

Operational Events and Market Impacts January 2014 Cold Weather

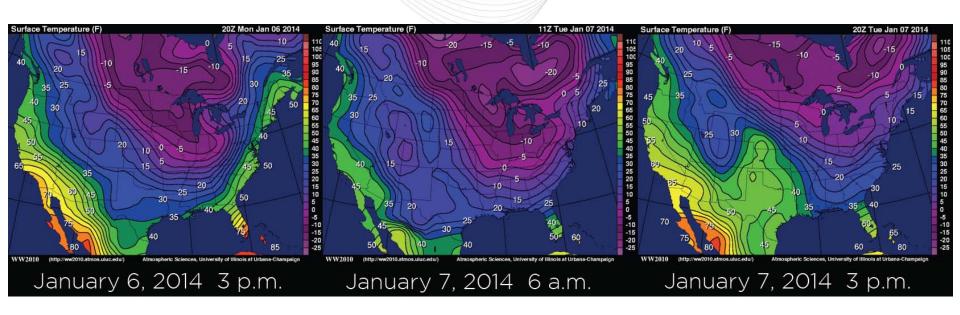
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Source: University of Illinois at Urbana-Champaign

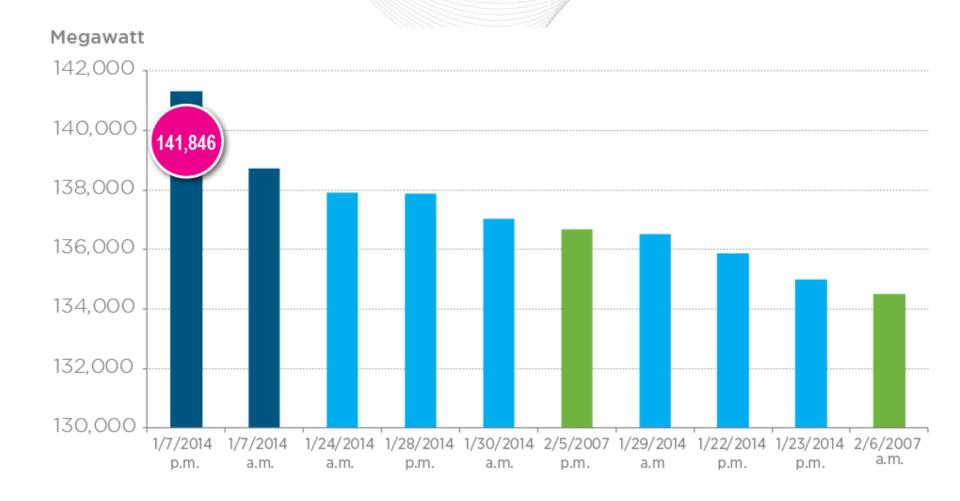


Minimum Temperatures – January 2014 Columbus, Philadelphia, Chicago and Richmond



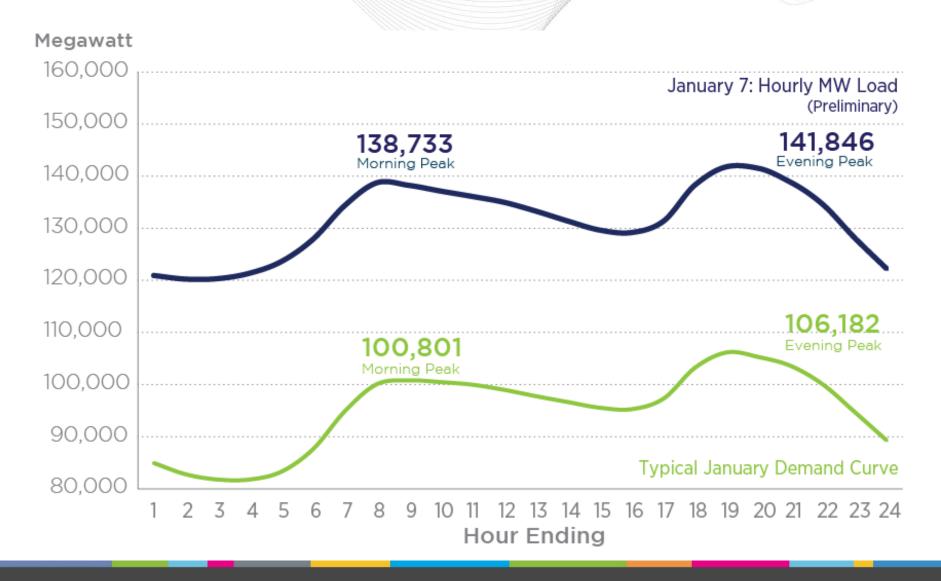


Maximum Winter Peak Demands





January 7 Load Compared to Typical January Day

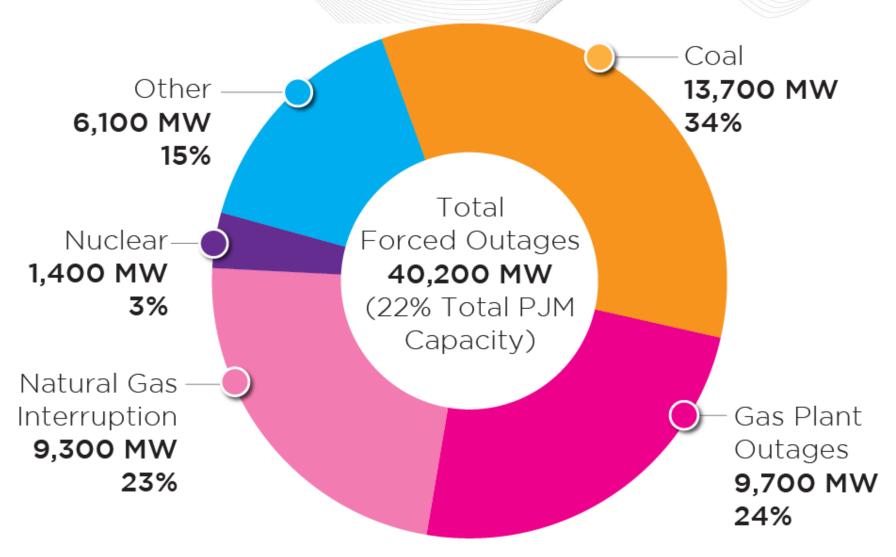


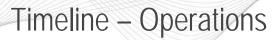
Timeline – Operations

Advance Communications Forecasting Operational Planning 🦻 Weather — PJM's meteorologist PJM directed transmission began tracking snow storm and generation owners to cancel planned outages Load — PJM utilized worst-case forecasts of load to proactively prepare 🍞 PJM prepared a plan Gas operators expected tight Jan. conditions through January 7 and communicated with stakeholders > PJM requested permission to share certain operational info with natural gas pipelines PJM held first operational call with major pipeline operators Jan. 🎙 PJM refines plan based Jan. on revised forecasts to system conditions Unit commitments finalized PJM issued alerts and FERC Commission granted waiver increased frequency of communication



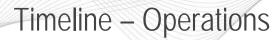
Forced Outages – January 7 Evening Peak (7pm)







WEATHER CONDITIONS **	Emergency Actions	Operation Expectations	Gas Expectations
Snowstorm across PJM Tracking extreme cold	Jan. 2	lssues with oil and emissions	∜Gas unavailability
Record low temps	Jan. Voltage reduction and shortage pricing	reserves and losing units	∜ Gas interruptions
Breaking cold weather records	Jan. Reserve action	₹22% forced outage rate	Gas conditions deteriorate

