MMU EMUSTF Phase 1: Solution Details

The Independent Market Monitor for PJM

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Solution Details

2013 State of the Market Report Recommendations

Day-Ahead Operating Reserve Credits

Day-ahead operating reserve credits are paid to market participants under specific conditions in order to ensure that units are not scheduled in the Day-Ahead Energy Market by PJM to operate at a loss in real time. Balancing operating reserve credits are paid to market participants under specific conditions in order to ensure that units are not operated by PJM at a loss. Units are paid day-ahead operating reserve credits whenever their total offer (including no load and startup costs and based on their day-ahead scheduled output) is not covered by the day-ahead energy revenues (day-ahead LMP times day-ahead scheduled output). Units are paid balancing operating reserve credits whenever their total offer (including no load and startup costs and based on their real-time output) are not covered by their day-ahead energy revenues, balancing energy revenues and a subset of net ancillary services revenues.[1]

Units scheduled in the Day-Ahead Energy Market do not operate until committed or dispatched in real time. Therefore, it cannot be determined if a unit was operated at a loss or not until the unit actually operates. The current operating reserve rules governing the day-ahead operating reserve credits assume that units are going to operate exactly as scheduled because they are made whole based on their day-ahead scheduled output. A unit's real-time output may be greater or lower than their day-ahead scheduled output. Units dispatched in real time by PJM above their day-ahead scheduled output could be paid energy uplift in the form of balancing operating reserve credits if by increasing their output they operate at a loss because their offers are greater than the real-time LMP. In the same way, if units are dispatched in real time by PJM below their day-ahead scheduled output, they could be paid energy uplift in the form of balancing operating reserve credits if by decreasing their output the units operate at a loss because real-time LMP is greater than the day-ahead LMP or they could be paid energy uplift in the form of lost opportunity cost credits if by decreasing their output units lose profit because real-time LMP is greater than their offers. The balancing operating reserve credits and lost opportunity costs credits ensure that units recover their total offers or keep their profits in real time.

Units scheduled in the Day-Ahead Energy Market that receive day-ahead operating reserve credits and for which real-time operation results in additional losses, are paid energy uplift in the form of balancing operating reserve or lost opportunity cost credits

1 Balancing operating reserve credit calculation uses the net DASR revenues, net synchronized reserve revenues, net non-synchronized reserve revenues and reactive services revenues.

to ensure that they do not operate at a loss. This determination is not symmetrical because units scheduled in the Day-Ahead Energy Market that receive day-ahead operating reserve credits and for which real-time generation is lower than their day-ahead scheduled generation which subsequently results in reduced losses do not have a reduction in uplift payments.

Units that follow PJM dispatch instructions are made whole through operating reserve credits to ensure that they do not operate at a loss. In order to determine if a unit operated at a loss or not, it needs to be committed or dispatched. The day-ahead scheduled output is one of PJM dispatch instructions, but it does not determine if a unit actually operated at a loss. In order to determine if a unit operated at a loss it is necessary to take into account the unit's real-time output.

The MMU recommends enhancing the day-ahead operating reserve credits calculation in order to ensure that units receive an energy uplift payment based on their real-time output and not their day-ahead scheduled output when their operation results in reduced losses. The MMU calculated the impact of this recommendation in 2013 and estimated a decrease of $25.5 million in day-ahead operating reserve credits or 5.8 percent ($13.4 million paid to units providing reactive support and $5.0 million paid to units providing black start support, the remaining $7.1 were normal day-ahead operating reserves) and an increase of $0.2 million in balancing operating reserve credits. This estimate was calculated using the current settlement database which is not structured to account for this rule change.

Net DASR Revenues Offset

Day-ahead operating reserve credits are paid to market participants under specific conditions in order to ensure that units are not scheduled in the Day-Ahead Energy Market by PJM at a loss. The current rules determine whether a unit is scheduled at a loss by comparing units' total offers (including no load and startup costs) to the units' day-ahead energy revenues. If day-ahead energy revenues are not enough to cover the total offer then units are made whole through day-ahead operating reserve credits.

