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Communication

1. I participate in PJM's emergency drills, wherein I receive automated phone calls and emails. Why didn't PJM use this method during the January events?

   PJM's emergency procedure drills are scripted events which require robust dissemination and detail in order for participants to get a sense and impact of the simulated events that are driving the drill-related activities. Actual events, such as those experienced during the recent January Polar Vortex, typically align with an observable event to PJM members and the public at large. PJM disseminates information during these events in a variety of ways including:

   - PJM Corporate Communications Messages and Postings
   - PJM Corporate Communications Conference Calls
   - PJM Stakeholder Conference Calls and WebEx
   - Emergency Procedures (Information is public via GUEST login)
   - eDATA (also available via GUEST login)
   - PJM All-Call System (Non-public and either TO or TO-GO target audience)
   - Satellite Communications (Operator to Operator)
   - Telecommunications (Operator to Operator)
   - Reliability Coordinator Information System (Eastern Interconnection Wide)

   Each of these communication tools is considered based on the nature and timing of the emergency procedure. While PJM makes every effort to inform the general public, not all information is made available to the general public using all of these methods.

Operations

2. Was emergency power purchased? If it was, did it set price and for what hours? Who are the best suppliers?

   PJM requested emergency bids on January 7, 2014 and January 23, 2014. The emergency bids did not set price. PJM considers all suppliers equal from a quality perspective.

3. Can you provide the price of the highest cost resource not eligible to set price (resource, import, DR)?

   PJM is actively working on making this information available to our members. Due to the complexity of the data retrieval process, at this time the information requested is not available. A future report will provide more detail.
4. **Was there a period when PJM did not have enough reserves on the system at any given instance? How often does PJM do reserve checks?**

PJM was below the Synchronized Reserve requirement at various times during the evening of January 6, 2014 and again the morning of January 7, 2014. At all other times during the month the reserves obligations were met. PJM monitors reserves utilizing real time calculations that continuously update as generator output and system conditions change. In addition, as system require, PJM periodically performs an "Instantaneous Reserve Check ", whereby we request the reserves our generator owners calculate on their fleet to compare against the PJM reserve calculation.

5. **Is there any precedent for this level of generation being unavailable? The last time we've seen temperatures this cold across the entire region was in the late 70s/early 80s, and we don't have generation availability data going back this far.**

PJM has good data for seasonal eFOR but it is not broken down by actual cold weather months. Anecdotally, the last time failure rates were this high was January 1994 during the “Deep Freeze” event in which rotating blackouts were implemented for several hours. PJM was only the MAAC region at that time and the GADS data for that period is not readily available.

6. **Operational summary data. Can we get PJM to update this throughout the day? We also saw that this number appeared to be inconsistent with the actual generation that appeared online during the very cold days last week, so there could also be a reporting issue?**

PJM publishes numerous data via various toolsets. In an effort to be as transparent as possible, PJM requests that specific changes to tools/reports be discussed at the appropriate PJM Committee/Subcommittee/User Group so any adjustments to existing toolsets/reports are vetted by the appropriate PJM members. Specific questions can be addressed in real-time by calling PJM Customer Service at (610) 666-8980

7. **Was there any gas procurement issues associated with non-firm rights getting curtailed for a set of generators? Or were there issues associated with specific pipeline outages (e.g., I believe there was a compressor outage on part of Tetco M3)?**

In general the natural gas infrastructure performed as designed, and provided adequate gas supply. The extended cold weather did increase natural gas demand, and in order to maintain pipeline integrity and serve customers, tariff provisions were enforced, such as limiting takes (usage) to contracted hourly limits, and interrupting customers with interruptible transportation (IT) contracts. IT customers still had the option to procure gas in the secondary market; however, during the extended cold weather, we witnessed prices higher than average.

In certain instances the direction of gas flow on the pipelines prohibited the ability to get gas to certain locations. On January 7, there was a compressor failure near Pittsburgh, PA on Texas Eastern, which lasted for approximately 14 hours and resulted in an across the board reduction of gas nominations on the pipeline downstream of the compressor in order to maintain adequate pressures.
Additionally, there was a reduction in supply from Marcellus production region in western Pennsylvania which was announced via the pipeline’s Electronic Bulletin Board during the late morning of January 7.

8. **Is there a temperature at which PJM expects generators to fail? Do CTs fail to start 40-50% of the time in cold weather? Is there more detailed operating data or forced outage information that they could provide?**

PJM expects that start performance on combustion turbines will degrade as temperatures go below freezing. Section 3.3 of Manual 13 references the procedures PJM’s operators use during a Cold Weather Alert. Those procedures include the following assumptions on generator unavailability.

