



August 29, 2018

Dr. Joseph Bowring  
Monitoring Analytics, LLC  
2621 Van Buren Avenue, Suite 160  
Eagleville, PA 19403

Dear Joe:

Last week's discussions of Opportunity Cost Calculators (OCCs) at both Thursday's Markets and Reliability Committee (MRC) meeting and Friday's Special Market Implementation Committee (MIC) meeting on OCCs clearly highlighted Members' frustrations and confusion around OCCs. This letter proposes a path forward that considers Members' requests, the Independent Market Monitor's (IMM's) points, and PJM's Tariff administration obligations, including opportunity cost determinations, as established by the Federal Energy Regulatory Commission (FERC).

In FERC Docket No. EL08-47-005, regarding opportunity cost determinations as documented in the Amended and Restated Operating Agreement of PJM Interconnection, L.L.C. (Operating Agreement) Schedule 2, FERC ruled on October 25, 2010, that *"Order No. 719 permits the PJM IMM to have a role in providing the inputs for such a process as long as PJM retains the ultimate decision making authority."* At that time and for several years subsequent to this ruling, PJM's OCC and the IMM's OCC resulted in consistent calculations of opportunity cost adders. As such, Market Sellers could have used either calculator because they arrived at a consistent result. However, at some point we believe during the latter part of 2016, due to changes in the IMM's OCC, the details of which have not been shared with PJM, the PJM OCC and the IMM OCC started to result in different opportunity cost calculations for a number of units.<sup>1</sup> To date, the IMM has not provided enough detail around its OCC for PJM to fulfil its obligation to ensure that the IMM's OCC is producing results in accordance with Schedule 2 of the Operating Agreement and Manual 15.

Accordingly, Special MIC meetings on PJM's and the IMM's OCCs were established in March 2017. Despite missing its target completion date in December 2017, this stakeholder group has worked to develop packages of reforms for consideration in the near term. Based on feedback to PJM from Market

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<sup>1</sup> PJM is unsure as to exactly when the divergence began or the specific changes to the IMM OCC that resulted in that divergence. While the potential for these differences initially was raised by participants in early 2017, the first occurrence of a participant actually providing significantly different results produced by both calculators to PJM was in April of 2018.

Sellers that IMM staff was indicating that they must use the output of the IMM OCC, PJM issued a letter to Members on August 7, 2018, consistent with PJM statements in the Special MIC meetings and the requirements in Schedule 2 of the Operating Agreement confirming that market sellers may not use an opportunity cost adder value higher than that which is produced by PJM's OCC unless the alternative OCC calculation is approved by PJM. This letter specifically communicated that *"PJM does not recommend alternative methods for calculating this adder (including the [IMM] calculator), without approval from PJM."*

We appreciate the acknowledgement by IMM staff in last Friday's Special MIC meeting on OCCs that PJM has "generously shared" its OCC methodology and several example calculations with the IMM. PJM believes that this level of transparency between PJM and the IMM is valuable to all Members. Additionally, PJM believes the detailed description of its OCC in Manual 15 is appropriate for Members to understand how PJM's OCC calculates opportunity costs.

PJM remains hopeful that we can review sufficient information around the IMM's OCC to consider whether PJM can approve it. We recognize the IMM's concerns about sharing its software code with PJM and have thought about the IMM's point that PJM has not always been able to share vendor-developed software code with the IMM. So, we are suggesting that the IMM could instead share with PJM its OCC design specifications, with step-by-step examples of OCC calculations, as a means for PJM to review the IMM's OCC. As you may recall, this is the approach PJM has taken with sharing its application logic with the IMM for certain PJM applications, such as Security Constrained Economic Dispatch (SCED) and Ancillary Service Optimizer (ASO), to make sure the IMM could review those applications for which PJM was unable to provide the vendor-developed software code.

