



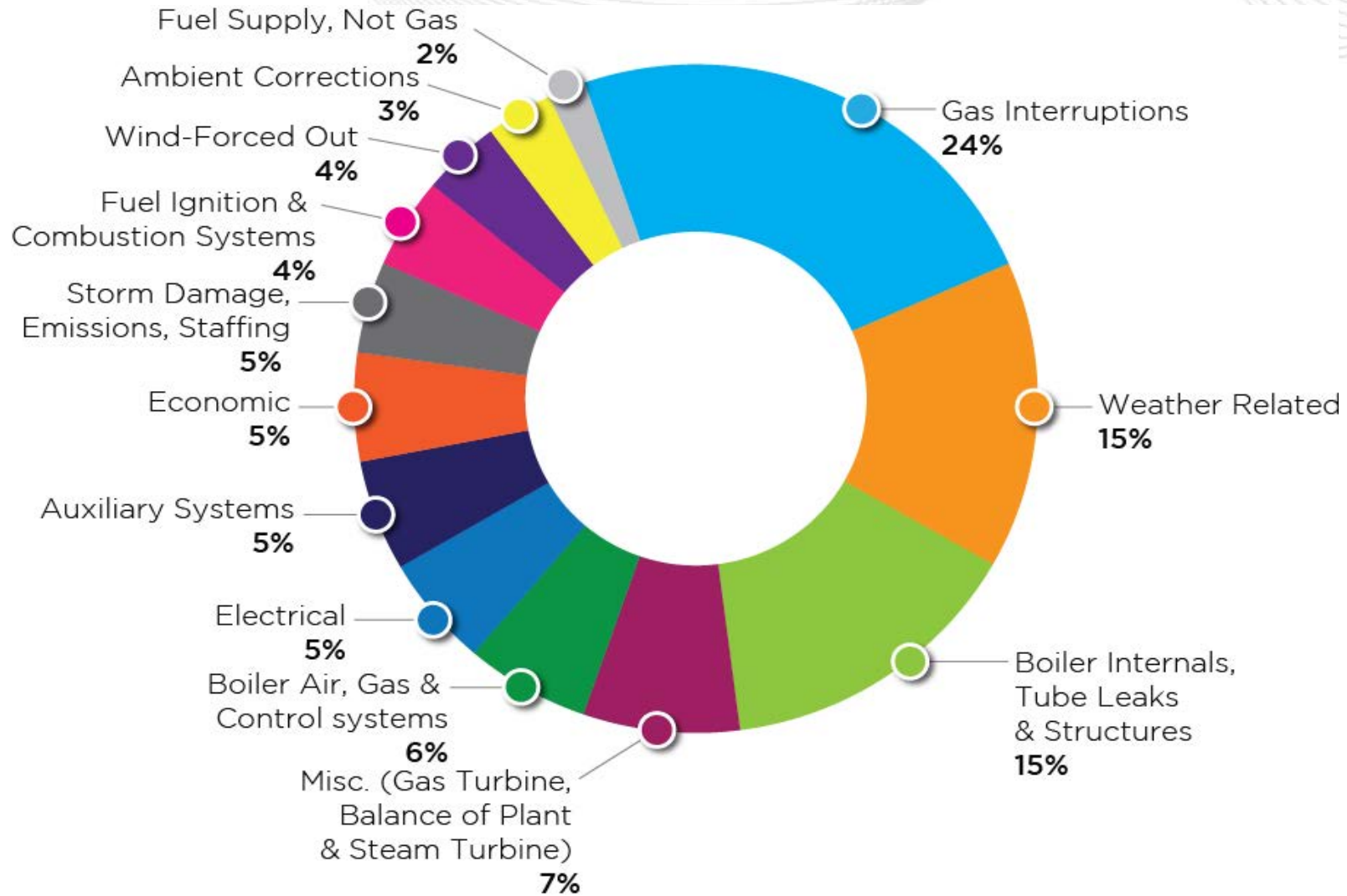
# Cold Weather Resource Performance Improvement Education

PJM Operating Committee, May 6, 2014

- Review Problem Statement/Issue Charge
- Review meeting schedule/work plan
- Review data from Winter 2013/2014
- Review SW outage event
- Review current and past PJM business rules
- Review information from "neighbors"
- Review of cold weather experience template
- Solicit GO experiences
- Solicit ideas for further education
- Action items/next steps

