



October 2018

To: Markets Committee of the Board of Directors
From: Clair Moeller, President
Re: MISO Response to the IMM 2017 State of the Market Report

Per MISO's June 2018 Memorandum to the Markets Committee of the Board of Directors, please find attached MISO's response to the IMM's 2017 State of the Market ("SOM") Report. This constitutes our official response to Dr. Patton's observations and recommendations. MISO has provided two forms of response to the 2017 report including both a narrative description responding to each recommendation and a summary presentation that will support the planned discussion with the Market's Committee of the Board.

As required under the tariff, our responses include the following:

- MISO's agreement or disagreement with each issue and with each solution presented by the IMM. In some instances MISO and the IMM have agreed to spend additional time exploring priority of recommendations and more fully detailed solution options for agreed upon market issues.
- MISO's underlying rationale for each response is based on a detailed assessment of any data and analysis provided by the IMM and other relevant context assembled by MISO staff.
- Next steps planned by MISO to address each recommendation includes specific timing (where possible) of such actions and our view of appropriate prioritization within MISO's forward work plans. Where SOM recommendations are Market Roadmap candidates, plans are subject to the Market Roadmap prioritization process. Prior to the December Board Week we will update our response to include the results of the Market Roadmap process and the associated impact on forward plans.

With respect to the Market Roadmap process, it has been very beneficial for the IMM to submit relevant SOM recommendations as formal candidates to the Market Roadmap prioritization that remains underway as of the date of this response publication. Along with the IMM's proposals, the Market Roadmap process also evaluates stakeholder and MISO project candidates for prioritization into the active work plan or deferral to the issues parking lot. The Market Roadmap process concludes each year with an updated product pipeline prioritization published by MISO management that is informed by advice given from all parties, including the IMM. MISO will update its response to reflect these priorities.

The prioritization work plan that emerges from the Market Roadmap process in November and this response to SOM recommendations will be presented and discussed during the December meeting of the Markets Committee of the Board.



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New Recommendation Responses

The 2017 State of the Market report contained seven (7) new recommendations. The following sections provide MISO's response to the recommendations as well as plans for these recommendations as appropriate.

2017-1: Improve the market power mitigation rules

IMM Recommendation:

The IMM recommends improvements to Module D provisions of the MISO Tariff including mitigation measures to ensure that the market power mitigation provisions are fully effective. These changes include impact of negative prices, price impact threshold for ancillary services, generation shift factor cutoff for Broad Constrained Area (BCA) mitigation and certain aspects of market power mitigation sanction calculations.

MISO Response:

MISO **agrees** with the IMM's statement of the issue and **agrees** with the recommended solution. Enhancing mitigation and sanction provisions in Module D will address evolving market conditions such as negative prices and BCA mitigation.

Status and Next Steps:

MISO will work with the IMM to develop more detail on specific tariff language changes, stakeholder engagement process, and system impacts to MISO and IMM processes and technology platforms. Target filing by end of Second Quarter 2019.

2018 Market Roadmap Priority (Members/IMM/MISO): Not a Market Roadmap Candidate, not assessed.



2017-2: Remove transmission charges from Coordinated Transaction Schedules (CTS) transactions

IMM Recommendation:

Coordinated Transaction Schedules (CTS) was implemented in 2017 representing a new platform to allow market participants to more dynamically schedule and sell energy between MISO and PJM. MISO applies transmission charges to CTS transactions when they are offered (not just when they are confirmed and “flow”). The IMM asserts these charges currently average \$6.24 per MWh on MISO imports from PJM and \$2.57 per MWh on MISO exports to PJM. The IMM recommends that MISO unilaterally eliminate all MISO charges from CTS transactions. Additionally, the IMM recommends that MISO eliminate the requirement that participants reserve transmission for CTS transactions since the RTOs can make interface adjustments by directly utilizing any and all available transmission capability in real time.

MISO Response:

MISO **agrees** that CTS is not performing as desired, however, MISO **requires further evaluation** of the recommended solution of eliminating transmission service reservations and associated charges. While the underperformance is a concern, based on MISO’s own quantitative and qualitative assessment, MISO has concluded that the impact of the IMM’s proposed solution would have, at best, limited impact on product use. Instead, MISO believes a more holistic approach to address impediments, including but not limited to the transmission charge issue noted by the IMM is needed to meaningfully improve the underperformance. Prior to the IMM recommendation, MISO had already been exploring these issues and proposes to continue that holistic assessment jointly with the IMM in the fashion noted below in the next steps section.

Since implementing CTS in October 2017, MISO has observed very low participation and very low clearing volumes of the product. Given the low participation, MISO uncovered significant issues impacting CTS profitability and CTS activity through detailed quantitative analysis and interviewing the most active CTS traders. Impacts included:

- Forecast errors – CTS transactions are cleared 75 minutes ahead of the market interval on forecasted interface prices. These forecasts have shown significant errors, impacting product clearing and bid strategies.
- Price risk – CTS transactions are cleared on actual ex-post interface prices. Market Participants bear all the settlement risk on differences between forecasted prices and ex-post prices.
- Cost allocation, including Transmission Service charges. While MISO has exempted CTS Transactions from certain uplift charges, MISO charges for Transmission Service Reservations. PJM has elected not to exempt CTS from uplift charges or Transmission Service Charges.
- Intra-hour scheduling flexibility - CTS was conceived and designed prior to FERC’s Order 764, requiring intra-hour scheduling flexibility. As a result, since mid-2015, Market Participants have the ability to submit and adjust schedules up to 20 minutes prior to the start of the scheduled interval, including within the hour. Based on outreach to stakeholders, potential CTS traders prefer intra-hour fixed schedules over CTS due to less expected price volatility and forecast error.



- MISO’s own estimate of transmission charges assessed to CTS bids is \$2.61 per MWh on MISO exports to PJM, while imports into MISO from PJM incur no transmission charges. The difference between MISO’s estimates for imports and the IMM’s estimates, noted above, is due to the availability and utilization of “Spot-In” service for imports which has no associated charges. For exports, the IMM based this charge on the Regional Through and Out rate; however, MISO has a \$0 out rate (Schedule 8) to PJM in order to eliminate the rate pancaking. The remainder of the \$2.57 is made up of scheduling, voltage, and MVP charges applied only to exports.

MISO has also concluded that while completely removing all transmission charges may slightly improve utilization of CTS, such an exemption may also preferentially treat CTS use of the transmission system over other uses. Generally, stakeholders want to ensure equitable payment for use of the transmission system. Reservations are the traditional way to ensure this, but other ways of allocating transmission charges after the fact exist in other markets. For example, ISO-NE and NYISO allocate transmission charges when CTS clears.

