Working to Perfect the Flow of Energy

PJM Manual 10:

Pre-Scheduling Operations

Revision: 35

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Prepared by

Operations Support Division

Generation Department

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PJM Manual 10:

Pre-Scheduling Operations

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Approval

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David Schweizer, Manager

Generation Department

Current Revision

Revision 35 (1/1/2017):

- Periodic Review
- Exhibit 1 and Section 5.1 – administrative changes - updated market deadlines
- Section 2.3 – Maintenance Outages – administrative change - deleted last sentence which is obsolete
- Section 2.3.2.1 – added sub-bullets to clarify steps taken during recall of maintenance outages
- Section 2.6, Ending Outages in eDART – new section listing rules regarding ending outages in eDART
- Section 5.1 – Markets Database – added new bulleted item to reflect the proper status of units in Markets Gateway when reduced or on an outage.
- Section 5.2 – Changed section title from “Change of Generation Ownership Process” to “Generation Transfer Process”. Added new rules for implementation of the Generation Transfer Process.

Introduction

Welcome to the ***PJM Manual for Pre-Scheduling Operations.*** In this Introduction, you will find the following information:

- What you can expect from the PJM Manuals in general (see "About PJM Manuals").
- What you can expect from this PJM Manual (see "About This Manual").
- How to use this manual (see "Using This Manual").

About PJM Manuals

The PJM Manuals are the instructions, rules, procedures, and guidelines established by PJM for the operation, planning, and accounting requirements of the PJM RTO and the PJM Energy Market. The manuals are grouped under the following categories:

- Transmission
- Energy Market
- Regional Transmission Planning Process
- Reserve
- Accounting and Billing
- Administration
- Miscellaneous

For a complete list of all PJM Manuals, go to www.pjm.com and select "Manuals" under the "Documents" menu.

About This Manual

The ***PJM Manual for Pre-Scheduling Operations*** is within the PJM Energy Market series. This manual focuses on PJM and PJM Member pre-scheduling activities that set the stage for the scheduling and dispatching phases of the PJM RTO operation.

The ***PJM Manual for Pre-Scheduling Operations*** consists of five sections. These sections are listed in the table of contents beginning on page ii.

Intended Audience

The intended audiences for the PJM Manual for Pre-Scheduling Operations are:

- PJM operations staff
- Transmission Owner operations support staff
- Market Operations Center (MOC) operators and support staff
- Generation Owners / Operators
- Transmission Service Providers
- PJM Members

References

The References to other documents that provide background or additional detail directly related to the ***PJM Manual for Pre-Scheduling Operations*** are:

- Operating Agreement of PJM Interconnection, L.L.C.
- NERC Reliability Standards
- PJM eDART User Guide
- PJM Manual for Transmission Operations (M-03)
- PJM Manual for Energy & Ancillary Services Market Operations (M-11)
- PJM Manual for Balancing Operations (M-12)
- PJM Manual for Emergency Operations (M-13)
- PJM Manual for Generator Operational Requirements (M14D)

Using This Manual

We believe that explaining concepts is just as important as presenting the procedures. Therefore, we start each section with an overview. Then, we present details and

procedures. This philosophy is reflected in the way we organize the material in this manual. The following paragraphs provide an orientation to the manual's structure

What You Will Find In This Manual

- A table of contents that lists two levels of subheadings within each of the sections
- An approval page that lists the required approvals and a brief outline of the current revision
- Sections containing the specific guidelines, requirements, or procedures including PJM actions and PJM Member actions
- Attachments that include additional supporting documents, forms, or tables in this PJM Manual
- A section at the end detailing all previous revisions of the PJM Manual

Section 1: Pre-Scheduling Overview

Welcome to the *Pre-scheduling Overview* section of the ***PJM Manual for Pre-Scheduling Operations***. In this section you will find the following information:

- A description of the scope and purpose of pre-scheduling (see "Scope & Purpose of Pre-Scheduling")
- A description of PJM pre-scheduling responsibilities (see "PJM Responsibilities")
- A description of PJM Members' pre-scheduling responsibilities (see "PJM Member Responsibilities")

1.1 Scope & Purpose of Pre-Scheduling

Operation of the PJM RTO involves many activities by different operating and technical personnel. These activities take place in parallel on a continuous basis, 24 hours a day and are grouped into three overlapping time frames:

- Pre-scheduling Operations
- Scheduling Operations
- Dispatching Operations

In this ***PJM Manual for Pre-Scheduling Operations*** we focus mainly on the activities that take place before the PJM Energy Market opens each day. Exhibit 1 depicts the Pre-scheduling activities in the form of a timeline. The reference point for the timeline is the "Operating Day", recognizing that every new day becomes an Operating Day. This timeline-type of description is used throughout this PJM Manual and the other ***PJM Manuals for Energy & Ancillary Services Market Operations (M-11)*** ***and*** ***Balancing Operations (M-12)***.

PJM Energy Market bidding is described in the ***PJM Manual for Energy & Ancillary Services Market Operations (M-11)***.

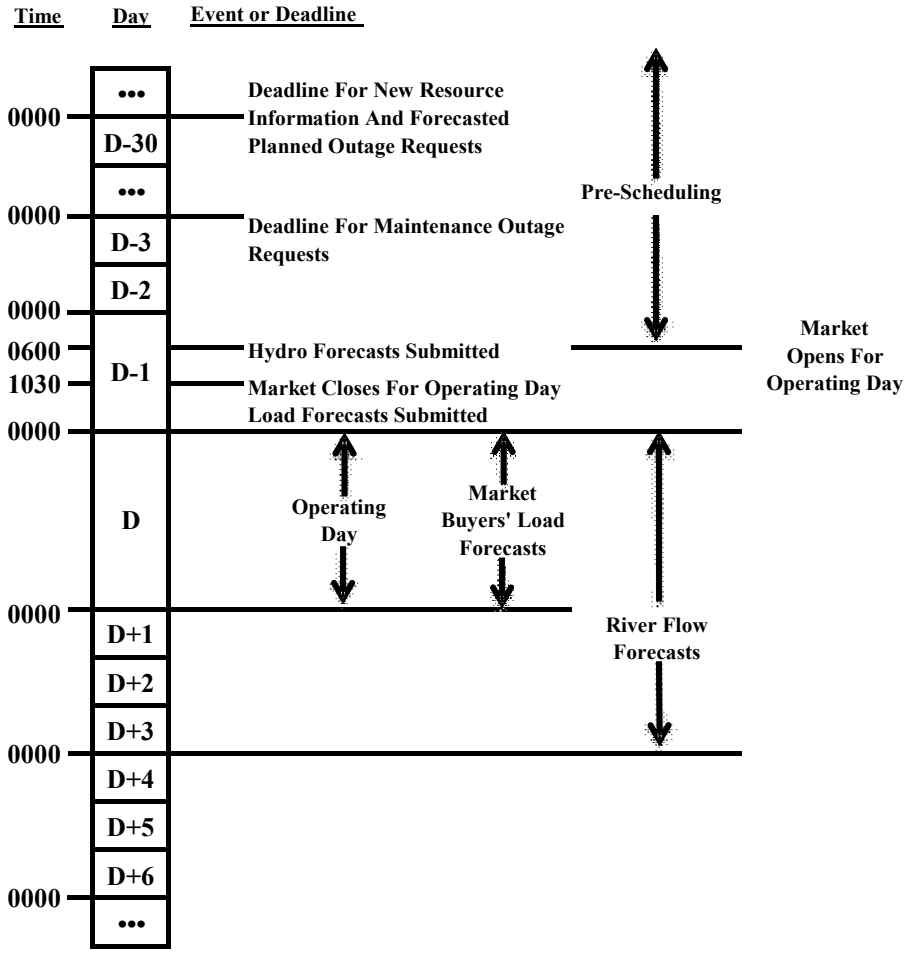

Exhibit 1: Pre-Scheduling, Scheduling, and Dispatching Timeline

The following notation is used in the timeline:

- D represents the Operating Day
- D-30 represents 30 days before the Operating Day
- D+6 represents 6 days after the Operating Day

In this manual we make no special distinction between the terms “price” and “cost”. PJM Members submit their bids according to either actual cost or offer price as designated by PJM for each generation resource. For specific information as to the use of price and cost, refer to **Markets Database Dictionary**.

1.2 PJM Responsibilities

PJM responsibilities to support pre-scheduling are to:

- maintain data and information relating to generation and transmission facilities in the PJM RTO, as may be necessary or appropriate to conduct the scheduling and dispatch of the PJM Energy Market and PJM RTO

- maintain data and information relating to generation and transmission facilities external to the PJM RTO, as may be necessary or appropriate to conduct the scheduling and dispatch of the PJM Energy Market and PJM RTO with respect to Non-Metered PJM Members

- process and respond to requests for Generation Capacity and Energy resource outages, which are referred to collectively in this manual as generation resources

- perform seasonal operating studies to assess the forecasted adequacy of generating reserves and of the transmission system

Note: **PJM reviews this manual annually, with periodic updates as required. PJM coordinates identified issues with PJM TOs, PJM GOs and neighboring RCs. As PJM and neighboring Reliability Coordinators deem necessary, PJM will facilitate conference calls that include neighboring Reliability Coordinators, neighboring Transmission Operators, neighboring Balancing Authorities, PJM TOs and PJM GOs.**

1.3 PJM Member Responsibilities

Exhibit 2 shows the general structure of the PJM Energy Market according to participation.

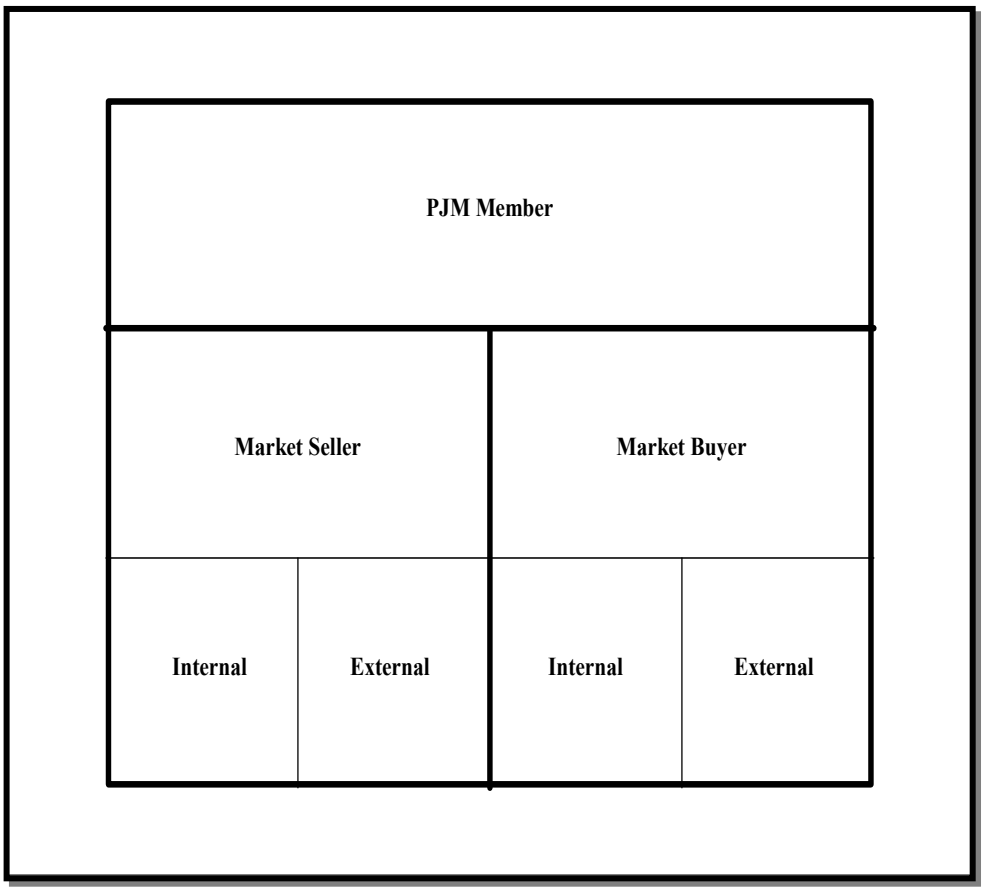

Exhibit 2: PJM Energy Market Structure

PJM Member pre-scheduling responsibilities are to:

- report to PJM all bilateral transactions that extend beyond the next Operating Day

The Market Seller pre-scheduling responsibilities are to:

- furnish to PJM the information specified in the Offer Data for new generation resources
- furnish to PJM start-up and no-load fees for each resource as specified by Section 1.9.7 of Schedule 1 to the Operating Agreement of PJM Interconnection, L.L.C.
- request approval from PJM for generation resource outages within the PJM RTO

1.4 Unit Startup Notification

The purpose of the Unit Startup Notification procedure is to place units in a state of readiness so they can be brought online within 48 hours for an anticipated shortage of operating capacity, stability issues or constrained operations for future periods. Alerted unit(s) must be in the state of readiness (i.e. able to be online within 48 hours) in the lesser of (submitted notification time + startup time or 6 days) minus 48 hours. After reaching the state of readiness, if PJM subsequently calls the unit(s) to come online, the unit must be online within 48 hours. Failure to do so will result in a forced outage. PJM will evaluate system conditions daily to determine when to release unit(s) from the state of readiness or call units to come online. PJM will schedule an amount of long lead time generation anticipated to be needed for the operating day(s) in economic order respecting unit operating parameters. Once a generator is scheduled its offer price is locked for the operating day.

1.4.1 Peak Period Months (Jan, Feb, Jun, July and Aug)

Unit total time to start (submitted notification time + startup time) is limited to 6 days. Unit(s) with greater than 6 days total time to start will be in a forced outage until it can be within the 6 day limit. Units that fail to meet their scheduled online target will be considered to be on a forced outage at that time.

1.4.2 Off-peak Period Months (Mar, Apr, May, Sep, Oct, Nov, Dec)

Unit notification time may be extended as long as those times accurately reflect the physical time to bring the unit to the beginning of the unit start up sequence. However, if PJM has a need to call the unit(s) with extended notification times, the unit must respond to the call at the lesser of the submitted notification time + startup time or 6 days. Units that fail to meet their scheduled online target will be considered to be on a forced outage at that time.