	OC 5/6	5/23 1 – 4 PM	OC 6/3	6/23 9 AM - 12	OC 7/8	7/22 9 AM - 12	OC 8/5	8/18 1-4 PM	OC 9/4
Problem Statement Approval	X								
Develop/Review Work Plan	X								
Education & Joint Fact-Finding	X	X	X						
Interest Identification			X	X					
Develop Design Components				X	X				
Document Relative Importance of each Component				X	X				
Develop Options for each Component				X	X	X			
Narrow Options					X	X			
Develop Packages						X	X		
Narrow Packages (Compare Packages to Interests & Importance Ratings)							X	X	
Consensus Testing								X	
Report to OC									X

# January 7, 1900 hrs Forced Outage Causes





# January 7, 1900 hrs Forced Outages by Geographic Areas

<b>Geographic Location</b>	<b>Average % Generation on Force Outage</b>
East: AE, DPL, JC, ME, PE, PL, PS	25%
Central: DUQU, FE-S, PN	24%
South: BC, DOM, PEP	16%
West: AEP, COMED, DAY, DEOK, EKPC, FE-W	22%

- **Background**
  - The southwest region of the United States experienced unusually cold and windy weather during the first week of February 2011.
  - Lows during this period were below freezing temperatures for five consecutive mornings.
  - In addition, sustained high winds of over 20 mph produced severe wind chill factors.

- **Impacts**
  - **Increased Energy Demand**
    - New winter peak demand were set for many registered entities.
  - **Generation losses due to frozen equipment and fuel issues**
    - 225 units tripped, de-rated or failed to start
    - Except for nuclear facilities, all power plant types including coal/lignite, simple cycle gas, combined cycle gas and wind resources experienced problems
  - **1.3 million customers lost power**



- **Generation Preparation**

- Many generators failed to adequately prepare for the 2011 winter storm, including the following:
  - Heat traces failed or not adequate
  - Wind breaks missing or not adequate
  - Insulation removed, damaged, not adequate
  - Instrument cabinet heating elements failed or not adequate
  - Freeze protection equipment not on hand



**Portions of the following were reviewed at the September 25, 2013 Joint SOS Meeting**

SW Cold Weather Event Final:

[http://www.nerc.com/pa/rrm/ea/February%202011%20Southwest%20Cold%20Weather%20Event/SW\\_Cold\\_Weather\\_Event\\_Final.pdf](http://www.nerc.com/pa/rrm/ea/February%202011%20Southwest%20Cold%20Weather%20Event/SW_Cold_Weather_Event_Final.pdf)

SW Cold Weather Event NERC Reference Material:

<http://www.nerc.com/pa/rrm/ea/Pages/February-2011-Southwest-Cold-Weather-Event.aspx>

Reliability Guideline - Generating Unit Winter Weather Readiness –

Current Industry Practices:

[http://www.nerc.com/comm/OC/Reliability%20Guideline%20DL/Generating\\_Unit\\_Winter\\_Weather\\_Readiness\\_final.pdf](http://www.nerc.com/comm/OC/Reliability%20Guideline%20DL/Generating_Unit_Winter_Weather_Readiness_final.pdf)

February 2011 Cold Snap Event Recommendations:

[http://www.nerc.com/pa/rrm/ea/February%202011%20Southwest%20Cold%20Weather%20Event/Cold\\_Snap\\_Event\\_Recommendations\\_1.pdf](http://www.nerc.com/pa/rrm/ea/February%202011%20Southwest%20Cold%20Weather%20Event/Cold_Snap_Event_Recommendations_1.pdf)

- September 20, 2011 OC Meeting
- <http://pjm.com/~media/committees-groups/committees/oc/20110920/20110920-item-03-southwest-recommendations-nerc-ferc.ashx>
- November 15, 2011 OC Meeting
- <http://pjm.com/~media/committees-groups/committees/oc/20111115/20111115-item-03-ferc-and-nerc-release-southwest-recommendations-nov-2011.ashx>

- Emergency Procedures Manual 13, Section 6.4 – Fuel Limitation Reporting
  - Seasonal Reporting
    - PJM may request Fuel Baseline Data going into the winter season and on an as needed basis
  - Real-Time Reporting
    - Required when severe cold weather forecasted, a potential fuel crisis is foreseen, or during other situations
    - Reporting done via Part G of the Supplementary Status Report (Attachment C of M13)