This determination of whether a unit is scheduled at a loss is inaccurate because it does not take into account all the revenues received in the Day-Ahead Energy Market. The PJM Day-Ahead Energy Market includes a joint procurement of energy and day-ahead scheduling reserves (DASR).[2] The current rules governing day-ahead operating reserve credits do not include the net revenues from the DASR Market in units' revenues. The net DASR revenues equal gross DASR revenues minus DASR offer (which includes lost

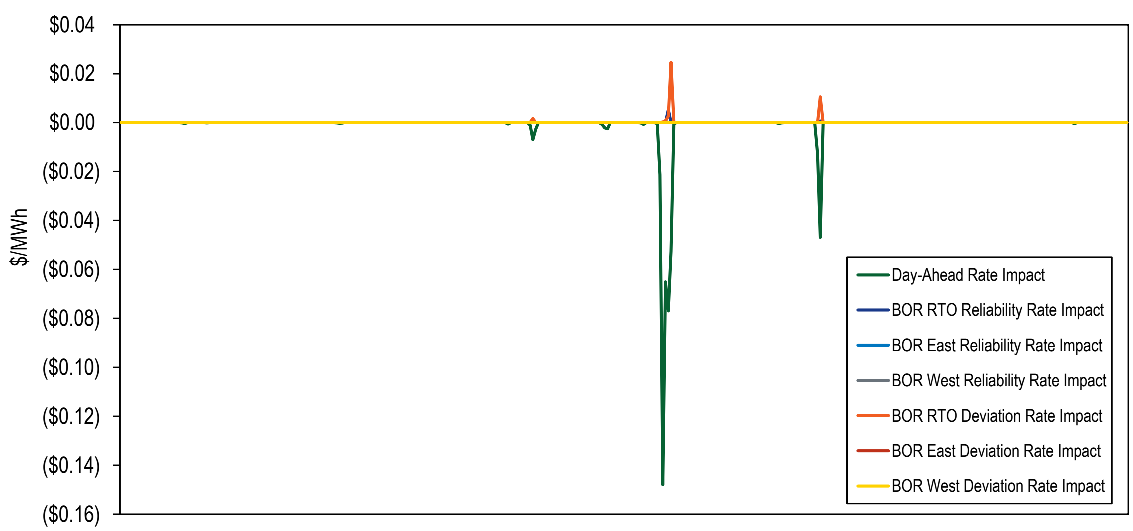
[2] See *2013 State of the Market Report for PJM*, Section 10, "Ancillary Service Markets," at "Day-Ahead Scheduling Reserve (DASR)," for an explanation of this service.

opportunity cost). The current rules do include net DASR revenues in the balancing operating reserve credit calculation.

The result of not including the net DASR revenues in the day-ahead operating reserve credit calculation is that resources scheduled to provide day-ahead scheduling reserves may appear to be scheduled to operate at a loss when they are not. This issue only becomes relevant whenever the DASR clearing price is above zero. In 2013, the DASR price reached $1 per MW or more during 114 hours or 1.3 percent of the time.

The MMU recommends including net DASR revenues as part of the offsets used in determining day-ahead operating reserve credits. In 2013, this recommendation would have had a net impact of a $1.2 million reduction, comprised of a $1.3 million decrease in day-ahead operating reserve credits and an increase of $0.1 million increase in balancing operating reserve credits. Balancing operating reserve credits increase because the current rules ensure that resources do not operate at a loss, which means that if revenues from the Day-Ahead Energy Market, plus revenues or charges from the Balancing Energy Market, net revenues from a subset of ancillary services are not enough to cover a units offer based on their real-time operation, such units are made whole to their offers. Figure 1 shows the impact this recommendation would have had on the day-ahead operating reserve and balancing operating reserve rates.

Figure 1 Impact of net DASR net revenues offset change on daily operating reserve rates ($/MWh):



Net Regulation Revenues Offset

On October 1, 2008, PJM filed revisions to the Operating Agreement and Tariff with FERC related to the Regulation Market. The filing included four elements: implement the TPS test in the Regulation Market; increase the regulation offer adder from $7.50 per MW to $12.00 per MW; eliminate the use of net regulation revenues as an offset in the balancing operating reserve calculation; and calculate the lost opportunity cost on the lower of a unit's price-based or cost-based offer.

The elimination of the use of net regulation revenues as an offset in the balancing operating reserve calculation had a direct impact on the level of energy uplift paid to participants that regulate while operating noneconomic. The result of not using the net regulation revenues as an offset in the balancing operating reserve credit calculation is that PJM does not accurately calculate whether a unit is running at a loss. PJM procures energy, regulation, synchronized and non-synchronized reserves in a jointly optimized manner. PJM determines the mix of resources that could provide all of those services in a least-cost manner. Excluding the net regulation revenues from the balancing operating reserve credit calculation is inconsistent with the process used by PJM to procure these services.