Status and Next Steps:

MISO will continue to evaluate the performance of CTS including a performance review of the first year’s results at the November, 2018 Joint and Common Market meeting with PJM. This issue was submitted as a Market Roadmap candidate by the IMM and was included for prioritization from stakeholders. MISO and voting stakeholders ranked this item as a low priority while the IMM ranked it as medium.

Pending the outcome of the final Roadmap prioritization in 2018, MISO will perform additional evaluation and analysis of the issues noted by traders including: forecast accuracy, price risk, and intra-hour scheduling flexibility. MISO will also work with the IMM to better identify appropriate actions.

2018 Market Roadmap Priority (Members/IMM/MISO): Low/Medium/Low (MR#66)

IMM Response to Further Evaluation:

The IMM disagrees the recommended solution requires further evaluation by MISO.



2017-3: Improve commitment classifications and implement a process to correct errors

IMM Recommendation:

The IMM has observed MISO operators sometimes misclassify commitments. Most cases have involved commitments of resources classified as capacity commitments or commitments to resolve the Regional Directional Transfer (“RDT”) constraint that are later determined to have been needed to manage other transmission constraints. It is imperative that MISO have a robust process for reviewing and correcting commitment classifications as needed. In addition, recognizing that commitments may often address multiple issues and constraints simultaneously, MISO needs clear procedures for determining the classification that is driven by cost-causation principles.

MISO Response:

MISO **agrees** with the issue described by the IMM that commitments may be misclassified by operators. MISO also **agrees** with the recommendation to develop processes and procedures for determining commitment classifications before the fact, and, reviewing, as appropriate, and correcting commitment classifications after the fact.

Status and Next Steps:

While MISO agrees with the recommendation, MISO does not currently believe this issue is a higher priority than other work already in the 2019 resource and budget plan and therefore will not receive immediate attention. MISO will conduct additional analysis, and planning work in the first quarter of 2019 to estimate the frequency and impact of the issue and use that assessment to determine appropriate prioritization in the multi-year plan. That plan will be developed by end of the first quarter of 2019 and would include a proposed implementation timeline for possible inclusion in the 2020 budget planning cycle.

2018 Market Roadmap Priority (Members/IMM/MISO): Not a Market Roadmap Candidate, not assessed.



2017-4: Improve operator logging tools and processes related to operator decisions and actions.

IMM Recommendation:

The IMM recommends that MISO upgrade its systems and procedures to allow operator actions to be logged in a more complete and detailed manner. In particular, the IMM suggests that the transition to the Market System Enhancement (MSE) could include enhancements to the logging tools to enable the improved logging.

MISO Response:

MISO **agrees** with the IMM's statement of the issue and we **agree** with the proposed solution. In fact, we have already proposed "Human Factor Enhancements" through the development of the draft Primary Business Requirements of the MSE program. Those enhancements could include operator logging tools.

Status and Next Steps:

The IMM has committed to review the published MSE Primary Business Requirements by end of Q4 2018 and provide any recommendations to ensure the concerns raised on this issue in the SOM recommendation are adequately addressed in the MSE program plans. MISO will update the MSE Primary Business Requirements in 2019.

The relative priority of enhanced logging tools has not been assessed in the MSE program to date and may not rise to the level of first tier improvements implemented concurrent with the new systems. As such, the timing of addressing this recommendation is uncertain and will become part of the ongoing prioritization process that will emerge from the MSE program for new feature implementation. At this time, this recommendation will be placed in the MSE scope for future prioritization.

2018 Market Roadmap Priority (Members/IMM/MISO): Not a Market Roadmap Candidate, not assessed.



2017-5: Evaluate the feasibility of implementing a 15-minute Day-Ahead Market under the Market System Enhancement.

IMM Recommendation:

By producing hourly schedules based on 60-minutes of ramp capability and hourly load forecasts, the day-ahead schedules cannot track the expected changes in real-time system needs, particularly during ramping periods. It also regularly results in generator schedule changes from hour to hour that are not feasible, which results in substantial make-whole payments. More granular day-ahead market schedules would lower these uplift costs and better prepare the system to respond to the real-time needs. Therefore, as MISO proceeds with the Market System Enhancement (MSE) effort, the IMM recommends MISO evaluate the feasibility of solving the day-ahead market with 15-minute scheduling intervals.

MISO Response:

MISO **agrees** that a more granular Day-Ahead Market would likely deliver some reliability and efficiency benefits through improved unit commitment and scheduling, reduced uplift, and more effective procurement of required system capabilities including ramping¹. MISO also **agrees** with the recommended solution to evaluate implementation feasibility for a Day-Ahead market that is configurable to shorter time intervals in the ongoing MSE requirements process. In fact, evaluation of intra-hour Day-Ahead Market is included with the draft MSE Primary Business Requirements. Currently planned further analysis and requirements definition will identify the impacts to performance, cost, and schedule, allowing for business case development and appropriate prioritization.

Status and Next Steps:

Initial draft Primary Business Requirements for the MSE were presented to the Board in September, 2018. MISO will work to finalize business requirements in partnership with our vendor and consortium partners as part of MSE program. MISO will update the MSE Primary Business Requirements in 2019.

2018 Market Roadmap Priority (Members/IMM/MISO): Medium/Low/Low (MR#68)

¹ California ISO Day-Ahead Market Enhancements Phase 1: Fifteen-Minute Granularity.
<http://www.caiso.com/Documents/SecondRevisedStrawProposal-Day-AheadMarketEnhancementsPhase1-Fifteen-MinuteGranularity.pdf>



2017-6: Require the ICAP of Planning Resources be Deliverable

IMM Recommendation:

MISO has implemented its deliverability requirements in a manner that is not comparable for the Network Resource Interconnection Service (NRIS) and Energy Resource Interconnection Service (ERIS) resources. The entire Installed Capacity (ICAP) level of the NRIS resources must be deliverable, but ERIS resources need only secure firm transmission for the Unforced Capacity (UCAP) level of their resources, which is less than the ICAP level. The IMM recommends that MISO determine deliverability for all resources based on the entire ICAP of applicable planning resources (both NRIS and ERIS resources).

The Planning Resource Auction requires deliverability for UCAP while Loss of Load Expectation studies utilize the full ICAP value (deliverable and not-deliverable) when calculating Planning Reserve Margin (PRM). This can create a discrepancy wherein portions of a resource's capacity used to set the PRM are not deliverable and thus possibly not able to be dispatched to serve load in real time.