- Fuel or resource limited reporting
  - Unit considered fuel or resource limited if it cannot run at maximum capacity for the next 72 hrs
  - Applies to fuel or any other consumable resource required for unit operation
  - If steam units have < 32 hrs (at maximum capacity), liquid fueled units have < 16 hrs, or gas fired units have < 8 hrs of operation available, PJM must be notified. Also they must be offered in at Maximum Emergency if PJM has declared conservative operation including hot or cold weather alerts, unless directed differently

- Additional references:
  - M13, Section 3, Weather/Environmental Emergencies
  - Manual M14, Generator Operational Requirements, Section 7.3.5, Fuel Limitation Reporting (similar to M13 requirements)

- Link to archived version of M10 that includes Winter Net Capability Test Exemption Program:  
<http://pjm.com/~media/documents/manuals/archive/m10/m10v24-pre-scheduling-operations-10-01-2009.ashx>
- Link to archived version of M21 that includes Winter Testing Requirements and references to the Winter Net Capability Test Exemption Program:  
<http://pjm.com/~media/documents/manuals/archive/m21/m21v07-rules-and-procedures-for-determination-of-generating-capability-06-01-2008.ashx>

- Mandatory winter capability testing was eliminated in 2010 due to economic concerns and RFC issuing a regional standard (RFC MOD-024) that allowed adjustment of summer test data to determine winter capability
- Winter testing requirements were same as current summer requirements as defined in Manual 21 except needed to consider winter ambient conditions and the testing period was 12/1 – 2/28 (or 2/29)
- In addition, a "Winter Net Capability Test Exemption Program" was in place as detailed in the next two slides



- Offered as an alternative to the PJM winter net capability verification requirement
- By November 1, unit owners nominated their units to be scheduled as-needed by PJM from December 1 through the first two weeks of February - maximum of 12 units or 1000 MW per unit owner (RPM capacity value)
- Units that tested successfully or had not been scheduled to test by PJM met their winter net capability testing requirements
- Only units that had submitted successful summer tests for the same year were eligible
- Winter capacity had to be greater than or equal to summer capacity rating unless an exception was granted based on unit winter physical design limitations

- Selection for participation was not a guarantee of exemption. Units that were unavailable for > two weeks or incurred > two start failures during the program period lost eligibility
- PJM scheduled participating units as-required based on economics
- The unit was compensated at the lesser of the cost based or price schedules through PJM operating reserve credit provisions of the PJM OATT
- If a unit was not economically scheduled by PJM over the winter period by the second week of February, the unit was granted an exemption to the winter test for that period
- Failure of a test at the end of the winter verification window had capacity accounting implications. If a unit failed on the last day of the test exemption program, February 14, the generation owner had 2 weeks remaining to re-test within the winter verification window
- For additional details please refer to the archived manuals

- ISO-NE
- NYPP
- MISO
- SPP
- NRG
- Source of data – April 1, 2014 FERC Technical Conference presentations
- <http://www.ferc.gov/EventCalendar/EventDetails.aspx?ID=7272&CalType=%20&CalendarID=116&Date=&View=Listview>

- Performed monthly (more frequent if needed) generator fuel surveys
- Participated in numerous calls between gas pipelines and ISOs
- Made changes to day ahead market timing advancing the day ahead settlement to 1:30 PM
- Implemented a program to incent and compensate dual fuel units to keep adequate fuel oil inventory (Winter Reliability Program)
- Implemented changes in the energy market to allow intra-day energy offer changes and allow submission of hourly energy offers
- Winter capability tests performed when the ambient temperatures were below 32 deg F or within a prescribed in advance "test window"

- Dual fuel unit testing performed including one time compensation
- Held a Pre-Winter readiness seminar for generators
- Increased reserve requirement
- Gas pipelines were constrained
- Incurred significant unit outages
- Lessons Learned
  - Oil inventory was vitally important and lead time to replenish inventory was variable

- Conducted fuel surveys including gas transportation, oil inventory, and oil replenishment capability
- Participated in calls with NPCC/PJM
- Canceled outages
- Requested price cap waiver
- Set a new winter peak on January 7

- Managed significant generator derates in early January
- Managed potential fuel shortages – particularly oil depletions in late January
- Called emergency procedures
- Gas pipeline issues limited operating flexibility
- Lessons Learned
  - Run planning scenarios modeling sustained cold weather, dual fuel inventories, and fuel replacement capabilities
  - Improve operator awareness of fuel status and pipeline conditions