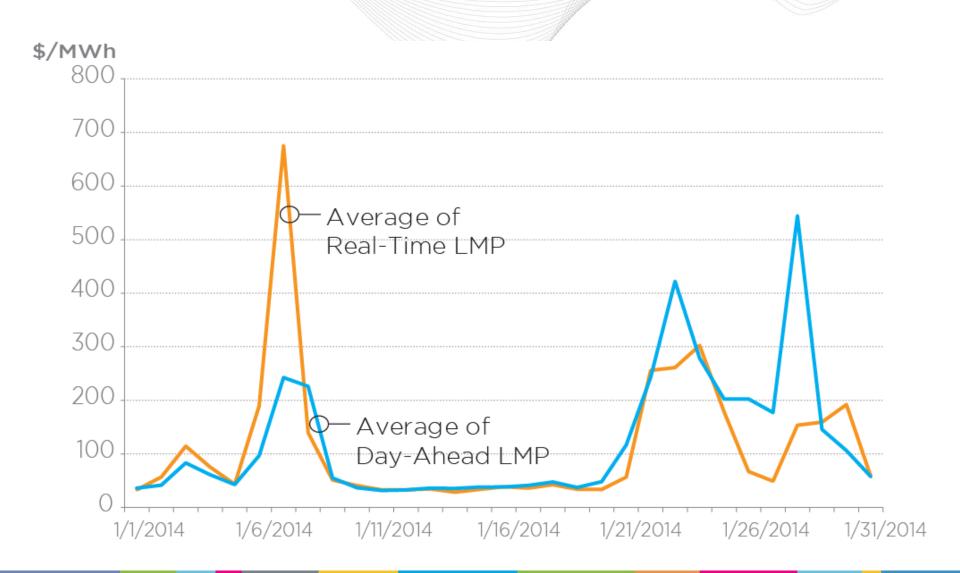




WEATHER EXPECTATIONS **	Conditions	Operation Expectations	Gas Expectations
	Unkown forced outage rate	Dispatchers contact units on fuel availabilityOil inventories depleted	Conditions seem tighter
1 CITIPCI atal C5 10 WCI	Max. emergency conditions		Critical notices across footprint
	an. 25	Dual fuel units prepare to switch to oil	
Forecasts more severe than actual	Lack of oil inventory		₹Weekend packages
Snow storm in the south and east	an. 8-27		