Another issue related to this exclusion is the treatment of pool-scheduled units that elect to self-schedule a portion of their capacity for regulation. A unit can be pool-scheduled for energy, which means PJM may commit or dispatch the unit based on economics, but it can also self-schedule some of its capacity for regulation. When this happens the capacity self-scheduled for regulation is treated as a price-taker, but in the Energy Market any increase in MW to provide regulation are treated as additional costs, which can result in increased balancing operating reserve credits whenever the real-time LMP is lower than the unit's offer.

The MMU recommends reincorporating the use of net regulation revenues as an offset in the calculation of balancing operating reserve credits. In 2013, using net regulation revenues as an offset in the balancing operating reserve calculation would have resulted in a net decrease of balancing operating reserve charges of $13.0 million, of which $11.7 million or 89.7 percent was due to generators that elected to self-schedule for regulation while being noneconomic and receiving balancing operating reserve credits.

Self-Startup

Participants may offer their units as pool-scheduled (economic) or self-scheduled (must run).[3] Units offered as pool-scheduled clear the Day-Ahead Energy Market based on their offers and operate in real time following PJM dispatch instructions. Units offered as self-scheduled are price takers in both the Day-Ahead and Real-Time Energy Markets. Self-scheduled units may elect to submit a fixed energy amount per hour or a minimum must run amount from which the unit may be dispatched up but not down. Self-scheduled units are not eligible to receive day-ahead or balancing operating reserve

3 See "PJM eMkt Users Guide," Section Managing Unit Data (version November 11, 2013) p. 48. <http://www.pjm.com/~/media/etools/emkt/ts-userguide.ashx>.

credits. The current rules determine if a unit is pool-scheduled or self-scheduled for operating reserve credits purposes using the hourly commitment status flag. If the flag is set as economic the unit is assumed to be pool-scheduled, if the flag is set as must run the unit is assumed to be self-scheduled. When a unit submits different flags within a day, the day-ahead operating reserve credit calculation treats each group of hours separately. The day-ahead operating reserve credit calculation only uses the hours flagged as economic and excludes any hours flagged as must run.

In some cases, units offered as self-scheduled for some hours of the day and pool-scheduled for the remaining hours are made whole for startup cost. The MMU recommends not compensating self-scheduled units for their startup cost when the units are scheduled by PJM to start before the self-scheduled hours. This issue was not significant in 2013 since it only had an impact of $0.2 million among a small number of units, but it is important to establish rules that properly compensate resources.

Reactive Services Credits and Balancing Operating Reserve Credits

Energy uplift credits to resources providing reactive services are separate from balancing operating reserve credits.[4] Under the current rules regarding energy uplift credits for reactive services, units are not assured recovery of the entire offer including no load and startup costs as they are under the operating reserve credits rules. Units providing reactive services at the request of PJM are made whole through reactive service credits. But when the reactive services credits do not cover a unit's entire offer, the unit is made whole the balance through balancing operating reserves. The result is a misallocation of the costs of providing reactive services. Reactive services credits are paid by real-time load in the control zone or zones where the service is provided while balancing operating reserve charges are paid by deviations from day-ahead or real-time load plus exports in the RTO, Eastern or Western Region depending on the allocation process rather than by zone.

In 2013, units providing reactive services were paid $8.2 million in balancing operating reserve credits in order to cover their total energy offer. In 2012, this misallocation was $18.6 million, for a total of $26.7 million in the last two years.

On October 10, 2012 and November 7, 2012, the MMU presented this issue at PJM's Market Implementation Committee (MIC).[5] [6] The MIC endorsed the issue charge and

4 OATT Attachment K - Appendix § -3.2.3B (f).

5 See "Item 7: Reactive Service and Operating Reserve Credits Problem Statement and Issue Charge," MMU Problem Statement to the Market Implementation Committee (October 10, 2012). <http://www.pjm.com/~/media/committees-

approved merging this issue with the long term solution for the allocation of the cost of day-ahead operating reserves for reliability.[7]

The MMU had previously proposed changes to the way reactive services credits are calculated and how reactive services charges are allocated. The MMU continues to recommend that reactive services credits be calculated consistent with the balancing operating reserve credit calculation. The MMU also continues to recommend including real-time exports in the allocation of the cost of providing reactive support to the 500 kV system or above. Currently, only real-time load across the entire RTO pays.[8]

Lost Opportunity Cost

On February 17, 2012, the PJM Market Implementation Committee (MIC) endorsed the charge to prepare a proposal to make all energy related lost opportunity costs (LOC) calculations consistent throughout the PJM rules.[9] PJM and the MMU jointly proposed two specific modifications.[10] The MMU also believes that two additional modifications would be appropriate, but the MMU did not formally recommend these to the MIC for consideration although they were brought to the attention of the MIC. These are three of the MMU recommendations that have been brought by PJM in the EMUSTF.

