

Winter Operations and Market Performance

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FERC Winter Operations Panel

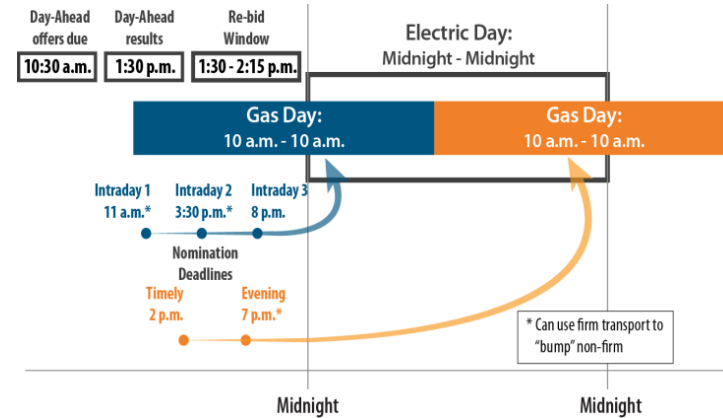
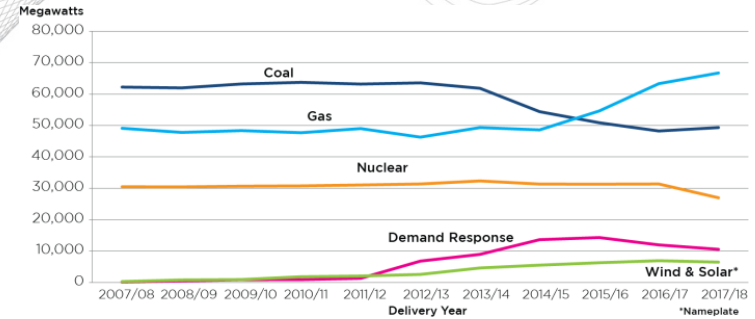
October 20, 2016

PJM staff conducted an event analysis on the 2014 Winter Operations to include the Polar Vortex operations

Key recommendations were as follows:

- Capacity Performance (CP) - Improve generator availability during extreme weather events,
- Testing of generation in advance of winter operations,
- Improve natural gas and electricity market alignment,
- Implement market incentives for ensuring fuel availability or dual-fuel capability, and

- Implement Capacity Performance
- Enhanced gas/electric coordination
- Enhanced Generator Requirements
 - Winter Generation Testing Program
 - Winter Readiness preparation training
 - Winterization checklist
- Tools which provide better information on unit performance
 - Generation Database development to track unit performance real-time provides system operators with better unit performance metrics

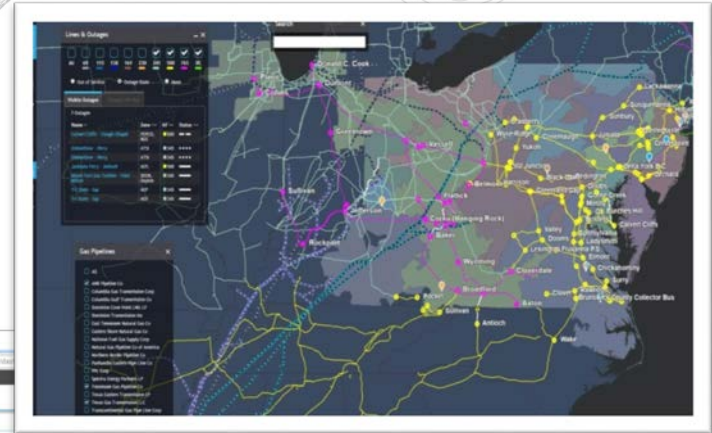


CP Resources are expected to be available and perform with more flexible parameters during Emergency Conditions

- Penalties assessed for during Emergency conditions
- PJM Operator and Member Training and Drills conducted prior to prepare for new CP rules, processes and tools
- Unit Specific Parameters implemented - based on the resources' physical operating abilities
- Tool enhancements implemented to support communications to members during Performance Assessment Hours
- Summer performance evaluations in progress, additional analysis will be conducted after winter to consider further enhancements

PJM team formed to:

- Analyze data related to gas delivery to units
- Provide operational info that allows operators to make better decisions
- Improve coordination with pipelines and LDCs
- Develop tools to support processes