PJM Load-Weighted LMPs – January 2014



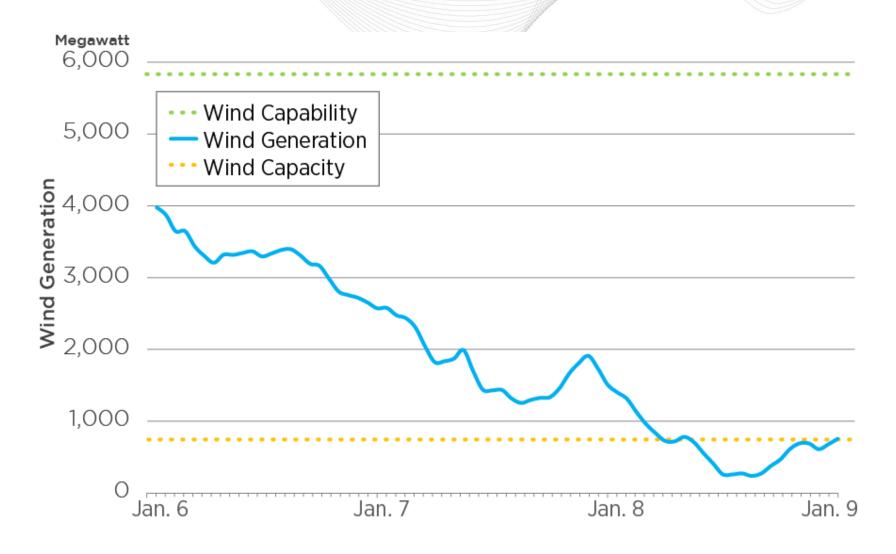


Generation Outages – January 2014



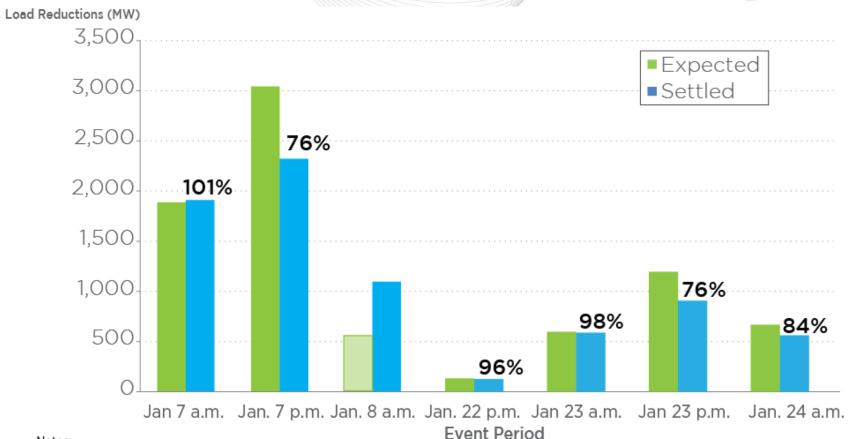


Polar Vortex – Wind Generation



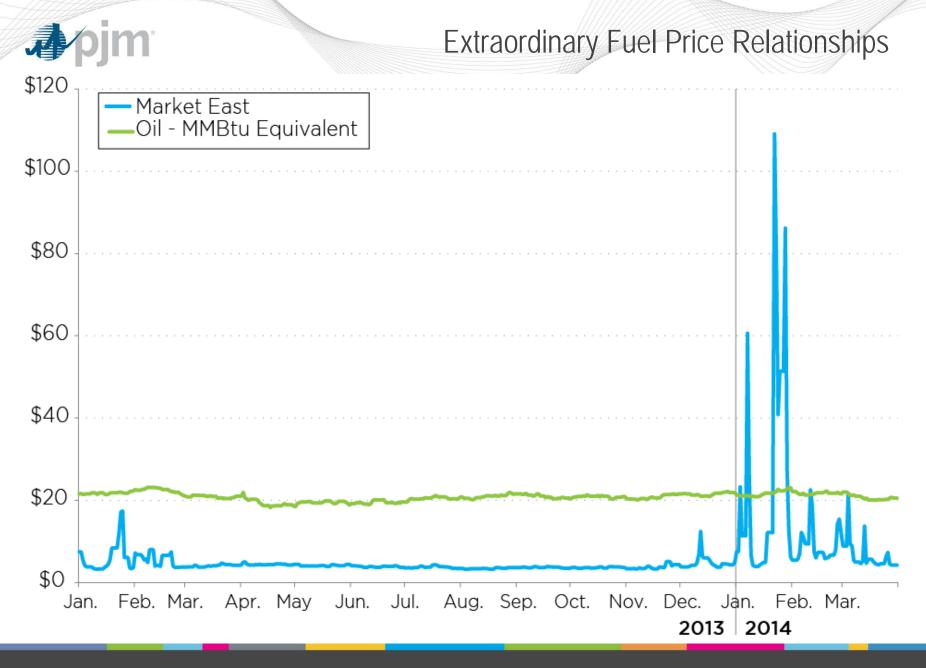


Demand Response – Winter Storms



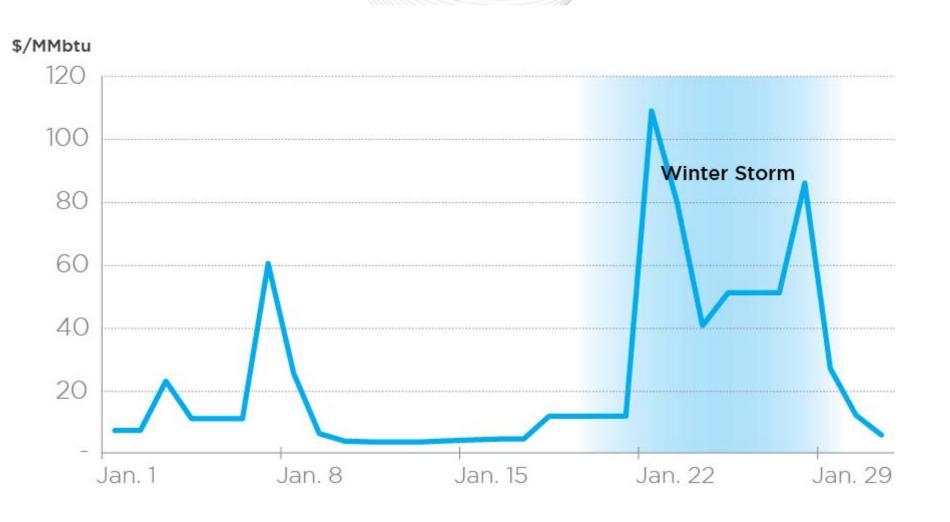
Notes:

- 1. DR events dispatched during non-compliance period.
- 2. Expected Energy Load Reductions (MW) CSP reported estimate based on current market rule.
- 3. MW value is average hourly load reduction for non-ramp in hours.
- 4. Event on Jan. 8 was cancelled by PJM prior to official start time. In order to honor the Emergency DR resource 2-hour minimum down time, PJM allowed CSPs to settle if their load reduction had started prior to cancellation and/or needed to reduce for 2 hours. PJM estimated amount of DR that needed to continue to reduce for 2 hours. "Performance" for this event cannot be measured based on the circumstances of this event





Gas Prices (Market East) – January 2014





Reliability Credit

- Generator committed in advance of the operating day and outside of the Day-Ahead Market.
- Generator committed during the operating day and is out of the economic merit order.

