M-12 Balancing Operations Revision 55

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PJM System Operations
Markets and Reliability Committee
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M12 Rev 55

- Periodic Review
  - 3.1.2 – Minor edits to Real Time Market Applications section
  - Section 4.5
    - Updated section 4.5.12 for black start annual testing
  - Section 5.4.3
  - Section 5.4.4
  - F.2& F6 Updated link for the PJM Dynamic Transfer Request form. Updated various reference links
  - F.4 updated exhibit number for dynamic transfers and notification to PJM control room
- Conforming Changes to support FERC Order in Docket ER25-1095.
  - Attachment B2 -Notes 4 & 6

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- Grammatical and minor edits to the Real Time Market Applications overview section

Real-Time Market Applications

To conduct the Rr~~r~~eal-time Mm~~m~~arkets, a multi-module software platform is used by PJM to dispatch energy, ~~and~~ ensure adequate reserves in real-time and regulation in near time (see the image below). The Rr~~r~~eal time market ~~applications~~ Clearing Enginesand various other applications communicate jointly and the most recent information from each application is stored and upon request provides the relevant data to each application. To run the Real-time Markets, data is processed from the markets database and other PJM systems.

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M12 Section 3.1.2 Cont

The real-time market applications consist of the following:

- **Ancillary Service Optimizer (ASO):** The Ancillary Services Optimizer (ASO) performs the joint optimization function of energy, reserves and regulation. The ASO creates an interval-based solution over a one hour look-ahead period, as well as performs the regulation three pivotal supplier test. ASO does not calculate final market clearing prices. The main functions of ASO are the commitment of all regulation resources and inflexible reserve resources for the next operating hour.
- **Real-Time Security Constrained Economic Dispatch (RT SCED):** The Real-Time Security Constrained Economic Dispatch (RT SCED) application is responsible for dispatching resources to maintain the system balance of energy and reserves over a near-term look-ahead period. Historical and current system information is used to anticipate generator performance to various requests, and to provide accurate information regarding generator operating parameters under multiple scenarios. RT SCED will jointly optimize energy, online regulation and reserves ~~on online,~~ with dispatchable resources to ensure system needs are maintained. The results from the RT SCED are energy basepoints and reserve commitments that are sent to resource owners in real-time. All quantities may change with each solution based on system economics and reserve needs. RT SCED determines reserves shortages.

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M12 Section 3.1.2 Cont

An RT SCED dispatch solution case is executed automatically every five minutes or when executed by the operator. To calculate the solution in each case, data from multiple sources is used, including but not limited to, data regarding online and available resources, resource offers, forecasted load, scheduled and current interchange, as well as various other input parameters. The RT SCED cases use the load forecast and other system information that are effective for the look-ahead interval, rather than the time at which the case is executing, to achieve a dispatch solution that will adequately control for those forecasted conditions.

Real-time data sources include:

- Load forecast data from EMS
- Constraint data - including resource sensitivities from EMS
- State Estimator output from EMS
- Outage data from eDART
- Transaction data from ExSchedule
- Generator operating parameters and offer data

Multiple RT SCED cases are then produced, with each solution solving the security constrained economic dispatch problem. Each of these solution cases contains:

- A recommended set of zonal dispatch rates
- A list of exceptions to the dispatch rates for constraint control
- Individual resource dispatch rates
- Individual Resource Desired MW level
- Individual Resource Reserve Commitments

The operator may have to adjust Real Time SCED cases to produce an output to control the system reliably by adjusting the load bias. Biasing is used to compensate for the any deviations in load forecast, wind and solar forecast, interchange forecast and generator operating parameters. The bias is entered as a MW value and is distributed across the entire RTO. Biasing is used to account for various variances between the demand and generation and helps

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- Edits to Black Start Service Section

4.5 Black Start Service

Black Start Capability is necessary to restore the PJM transmission system following a blackout event. Resources participating in PJM's Black Start Service, known as Black Start units ~~shall~~ enables PJM and Transmission Owners, ~~in collaboration with the Transmission Owners, to designate specific generators whose location and capabilities are required~~ to re-energize the transmission system.

~~These designated resources, called~~ Black Start Units, ~~s, are generating units that~~ are able to start without an outside electrical supply; or, have ~~the~~ demonstrated ~~ability of a unit with~~ a high operating factor (subject to PJM approval) to remain operating, at reduced levels, when automatically disconnected from the grid. The planning and maintenance of adequate Black Start Capability for restoration of the PJM balancing area following a blackout represents a benefit to all transmission customers. All Transmission Customers must therefore take this service from PJM.

