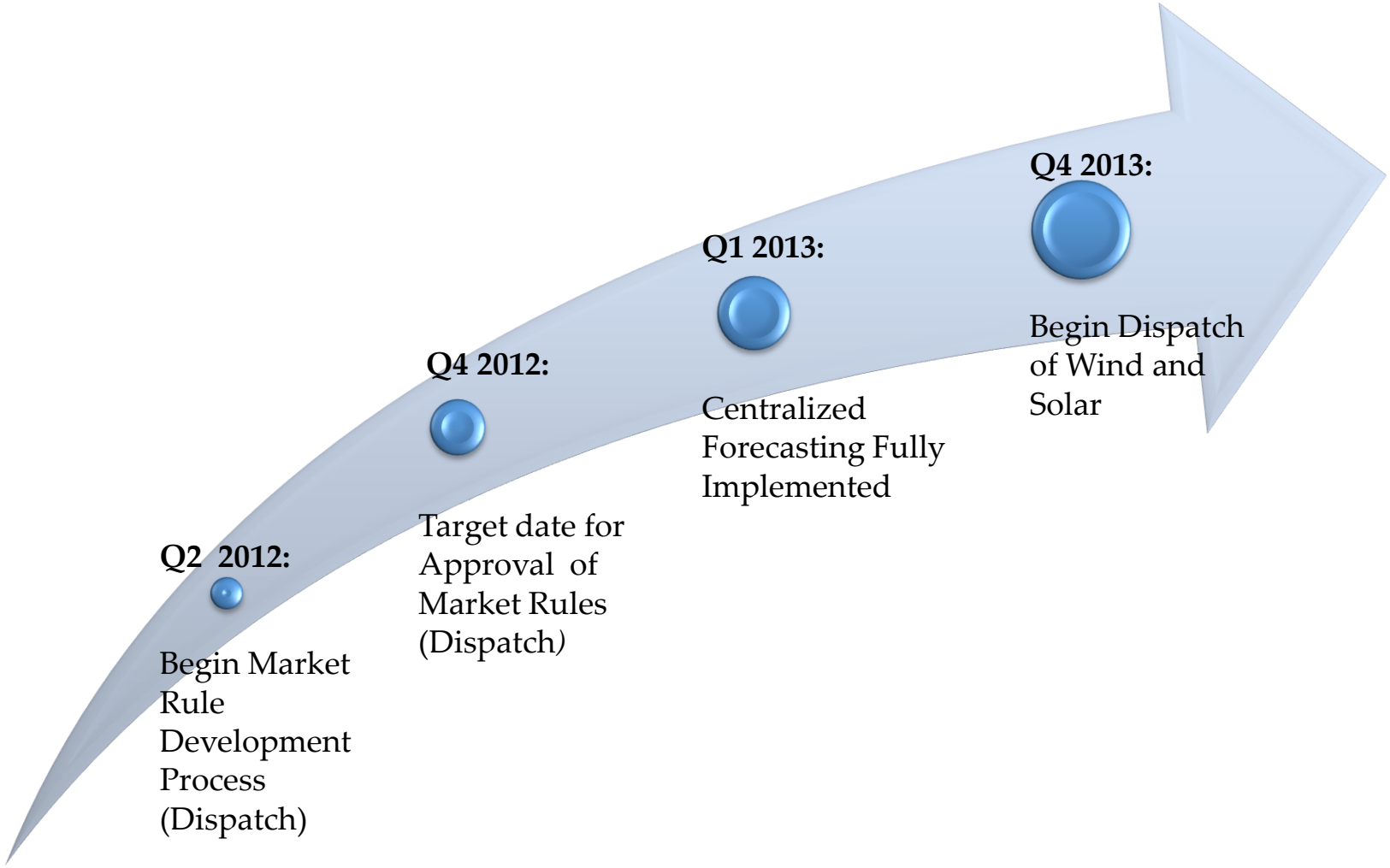
With 1700 MW of installed wind capacity this 400MW change over 10 minutes was manageable. As wind resources come on line this would equate to an 800 MW change by 2014 and 1800MW change by 2018.

To manage these events reliably , controlling wind output is a must.

Design Principles and Direction

- 11 Design Principles Approved
- Principles relate to dispatch, forecasting, compensation and visibility
- 5 MW or greater will be forecasted centrally
- Grid-connected variable generators old and new will be dispatched on a 5-minute basis
- Compensation mechanisms will be consistent with other dispatchable generation

What These Changes Mean

- The IESO will have access to plant-specific data from wind and solar facilities
  - 5 MW and greater on the distribution system
  - Static and dynamic data requirements
- The IESO is implementing a centralized forecasting system for wind and solar facilities
  - 5 MW and greater
  - Solar and wind forecasting requirements were developed by the Visibility Technical Working Group
- The IESO will dispatch wind and solar facilities participating in the IESO-Administered markets

Renewable Integration Initiative: Key Milestones