Section 2: Generation Outage Reporting

Welcome to the *Outage Reporting* section of the ***PJM Manual for Pre-Scheduling Operations***. In this section you will find the following information:

What you can expect from the Outage Reporting section in general (see "*Outage Reporting Overview*").

- A description of Planned Outages (see "Planned Outages")
- A description of Maintenance Outages (see "Maintenance Outages")
- A description of Unplanned Outages (see "Unplanned Outages")

2.1 Generation Outage Reporting Overview

PJM is responsible for coordinating and approving requests for outages of generation and transmission facilities, as necessary, for the reliable operation of the PJM RTO. PJM maintains records of outages and outage requests for these facilities. In this PJM Manual we only consider those outages that are associated with generation. See the ***PJM Manual for Transmission Operations (M-03)*** for the treatment of transmission facility outages.

Generation outages fall into the following three categories:

- Planned
- Maintenance
- Unplanned (Forced)

The general procedure begins with the PJM Members requesting outages via the eDART tool. PJM may either accept or reject a specific outage request.

It is important to emphasize that PJM does not "schedule" when generation outages should take place. PJM only accepts/rejects the requests for outages. PJM only rejects outage requests when they affect the reliability of the PJM RTO. It is the responsibility of each PJM Member to determine its own best schedule of outages. Forecasted Planned, Planned, and Maintenance generation outage requests are generally prioritized by PJM based on the order in which they were submitted via eDART, with the earlier submissions having a higher priority.

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All generation resources, shall provide outage schedule information to PJM via eDART per the timelines established in Sections 2.2, 2.3 and 2.4 of this manual to support PJM's obligations as a Reliability Coordinator and Transmission Operator under several NERC Standards including IRO-005, IRO-010, IRO-017, TOP-001, TOP-002, TOP-006 and TOP-003. Outages on synchronous condensers must also be reported (TOP-003-1, R2) to PJM via eDART and shall be coordinated with the TO to allow the TO to submit corresponding outage requests to PJM.

If all or a portion of a generation resource is made unavailable due to a transmission facility outage, the Generation Owner shall submit an outage request corresponding to the timeframe that the generation resource will be made unavailable due to the transmission facility outage.

2.2 Planned Outages

A Generator Planned Outage is the scheduled removal from service, in whole or in part, of a generating unit for inspection, maintenance or repair with the approval of PJM. Planned Outages are scheduled by the PJM Members well in advance and are of a predetermined duration. Turbine and boiler overhauls or inspections, testing, nuclear re-fuelings and installation of environmental control systems are typical Planned Outages. Characteristically, Planned Outages usually occur during those seasons of the year when the peak demand on the power system is lowest. Planned Outages have flexible start dates, have a predetermined duration, last for several weeks, and occur only once or twice a year. Planned Outages on generation resources may not be scheduled during the PJM Peak Period Maintenance Season, which is defined as those weeks containing the 24th through 36th Wednesday of the calendar year with the weeks beginning at 0800 hours Monday.

Peak Period Maintenance Seasons are listed in the file linked below:
www.pjm.com/~/media/markets-ops/rpm/2016-2057-peak-period-maintenance-seasons.ashx

2.2.1 Planned Outage Request Procedure

Refer to the Pre-scheduling Timeline shown in Exhibit 1 as we describe the process for a Planned Outage request.

- In order to be classified as a Planned Outage, the PJM Member submits the initial outage request to PJM through eDART no later than 30 days prior to the Operating Day in which the Planned Outage is to begin. These outages are initially submitted through eDART as Forecasted Planned outages and will automatically change to Planned Outages 30 days prior the start date.

- Upon receipt of the initial Forecasted Planned Outage request, PJM executes the validation process and notifies the PJM Member if the Forecasted Planned Outage request is approved or placed in the pending evaluation category.

- In the event that the Forecasted Planned Outage request is denied following PJM's evaluation, the PJM Member re-evaluates its Planned Outage schedule and submits a new outage request. This process is repeated until the PJM Member submits an outage request that is acceptable. The PJM Member may contact PJM to assist in determining when the outage may be scheduled.

- PJM maintains a record of the approved Forecasted Planned outage requests so that the validation process is kept up to date.

2.2.2 Planned Outage Rules

1. PJM may withdraw its approval for a Planned Outage by notifying the PJM Member owning or controlling the generation resource in advance of the planned commencement of the outage, in accordance with deadlines for such notice as specified by PJM. Currently the deadline is at least 24 hours in advance. Approval for a Planned Outage is withdrawn only as necessary to ensure the adequacy of reserves or the reliability of the PJM RTO in connection with anticipated implementation or avoidance of emergency procedures.

2. A PJM Member is not expected to submit offers for the sale of energy or other services or to satisfy delivery obligations from all or part of a generation resource undergoing an approved Planned Outage.

3. The PJM Member shall provide PJM with an estimate of the amount of time it needs to return to service any Generation Capacity Resource on a Generator Planned Outage. This estimated "early return time" should be a reasonable estimate of the time it would take to return the unit or a portion of the unit to service that is currently in a Planned Outage. This early return time is intended to be informational and allow the planned scope of work to be completed. The submission of an "early return time" will not affect the Planned Outage estimated end date. PJM may request an update to this time during potential PJM Emergency conditions such as Hot Weather Alerts, Cold Weather Alerts, Maximum Emergency Generation Alerts, etc. The request to update the "early return time" and the expected response time to this request will be via PJM Dispatch communications.

4. PJM will coordinate any delays or withdraws of approval of a Planned Outage of a generation resource. PJM will coordinate with the Member to reschedule the Generator Planned Outage of the resource at the earliest practical time. PJM will, if possible, propose alternative schedules with the intent of minimizing the economic impact on the impacted resource.

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2.2.3 Planned Outage Extension

A Planned Outage may be extended beyond its originally estimated completion date in those instances when the original scope of work requires more time to complete than originally scheduled. The outage extension is not used for those instances when unexpected problems or delays are encountered to render the generation resource in question, out of service past the expected date of the Planned Outage.

The request for a Planned Outage Extension must be submitted via eDART at least 48 hours before the end date of the outage.

2.2.4 Planned Outage Restrictions for Black Start Units

A Black Start Unit is defined as a generating unit that can start without the assistance of an off-site source of power. Critical black start units are those receiving compensation for providing black start through the PJM Black Start Service as maintained by PJM.

In order to ensure adequate black start capability is available in case of a system restoration, no more than one unit at a black start plant with multiple black start units may be on planned maintenance at any one time (excluding outages on common plant equipment which may make all units unavailable).

In addition, concurrent planned outages at multiple black start plants within a zone may be restricted based on Transmission Owner requirements for black start availability. These restrictions have been predefined, approved by PJM and will be incorporated into the eDART tool.

A Generation Owner may substitute another black start unit (currently not designated as critical) at a plant (on the same voltage level) for a black start unit that is on a planned outage to allow a concurrent planned outage of another critical black start unit at a plant to begin. This substituted unit must have a valid black start test within the last 13 months to be considered as an eligible substitution.