MISO Response:

MISO **agrees** that, in general, the deliverability requirements for Planning Resources should be aligned with the resource ICAP volumes, but with a likely adjustment of certain intermittent resource types to reflect the expected maximum output of such resources at system and local peak conditions. In order to fully address the treatment of intermittent resources and determine the impact of the issue, MISO **agrees** with the general solution laid out by the IMM that will calculate UCAP with further consideration of deliverability without disqualifying resources in their entirety or requiring additional transmission service. However, MISO and the IMM require further evaluation to determine how this recommended solution would be adjusted for intermittent resources.

The premise of the IMM's recommendation is to ensure that sufficient deliverability exists to cover the full expected output from all units during summer peak. For most units, this requires deliverability up to the installed capacity of the generator. For wind and solar units, their expected output is typically 15 – 50% of their installed capacity during peak hours of the year, with the units being granted credit based on their average output during summer peak days. MISO will continue to work with the IMM to develop a comparable treatment for intermittent resources that ensures the deliverability of their expected summer output.

Status and Next Steps:

This issue was submitted as a Market Roadmap candidate by the IMM and was included for prioritization from stakeholders. MISO and voting stakeholders ranked this item as a low priority while the IMM ranked it as medium. The topic has since been raised at the Resource Adequacy Subcommittee (RASC), both by the IMM to clarify the issue and by MISO to include it in stakeholder priorities. Any resolution related to capacity deliverability requirements, including the appropriate treatment of intermittent resources noted above, will take time to address and implement because of the potential impacts to stakeholder capacity positions, especially owners of wind and solar resources, and related updates required within MISO's systems. MISO will work with stakeholders to implement for the 2020/21 Planning Resource Auction (PRA).



2018 Market Roadmap Priority (Members/IMM/MISO): Low/Medium/Low (MR#65)



2017-7: Establish PRA capacity credits for emergency-only resources that better reflect their expected availability and deployment performance

IMM Recommendation:

Emergency-only resources can sell and receive full credit for capacity but are only required to deploy during emergencies when instructed by MISO. While they are not required to offer energy day-ahead like other non-emergency resources, they may require MISO to give significant advance notice of the need to respond to a MISO emergency. While shorter notice periods are more common, the notice requirement can be as long as 12 hours ahead of use. These resources are compensated in the PRA because they can provide MISO with additional resources to manage emergency conditions. However, if they are not available to mitigate capacity shortages that occur early in the emergency events, then they are not providing the reliability value assumed in the planning studies and for which they are compensated. The IMM asserts that some emergency-only resources with long notification, start-up or shut-down times are essentially unavailable for emergencies because emergencies are typically not declared more than a few hours in advance of a shortage. The IMM recommends that LMRs and emergency-only resources receive full PRA capacity credit only if they are expected to be reasonably available in an emergency. This means their time to deployment (notification plus start-up time/shut-down time) should be less than a benchmark to be determined by MISO; possibly as little as one or two hours.

MISO Response:

MISO **agrees** that growing reliance on Load Modifying Resources and other emergency-only resources by Load Serving Entities to meet capacity requirements should be addressed in both markets and operations. However, MISO will **require further evaluation** to determine if we agree on the recommended solution. At present, all LMRs are expected to contribute to the reliable operation of the grid during emergencies and any actions that would impact a large class of resources available to meet emergency conditions may have unintended and potentially negative consequence. As such, in 2017 MISO previously identified this issue as part of a larger set of trends that should be addressed and began in January 2018 a comprehensive review with stakeholders of "Resource Availability and Need" that includes the noted emergency resources. That holistic process is ongoing and MISO believes that process with stakeholders remains the best approach to identifying feasible and effective solutions for this already identified issue.

Status and Next Steps:

MISO will evaluate this issue as part of the Resource Availability and Need (RAN) process. As part of the active RAN process, MISO stated during the October Reliability Subcommittee meeting that it intends to bring initial proposals for near term improvements for stakeholder review on November 1st. MISO intends to move quickly on some near term improvements on resource performance in advance of the next Planning Resource Auction in spring 2019. Such improvements would, in part, focus on improving the availability throughout the year as well as the manner and timing for LMR response during emergencies. This issue was submitted as a Market Roadmap candidate by the IMM and was included for prioritization from stakeholders.

2018 Market Roadmap Priority (Members/IMM/MISO): Low/Medium/Low (MR#67)



IMM Response to Further Evaluation:

IMM agrees that further evaluation is required.



Modified Existing Recommendations

The 2017 State of the Market report contained two existing recommendations that were materially modified this year. The following sections provide updates a response to the updated recommendations as well as progress, status, and plans for these recommendations as appropriate.

2012-3: Remove external congestion from interface prices

IMM Recommendation:

When MISO includes congestion associated with external constraints in its interface prices, the congestion pricing is inefficient because it is generally not accurate and duplicates the congestion pricing by the external system operator. The IMM continues to recommend that MISO eliminate the portions of the congestion components of each of MISO's interface prices associated with the external constraints.

MISO Response:

MISO **agrees** pricing could be improved by removal of external congestion, and achieved a bulk of improvements with PJM price reforms. Non-market interfaces could also benefit from improved congestion pricing. However, MISO **requires further evaluation** in order to develop costs, benefits and feasible solutions to the issue.

Initial evaluation shows that resolution will require solutions to be implemented in MISO's Market Systems. MISO is currently deferring work on implementing any solution until full implementation of Market Systems Enhancement.

Status and Next Steps:

Due to resource constraints, including focus on the Market System Enhancement, MISO is deferring further evaluation of this issue and recommendation, likely for at least the next few years. This item was not prioritized with other 2018 Market Roadmap items and will be **evaluated** pending staff availability and further investigation by MISO.



2015-1: Expand eligibility for online resources to set prices in ELMP and suspend pricing by offline resources

IMM Recommendation:

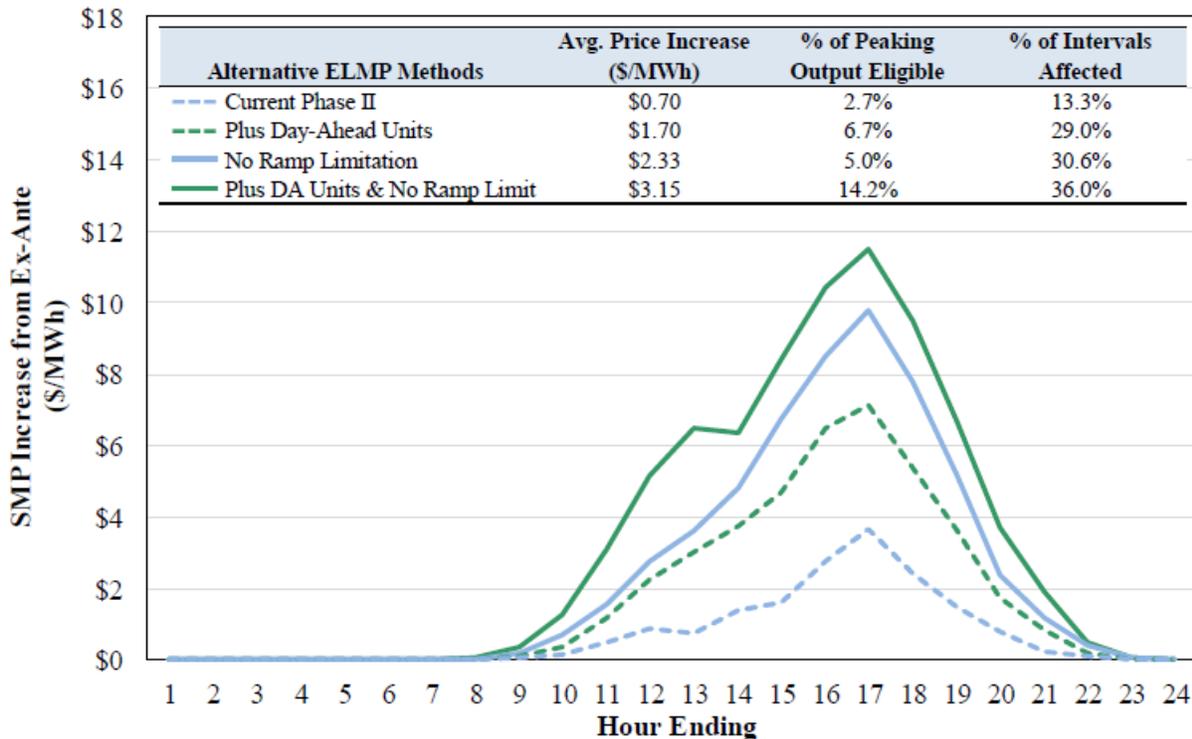
The IMM's analysis continues to indicate that, even with the Phase II changes, ELMP has not been effective in allowing online peaking resources to set prices when they are the marginal source of supply in MISO. The IMM recommends: expanding the price-setting eligibility to include peaking resources committed in the day-ahead market; relaxing the ramp-down limitation for peaking resources in the ELMP model; and, establishing constraints to ensure the quantity of capacity (energy plus reserves) does not increase or decrease in the ELMP model from the physical dispatch in the Unit Dispatch System ("UDS"). In addition, the IMM continues to recommend that MISO suspend the offline pricing, finding it generally results in inefficiently-low ELMP prices during shortage conditions.

MISO notes that the IMM has modified this recommendation in the 2017 report. Modifications include removing the element of expanding eligibility to include peaking resources with a minimum runtimes up to two hours², adding the elements of relaxing ramp-down limitations, and adding establishing constraints related to capacity in ELMP versus UDS. The chart below presented by the IMM at the September 18, 2018 Market Committed of the Board of Directors³ illustrates the impact of an on-line portion of recommendation.

² 2016 IMM State of the Market Report, p. 75.

³ <https://cdn.misoenergy.org/20180918%20Markets%20Committee%20of%20BOD%20Item%2006%20IMM%20Quarterly%20Report%20Summer%202018%20rev1275260.pdf>

Evaluation of ELMP Assumptions Summer 2018



MISO Response:

MISO's response to this recommendation is segmented into three parts given our varying perspectives on the IMM's three distinct recommended solutions.

First, MISO **agrees** with expanding online fast start pricing by including fast start resources committed in the day-ahead market and therefore **agrees** with the solution. MISO's Research & Development team utilized ELMP Phase III analysis work to prototype and simulate the recommendation of including day-ahead committed fast start units, confirming the IMM's pricing impacts. Including day-ahead committed units in real-time ELMP price setting is consistent with the Market Vision Guiding Principle to develop transparent market prices reflective of marginal system cost and cost allocation reflective of cost causation and service beneficiaries. While the change appears to be low in complexity; implementation of this enhancement requires a change to the Day-Ahead Real-Time system (DART), stakeholder discussion, and tariff modifications. Prioritization with other initiatives, including the Market Systems Enhancement, is required to determine scheduling and delivery of this change.

Second, for the issue of ramp relaxation, MISO **agrees** with the issue but **requires further evaluation** of the IMM's recommended solution. As part of ELMP Phase III research, MISO has already been exploring ramp modeling alternatives to best reflect supply conditions without



negatively impacting other aspects of market clearing and pricing under ELMP. MISO has been collaborating with the IMM to analyze ramp modeling, aligning on approaches and the complexity of the problem. MISO will publish the findings of our investigation into ramp modeling and relaxation in ELMP as early as Q4 2018. However, any identified solutions will involve market system software changes. And thus will require coordination with the Market System Enhancement and should be managed through the Market Roadmap depending on scope and impact.

For the issue with constraints related to capacity in ELMP versus UDS, MISO has reviewed the recommendation with the IMM and determined it is related to the relaxation of ramp in the ELMP model and will address it as appropriate in any proposed modifications to ELMP.

And third, while MISO has previously **disagreed** with the IMM recommendation to suspend offline fast start unit pricing in ELMP, MISO and the IMM have **agreed** to perform **further evaluation** into the use of offline unit pricing for Transmission Constraints alone. This assessment will be done in the context of MISO's guiding principal that led to the prior disagreement on this issue. MISO's overarching principal for pricing continues to be the use actual offers from actual resources is the most accurate way to reflect the cost of serving load in managing short transitory deficits in ancillary services or transmission. While the IMM would skip the step of looking first to available offline fast start units to set price, MISO has previously stated that only when such offers from physically available resources are exhausted should the price be instead set through administratively determined scarcity pricing. It is noteworthy that the use of offline resources when they are feasible and economic has been previously recognized by FERC as efficient⁴ and beneficial to the market.

Within that context, MISO and the IMM will look at specific instances where offline resources are setting prices on binding transmission constraints below administrative determined penalty prices and review the appropriateness and impacts.

Status and Next Steps:

As noted above:

- The Day-Ahead committed Fast Start Resources element of this recommendation is in **evaluate** status with expected timing of impacts and determination of our ability to implement by the first quarter of 2019, at which time we would be able to determine an implementation plan.
- MISO is **evaluating** the issue related to ramp relaxation of Fast Start Resources in ELMP through simulation during the first half of 2019 and anticipates working with the IMM to assess results of such simulations.

⁴ Order 825, at P.168. "Also, the shortage pricing proposal did not intend to require any changes to existing pricing methods, such as ELMP in MISO that allows offline resources to set energy prices, and we agree that the use of offline resources can result in efficient pricing"



- MISO has agreed with the IMM to **evaluate** the offline element of this recommendation related to the management of transmission constraints, and will do so through the first half of 2019.