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- Clarification added to black start annual testing section update

Annual tests shall include:

- Starting and bringing the resource to synchronous speed without assistance from a system electrical feed; or, demonstrating the ability to remain operating at reduced levels when automatically disconnected from the grid
- Testing of all communication circuits
- Actual or simulated switching needed to connect the Black Start Unit to the transmission system following a system blackout
- Testing the features unique to each facility that relate to Black Start Service
- For new Units:
  - For a generator that is a new Black Start Unit, revenue requirements must be submitted to PJM and the IMM through the eDART upload process. Next, the unit must successfully pass a Black Start Service test according to their plant's procedures (and restoration plan requirements) and submit the test results to PJM using the PJM Black Start Test Report Form (Attachment C). Upon successful completion of the Black Start Service test, the payment start date is the first day of the next month following the receipt of both test and cost data.

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- Updated the Operating Mode Change Procedure

5.4.3 Operating Mode Change Procedure

The following procedures are applied when the PJM RTO conditions require a change in on/off-cost operating modes:

- From On-Cost to Off-Cost — When generation redispatch is necessary, the PJM dispatcher notifies and coordinates with the applicable Transmission Owner (s). If PJM initiates off cost for an IROL interface, all Generation Owners/Transmission Owners/LSEs are notified, via the PJM ALL-CALL, that particular Control Zones will be operating off-cost.
- From Off-Cost to On-Cost — When conditions permit the the PJM dispatcher notifies and coordinates with the applicable Transmission Owner (s) that the off cost is being ended. If PJM ends off cost operations for a IROL interface, the ~~affected~~ Generation Owners/ Transmission Owners/LSE ~~return to economic dispatch (on-cost), PJM dispatcher notifies~~ are notified ~~all Local Control Centers,~~ via the PJM ALL-CALL, ~~when the affected LSEs will return to on-cost operations.~~

A summary of PJM Constraint Control guidelines is included as Attachment B.

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- Added the note for Non Market PCLLRW

5.4.4 Generation Redispatch (Non-Market Facilities)

In the event that further corrective actions are required beyond non-cost actions, PJM will issue a Non Market Post-Contingency Local Load Relief Warning (PCLLRW).

At the request of the Transmission Owner, PJM will manually direct the redispatch of effective generation. The effective generation will be cost-capped but not permitted to set LMP since the facility is not a "Market" facility. PJM will commit effective generation in order to minimize the total megawatts committed to control the constraint.

Note:
If post-contingency flows exceed the facility's Load Dump limit, the Transmission Owner's option to control will no longer apply. PJM will manually direct the re-dispatch of effective generation to maintain the post-contingency flow below the Load Dump limit.

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- Updated Generation Dynamic Transfer Business Rules
  - Updated exhibit reference for dynamic transfer of units and self scheduling notification requirements to PJM

    - If a dynamically transferred unit is self-scheduled in the PJM Real-Time Energy Market, the Market Participant must notify PJM Dispatch at least 20 minutes in advance when the instantaneous MW value of the Dynamic Transfer is to be changed. This advance notice is required so that adequate system control may be maintained. If in the event that the NERC tag (s) cannot be processed, a call is required to the PJM Master Coordinator for notification of change in MW output prior to changing.

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- Made edits to the Transmission Constraint Control Guidelines

B.2 Generation Re-dispatch

PJM, prior to initiating re-dispatch, reviews available controlling actions and the distribution factor effect on the overloaded facility. PJM also considers whether there are sufficient resources available to control transmission facilities within acceptable limits.

1. **Contingency Operations:** PJM will initiate off-cost operations if reasonable controlling actions are available with an impact effect generally greater than 5 percent. Once off-cost is initiated, RT-SCED tools will re-dispatch generation based on the dollar-per-megawatt effect, considering all online flexible units with an impact of greater than zero percent unless a specific impact threshold is defined for the off-cost action. PJM staff has the ability to adjust the controlling percentage on an individual constraint basis. PJM will initiate a Post Contingency Local Load Relief Warning/Action if post-contingency flows exceed designated ratings and insufficient resources are available to control the overloaded facilities.
2. **Normal/Actual Overload:** In general, PJM initiates off-cost and utilizes controlling actions greater than 5 percent impact; however, since an actual overload causes real-time equipment degradation on the affected facility, PJM will load generation with an impact effect of less than 5 percent. Once off-cost is initiated, the RT-SCED tool will re-dispatch generation based on the dollar-per-megawatt effect., considering all on-line flexible units with an impact of 1 percent or greater. PJM staff has the ability to adjust the controlling percentage on an individual constraint basis.

The RT-SCED software continues to monitor projected flows on constrained facilities and sends ramp-limited set points to optimize re-dispatch for constraint control to the designated threshold. The eligibility of resources to set the Locational Marginal Price is determined in the Locational Price Calculator "LPC" reference section M11 section 2.7 market clearing engine from the set of pool scheduled online dispatchable resources. Please reference Manual 11, Section 2.7 for more details about the Locational Pricing Calculator

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- Conforming manual changes for Hybrids to Attachment B.2 Note 4 & 6

Note:

1: In order to ensure resources do not force emergency procedures, they must be dispatchable (Dispatchable Generation) in the range between the greater of the resource's physical minimum operating level or Capacity Interconnection Rights (CIR) and Maximum Facility Output (MFO) (i.e., the fixed generation flag must not be selected).