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2.3 Maintenance Outages

A Generator Maintenance Outage is the scheduled removal from service, in whole or in part, of a generating unit in order to perform necessary repairs on specific components of the facility with the approval of PJM. Maintenance Outages can be deferred beyond the next weekend but require that the generation resource be removed from service before the next Planned Outage. Characteristically, Maintenance Outages may occur throughout the year, have flexible start dates, are much shorter than Planned Outages, and have a predetermined duration established at the start of the outage. Tube leak repairs, maintenance on mills or pulverizes, testing, and valve repairs are examples of Maintenance Outages.

The duration of a Maintenance Outage is generally limited to a maximum duration of 9 consecutive days (5 days plus the included weekends with the weekend period being defined as starting Friday at 2200 hours and ending Monday at 0800 hours) during the PJM Peak Period Maintenance Season, which is defined as those weeks containing the 24th through 36th Wednesday of the calendar year with each week beginning on a Monday. The definition of Weekend and Weekday Periods are shown in Exhibit 3.

Peak Period Maintenance Seasons are listed in the file linked below:
www.pjm.com/~/media/markets-ops/rpm/2016-2057-peak-period-maintenance-seasons.ashx

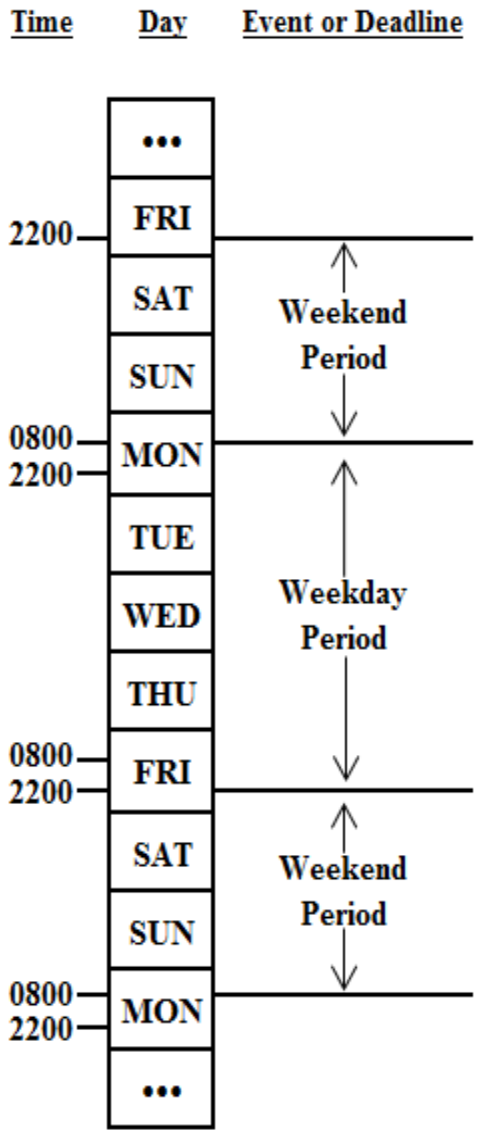

Exhibit 3: Maintenance Outage Timeline

If a Maintenance Outage request is submitted for a generator outside the Peak Period Maintenance Season and an extended outage poses potential reliability concerns, then the outage duration can be limited to 9 days, same as during the Peak Period Maintenance Season. Examples of reliability concerns include:

- The unit is a critical blackstart unit and another blackstart unit in the area is already on Planned Outage.

- The unit is critical for scheduled transmission work.

- There is a reserve shortage in the area.

2.3.1 Maintenance Outage General Information

Refer to the Pre-scheduling Timeline shown in Exhibit 1 and the Maintenance Outage Timeline shown in Exhibit 3 as the Maintenance Outage process is described.

Upon receipt of the initial Maintenance Outage request, PJM executes the validation process and notifies the PJM Member if the Maintenance Outage request is approved or placed in the pending evaluation category via eDART. In the event that the Maintenance Outage request is denied following PJM's evaluation, the PJM Member re-evaluates its Maintenance Outage request and submits a new outage request. The PJM Member may contact PJM to assist in determining when the outage may be scheduled.

The Weekend Period is defined from Friday at 2200 to Monday at 0800. Therefore, during the week, an outage is considered a Maintenance Outage if, at the time of the request to the PJM dispatcher, the generation resource can carry load at its present capacity beyond the next Monday morning at 0800. If the release of a generation resource is requested during the weekend, the outage is considered a Maintenance Outage if, at the time of the request to the PJM dispatcher, the generation resource can carry load at its present capacity beyond Monday morning, 0800 of the following weekend.

Three examples are given, as follows:

1. If an outage request is submitted to PJM and it can be postponed, it is the responsibility of the PJM dispatcher to decide, as directed by the PJM RTO conditions, whether the outage should be postponed. If the PJM dispatcher decides that the outage should be postponed beyond the next weekend and the generation resource fails before 0800 on Monday, the outage is considered an Unplanned Outage.

2. If the PJM dispatcher decides that the outage should be postponed beyond the next weekend and the generation resource fails beyond that weekend, but before the scheduled start time of the outage, the outage is considered a Unplanned Outage; provided, that the component which failed is the component which would have been repaired as specified in the original request. The outage request must be properly documented to explain this situation. This allows internal PJM calculations to consider the fact that the PJM dispatcher requested deferral of the event.

3. If the PJM dispatcher decides that the outage should not be postponed, but the outage is postponed by the PJM Member and the generation resource fails, the outage is considered an Unplanned Outage.

2.3.2 Maintenance Outage Rules

1. Approval of a Generator Maintenance Outage of a generation resource shall be withheld or withdrawn only as necessary to ensure the adequacy of reserves or

the reliability of the PJM Region. In addition, if PJM determines that it must rescind its approval of a Generator Maintenance Outage of a Generation Capacity Resource that is already underway in order to preserve the reliable operation of the PJM Region, PJM will provide the Member at least 72 hours advance notice. The Member shall be required to make the Generation Capacity Resource available for normal operation within 72 hours and if the generator is not made available for normal operation by 72 hours after the notice of the rescission of the approval of the Generator Maintenance Outage, the remaining time the resource continues on the outage it shall be deemed to have experienced a Generator Forced Outage as set forth in OATT, Attachment K-Appendix, section 1.9.3 (see also OATT, Attachment K-Appendix, section 1.9.4). If PJM withholds, withdraws or rescinds approval of a Generator Maintenance Outage, it shall coordinate with the Member to reschedule the Generator Maintenance Outage at the earliest practical time. PJM shall, if possible, propose alternative schedules with the intent of minimizing the economic impact on the Member.

a. If the Maintenance outage eDART ticket has not been closed by the recall time, a Forced Outage date and time will be added to the existing Maintenance Outage and the outage will be treated as a Forced Outage. These Forced Outages may be converted back to Maintenance Outages after the recall period has ended.

b. Once PJM notifies the members that Maintenance Outages have been cancelled or withdrawn, this status will remain in effect until PJM notifies the Members that Maintenance Outages may be approved.

c. To enhance reliability during the on-peak hours when Maintenance Outages have been recalled, short duration Maintenance Outage or reduction requests over off-peak hours, for items such as boiler deslags, valve tests, inspections, etc., may be approved.