Specifically, the following list of information regarding the IMM's OCC should be sufficient for PJM to review the IMM's OCC in the same manner in which the IMM has been able to review PJM's OCC and in a similar level of detail as PJM's OCC is described in Manual 15:

1. Ideally, PJM would like to review the IMM's OCC design requirement specification documents, assuming such documents include descriptions of steps taken to calculate the adder as well as the mathematical formulas used in those steps.
2. Alternatively, as Members requested at last Friday's Special MIC meeting, a sample generator's calculation from the IMM's OCC could be compared with the same sample generator's calculation from the PJM OCC. PJM and the IMM would supply interim output from two agreed-upon annual cases, one with an annual compliance period and one with a rolling 12-month compliance period, which includes:
  - a. Verification of common inputs such as fuel type, fuel index, Eco Min, Eco Max, Duct burner megawatts, minimum run time, start cost, heat rate, maintenance adder, emission rates, and the optional 10% adder for cost-based offers

- b. Historical locational marginal prices (LMPs) and fuel pricing data for three previous years
  - c. Calculated scalars to convert monthly on-peak and off-peak LMP forwards to hourly values for the three simulation years
  - d. Calculated scalars to convert monthly fuel forwards to daily values for the three simulation years
  - e. The products of the scaled LMPs and the scaled fuel forwards for the three simulation years
  - f. Calculated hourly dispatch costs for Eco Min, Eco Max, and the duct burner MWs for the three simulation years
  - g. Calculated hourly margins for the three simulation years
  - h. The selected blocks ranked in descending order of margin for the three simulation years
  - i. The final opportunity cost adder for each of the simulation years
3. A commitment by the IMM to notify PJM of any design specification changes made to the IMM's OCC prior to their implementation and the agreement to rerun the test cases outlined above to determine the impact of, and allow PJM to determine if, it continues its approval of the IMM OCC given the proposed changes.

I am aware of your offer to share a similar level of information on the IMM's OCC with an external party, such as an audit firm, for review presumably under an attestation engagement. I am hopeful that you will see the value to PJM's Members, the IMM and PJM in agreeing to share this level of information with PJM directly instead. This approach would be much more efficient and less costly than engaging an external party. Specifically, the details of the IMM's OCC would need to be documented to support an Agreed Upon Procedures attestation review and thus much of the information sought in the above list would need to be provided to the external firm and likely included in their public report to PJM and PJM's Members. Also, PJM and the IMM would need to collaborate on the scope of such an Agreed Upon Procedures engagement to ensure it would provide the level of information PJM would need to confirm if we can conclude that the IMM's OCC is consistent with the provisions of Manual 15 and hence PJM-approved. Also, such a point-in-time review would not address any changes that might be made to the IMM's OCC prospectively.

I am also aware of your opinion that the provisions in Manual 15 specific to opportunity cost calculations should be updated. To the extent that the IMM OCC does not operate consistently with the current Manual 15 provisions, PJM believes that Market Sellers should use the PJM OCC, or the IMM OCC should be modified to be consistent with the current Manual 15 provisions until any potential revisions are made to Manual 15. PJM stands ready to work expeditiously through the stakeholder process to consider

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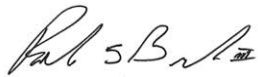
August 29, 2018

Page 4

enhancements to the opportunity cost calculations in Manual 15 that the IMM might propose, if PJM's Members agree that such a review of the applicable sections of Manual 15 is warranted.

Please let PJM know in writing by the close of business on Monday, September 10, 2018, if the IMM agrees with PJM's suggested path forward as detailed above and we can establish a schedule of meetings towards a resolution. I believe it is important to provide feedback to Members on whether PJM and the IMM are making progress on this topic before the agenda and materials are posted on September 20, 2018, for the September 27, 2018, Members Committee meeting.

Sincerely,

A handwritten signature in cursive script, appearing to read "Stu Bresler".

Stu Bresler

cc: PJM Members Committee  
PJM Markets and Reliability Committee  
PJM Market Implementation Committee