<table>
<thead>
<tr>
<th>Control Zone</th>
<th>Region</th>
<th>Weather</th>
<th>Unavailability</th>
</tr>
</thead>
<tbody>
<tr>
<td>PJM</td>
<td>Mid-Atlantic</td>
<td>Philadelphia</td>
<td>4000 - 5000 MW</td>
</tr>
<tr>
<td>FE Fairmont</td>
<td>Western</td>
<td>Pittsburgh</td>
<td>500 – 1000 MW</td>
</tr>
<tr>
<td>AEP</td>
<td>Western</td>
<td>Columbus</td>
<td>1000 – 1500 MW</td>
</tr>
<tr>
<td>Dayton</td>
<td>Western</td>
<td>Dayton</td>
<td>500 – 1000 MW</td>
</tr>
<tr>
<td>ComEd</td>
<td>Western</td>
<td>Chicago</td>
<td>2000 – 3000 MW</td>
</tr>
<tr>
<td>Dominion</td>
<td>Southern</td>
<td>Richmond</td>
<td>1000 – 2000 MW</td>
</tr>
<tr>
<td>FE Wadsworth</td>
<td>Western</td>
<td>Cleveland</td>
<td>500 – 1000 MW</td>
</tr>
<tr>
<td>DEOK</td>
<td>Western</td>
<td>Cincinnati</td>
<td>200 – 300 MW</td>
</tr>
<tr>
<td>EKPC</td>
<td>Western</td>
<td>Winchester</td>
<td>200 – 300 MW</td>
</tr>
</tbody>
</table>

PJM will analyze whether the generator performance during the cold weather in the winter of 2014 warrant an update to these assumptions.

9. **Does PJM foresee ongoing operational issues with any of the plants that were not available due to forced outage during Polar Vortex?**

This question will be a unit by unit issue depending on the outage reason. PJM is not aware of any “long term” issues.

10. **Is there anything that PJM plans to change going forward given the reliability issues? If so, what is the time horizon for these changes (i.e., will they change anything for another cold snap this planning year)?**

PJM is developing lessons learned; some will have quick turn-around (e.g. gas coordination); others long term (e.g. firm gas requirements; winter Demand Response, etc.). Lessons learned and subsequent action plans will be discussed at the appropriate PJM committees, such as the MIC, Gas Electric Senior Task Force, Operating Committee, System Operation Subcommittee, Capacity Senior Task Force, etc.

11. **How much wind energy was generating during the peak hours?**

Monday Jan 6 Evening Peak: 3,109 MW  
Tuesday Jan 7 Morning Peak: 2,120 MW  
Tuesday Jan 7 Evening Peak: 1,781 MW  
Wednesday Jan 8 Morning Peak: 822 MW
12. If PJM requests me to buy gas to run the next day and cancels the run, will I be compensated for the gas purchased and not used?

Section 3.2.3 of Attachment K-Appendix of the Tariff, and the parallel provisions of Schedule 1 of the Operating Agreement, are the applicable provisions governing make whole and lost opportunity cost payments. Section 3.2.3 does not allow for make whole or lost opportunity cost payments to market participants that were not called on to run in real time and did not have a day-ahead commitment.

Currently the PJM tariff does not allow for make whole payments associated with fuel which was not burned during hours the unit did not actually run for PJM (cancelled by PJM, unit trip, etc.).

PJM has been engaging in discussions with resource owners who experienced these types of issues during the cold weather events in 2014 in order to better understand the scenarios for future discussions on the topic.

13. What triggers shortage pricing and what prices can I expect?

Shortage Pricing will be triggered under either of the following conditions:

- The amount of available reserves dips below the reserve requirement for a predetermined amount of time in the IT SCED application and the RT SCED application confirms that the shortage exists. This can be either:
  - Available Synchronized Reserve MW less than Synchronized Reserve Requirement
  - Available Primary Reserve MW less than Primary Reserve Requirement
- The implementation of a Voltage Reduction Action or a Manual Load Dump Action will automatically trigger shortage pricing.
- Shortage pricing can be triggered locationally in the Mid-Atlantic and Dominion (MAD) reserve zone or across the entire RTO depending on the nature of the reserve shortage or aforementioned emergency procedure.
- Reserve shortages and/or emergency procedures in MAD reserve zone do not automatically trigger shortage pricing in RTO reserve zone.
- Shortage Pricing was triggered by the Voltage Reduction ACTION on the evening of Jan 6 and by a reserve shortage on the morning of Jan 7.