2. Maintenance Outages should be submitted no later than three days prior to the operating day in which the Maintenance Outage is scheduled to begin. Under certain conditions, maintenance outages submitted greater than three days in advance may be approved automatically following a programmatic reliability analysis considering the reserve maintenance margin and local reliability issues. Maintenance Outages submitted with less than three days' notice will not be automatically approved and will initially be designated as "Pending Evaluation." Pending Evaluation outages will be approved or denied based on a manual review of reserve maintenance margins and local reliability issues

3. A PJM Member is not expected to submit offers for the sale of energy or other services or to satisfy delivery obligations, from a part of the generation resource undergoing an approved full or partial Maintenance Outage.

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2.3.3 Maintenance Outage Extension

A Maintenance Outage may be extended beyond its originally estimated completion date in those instances when the original scope of work requires more time to complete than originally scheduled. The outage extension is not used for those instances when unexpected problems or delays are encountered to render the generation resource in question, out of service past the expected date of the Maintenance Outage.

The request for a Maintenance Outage extension must be submitted before the original end date.

2.4 Unplanned (Forced) Outages

A Generator Unplanned (Forced) Outage is an immediate reduction in output or capacity or removal from service, in whole or in part, of a generating unit by reason of an Emergency or threatened Emergency, unanticipated failure, or other cause beyond the control of the owner or operator of the facility. If the Generator has any advanced knowledge of an imminent unplanned outage, the Generator shall notify PJM with as much lead-time as practical. Members that own or control a generation resource are expected to:

- Inform PJM of the Unplanned Outage as promptly as possible
- Submit an Unplanned Outage ticket via eDART
- As soon as possible following the start of the outage:
    - Provide PJM with the expected date and time that the generation resource will be made available
    - Provide PJM the reason for the outage

PJM acknowledges the Unplanned Outage and records the outage via eDART.

2.5 Outage Reporting for Facilities Providing PJM Black Start Service

All units providing PJM Black Start Service shall report outages on cranking diesel generators or any other station auxiliary equipment that will affect the ability of the unit to provide Black Start Service. The outages shall be reported via eDART as “Informational” for the main Black Start Unit with a zero MW reduction (assuming that the work will not be restricting the normal operation of the unit) and in the description area of the eDART ticket the work being done that restricts the black start capability should be included. If the cause is work on the cranking diesel generator(s), the outage cause “cranking diesel” shall be entered in eDART. If the work is on any other station auxiliary equipment that renders the

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Black Start Service unavailable, the outage cause “black start auxiliary equipment” shall be used. These outages shall be reported on a prospective basis whenever possible.

2.6 Ending Outages in eDART

The end of a MW outage or MW reduction in eDART should be recorded as follows:

1. If the unit (or the portion of the unit that is reduced) is scheduled to operate by PJM (day ahead or real-time) or self scheduled by the unit owner/operator, the outage should end when the work is complete and the unit synchronizes to the grid.
2. If the unit is not scheduled by PJM or not self scheduled by the unit owner/operator, the outage should end when the work is complete and the unit is available to start up if required.
3. For outages where major work was performed, such as unit overhauls, nuclear refueling outages, etc., the unit owner/operator may, if approved by PJM, keep the outage active as a partial reduction and change the reduction as the unit increases output to full load.

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Section 3: Reserve Requirements

Welcome to the *Reserve Requirements* section of the ***PJM Manual for Pre-Scheduling Operations***. In this section you will find the following information:

- A description of each type of Reserve (see "Reserve Definitions").
- How Reserve Requirements are determined (see "Requirement Determination").
- A description of the PJM Day-ahead Scheduling (Operating) Reserve Requirements (see "PJM Day-ahead Scheduling (Operating) Reserves").

3.1 Reserve Definition

Reserve represents the generating capability that is "standing by" ready for service in the event that something happens on the power system, such as the loss of a large generator. (Reference NERC Performance Standard BAL-002-1, Disturbance Control Performance, and PJM Manual 12, Attachment D). The severity of the event determines how quickly the reserves have to be picked up. Exhibit 4 illustrates how PJM classifies the different types of reserve.

<table>
<tr><td colspan="3">Day-ahead Scheduling (Operating) Reserve
(T ≤ 30 Minutes)</td><td rowspan="3">Reserve Beyond 30 Minutes</td></tr>
<tr><td colspan="2">Contingency (Primary) Reserve
(T ≤ 10 Minutes)</td><td rowspan="2">Secondary Reserve
(10 Min. ≤ 30 Minutes)</td></tr>
<tr><td>Synchronized Reserve (Synchronized)</td><td>Non-Synchronized Reserve (Off-Line)</td></tr>
<tr><td colspan="4">T = Time Interval Following PJM Request</td></tr>
</table>

Exhibit 4: Graphic Representation of Reserves

3.1.1 Day-ahead Scheduling (Operating) Reserve

Day-ahead Scheduling (Operating) Reserve is reserve capability including:

1. generating capability and/or equivalent generating capability scheduled to operate in excess of the forecast hourly integrated PJM RTO load that can be converted fully into energy within 30 minutes from the request of the PJM dispatcher or,
2. load that can be removed from the system in 30 minutes from the request of the PJM dispatcher.

Based on the time required to effect the reserve energy incremental contribution, Day-ahead Scheduling (Operating) Reserve is subdivided into Contingency (Primary) Reserve and Secondary Reserve.

Contingency (Primary) Reserve

NERC utilizes the term Contingency Reserves, which are on/off-line reserves available within 15 minutes. PJM criteria require response within 10 minutes. For the purposes of this manual, Contingency and Primary reserves are interchangeable. Contingency (Primary) Reserve is reserve capability that can be converted fully into energy or load that can be removed from the system within 10 minutes of the request from the PJM dispatcher.

Based on the operating status of the facility that is providing the reserve capability, Contingency (Primary) Reserve is subdivided into Synchronized Reserve and Non-Synchronized Reserve.

Synchronized Reserve

Synchronized Reserve is reserve capability that can be converted fully into energy or load that can be removed from the system within 10 minutes of the request from the PJM dispatcher and must be provided by equipment electrically synchronized to the system. Included as Synchronized Reserve are:

i. the increase in the output energy level of a synchronized generator which can be attained within 10 minutes;

ii. the reduction in load from a synchronized resource which can be attained in 10 minutes;

iii. the load of a pumped hydro resource currently synchronized in the pumping mode and capable of being shut down within 10 minutes (provided that the PJM dispatcher had determined that the loss of the generating capability which the pumping would provide would not seriously affect future PJM RTO reliability); and

iv. the maximum output energy level that could be attained within 10 minutes on a resource operating as a synchronous condenser, provided that:

   (a) it has been determined that the loss of voltage control that would occur by reversing the synchronous condenser to generating mode would not seriously affect future PJM RTO reliability; and

   (b) the interruption of the resource's synchronization is not required during transfer to the generating mode.