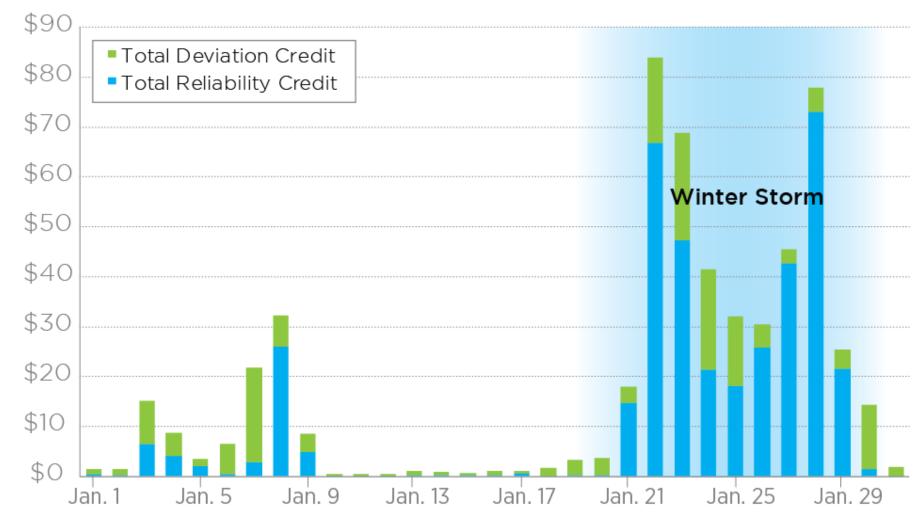
Deviation Credit

- Generator is needed to meet anticipated load plus reserves.
- Generator is committed during the operating day and cost is greater than locational marginal prices most of the time.



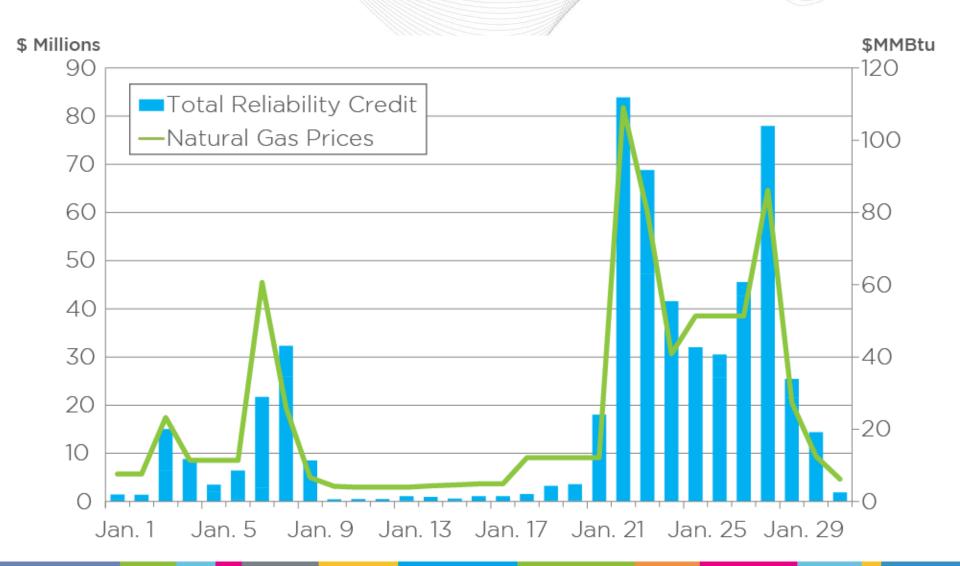
Balancing Operating Reserves – January 2014

\$ Millions



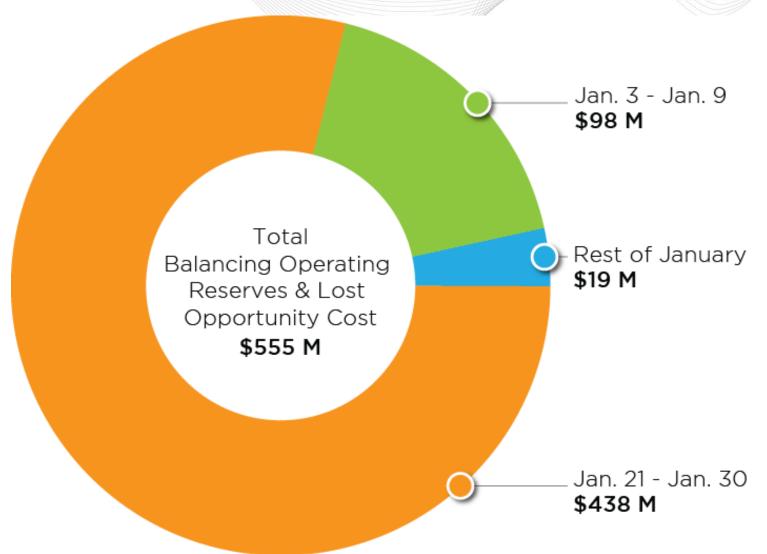


Gas Prices and Reliability Balancing Operating Reserves – January 2014





Uplift Costs – January 2014



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 Improve generator availability and performance during extreme weather events,

 Implement performance verification or testing of generation in advance of winter operations,

Continue to engage in discussions with industry and regulators to improve natural gas and electricity market alignment,





- Implement market mechanisms that encourage better generator availability, such as incentives for ensuring fuel availability or dual-fuel capability, and
- Review the cost allocation for uplift charges and investigate a mechanism to allocate uplift costs during emergency operations that minimizes volatility.



LET'S TALK...

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