Gas Pipeline

Pipeline ID	Alt ID	Type	Location	Rated GPM	Effective PFC ID	End PFC ID
262	186	Pipeline Conditions	Canada Pipeline Conditions	12/08/2014 22:23	12/08/2014 22:23	06/08/2015 23:23
252	4748	Electricity Conditions	DC Pipeline Conditions, DC, 12/10/2014	12/08/2014 23:06	12/08/2014 23:06	12/11/2014 16:00
272	4750	Electricity Conditions	DC Pipeline Conditions, DC, 12/10/2014	12/08/2014 23:08	12/08/2014 23:08	12/11/2014 16:00
182	1826	Pipeline Conditions	Canada Pipeline Conditions	12/08/2014 23:08	12/08/2014 23:08	12/11/2014 16:00
82	4757	Electricity Conditions	DC Pipeline Conditions, DC, 12/10/2014	12/08/2014 19:05	12/08/2014 19:05	12/11/2014 16:00
LDC	236127	Operational Alerts	DC, DC, 12/08/2014 19:14	12/08/2014 19:14	12/08/2014 19:00	01/08/2015 23:00
LDC	26201	Current Pipeline Conditions	Canada Pipeline Conditions, DC, 12/10/2014	12/08/2014 17:29	12/08/2014 17:29	12/11/2014 16:00
LDC	26201	DC	DC Pipeline Conditions, DC, 12/10/2014	12/08/2014 19:02	12/08/2014 19:02	12/11/2014 16:00
LDC	26201	Maintenance	Canada Pipeline Conditions, DC, 12/10/2014	12/08/2014 16:08	12/08/2014 16:08	12/11/2014 16:00
LDC	26201	DC	DC Pipeline Conditions, DC, 12/10/2014	12/08/2014 16:27	12/08/2014 16:27	12/11/2014 16:00
LDC	627008	Conditions	Canada Pipeline Conditions, DC, 12/10/2014	12/08/2014 13:54	11/12/2014 15:00	11/12/2014 15:00
LDC	236128	Electricity Conditions	Canada Pipeline Conditions, DC, 12/10/2014	12/08/2014 12:26	12/08/2014 12:26	01/08/2015 23:00
LDC	182	Pipeline Conditions	Canada Pipeline Conditions	12/08/2014 23:25	12/08/2014 23:25	06/08/2015 23:23
LDC	1826	Electricity Conditions	DC Pipeline Conditions, DC, 12/10/2014	12/08/2014 21:50	12/08/2014 21:50	12/08/2015 21:47
LDC	1826	Electricity Conditions	DC Pipeline Conditions, DC, 12/10/2014	12/08/2014 21:47	12/08/2014 21:47	12/08/2015 21:47



Winter Peak Load Base Case

Load Forecast	135,548 MW
RTO Net Interchange	Importing 5,175 MW
PJM RTO Installed Capacity	183,665 MW
Studied Generator Outages	20,230 MW

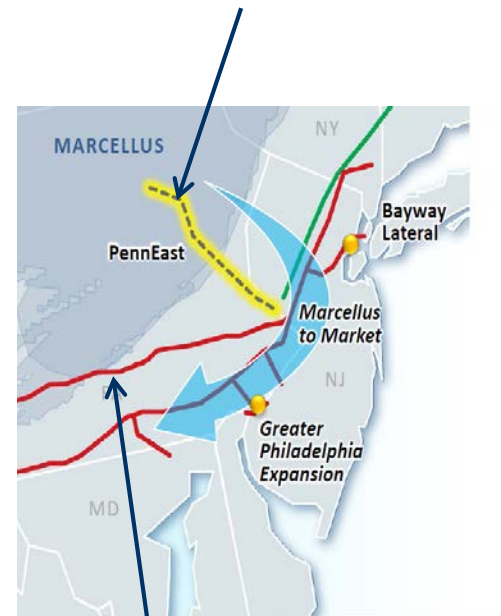
- No reliability issues identified for base and N-1 analysis.
- Re-dispatch and switching required to control local thermal or voltage violations in some areas.
- All networked transmission voltage violations were controlled by capacitors. All other voltage violations were caused by radial load.

- Pipeline inspection / maintenance activity - Summer 2016
- Vast majority of pipelines are well prepared for winter
- Major exception currently is Texas Eastern (TE) pipeline
 - TE Penn Jersey line rupture and explosion – April 29, 2016
 - Line runs from Pittsburgh to New Jersey
 - Currently running at 50% of design capacity
 - TE currently inspecting entire length of line for anomalies - Anticipated completion and return to full service – Nov. 1, 2016
- PJM believes that given current pace of inspection that TE will meet their November 1, 2016 in service date

TE incident highlights the importance of midstream pipeline projects designed to take shale supplies to market

- These projects (e.g. PennEast designed to transport 1 Bcf/day of natural gas from Northeastern PA to the southeastern PA and NJ demand centers) are being held up by significant local opposition
- Buildout of these pipeline projects would expand capacity and supply options and improve grid reliability

Proposed PennEast Pipeline



Penn Jersey Line