Non-Synchronized Reserve

Non-Synchronized Reserve is reserve capability of a resource that can be fully converted into energy within 10 minutes of the request from the PJM dispatcher and is provided by equipment not electrically synchronized to the system. Included as Non-Synchronized Reserve is the maximum output energy level of a resource which can be attained within 10 minutes from the PJM dispatcher's request to initiate the starting sequence.

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The resources that generally qualify in this category are currently shutdown run-of-river hydro, pumped storage hydro, industrial combustion turbines, jet engine/expander turbines, and diesel generators.

Secondary Reserve

Secondary Reserve is reserve capability that can be fully converted into energy or load that can be removed from the system within a 10-to-30 minute interval following the request of the PJM dispatcher. Resources providing Secondary Reserve need not be electrically synchronized to the system.

3.1.2 Requirement Determination

In the daily operation of the PJM RTO, the requirement is to operate generating capability and/or equivalent generating capability as required to carry the load reliably and economically by providing reasonable protection against instantaneous load variations in excess of the hourly integrated values, load forecasting error, and loss of system capability due to generation equipment failure or malfunction and by providing reasonable capability for frequency regulation and area protection. The amount of reserve capability necessary to obtain this requirement is established and reviewed periodically by PJM.

Reserve requirements are lower-limit reliability requirements. Synchronized Reserve, Non-Synchronized Reserve and Secondary Reserve have a priority sequence based on the level of reliability which each provides. Synchronized Reserve, being the most reliable, can also qualify for a requirement which requires Non-Synchronized Reserve or Secondary Reserve. Likewise, Non-Synchronized Reserve can also qualify for a requirement which requires Secondary Reserve. Since the system is to be operated in the most economical manner while satisfying each reserve requirement, economics dictate the extent to which more reliable reserve excesses can be applied to subordinate reserve categories.

Capacity backed purchases from external systems do not qualify as PJM RTO reserve but may permit the attaining of reserve on participant-owned equipment. Non-capacity backed purchases cannot permit the attaining of reserve on participant-owned equipment.

Note: PJM Emergency Operations Manual (M-13), Section 2: Capacity Emergencies, Part 2.2, Reserve Requirements, provides a table which illustrates Reserve Requirements for the RFC and SERC footprints of the PJM RTO.

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Section 4: Regulation Requirements

Welcome to the *Regulation Requirements* section of the ***PJM Manual for Pre-Scheduling Operations***. In this section, you will find the following information:

- A description of Regulation (see "PJM Regulation Service")
- A description of Regulating Resource Availability (see "Regulating Resource Availability")
- A description of Regulating Resources (see "Regulating Resource Characteristics")

4.1 PJM Regulation Service

The FERC Order 888 requires that the Transmission Service Providers within the PJM RTO provide the Ancillary Services for Regulation and frequency response. Since PJM is operating the PJM RTO, the Regulation and frequency response Ancillary Service is being coordinated by PJM.

NERC requires that the PJM RTO maintain regulating capability in order to match short-term deviations in system load. Regulation refers to the control action that is performed to correct for load changes that may cause the power system to operate above or below 60 Hz. To correct for these deviations from 60 Hz, PJM assigns the load changes to its faster responding resources, called regulating resources. By assigning regulation, PJM is better able to control the performance of the power system. Regulation is also referred to as regulation action or regulation response.

Regulation for the PJM RTO is supplied by resources that are located within the metered electrical boundaries of the PJM RTO. Regulation is scheduled in the following ways:

- Self-Scheduled Resources
- PJM RTO Regulation Market

Refer to the PJM Manual for ***Energy & Ancillary Services Market Operations (M-11)*** and the ***PJM Manual for Balancing Operations (M-12)*** for additional details regarding regulation requirements and regulation resource edibility and characteristics.

Section 5: Maintaining Market Information

Welcome to the *Maintaining Market Information* section of the ***PJM Manual for Pre-Scheduling Operations***. In this section, you will find the following information:

- A description of the Markets database (see "Markets Database").
- A description of the Market Sellers' inputs (see "Market Seller Inputs").
- A description of Bilateral Transaction inputs (see "Bilateral Transaction Inputs").

5.1 Markets Database

One of the principal purposes of the pre-scheduling activities is to establish and maintain a current database to be used for PJM scheduling and dispatching. This database is referred to as the Markets Database and contains the information described in detail in **Markets Database Dictionary**.

- Market Seller Inputs
- Design data for new generation resources are required by PJM at least 30 days prior to commercial operation. This information is submitted by the PJM Member to PJM following specifications outlined in the Markets Database Dictionary. The PJM Manual for Energy & Ancillary Services Market Operations (M-11) describes the PJM Member bidding information that is required by 1030 hours when the PJM day-ahead Energy Market closes.
- Bilateral Transaction Inputs
- PJM Members are expected to keep PJM informed of all Bilateral Transactions that involve the use of generation or transmission facilities in the PJM RTO. Each PJM Member involved in a Bilateral Transaction covering a period greater than the following Operating Day furnishes the required information to PJM. The PJM Manual for Energy & Ancillary Services Market Operations (M-11) describes the required Bilateral Transaction data that must be submitted and the rules pertaining to Bilateral Transactions.
- The proper unit status shall be reflected in Markets Gateway by the PJM Member when a generation resource is partially or totally unavailable due to a Planned, Maintenance or Forced outage.

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5.2 Generation Transfer Process

In the event that a generation resource changes ownership via transfer or sale, or a generation resource has a transfer of responsibilities, PJM Member Relations shall be contacted in advance of the change by initiating the Generation Transfer process through the PJM Member Community: http://www.pjm.com/markets-and-operations/etools/member-community.aspx.

PJM's client managers will facilitate the generation transfer process for members in order to effectuate the changes in PJM. Generation Transfer documentation shall be finalized and approved by impacted parties at least five business days prior to the transfer effective date in order to be implemented in PJM's systems and tools. Questions on the process should be directed to PJM Member Relations via http://www.pjm.com/about-pjm/who-we-are/contact-us.aspx

Revision History

Revision 34 (07/01/2016):

- Sections 1.2, 2.1, 2.2, & 2.3 - revised to clarify that outage scheduling and approval rules apply to all PJM generation resources, except where explicitly stated for Generation Capacity Resources.

- Section 2.1, Generation Outage Reporting Overview – revised to include that if a generation resource is made unavailable due to a transmission facility outage, the Generation Owner shall submit an outage request.

- Section 2.4, Unplanned Outages - revised to clarify the steps the Member should take with regards to an Unplanned Outage.

Revision 33 (12/22/2015):

- Periodic Review

- Section 2: Outage Reporting – Renamed section to Generation Outage Reporting

- Section 2.1: Outage Reporting Overview – Renamed section to Generation Outage Reporting Overview and revised sentence describing the initial evaluation process

- Section 2.2: Planned Outages – Included definition of Generator Planned Outage and included restriction of scheduling Planned Outages during Peak Period Maintenance Season, added link to a document that lists the Peak Period Maintenance Seasons

- Section 2.2.1: Request Procedure – Renamed section to Planned Outage Request Procedure and documented option to contact PJM after an outage is denied

- Section 2.2.2: Rules & Regulations – Renamed section to Planned Outage Rules and numbered rules

- Section 2.2.3: Planned Outage Extension – Consolidated wording.