Given the impact on common resources and potential for limited return on investment, the MSE program is coordinating all requests for material improvements to the legacy market systems. As such, MISO's Market System Enhancement team will be estimating and evaluating the cost and impacts of implementing changes to the legacy market systems for the elements of the recommendations where MISO agrees, allowing day-ahead committed fast start resources to set ELMP in the real time market.



Existing Recommendation Updates

The 2017 State of the Market report contains twenty existing recommendations that were not materially modified this year. The following sections provide updates on the progress, status, and plans for these recommendations as appropriate.

2010-14: Improve the modeling of demand in the Planning Resource Auction (PRA)

IMM Recommendation:

The use of only a minimum requirement and deficiency charges to represent demand in MISO's capacity market results in an implicit vertical demand curve for capacity. The IMM recommends a sloped demand curve, which would more accurately reflect the reliability value of capacity in excess of the minimum requirement. If a sloped demand curve cannot be implemented for all participants in the PRA, the IMM recommends MISO implement them for the competitive loads and suppliers.

Status and Next Steps:

MISO **disagrees** with this issue, and does not believe this recommendation is adequately supported by quantitative evidence, particularly for non-retail choice areas. Most rate-regulated entities manage resource adequacy requirements through their retail regulatory authority, which have decision rights on this issue. Using a sloped demand curve introduces quantity uncertainty towards meeting resource adequacy objectives, and does not align with the goals and timelines of the retail regulatory authority's planning processes.

With respect to retail choice areas, MISO continues to work with the states of Michigan and Illinois to develop state specific solutions to long term resource and reserve planning needs. Michigan passed resource adequacy legislation a few years ago. Illinois remains status quo and the Illinois Power Agency recently added a recommendation for 2-year forward procurement to its procurement plan.

Status (2017/2018): Inactive/ Inactive



2012-5: Introduce a virtual spread product

IMM Recommendation:

Nearly 70 percent of price-insensitive virtual bid and offer volumes (and five percent of all volumes) in 2017 were “matched” transactions. To the extent that the matched transactions are attempting to arbitrage congestion-related price differences, a virtual product to allow participants to do this based on price sensitivity would be more effective and efficient.

Status and Next Steps:

MISO originally **agreed** with this issue and the solution. Progress and prioritization of the issue remain impacted by concerns about technical feasibility in the legacy MISO market systems. Due to the detrimental impact on Day-Ahead Market technical performance, the project currently remains in low priority and no further work is planned until future the Market System Enhancement can address performance issues.

Status (2017/2018): Inactive/ Inactive



2012-12: Improve thresholds for uninstructed deviations

IMM Recommendation:

MISO's tolerance band is substantially more lenient than those of other RTOs, and effectively increases as the dispatch instruction increases. The IMM recommends MISO adopt thresholds based on resources' ramp rates that effectively differentiate poor performance from acceptable performance. Resources that are deemed to be deviating under these criteria should incur uninstructed deviation penalties and costs, lose eligibility to supply ancillary services and the ramp product, and forgo eligibility for PVMWP. Additionally, the IMM advises to remove the ramp and headroom on such units from the LAC in order to allow the LAC model to make better recommendations.

Status and Next Steps:

MISO has **agreed** with this recommendation and, with significant input from the IMM, recently presented the proposed solution at the May 2018 stakeholder Market Sub-Committee meeting. Extensive collaboration with stakeholders and the IMM produced extensive, mutually agreed upon revisions to tolerance bands and make-whole payment eligibility and computation. Draft Tariff language is in review, with a target for filing coincident with the writing of this report. Software construction is planned to begin in early 2019, with a second quarter 2019 effective date, subject to timely FERC approval.

Status (2017/2018): Design / Design



2012-16: Re-order MISO's emergency procedures to utilize demand response efficiently

IMM Recommendation:

As the capacity surplus falls in MISO, the peak needs of the system will increasingly be satisfied by interruptible load, behind the meter generation, or other forms of demand response. Unfortunately, these resources cannot be called by MISO before MISO has invoked nearly all other emergency actions. Further, most of MISO's demand response resources have very long notification times (e.g., 12 hours). The IMM recommends that MISO modify emergency procedures to allow it to utilize these resources in a more efficient manner.

Status and Next Steps:

MISO **agrees** that further investigation is needed for this issue and prioritized it as part of the broader "Resource Availability and Need" work that began in 2017 and has continued in 2018. Alternate solutions were discussed with stakeholders in September 2018 and are planned to be finalized by the end of 2018 and become effective for Planning Year 2019/2020. These solutions focus on options to call on emergency only resources in advance of predicted emergency conditions. The next steps are to collaborate with the IMM to identify practically feasible options and explore the proposed paths with Transmission Owners in more detail.

Status (2017/2018): Design / Design



2014-2: Introduce a 30-minute reserve product to reflect VLR requirements and other local reliability needs

IMM Recommendation:

MISO is incurring substantial RSG costs in a limited number of areas to satisfy VLR requirements. The IMM recommends that MISO create a local 30-minute reserve product in these areas so that these requirements can be priced and procured through MISO's markets (rather than through out-of-market commitments that result in uplift costs). The IMM also recommends that MISO consider establishing market-wide requirements for 30-minute reserves.

Status and Next Steps:

MISO agrees with this issue and has previously stated **general agreement** with the proposed solution. Short-term capacity that can provide energy within a relatively short period of time (e.g. 30 minutes) is an important tool for maintaining reliability. It provides the ability to manage capacity needs that may not be efficiently addressed by shorter notice higher cost Operating Reserves or MISO's Ramp Capability Reserve product.

MISO is currently completing conceptual design of the Short-Term Reserve product (the Market Roadmap project addressing this IMM recommendation). The forecasted implementation date, per the Market Roadmap is 1Q 2021 however, due to the required tight integration with other market products this schedule is subject to potential impacts from prioritization of the broader Market System Enhancement effort.

Status (2017/2018): Evaluate / Design

2018 Market Roadmap Priority (Members/IMM/MISO): High/High/High



2014-3: Improve external congestion related to TLRs by developing a JOA with TVA

IMM Recommendation:

The integration of MISO South has increased the frequency of TLRs called by TVA. Substantial benefits for MISO could be achieved by developing a Joint Operating Agreement that would allow MISO's day-ahead scheduled flows to be considered firm in the relief calculations. In addition, the TLR process could be replaced with a coordination process that would allow MISO and TVA to procure economic relief from each other.

Status and Next Steps:

MISO originally **agreed** with this issue and the recommended solution. We are progressing on a solution, but that progress is subject to external dependencies.