Pricing during a reserve shortage follows these rules:

- The energy price (LMP) will be determined based on the cost to provide the next increment of energy.
- This will typically include the penalty factor(s) for the reserve product(s) that are short in the locations they are short. This is due to the fact that providing another MW of energy will cause an additional MW of reserve shortage.
- The penalty factor(s) may not be included in the LMP when resources such as emergency purchases or emergency demand response are marginal because dispatching an additional MW of energy from those resources does not cause an additional MW of reserve shortage as those resources do not supply reserves.
- Reserve prices during a reserve shortage will be set to the appropriate penalty factors for the products that are short.

For more information on the shortage pricing rules, please visit the following link to view the training PJM has previously provided ([http://www.pjm.com/markets-and-operations/energy/shortage-pricing.aspx](http://www.pjm.com/markets-and-operations/energy/shortage-pricing.aspx)).

14. Could you tell me how the $1800/MWh pricing was reached?

In October of 2012, PJM implemented new business rules which allowed additional resources to be eligible to set real-time LMP. These additional resources included Emergency DR, Emergency Import Transactions, and emergency segments on generators in PJM. These new resources are not limited to the $1,000 offer cap that generation is subjected to. Instead, they can bid in up to $1,000 + 2*penalty factor. For the 2013-2014 delivery year, the penalty factor is $400 so they are limited to a bid cap of $1,800. In January there have been instances where both the emergency DR and emergency imports have set price at $1,800 either for the energy component of the LMP or for congestion.

Based on the existing price caps, LMPs may reach $1,800/MWh without there being a reserve shortage.
For more information on LMP pricing that occurred see the MC webinar presentation of January 27 and February 24.

http://www.pjm.com/~/media/committees-groups/committees/mc/20140127-webinar/20140127-item-02-cold-weather-operations-update.ashx

http://www.pjm.com/~/media/committees-groups/committees/mc/20140224-webinar/20140224-item-01-winter-operations.ashx

15. How can I tell when shortage pricing is in affect?

On the “Shortage $$” tab in eDATA there are indicators of whether or not PJM is short reserves.
The indicators above currently showing “RTO NORMAL” and “MAD NORMAL” will identify when PJM is short on reserves. These indicators are green when PJM has an excess of reserves, yellow when PJM is re-dispatching to maintain reserves and red when PJM is short on reserves. Additionally, the line graph shown above contains the five minute clearing prices for all reserve products in PJM. When PJM is short Synchronized and/or Primary Reserves in a location, the market clearing prices will be equal to the price caps for the associated product. For Primary Reserves the price cap is $400/MWh for 2013/2014, $550/MWh for 2014/2015) and for Synchronized Reserves the price cap is $800/MWh for 2013/2014, $1,100/MWh for 2014/2015).

16. How can I tell in real time if emergency imports or shortage pricing are setting price.

There is no way to definitively tell this in real-time. However, if PJM is in emergency procedures, the system energy price is in excess of $1000 and reserve prices do not indicate a shortage, it is a good indicator that some type of emergency capacity is setting the LMP.

17. How much external emergency imports are possible?

This depends on a number of factors including but not limited to how much external generation is available (often an unknown quantity), if there are any transmission limits in real-time, and if there are any internal/external system issues.

18. On e-Data, is there a way to differentiate the interchange between normal price driven and PJM emergency purchases?

eDATA does not have the ability to differentiate types of interchange.

19. Now that FERC has granted the first (make whole payment) waiver for high gas costs that PJM requested, gas plant owners want to know what they have to do to claim recovery of out of market energy production costs.

If you have not already done so, please contact Adrien Ford (adrien.ford@pjm.com). PJM and the IMM developed a single data request that you will be provided to allow us to consider your costs that were greater than $1,000/MWh.

20. Is there an existing requirement for resource owners to notify PJM schedulers or system operators when they are facing fuel costs that will result in energy costs near or over $1000/MWh? If not, is there a value to PJM to have such advance notification? Ideally, what information (expected cost, duration costs would be in effect) would you like to receive? When/how often? To whom? Phone call? E-mail?

There is not a notification requirement. Until this January 2014 this situation has never been an issue, and therefore, at the current time, no rules require a resource owner to notify PJM if its costs exceed $1,000/MWh. Knowing as much information as possible about the generation resources in PJM is always valuable. PJM will look to define a process for the communication of such information in the future. The markets hotline can be used to provide this information to PJM.
21. Unless PJM has already published guidelines about pre-operation sharing of fuel price/availability information, it might be helpful if PJM could notify to generation owners with any special requests associated with this issue.