- Coldest Temperatures in two decades
- Set all time winter peak
- Gas/Electric field trial allowed for open communications
- Multiple forced outages – frozen components and fuel restrictions
- Managed winter challenges successfully due to preparation and coordination
- Lessons Learned
  - Improve communications with NG pipeline operators
  - Substantial seasonal variation in DR
  - Better management of local transmission constraints
  - Enhance market pricing

- Set all time winter peak
- Coordinated with member BAs/GOPs
- Reviewed reserve levels
- Canceled planned outages
- Major generation outages occurred in certain BAs
- Gas pipeline restrictions occurred
- Coal units derated due to various reasons

- Emergency procedures implemented in at least one BA
- Lessons Learned
  - Review load forecasting process
  - Good coordination with neighbors was valuable
  - Continue with Gas/Electric coordination Task Force
  - Oil fueled generators that start up on gas were challenged to get start up gas
  - Some wind generation was unavailable due to low temperatures and low wind speeds

- Performed effective winter preparedness
- Participated in ISO-NE's fuel inventory program
- Sent employees from less affected areas to eastern US plants to assist
- Senior plant operations personnel were deployed on-site
- Plants implemented "conservative operations"
- Liquid fuel deliveries were limited by trucking
- Out of town truck drivers were utilized
- Limited trucking also affected other consumables such as ammonia, etc.

- Lessons Learned
  - Carrying cost of oil is extremely high
  - Modern Combined Cycle units have less oil storage capability than older oil fired stations
  - Dual fueled units often environmental permit limited when operation on the liquid fuel
  - Fuel diversity was critical
  - Oil units had record runs
  - NG curtailments were significant – including units with firm transportation contracts
  - Recommend improved NG/Electric market alignment

## COLD WEATHER IMPROVEMENT TEMPLATE

Categories	Sub-Categories	Comments
Testing	-	<ol style="list-style-type: none"> <li>1. Old “winter capacity testing” between Thanksgiving and New Years will not solve issues in extremely cold temps.</li> <li>2. Testing/tuning needs to be performed at extremely cold temps to meet emissions.</li> <li>3. Testing on alternate fuel would have mitigated some of the problems, but not all that occurred during the bitter cold.</li> <li>4. Looking for feedback on testing that would be beneficial to avoid start failures, forced outages, etc.</li> </ol>
Issues experience by GOs	Infrequent Unit Operation	<ol style="list-style-type: none"> <li>1. Units that have been off line for lengthy periods of time have higher chance of problems starting and operating reliably (tube leaks on steam units, etc.)</li> <li>2. Starting of mothballed units.</li> </ol>
	Gas/Fuel Availability	<ol style="list-style-type: none"> <li>1. Gas availability issues. Some had no availability, some had limited availability at extremely high prices.</li> </ol>
	Technical/Equipment Issues	<ol style="list-style-type: none"> <li>1. Need additional time to tune units to meet environmental compliance at bitter cold temps.</li> <li>2. Freezing of nozzles, boiler controls, coal, limestone, condensate lines, fly ash transfer equipment, cooling tower basins, SCR water injection systems, etc.</li> </ol>
Short term lessons learned	-	<ol style="list-style-type: none"> <li>1. Improved unit performance between January &amp; February.</li> <li>2. Starting dual fueled units on oil was problematic. Even units that were tested on oil before polar vortex – large performance improvement when started units on gas and then very quickly switch to oil.</li> <li>3. Improve winterization checklist communication to GO's. (Smaller GO's may not be as experience as large GO's and checklist would be helpful).</li> </ol>
Potential operational actions	-	<ol style="list-style-type: none"> <li>1. Start units earlier and stagger start times to allow limited workforce to resolve start-up issues before peak loading periods.</li> <li>2. Position units to be operable in "warm standby" if fuel availability is not an issue to reduce unnecessary start failures.</li> </ol>
PJM assistance to GOs	-	<ol style="list-style-type: none"> <li>1. Fuel transportation waivers.</li> <li>2. Advanced reach out to environmental regulators.</li> <li>3. Improve Gas/Electric coordination.</li> </ol>
Help us help you	-	<ol style="list-style-type: none"> <li>1. Index of unit performance characteristics by fuel type/temperatures in advance of cold weather. E.G. – if temps are predicted to be XX, assume YY% of unit unavailability of type ZZ.</li> </ol>

- Next Meeting – Friday May 23<sup>rd</sup> 1- 4 PM
  - Further education
  - Possible GO Presentations
  - GO Feedback



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