This issue is largely driven by TLR on TVA flowgates and resolution requires reaching a mutually agreeable approach with at least TVA and for many solutions multiple other parties. Currently MISO is involved in three efforts that will help to address the inefficiencies identified by the IMM from TLR on TVA flowgates, see description and timeline of the three efforts below:

First, MISO is working with TVA and others (e.g., SPP, PJM) as part of what is called the Congestion Management Process (CMP) Working Group to enhance the methodology currently used to calculate firm and non-firm flows on flowgates used to determine TLR relief requests, which is referred to as the freeze date. Updating this methodology should better reflect how the system is operated today and help to reduce the inefficiencies identified by the IMM. Reaching resolution on this item is complicated by the fact it requires getting agreement with multiple parties in addition to TVA. Target date for completion is end of 2018, but multiple key components remain undecided.

Second, MISO is involved with an industry-wide effort coordinated by NAESB and NERC to improve upon the Transmission Loading Relief (TLR) process by improving the real-time data and resulting visibility of the source and magnitude of flows on the bulk electric system, allowing reliability coordinators within the Eastern Interconnection to better assign more representative relief obligations during periods of congestion. This effort is known within the industry as Parallel Flow Visualization (PFV) and industry testing is scheduled to wrap-up in Q1 2019.

Third, MISO has started discussions with TVA on the possibility of implementing a more targeted congestion management process such as a redispatch agreement for areas of consistent congestion. This ultimately along with other enhanced seams coordination items could be codified in a Joint Operating Agreement. This is a longer-term effort that will continue into late 2019.

Status (2017/2018): Externally Dependent / Externally Dependent



2014-5: Transition to seasonal capacity market procurements

IMM Recommendation:

Both the needs of the system and the available system supply change substantially from one season to the next. The IMM recommends that MISO clear the PRA on a seasonal basis rather than on an annual basis to account for these changes.

Status and Next Steps:

MISO **agrees** that “seasonal” needs are becoming more critical in light of increased Emergency Declarations and real-time operational challenges during non-summer seasons. However, MISO has previously stated that the merits of the particular approach recommended by the IMM are uncertain. As such, this issue and possible solutions that address seasonality benefits has been folded into the broader “Resource Availability and Need” process. The specific timing for addressing seasonal issues remains subject to stakeholder process consideration.

Status (2017/2018): Evaluate / Evaluate

2018 Market Roadmap Priority (Members/IMM/MISO): Medium/Low/High (MR#25)



2014-6: Define local resource zones primarily based on transmission constraints and local reliability requirements

IMM Recommendation:

Currently a local resource zone cannot be smaller than an entire Local Balancing Authority Area or LBA. In some cases, however, capacity is needed in certain load pockets within an LBA. The IMM recommends that MISO adopt procedures for defining capacity zones that would allow the zones to be determined by transmission constraints and other local reliability needs rather than the historical boundaries that are unrelated to the transmission network.

Status and Next Steps:

MISO **agrees** with the IMM and will evaluate after near-term priorities on Resource Availability and Need. The largest point of contention is alignment of our processes with state and local jurisdiction over resource adequacy. This will complicate redefining the zones, and modeling transmission constraints which are not driven by zonal resource adequacy clearing. Due to other priorities, this issue is **inactive** in MISO's work plan.

If this issue were prioritized, estimated time to fully create and vet solutions is 18 – 24 months and would rely upon resources used for other Resource Adequacy updates (including near term locational, Resource Availability and Need (RAN), and other IMM SOM recommendations).

Status (2017/2018): Inactive/ Inactive



2015-2: Expand utilization of temperature-adjusted and short-term emergency ratings for transmission facilities

IMM Recommendation:

The IMM recommends MISO work with transmission owners to ensure more complete and timely use of both temperature-adjusted ratings (or use of dynamic factors such as conductor temperature, actual ground clearance, and actual and forecasted weather) and short-term emergency ratings. Additionally, the IMM recommends that MISO work with its transmission owners to establish a consistent rating methodology to communicate an expectation that emergency ratings should be based on short-term temperature-adjusted ratings.

Status and Next Steps:

MISO originally **agreed** with this IMM recommendation and proposed solution in responding to the 2015 State of the Market Report. MISO continues to evaluate and frame the issue including continuing pilot programs with individual Transmission Owners. Due to resource limitations associated with the Market Systems Enhancement, MISO may have limited ability to advance this issue in the next several years and is not currently in the active work plan.

Status (2017/2018): Evaluate/ Evaluate

2018 Market Roadmap Priority (Members/IMM/MISO): Low/High/Low (MR#54)



2015-5: Implement firm capacity delivery procedures with PJM

IMM Recommendation:

Pseudo-tying units to PJM will impose substantial costs on the joint region by reducing dispatch efficiency and reliability. Additionally, the reduced dispatch efficiency will impose substantial potential cost exposure on both RTOs as the number of market-to-market constraints has and will continue to increase substantially. The IMM has developed proposed “Capacity Delivery Procedures” that would facilitate the delivery of MISO capacity to PJM without incurring the adverse effects of pseudo-tying the resources. The IMM recommends that MISO work with PJM to develop these, or similar procedures to serve as an alternative to pseudo-tying MISO’s resources to PJM.

Status and Next Steps:

MISO **agrees** that pseudo-tied generation that lacks local visibility has implications for reliability, costs, unit commitment/de-commitment processes, congestion management and other operational functions in the MISO footprint. MISO and PJM have coordinated closely to on reliability issues related to pseudo-ties, and we have mitigated potential reliability implications.

MISO worked extensively with the IMM, Stakeholders and PJM and made a proposal to implement this recommendation at the May 2016 PJM Joint & Common Market Meeting. To date, however no agreement has been reached with PJM. The IMM has proposed an alternate solution through the FERC Section 206 complaint process, where PJM responded it is not interested in pursuing this option.

Status (2017/2018): Externally Dependent / Externally Dependent



2015-6: Improve the modeling of transmission constraints in the Planning Resource Auction (PRA)

IMM Recommendation:

MISO employs a relatively simple representation of transmission limits in the PRA, generally modeling only aggregate import and export limits to and from each capacity zone. Additionally, MISO accommodates the transfer limitations between the MISO South and Midwest regions as an additional constraint. The IMM recommends that MISO add the RDT and transmission constraints to its auction model as needed to address potential simultaneous feasibility issues and to reflect the differing impact of zonal resources on regional constraints.

Status and Next Steps:

MISO originally responded that **further evaluation** of the issue and recommendation was required.

A high level of effort would be required to develop a solution to this issue along with the linked issue 2014-6. Considerations of jurisdictional authority over resource adequacy, use of the signals from the OMS MISO survey, PRA, and LOLE studies in these local jurisdictions, and proper technical solutions provide more insight into local resource adequacy needs. Requested time to fully create and vet solutions would be approximately 18 – 24 months and relies upon resources used to other Resource Adequacy updates (including near term locational, Seasonal RAN, and other IMM SOM recommendations). This will also likely need to be paired with an effective capacity hedging solution.