- Section 2.3: Maintenance Outages – Included definition of Generator Maintenance Outage, added examples of Maintenance Outages, added link to a document that lists the Peak Period Maintenance Seasons

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- Exhibit 3: Maintenance Outage Timeline – replaced with cleaner version, no change in content

- Section 2.3.1: Maintenance Outage General Information – added reference to Exhibit 1 and Exhibit 3 and included additional process information

- Section 2.3.2: Rules & Regulations – Renamed section to Maintenance Outage Rules and numbered rules

- Section 2.3.3: Maintenance Outage Extension - Consolidated wording.

- Section 2.4: Unplanned (Forced) Outages – Included definition of an Unplanned (Forced) Outage and clarified notification requirements

- Section 3.1, Reserve Definition – Corrected description of Non-Synchronized Reserve

- Section 4.1, Regulation Service - eliminated outdated information and included references to current PJM documents

- Section 4.1.1, Regulation Resource Eligibility – deleted – current requirements are in PJM Manuals M11 & M12

- Section 4.1.2, Regulation Resource Characteristics - deleted – current requirements are in PJM Manuals M11 & M12

Section 5, Maintaining Market Information – eliminated outdated information and included references to current PJM documents and processes

Revision 32 (10/01/2015):

- Exhibit 1: Pre-Scheduling, Scheduling, and Dispatching Timeline – Removed reference to Planned Outage tickets at D-3

- Section 2.2.2 – (Planned Outage) Rules and Regulations – Added Note 1 referencing the requirement for a PJM Member to provide an estimated “early return time” for informational purposes for Planned Outages. (EL15-29-000 filing associated with CP)

- Section 2.2.2 – (Planned Outage) Rules and Regulations – Added Note 2 referencing PJM will coordinate any delays or withdraws of approval of a Generator Planned Outage and will also coordinate rescheduling the outage. (EL15-29-000 filing associated with CP)

- Section 2.3.2 – (Maintenance Outage) Rules and Regulations – Added Note 1 referencing the authority of PJM to withhold or withdraw approval, or rescind approval of an already underway Generator Maintenance Outage of a Generation Capacity Resource with at least 72 hours advance notice only as necessary to ensure the adequacy of reserves or the reliability of the PJM Region (EL15-29-000 filing associated with CP)

- Section 2.3.2 – (Maintenance Outage) Rules and Regulations – Added Note 2 referencing the requirement for Maintenance Outages to be submitted no later than three days prior to the operating day in which the Maintenance Outage is scheduled to begin. If submitted with less than three days' notice the outage will initially be designated as "Pending Evaluation."

Revision 31 (12/22/2014):

- Annual Review for 2014

- Introduction – changed Local Control Center to Transmission Owner

- Section 2.5 Outage Reporting for Facilities Providing PJM Black Start Service – new section added to clarify outage reporting requirements for facilities providing PJM Black Start Service

Revision 30 (04/11/2014):

Two of the eSuite Applications have been renamed. Moving forward EES will be known as ExSchedule and eMTR will be known as Power Meter.

Revision 29 (11/01/2013):

- Annual Review for 2013

- Multiple Sections - minor edits to update references and add clarity

- Exhibit 1 – Added reference to Forecasted Planned outages

- Section 2.1 – Added reference to reporting outages on synchronous condensers

- Section 2.2.1 – Added references to Forecasted Planned outages

- Section 3 – deleted Sections 3.1.3 and 3.1.4, Reserve Requirements details. Current Reserve Requirements are in the PJM Manual for Emergency Operations (M-13).

- Section 4.1.1 - deleted Regulating Resource details. Current Regulation details are in the PJM Manual for Energy & Ancillary Services Market Operations (M-11).

Revision 28 (09/26/2013):

- Section 1.4 – Removed note at top of the section that referenced a delay in implementation of the Unit Startup Notification process until PJM tools and software are in place.

Revision 27 (2/28/2013):

- Administrative Change: updated all references of “eSchedules” to “InSchedules”

Revision 26 (10/01/2012)

- Annual Review for 2012

- Added new Section 1.4: Unit Start-up Notification – Section defines purpose of Unit Start-up Notification, what happens when PJM issues a notification / start-up alert, and required notification plus start-up time requirements for Peak Period and Off-Peak Periods.

Revision 25 (01/01/2010):

Section 6: Winter Net Capability Test Exemption. Deleted section based on RFC Standard MOD-024-RFC-01, which permits verification of winter gross Real Power capability by adjusting the summer verification, eliminating the need for exemption program. Revisions approved by stakeholders at MRC on November 30, 2009 (tariff change filed and awaiting FERC approval by February 1, 2010).

Revision 24 (10/01/2009):

- Annual Review

- Reformatted manual to assist in NERC Compliance.

- Section 2.1: Outage Reporting Overview – clarified outage reporting requirement for both capacity and energy only resources.

- Section 6: Winter Net Capability Test Exemption – Modified section for the purpose of providing clarity based on PJM SOS member feedback.

Revision 23 (1/2/2008)

- Minor editing to align with NERC Reserve Definition Titles

- Section 3:
- Defined annual Day-ahead Scheduling Reserve Requirement
- Replaced Operating Reserves with Day-ahead Scheduling Reserves
- Replaced Primary Reserves with Contingency (Primary) Reserves
- Replaced Objective(s) with Requirement(s)
- Clarified Contingency (Primary) Reserve Requirements, referencing RFC Standards and adding Emergency Procedures Triggers for Mid-Atlantic Control Zone and RFC.

Attachment A: Deleted due to development of an annual RTO requirement

Revision 22 (05/15/2007)

- Minor editing to align with NERC Functional Model
- Section 3:
- Defined Contingency (Primary) Reserves
- Clarified Reserve Requirements, referencing PJM Emergency Operations Manual (M-13), Section 2 for additional details.
- Clarified more conservative Mid-Atlantic Reserve Requirement based on historical transmission constraint limitations.

Revision 21 (03/14/2007)

- Section 3: Reserve Objectives
- Include reference to NERC Performance Standard BAL-002-0, Disturbance Control Performance, and PJM Manual 11, Attachment B
- Clarified Ancillary Services Rules for Reliability First standards
- Section 5: Maintaining Market Information
- Revised to include a process for Change in Generation Ownership.

Revision 20 (06/15/06)

- Section 3: Reserve Objectives
- Revised Ancillary Services Rules for Demand Side Response providing Ancillary Services.
- Revised Ancillary Services Rules for Reliability First Corporation.
- Change “unit” references to “resource” as they apply to Demand Side Response providing Ancillary Services.
- Change “Spinning” references to “Synchronized” as they apply to Demand Side Resources providing Ancillary Services.
- Section 4: Regulation Requirements
- Revised Ancillary Services Rules for Demand Side Response providing Ancillary Services.
- Revised Ancillary Services Rules for Reliability First Corporation.
- Change “unit” references to “resource” as they apply to Demand Side Response providing Ancillary Services.
- Change “Spinning” references to “Synchronized” as they apply to Demand Side Resources providing Ancillary Services.