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groups/committees/mic/20121010/20121010-item-07-reactive-service-and-operating-reserve-credits-problem-statement-and-issue-charge.ashx>.

6 See "Minutes," from the Market Implementation Committee (November 7, 2012). <http://www.pjm.com/~/media/committees-groups/committees/mic/20121212/20121212-draft-minutes-mic-20121107.ashx>.

7 PJM created the MIC sub group Day Ahead (DA) Reliability and Reactive Cost Allocation (DARRCA) to address the allocation of the cost of reactive services in day ahead and real time. <http://www.pjm.com/committees-and-groups/issue-tracking/issue-tracking-details.aspx?Issue={323CE736-A41E-49D4-A8AF-687BB3697AE9}>.

8 See the Day-Ahead Reliability and Reactive Cost Allocation Final Report (December 13, 2013) for a complete description of the issues discussed in that group. <http://www.pjm.com/~/media/committees-groups/task-forces/emustf/20131220/20131220-item-02b-darrca-final-report.ashx>

9 See "Meeting Minutes," from the Market Implementation Committee (February 17, 2012). <http://www.pjm.com/~/media/committees-groups/committees/mic/20120217/20120217-minutes.ashx>.

10 See "LOC Session MA Energy LOC Proposal," MMU Presentation to the Market Implementation Committee (October 19, 2012) <http://www.pjm.com/~/media/committees-groups/committees/mic/20121019/20121019-loc-session-ma-energy-loc-proposal.ashx>.

- **No load and startup costs**: Current rules do not include in the calculation of LOC credits all of the costs not incurred by a scheduled unit not running in real time. Generating units do not incur no load or startup costs if they are not committed in real time. As a result, no load and startup costs should be subtracted from the real time LMP in the same way that the incremental energy offer is subtracted to calculate the actual value of the opportunity lost by the unit. The MMU recommends including no load and startup costs as part of the total avoided costs in the calculation of LOC credits paid to combustion turbines and diesels scheduled in the Day-Ahead Energy Market but not committed in real time. This recommendation was proposed at the MIC.
- **Day-Ahead LMP:** Current rules require the use of the day-ahead LMP as part of the LOC calculation logic when a unit is scheduled on a noneconomic basis day ahead, meaning that the unit's offer is greater than the day-ahead LMP. In the Day-Ahead Energy Market, such units receive operating reserve credits equal to the difference between the unit's offer (including no load and startup costs) and the day-ahead LMP. If such a unit is not dispatched in real time, under the current rules the unit receives LOC credits equal to the difference between the real-time LMP and the day-ahead LMP. This calculation results in double counting because the unit has already been made whole to its day-ahead offer in the Day-Ahead Energy Market through day-ahead operating reserve credits if necessary. If the unit is not committed in real time, it should receive only the difference between real-time LMP and the unit's offer, which is the actual LOC. The MMU recommends eliminating the use of the day-ahead LMP to calculate LOC credits paid to combustion turbines and diesels scheduled in the Day-Ahead Energy Market but not committed in real time.
- **Offer Curve:** Current rules require the use of the difference between the real-time LMP and the incremental offer at a single point on the offer curve (at the actual or scheduled output), instead of using the difference between the real-time LMP and the entire offer curve (area between the LMP and the offer curve) when calculating the LOC in the PJM Energy Markets for units scheduled in day ahead but which are reduced, suspended or not committed in real time. Units with an offer lower than the real-time LMP at the units' bus that are reduced in real time by PJM should be paid LOC based on the area between the real-time LMP and their offer curve between the actual and desired output points. Units scheduled in day ahead and not dispatched in real time should be paid LOC based on the area between the real-time LMP and their offer curve between zero output and scheduled output points. The MMU recommends using the entire offer curve and not a single point on the offer curve to calculate energy LOC.

EMUSTF Recommendations

Operating Reserve Synchronous Condensing Category

PJM has four reasons for committing units for synchronous condensing. The four reasons are synchronized reserves, reactive support, post-contingency operation and any other reason that does not fall under the first three. This last reason was a result of the creation of each of the first three.

When PJM established its Synchronized Reserve Market the operating reserve rule that compensated units for providing 10 minute reserves was reformed to compensate units providing synchronous condensing for purposes other than providing Synchronized Reserve.[11] The costs associated with units in condensing mode for synchronized reserves are allocated based on the synchronized reserve obligation (real-time load ratio).