Expected impacts include potential redesign of PRA clearing logic and constraint modeling, reevaluation of LOLE study processes (focusing primarily on CIL and CEL impacts), and potential elimination of the Simultaneous Feasibility Test.

MISO agreed with IMM to evaluate after near-term priorities on “Resource Availability and Need” (targeted towards PY 2021/2022).

Status (2017/2018): Inactive/ Inactive



2016-1: Improve shortage pricing by adopting an improved contingency reserve demand curve that reflects the expected value of lost load

IMM Recommendation:

The IMM recommends that MISO reform its Operating Reserve Demand Curve (ORDC). The IMM states that MISO's current ORDC does not reflect reliability value because it overstates the reliability risks for small, transient shortages and understates them for deep shortages. An optimal or "economic" ORDC would reflect the "expected value of lost load", equal to: "probability of losing load" * "net value of lost load (VOLL)".

Status and Next Steps:

MISO **agrees** with the IMM's description of this issue and has previously stated general agreement with the solution proposed. Initial review work has been underway in 2018, but future implementation will need to be prioritized as part of the MSE effort and its oversight of upgrades to legacy market systems. At this time, this has not been prioritized for implementation in the legacy systems.

While the notional concept is agreed upon, the details required to implement were not proposed by the IMM and much work is required to develop an implementable product. This project will also require substantial stakeholder engagement and advice. Key needs to be evaluated in 2019 include: (1) development of a new methodology to create the loss-of-load probability curve for different reserve levels; and, (2) establishing a reasonable cost of shedding firm load (a.k.a. Value of Lost Load). Increasing the VOLL from today's tariff level \$3,500/MWh to something like the IMM's proposed \$10,000/MWh will very likely generate "strong interest" from regulatory bodies and load-serving entities. There is no established timeline to implement this recommendation, but it remains on the Market Roadmap awaiting additional prioritization.

Status (2017/2018): New / Evaluate



2016-2: Improve procedures for M2M Activation and Coordination including identifying, testing, and transferring control of M2M Flowgates

IMM Recommendation:

The IMM's analysis indicates that, in 2017, \$243 million of congestion costs could have been more effectively managed if M2M coordination testing and activation procedures were more complete and timely. The IMM recommends that MISO improve the automation of its procedures for: identifying and making timely requests for M2M testing of new constraints; logging of the M2M testing requests and validating testing results; promptly activating M2M constraints; and transferring of monitoring of M2M constraints when it would be beneficial to do so.

Status and Next Steps:

MISO **agrees** with the issue and has developed new tools to identify real time constraints that could qualify for M2M coordination based on several tests in the JOA, including estimation of total market flow impacts. MISO has implemented procedures around when to test candidate constraints for M2M coordination. Additionally, MISO and SPP have implemented Power Swing software which includes a process for allowing the Non-Monitoring RTO the ability to control to physical flow instead of market flow. This change addresses the IMM's concern with transfer of control. This software is also being pursued with PJM.

While some effort remains to finalize the procedure for identifying and testing real time constraints for M2M coordination MISO expects to implement the software with PJM in Q1 of 2019 and work continues with SPP to expand use of the tool.

The new tools and procedures put in place in 2018 to identify and test these real time constraints, which would qualify for M2M, have reduced the amount of time they are left uncoordinated. The IMM's Quarterly Summer assessment delivered at the October 2018 Market Subcommittee highlighted market results demonstrating the effectiveness of these changes.

Status (2017/2018): New / Implement



2016-3: Enhanced Transmission and Generation Planned Outage Approval Authority

IMM Recommendation:

ISO New England has the authority to examine economic costs in evaluating and approving transmission outages. It can deny or move outages if doing so will result in “significantly reduced congestion costs.” The ISO New England program has been found to be very effective at avoiding unnecessary congestion costs. The IMM recommends that MISO explore alternatives to improve coordination of transmission and generation outages, including expanding its outage approval authority to include some form of economic criteria for approving and rescheduling planned outages.

Status and Next Steps:

MISO **agrees** with the issue. In our 2016 response we indicated engagement with stakeholders on the way forward was needed and have been working with stakeholders through the Resource Availability and Need initiative to discuss alternatives. However, MISO does not agree with the administrative solution proffered by the IMM. As such, this issue has been a key element of the discussions on the RAN effort in 2018.

MISO has committed to filing with FERC improvements to address RAN issues in the coming months with intent to implement some improvements as early as ahead of the 2019-2020 Planning Year. The specific timing for addressing outage coordination issues remains subject to stakeholder process consideration, but MISO is striving for shorter term improvements to be in place in time for the 2019/20 planning year. The major focus of these initial efforts will be on accreditation and forecasting. The question of additional outage authority will be revisited by the end of 2019.

In addition to changes that may be part of the RAN effort, enhancements to the existing Outage Coordination process are the next major milestone, scoping in 2019 with implementation in 2020.

Status (2017/2018): New / Evaluate



2016-4: Establish regional reserve requirements and cost allocation

IMM Recommendation:

In 2017 the IMM continued to identify a substantial number of resource commitments and associated RSG payments made in MISO Midwest and MISO South to satisfy regional capacity needs when the Regional Dispatch Transfer constraint was binding or potentially binding. These commitments are made outside of the market because MISO's markets do not include regional capacity requirements. The IMM notes that the 30-minute reserve product recommended in 2014-2 could be expanded to reflect these regional capacity needs.

Status and Next Steps:

MISO **agrees** with this issue. As the IMM indicates, MISO is pursuing this recommendation as part of the Short-Term Reserve Product, the Market Roadmap project MR#10 solution addressing the "Introduce a 30-minute reserve product to reflect VLR requirements and other local reliability need" (2014-2) recommendation. This work continues to move forward with a target implementation in 2021 subject prioritization as part of the broader market system enhancement effort.

Of note, MISO recently implemented the Reserve Procurement Enhancement on the Regional Directional Transfer limit constraint to procure deliverable reserves, price the cost of maintaining deliverability, and establish mitigation measures on the regional constraints. The IMM identified a regional capacity need driven by the Regional Directional Transfer constraint that is currently addressed by commitments incurring significant uplifts. The IMM recommends utilizing a short-term reserve product to address this regional capacity need more efficiently.