There are no published guidelines about providing advanced fuel price notification requirements at this time. However, this is something that will be reviewed and vetted through the stakeholder process to determine any next steps and potential PJM manual changes, eMkt (or other) member facing data input system changes, etc. PJM will also solicit fuel restriction information on the SSR – Part G during peak load periods.

22. Are generators required to submit their offers at the price cap (i.e. $1000/MWh) in order to qualify for the make whole payment?

There is no requirement for a generator to submit its offer at $1,000/MWh in order to be eligible for a make whole payment if its costs on the operating day were in excess of $1,000/MWh.

On February 11, 2014, the FERC accepted PJM’s waiver request to permit generation owners to submit market-based and cost-based offers above $1,000/MWh as long as the cost to run the resource truly exceeded $1,000/MWh. The market-based offer can only be submitted up to the actual cost-based offer when the cost-based offer exceeds $1,000/MWh. The intent of this waiver was to be able to capture the cost of the resources PJM is dispatching in the market clearing price as opposed to after-the-fact, non-transparent make-whole payments. As of that date, the only resources that will be made whole to a cost above $1,000/MWh are those that submit offers in excess of $1,000/MWh.

23. According to PJM’s filing 5000 MW were submitted with a price of $999/MWh. Since these units actually submitted offers below the price cap (manual 11 says "A Generation Capacity Resource offer may not exceed $1000/MWh"), would they be eligible to receive make whole payments above the offer cap? If so, what rules are in place to stop a generator from submitting an offer price more significantly below the offer cap and still receive a make whole payment above the offer cap?

Any resource whose cost exceeded $1,000/MWh, regardless of the offer submitted on the day of, will be eligible to be made whole to its cost for the period from January 24, 2014 through February 10, 2014. Starting February 11, 2014, resources will only be made whole in excess of $1,000/MWh if they submit an offer above that amount (See response #23).

Any resource requesting to be made whole above $1,000/MWh after the date of February 10, 2014 will be required to submit an offer reflecting its actual cost.
Demand Response and Price Formation

24. What is the nature of the DR that PJM called? Was it economic DR? Did PJM need to solicit this or did participants proactively schedule?

Economic DR resources did actively participated in energy market in January on a proactive basis. Economic DR resource participate in the energy market on a similar basis to generation and must either clear in the day ahead market or be dispatched by PJM based on the DR resources’ offer parameters and availability (please see the following link to monthly DR report which summarizes economic DR activity - http://www.pjm.com/~/media/markets-ops/dsr/2014-dsr-activity-report-20140212.ashx

PJM also called for Emergency DR resources in January as described in question 27 below. The Emergency DR called was voluntary and not subject to compliance.

25. What are the rules about cancelling DR early?

If emergency DR requires a two hour minimum downtime and PJM cancels DR early, the emergency DR may submit energy settlements for up to two hours to satisfy the minimum down time. PJM can cancel any resource early within the requirements of the minimum run rules.

26. What settlement account does the additional payment to DR providers flow through when they reduce their consumption?

Currently the uplift payments made to emergency DR resources is allocated to net purchasers in real-time on a pro-rata basis by the size of their shortfall. For example, if entity A has a position in day ahead as a purchaser of 50 MW but in real-time must purchase 75 MW to cover its position, it is allocated a 25 MW ratio share of the uplift payment made to DR resources. This cost is not directly allocated through congestion or Balancing Operating Reserves and does not impact FTR underfunding.

27. How much total demand response was called in PJM to meet load? How much emergency DR? How much economic DR?

Here is a summary table for emergency DR:

<table>
<thead>
<tr>
<th>Date</th>
<th>Peak</th>
<th>Notify Time</th>
<th>Start Time Short Lead</th>
<th>Start Time Long Lead</th>
<th>End Time (Long and Short)</th>
<th>Zones</th>
<th>Approx MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-Jan</td>
<td>AM</td>
<td>4:30</td>
<td>5:30</td>
<td>6:30</td>
<td>11:00</td>
<td>RTO</td>
<td>1,720</td>
</tr>
<tr>
<td>7-Jan</td>
<td>PM</td>
<td>15:00</td>
<td>16:00</td>
<td>17:00</td>
<td>18:15</td>
<td>RTO</td>
<td>2,920</td>
</tr>
<tr>
<td>8-Jan</td>
<td>AM</td>
<td>5:00</td>
<td>6:00</td>
<td>7:00</td>
<td>Cancelled at 07:00</td>
<td>RTO</td>
<td>1,960</td>
</tr>
<tr>
<td>22-Jan</td>
<td>PM</td>
<td>14:00</td>
<td>15:00</td>
<td>16:00</td>
<td>21:00</td>
<td>BGE, PEPCO</td>
<td>160</td>
</tr>
<tr>
<td>23-Jan</td>
<td>AM</td>
<td>4:30</td>
<td>5:30</td>
<td>6:30</td>
<td>8:30</td>
<td>Mid-Atlantic, DOM and</td>
<td>570</td>
</tr>
</tbody>
</table>
### During the January events estimated hourly economic DR volume varied from approximately 5 MW to 190 MW.