2: Resources may not submit an Economic Minimum that exceeds the greater of the resource's physical minimum operating level or the level of their Capacity Interconnection Rights (CIR) in the real-time energy market. This restriction does not apply to the day-ahead market.

3: An Intermittent or Hybrid Resource's Economic Minimum shall represent the lowest operating MW point of the resource.

4: ~~An Intermittent or Hybrid Resource's Emergency Minimum should be set to 0.~~ An intermittent or Hybrid Resource comprised exclusively of solar, wind, and/or battery components should set its emergency minimum to 0. A Hybrid Resource with a non-inverter component must set emergency min at or below the Economic Minimum of the non-inverter component.

5: The output of a Hybrid Resource should achieve its dispatch point within 5 minutes or consistent with the resource's ramp rate bid. PJM should be notified if the response time is expected to exceed 5 minutes

6: The operator of a Hybrid Resource with a battery component that is dispatchable must indicate to PJM the hours for which the plant is operating in "Generation~~intermittent only~~" mode, during which time the battery is not providing power for the purpose of maintaining hybrid output consistent with PJM dispatch. Dispatchable Hybrid Resources must follow dispatch in ~~both "intermittent only" mode and~~ all ~~other~~ hybrid operational modes.

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Timeline

First Reads

- April 30 SOS
- May 8th OC
- May 21st MRC

Second Read

- May 29th SOS
- June 3rd OC
- June 18th MRC (Endorsement)

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M-12 Version 55 Revisions

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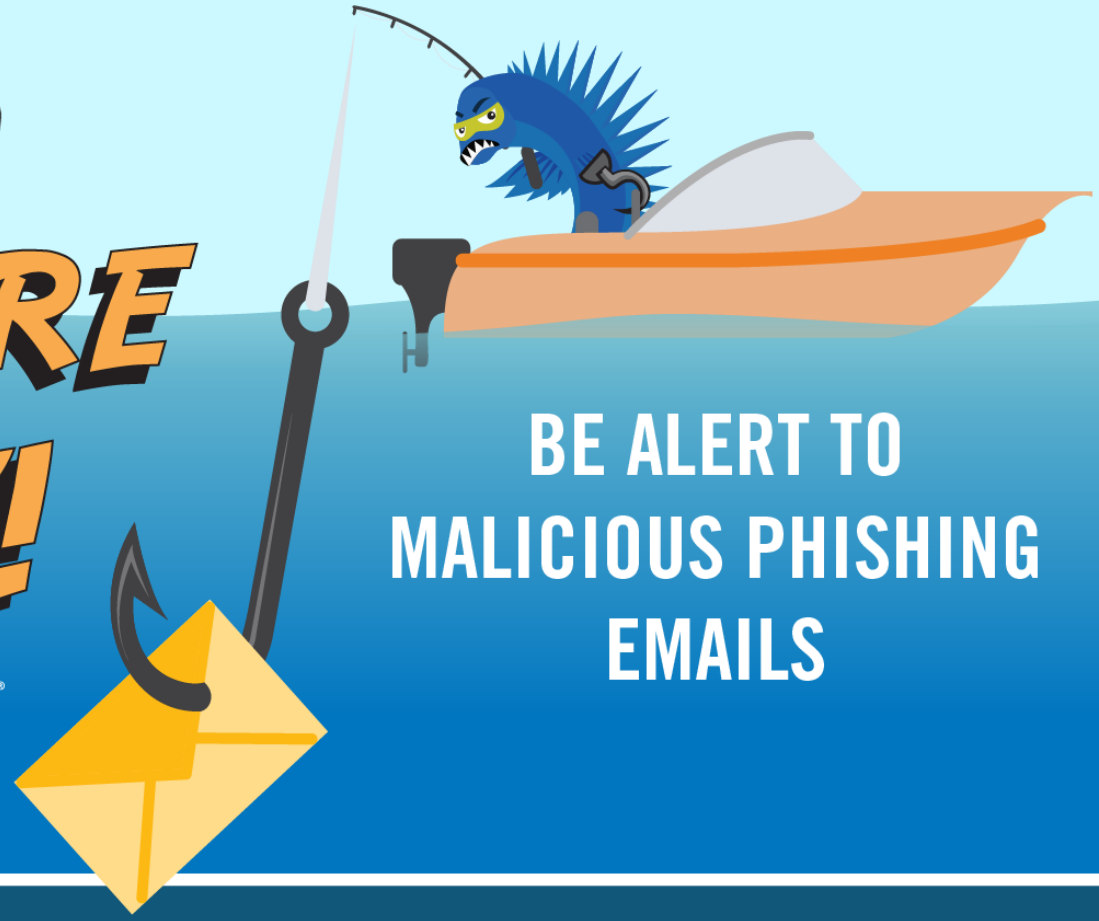

BE ALERT TO MALICIOUS PHISHING EMAILS

Report suspicious email activity to PJM.

Call (610) 666-2244 or email it_ops_ctr_shift@pjm.com

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