Status (2017/2018): New / Design

2018 Market Roadmap Priority (Members/IMM/MISO): High/High/High (MR#10)



2016-5: Reform DAMAP and RTORSGP rules to improve performance incentives, and reduce gaming opportunities and unjustified costs

IMM Recommendation:

The IMM's evaluation of DAMAP and RTORSGP reveals that significant amounts were paid to resources that were not performing well, essentially failing to follow dispatch without failing performance criteria. The IMM recommends that MISO incorporate a performance metric in the calculation of these make-whole payments that would reduce the payment by the amount that corresponds to resources' dispatch deviations.

Status and Next Steps:

MISO **agreed** with the recommendation to reform these uplift rules and engaged stakeholders and the IMM on a solution, which was conceived and agreed upon during 2nd Quarter of 2018. Extensive collaboration with stakeholders and the IMM produced consensus revisions to tolerance bands and make-whole payment eligibility and computation. Draft Tariff language is currently being reviewed with a target of October 2018 for filing with FERC. Software construction would begin in 2019, with a second quarter 2019 effective date subject to timely FERC approval.

Status (2017/2018): New / Design



2016-6: Improve the accuracy of the Look Ahead Commitment (LAC) recommendations

IMM Recommendation:

The IMM's evaluation of the LAC results in 2015 and 2016 indicates commitment recommendations are not accurate. The IMM also found that operators only adhere to 32 percent of the LAC recommendations, which may be attributable to the inaccuracy of the recommendations. The IMM recommends that MISO identify and address other sources of inaccuracies in the LAC model and, in conjunction with the IMM, develop procedures and logging processes to record operator decisions to respond to the LAC recommendations.

Status and Next Steps:

MISO **agrees** with this recommendation and sees merit in LAC accuracy improvements, and we have taken several shorter-term actions to better understand the inefficiencies in LAC and better evaluate the root issues. Specifically, MISO implemented in 2018 the "Optimal Dispatch Calculator" to better quantify LAC commitment accuracy and has enhanced the LAC engine with Day-Ahead Security Constrained Unit Commitment (DA SCUC) polishing functionality to better quantify commitment decisions in the engine. These two items enable MISO to better understand LAC decision quality, including what is causing sub-optimal commitment decisions. While operators now have the benefit of the information provided by these new tools, improvements that may incorporate some of this capability to the LAC system itself will now be prioritized as part of the broader Market System Enhancement effort that could stretch out as far as 2024.

Status (2017/2018): New / Evaluate



2016-7: Improve forecasting incentives for wind resources by modifying deviation thresholds and settlement rules

IMM Recommendation:

Dispatchable wind resources in MISO have a strong incentive to over-forecast their output in real time to maximize production. The IMM recommends MISO make the following two changes to improve the incentives of wind resources: 1) Consider a modified Excessive Energy threshold for wind resources that would allow these resources more latitude to exceed their dispatch levels (i.e., their forecasted output) when it will not cause congestion; 2) Modify the Excessive Energy settlement to help balance the Excessive and Deficient Energy settlements that wind resources face associated with forecast errors.

Status and Next Steps:

MISO **agreed** that an opportunity existed to improve participant incentives for accurate forecasting. Resource owners are incentivized to maximize production from wind resources, while performance criteria impacting energy revenues and make-whole payments allow for inaccurate forecast submittal to MISO's real time dispatch. MISO worked extensively with stakeholders and the IMM in 2017 and 2018 and achieved a broadly accepted solution that, while different from the original IMM recommendation, address the concerns and was agreed upon by the IMM.

The final solution to improve Excessive and Deficient Energy tolerance band is expected to better incent more accurate forecasts. Draft Tariff language is currently in stakeholder review, with a target of October 2018 for filing. Software construction possible with MISO recently implemented new Settlement System is planned for early 2019 with a second quarter 2019 effective date subject to timely FERC approvals.

MISO will continue to evaluate forecast performance, including the MISO Dispatchable Intermittent Resources forecasts for Wind and determine the need for additional tariff, systems and business practices changes.

Status (2017/2018): New / Design



2016-8: Validate wind resources' forecasts and use results to correct dispatch instructions

IMM Recommendation:

MISO does not validate the accuracy of wind suppliers' forecasts used to develop dispatch instructions for the DIRs. Because the MISO dispatch uses these forecasts as the dispatch maximum, the lack of validation makes the MISO energy dispatch subject to chronic shortfalls related to the over forecasting. The IMM recommends that MISO develop appropriate operating procedures, including any necessary Tariff provisions to implement performance standards, in order to validate market participant forecasts.

Status and Next Steps:

MISO **agrees** that wind forecasts can be improved; however, MISO has proposed an alternative solution to address the issues.

MISO has established a monitoring and alerting process (Wind Alerting System tool) for when market participant submitted forecasts that are not accurate. MISO is currently monitoring DIR forecast submittals. The IMM 2012-12 and 2016-7 (and Market Roadmap #40) recommendation could resolve the market submitted DIR over-forecasting concerns, as Market Participants will be incentivized to choose MISO's DIR forecast over their own, which has been observed to be of better quality compared to many market participant submitted forecasts. And those that continue to submit their own forecasts will be subject to tighter uninstructed deviation thresholds (2012-12) and low uplift payments (2016-7) when forecast are off.

MISO will be evaluating the impact of the solutions that will be implemented in response to 2012-12 and 2016-7 recommendations prior to enacting next steps on this recommendation. If reliability and/or inefficiency concerns remain, MISO would propose implementing system changes that would replace a Market Participant forecast with the MISO generated forecast, when an erroneous forecast was identified by the Wind Alerting System. Subsequently, when the Market Participant forecast becomes more accurate, the system would switch back to using the Market Participant forecast.

Status (2017/2018): New / Evaluate



2016-9: Qualification of Planning Resources and Treatment of Unavailable Resources

IMM Recommendation:

Resources with no reasonable expectation of being available during system peak conditions should not qualify as planning resources. Current market rules and Tariff provisions do not impose requirements that market participants with inoperable units downgrade their operating status.

The IMM recommends that MISO require unavailable resources to be suspended and not qualified to sell capacity if they will not be operable during the peak season of the upcoming planning year.

Status and Next Steps:

MISO **agrees** with this issue, but believes a more holistic approach than is recommended by the IMM is needed to adequately and efficiently address it. MISO independently identified growing risk of outages as part of the resource adequacy issues statement in 2015. As such, In 2017 MISO included this issue to be part of the larger “Resource Availability and Need” effort. MISO began in January 2018 a broad and comprehensive review with stakeholders of “Resource Availability” that includes addressing unavailability of resources due to outages among a number of interrelated issues. That holistic process remains underway. MISO believes the already in flight process with stakeholders remains the best approach to identifying feasible and effective solutions for this already identified issue. MISO expects to make recommendations in the next 6 months intended to improve performance in this area.

Status (2017/2018): New / Evaluate