Revision 19 (04/17/06)

- Eliminated Attachment B and changed any references to Attachment B in the manual to the Markets Database Dictionary.
- Revisions were made on the following page: 29.

Revision 18 (08/10/05)

- Added new Section 6 on Winter Net Capability Test Exemption.

Revision 17 (07/29/05)

- Attachment A: Replaced old Reserve Objective Tables (Winter 2002 – 2003) with hyperlinks to current and previous PJM Operating Reserve Objective Summaries.

Revision 16 (12/24/03)

- Revised Attachment A: PJM Operating Reserve Objective Summary. Updated Exhibits A5 and A6, Winter 2002 - 2003.

- Updated Exhibit 1 PJM Manuals List

Revision 15 (10/01/03)

- *Section 4: Regulation Requirements* – Updated Exhibit 6 on Limit Relationship for Regulation. Also updated definition of energy dispatch range of a unit under regulation to be consistent with definitions in other PJM manuals.

- ATTACHMENT B: Replace attachment B (a copy of the Markets Database Dictionary) with a hyperlink to the Markets Database Dictionary.

Revision 14 (06/25/03)

- *Section 2: Outaqe Reporting – Rules & Regulations* – **Deleted**: "At least three days prior to the Operating Day during which the Planned Outage is to begin, the PJM Member submits a MW Outage Generator ticket through eDART for PJM to confirm the Planned Outage request.

- *Section 2: Outage Reporting – Maintenance General Information* – **Deleted**: "If approved, PJM acknowledges the Maintenance Outage request via eDART tool.

Revision 13 (06/01/03)

- Revised Attachment A: PJM Operating Reserve Objective Summary. Updated Exhibits A1 and A2, Summer 2003.

- Changed references to PJM Interconnection, L.L.C. to PJM.

- Changed department name "Real Time Market Operations" to "Forward Market Operations."

- Renamed Exhibits I.1 through C.3 to Exhibit 1 through Exhibit 17.

- Reformatted to new PJM formatting standard.

- Renumbered pages to consecutive numbering.

Revision 12 (03/01/03)

- Revised Attachment A: PJM Operating Reserve Objective Summary. Updated Exhibits A7 and A8, Spring 2003.

Revision 11 (12/01/02)

- Revised Section 2: Outage Reporting

- Incorporated the procedures that PJM follows to ensure and monitor Black Start Service.

Revision 10 (11/01/02)

- Revised Attachment A: PJM Operating Reserve Objective Summary. Updated Exhibits A5 and A6, Winter 2002 - 2003.

Revision 09 (10/01/02)

- Revised Attachment A: PJM Operating Reserve Objective Summary. Updated Exhibits A3 and A4, Fall 2002.

Revision 08 (06/01/02)

- Revised Attachment A: PJM Operating Reserve Objective Summary. Updated Exhibits A1 and A2, Summer 2002.

Revision 07 (03/01/02)

- Revised Attachment A: PJM Operating Reserve Objective Summary. Updated Exhibits A7 and A8, Spring 2002.

Revision 06 (11/01/01)

- Revised Attachment A: PJM Operating Reserve Objective Summary. Updated Exhibits A5 and A6, Winter 2001 - 2002.

Revision 05 (10/01/01)

- Revised Attachment A: PJM Operating Reserve Objective Summary. Updated Exhibits A3 and A4, Fall 2001.

Revision 04 (06/01/01)

- Revised to reflect PJM eDART tool implementation.

- Removed Attachment A: Definitions & Abbreviations. Attachment A is being developed into a new PJM Manual for ***Definitions & Abbreviations (M-35)***. Also, removed Attachment B: PJM Generating Unit Event Request. Renamed Attachment C, D and E to be A, B and C, respectively. Revised new Attachment A: PJM Operating Reserve Objective Summary.

Revision 03 (06/01/00)

- Revised to reflect the Multi-Settlement Process implementation.

Revision 02 (04/01/00)

- Attachment D: Unit Commitment Database

- Removed reference to Maximum Scheduled Generation in section Unit Commitment – Scheduling Data (Cost Capped) for Steam Unit and Schedule Data #7 Schedule Operating Data.

- Removed reference to Maximum Scheduled Generation in section Unit Commitment – Scheduling Data (Cost Capped) CT Unit and Schedule Data #5 Unit & Schedule Operating Data. Removed reference to Maximum Scheduled Generation in section Unit Commitment – Scheduling Data (Cost Capped) Diesel Unit Data #5 Schedule Operating Data. Revision 01 (09/22/97)

- Attachment C: PJM Operating Reserve Objective Summary

- Added Operating Reserve Objectives for October 1, 1997 to October 31, 1997 and November 1, 1997 to February 28, 1998.

Revision 01 (07/21/97)

- Section 1: Pre-Scheduling Overview

  Changed “Market Participant” to “PJM Member” in Exhibit 2.

- Section 5: Maintaining Market Information

  Changed “company data (name, long name, short name, gross/net ID)” to “company data (name, long name, short name, gross/net switch)” in Thermal Resource Design Data under Resource Scheduling Database.

- Attachment B: PJM Generating Unit Event Request

- Added unit choices “CT, CC” and company choices “PEP, AE, DPL JO” to PJM Steam Generating Unit Event Request form.
- Attachment D: Unit Commitment Database
- Exhibit B.2: Steam Unit and Schedule Data (Cost Capped)
- Changed “Price in dollars to release a PJM RTO scheduled unit if the unit is not synchronized." to “Price/cost in dollars to release a PJM RTO scheduled unit if the unit has begun the start-up sequence and is not synchronized. Note: for cost-based-units, this fee is defaulted to the Hot Start Cost.” in Unit Cancellation Fee Data.
- Changed “2. Available (marginal)” to “2. Available (marginal) (Bid into market)” in Schedule Operating Data.
- Deleted “Scheduled to run for Company (R)” from Schedule Operating Data.
- Deleted “Scheduled to run for PJM (P)” from Schedule Operating Data.

Revision 00 (05/01/97)

- Attachment C: PJM Operating Reserve Objective Summary
- Replaced Operating Reserve Objectives for March 1, 1997 to May 31, 1997 with Objectives for June 1, 1997 to September 30, 1997.
- Section 2: Outage Reporting
- Maintenance Outage Extension
- The request for a Maintenance Outage Extension must be submitted at least 48 hours before the original end date.
- Changed references to PJM Interconnection Association to PJM Interconnection, L.L.C.
- Changed references to PJM to PJM where appropriate.
- Changed references to PJM to PJM RTO where appropriate.
- Changed references to PJM IA to PJM.

- Changed references to IA to PJM.
- Changed references to Mid-Atlantic Market to PJM Interchange Energy Market.
- Changed references to Mid-Atlantic Market Operations Agreement to Operating Agreement of PJM Interconnection, L.L.C.
- Changed references to pool to control area.
- Changed references to parties to PJM Members.
- Changed references to External Market Participant to Non-Metered PJM Member.
- Changed references to Internal Market Participant to Metered PJM Member.

Revision 00 (03/13/97)

- This revision is a draft of the PJM Manual for ***Pre-Scheduling Operations***.