When PJM established a different make-whole payment category for units providing reactive services (different than the existing operating reserve category), the operating reserve rule that compensated units for providing synchronous condensing for purposes other than providing Synchronized Reserve was reformed to also exclude units providing synchronous condensing for Reactive Services.[12] The costs associated with units in condensing mode for reactive support are allocated based on real-time load in the control zone or zones where the service was provided.

When PJM established a different make whole-payment category for units supporting post-contingency operation (different than the existing operating reserve category), the operating reserve rule that compensated units for providing synchronous condensing for purposes other than providing Synchronized Reserve or Reactive Services was reformed to also exclude units providing synchronous condensing for post-contingency operation.[13] The costs associated with units in condensing mode for post-contingency operation are allocated based on real-time load in the control zone or zones where the service was provided.[14]

As a result of the definition of these three synchronous condensing categories a fourth, ambiguous, category was created. The costs associated with units in condensing mode for reasons other than Synchronized Reserve, reactive services or post-contingency operation are allocated to real-time load and real-time exports in the entire RTO. This type of synchronous condensing charge totaled $4.74 million from 2009 through 2013.

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11 See 101 FERC ¶ 61,115Order accepting Spinning Reserve Market (2002).

12 See 106 FERC ¶ 61,127 Order accepting tariff changes (2004).

13 See 108 FERC ¶ 61,196 Allocation of Costs of Synchronous Condensers to Support Post-Contingency Congestion Management Program (2004).

14 The MMU acknowledges that PJM does not have a synchronous condensing for post-contingency operation charge or credit billing line item.

The MMU recommends, if possible, defining a category for this type of synchronous condensing. If a definition is not possible, the MMU recommends eliminating this credit category to avoid having an ambiguous category. Having an ambiguous category could become an issue because of the different allocation.

Staffing / Manning Credit Methodology

The tariff does not contain any reference to compensation of manning costs above normal manning levels. Capacity resources are allowed to include as part of their avoidable cost rate labor expenses related to operations and maintenance (Avoidable Operations and Maintenance Labor) and administrative expenses related to employees (Avoidable Administrative Expenses). Capacity resources are paid to be available when called upon. Resources are paid the energy prices or are made whole to their short run marginal cost or offered price. Manual 15 allows units to include as part of their startup cost a cost adder for startup required above normal station manning levels, but it does not include an adder for operation required above normal station manning levels. OA 1.10.2 (d) establishes compensating pool-scheduled resources for the costs incurred (up to the startup cost) if the resource is canceled by PJM. The tariff does not specify which costs are includable under this clause.

The MMU recommends eliminating the compensation of manning costs above normal manning levels. The MMU also recommends specifying in OA 1.10.2 (d) that only costs allowable under Manual 15 as startup costs can be included in cancellation credits.

Transmission Planning

PJM's market efficiency planning process identifies transmission projects that are economically feasible rather than based solely on reliability requirements. Historic and forecasted congestion are used for the economic evaluation of transmission projects under the market efficiency planning process. Transmission projects identified in the reliability analysis process or new projects that relieve historical and projected congestion become candidates for market efficiency solutions. Projects are evaluated using an economic efficiency test that measures savings in the production cost of the system in both energy and capacity, and savings in the cost of energy and capacity to load. The benefits are weighted as 70 percent production cost savings and 30 percent load payment savings. Projects are included in RTEP if the present value of the benefits using a 15 year period is 25 percent greater than the present value of the costs (1.25 benefit/cost ratio).

In this analysis the cost of energy uplift is not taken into account. Units that receive energy uplift in the form of make whole payments tend to depress energy prices and therefore reduce congestion. The MMU recommends including in PJM's market efficiency planning process an analysis that evaluates transmission projects that reduce the need to run resources out of merit. Because units that run noneconomic reduce energy prices it is important to differentiate the benefit/cost analysis of these projects from projects that reduce congestion. In the case of projects needed to reduce energy uplift, the benefits should be evaluated using 100 percent of the savings on production costs.

Day-Ahead and Real-Time Modeling Methodology Inconsistencies

Table 1 shows areas where there are or there could be inconsistencies in the modeling of the Day-Ahead and the Real-Time Markets. The MMU recommends that PJM explain the different modeling assumptions used in each market for each of these areas.

Table 1 Modeling inconsistencies areas

Area	Day Ahead	Real Time
Time granularity	1 hour	5 minutes
Optimization period	24 hours	5 minutes to 2 hours
Reactive interface limits		To be determined
Loop flows		To be determined
Interchanges		To be determined
M2M constraints		To be determined
Reserves		To be determined