#### 28. Does PJM publish that exact times shortage pricing took effect for 6/7 Jan 2014? While we all saw the two categories turn red in E-data, I cannot find the exact 5 minute marks published.

PJM has not published the exact five minute intervals where it was short reserves. As stated previously, the only days with reserve shortages were January 6 and 7. The reserve market clearing prices can be used as indicators for shortages. Any time they were equal to the respective price caps for each product, it is a good indicator that we were short that reserve product. The response to Question #15 of this document can also serve as a guide to determine the hours where the shortages existed.

Additionally, PJM is currently working on a review of the cold weather events which will result in publishing a report detailing some of the events. More information can be provided in this report.

#### 29. Was any of the economic demand response called and did it set prices? How much uplift was paid to economic demand response providers? Can PJM create a histogram of the MW of economic demand response by price bid range and how much uplift was associated with that range? I.e. how much demand response was priced $100-500, 500-1000, 1000-1800, etc. and how much uplift was associated with each bucket?

Economic DR did clear in the day ahead market and was dispatched in real time as discussed above. Because economic DR settlements will not be finalized until up to 75 days after each event day, PJM does not know the final settlement values for January. Further, PJM currently does not publish resource specific uplift (type of generation and demand response) or a histogram of resource specific uplift by price bid range. Historic economic demand response offers are published on a comparable basis to generation and can be found at the following link (http://pjm.com/markets-and-operations/energy/real-time/historical-bid-data/dr-bid.aspx)

#### 30. Was any of the emergency demand response called and did it set prices? How much uplift was paid to emergency demand response providers? Is it the case that PJM assumes all emergency demand response is effectively offered with an $1800/MWh bid? How much emergency demand response was called in each zone?

PJM does not assume that all emergency demand response is offered in at $1800/MWh. PJM uses the actual bids of the resources in each zone when prices are calculated.

Once PJM has all the data, the total uplift payments to generation and demand response can be made available for each day and will be posted to the PJM web site as part of the DR and Operating Reserve reports that are currently available.
Market Settlements & Billing

31. If emergency power is purchased how is that cost distributed to PJM participants?

The PJM settlement process allocates the total hourly charge for emergency energy purchases to PJM market participants in proportion to their net purchases in real-time. This is the same methodology use to allocate and make whole charges associated with emergency DR as well.

32. Synchronous reserve charges for the loads were more than we see in a year. Please explain.

The increase in Synchronous Reserve charges largely resulted from the high hourly Synchronous Reserve market clearing price for multiple days in January. The Synchronized reserve market clearing price can be located under the Synchronized Reserve Zone Preliminary Billing Data report posted at http://www.pjm.com/markets-and-operations/market-settlements/preliminary-billing-reports/sync-reserve.aspx

33. On the days in questions, we procured gas to meet our anticipated DA award; however PJM extended the runs for the station. At the time of PJM’s request, we informed the operator, that given gas pipeline restrictions that we have to be dispatched on another Cost schedule to account for the higher cost of penalty gas for exceeding that gas day’s nominated gas volumes. How do we get compensated?

If a unit has been asked to extend its hours of operation in real time and the unit has a limited fuel supply and must utilize higher priced fuel to remain online, the participant must inform the PJM system operator of the fuel cost change by requesting the real time offer to be switched to one of the additional available schedules. The participant must verify that the new schedule is the one reflecting fuel costs closest to those that will actually be paid to operate for the extended hours requested. The PJM operator will evaluate whether the higher cost schedule is economic and if so, will log and dispatch the unit on the new schedule. Market operations personnel will confirm with System Operations the operation of the unit. A more formal description of the process is in Attachment C of Manual 11.

The information will be forwarded to the Market Settlement Operations department for compensation. In the event that this occurrence cannot be confirmed, the unit will be paid on the original schedule logged by the system operators.

34. If we have a “make-whole” issue for last week prior to the 24th do we submit something as well to file at FERC with PJM? Or is that process still being decided?

If you have not already done so, please contact Adrien Ford (adrien.ford@pjm.com). PJM and the IMM developed a single data request that you will be provided to allow us to consider your costs that were greater than $1,000/MWh. Although costs before Jan
24 2014 are not covered by the FERC waiver, PJM would like to understand your costs and discuss appropriate next steps.