



Planned Maintenance Modeling

Loss of Load Expectation (LOLE)
Working Group

February 3, 2025

Purpose & Key Takeaways



Purpose:

Review the problem statement around planned maintenance in the LOLE model and discuss sensitivity results.

Key Takeaways:

- MISO sincerely appreciates the feedback received from our stakeholders on this topic and will continue to work toward an adequate solution for the PY 2026-2027 LOLE model.
- It is important to note that during this discussion, MISO is not recommending changing the source or range of data that will be collected in determining the appropriate quantity of planned maintenance in the LOLE model. Planned maintenance rates are derived from PowerGADS and will continue to be an average over the last 5 years of historical data.
- After conducting several sensitivities around this topic, MISO believes it could be appropriate to adjust planned maintenance in the LOLE model for both the Planning Reserve Margin (PRM) and Local Reliability Requirement (LRR) analyses. As a result, both analyses would have the same maintenance profile that mirrors a similar annual schedule to MISO operations.

MISO Response to Stakeholder Feedback on Planned Maintenance in the LOLE Model

Feedback Category	Stakeholder Comments	MISO Response
Support	<p>All feedback submissions supported MISO’s efforts to take a deeper dive into the modeled LOLE planned maintenance, however, there were requests to continue discussion on this topic before changes are implemented for the PY 2026-2027 LOLE model.</p>	<p>MISO appreciates the feedback received from the stakeholder community on this topic and will continue to work diligently toward a solution. This topic will remain a topic of discussion at the LOLEWG meetings until a path forward on how to best incorporate these changes into the LOLE model is reached.</p>
Areas of Concern	<ul style="list-style-type: none"> • Do not support the use of the PRM planned maintenance schedule in the LRR studies. • Believe that MISO should continue to use a 5 year look back period for determining planned outage rates used in the LOLE study. • Believe that annual planned maintenance rate inputs should continue to be used in the LOLE study because it will produce more stable modeling results. 	<p>Once the correct path forward has been identified for planned maintenance, MISO expects that both the planned maintenance used in the PRM and LRR analyses will align and be more optimized zonally, similar to MISO operations.</p> <p>MISO will continue to use 5 years of historical planned outage data in its LOLE study analysis. Additional testing may still be done with seasonal planned maintenance rates once updates to MISO’s probabilistic modeling software are made.</p>
Request for Clarifications	<ul style="list-style-type: none"> • Want clarifications on whether new planned outage assumptions would affect the PRM or LRR or both. • General confusion about the implications of this discussion and what the impacts of these changes might be. 	<p>At the December 2024 LOLEWG, MISO discussed the misalignment between planned maintenance in the LOLE model and what is currently seen in MISO operations throughout the last several years per region. At the February 2025 LOLEWG meeting, MISO will continue this discussion, redefine the problem statement, and detail the resulting impacts these planned maintenance changes could have in future LOLE studies. MISO will additionally continue to discuss this topic at the LOLEWG and encourages stakeholders to reach out through the help center if additional questions or needed clarifications arise.</p>

Problem Statement

Planned maintenance outage schedules in the LOLE model do not align with historical operational schedules which lead to seasonal and zonal misalignment between operations and resource adequacy models.

Why change this and when do we implement?

- MISO and stakeholders have discussed this issue over the past several years. Given recent tariff filings, it is crucial that inputs align with how the MISO system is operated today so that we can better account for emerging system risks. MISO aims to better align planned maintenance schedules between operations and resource adequacy models in the Planning Year 2026-2027 LOLE model.

What will be affected?

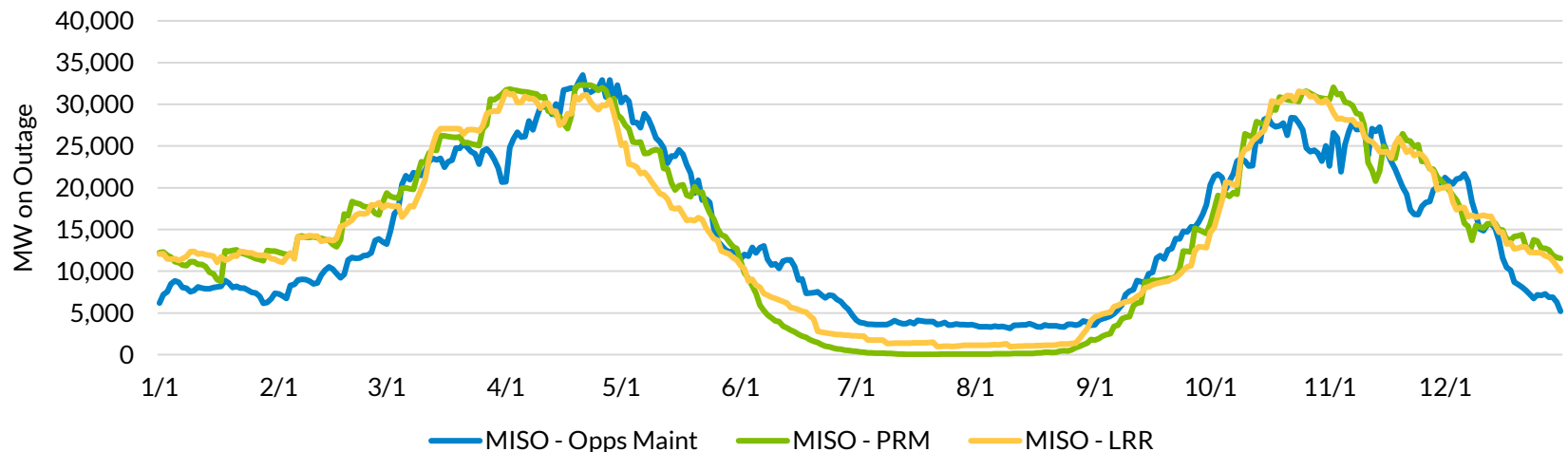
- Planned maintenance schedule changes will affect both PRM and LRR results in the LOLE study. The goal of this is to align planned maintenance schedules in both the PRM and LRR analysis with a more optimized regional schedule, or planned maintenance shape, like what occurs in MISO operations.

Sensitivity 1: Seasonal Optimized Planned Maintenance Schedule

General Update: The SERVVM program does not have the capability to input seasonal planned maintenance rates into the model currently, however, we are able to input a profile that determines the annual maintenance shape for these types of outages.

- In this sensitivity, outage rates and total MW outages remained the same, but their annual schedule was shifted to mirror what has been occurring in MISO operations. This was done for each of the 10 LRZs and combined to get the full MISO planned maintenance shape.

Operational, PRM, and LRR Planned Maintenance Shapes



Sensitivity 1: Next Steps

- MISO is not yet done with sensitivity 1 at this time but will present the results of this analysis at the April LOLEWG.
- Wind and solar ELCC and cold weather outage sensitivities are still being completed so that we may determine the full impacts this new maintenance schedule would have had to the Planning Year 2025-2026 UCAP PRM values.

Sensitivity 2: System-wide determined maintenance input into the LRR analysis, Summer and Winter

Summer 2025

LRZ	Zonal Maintenance LRR%	System Maintenance LRR%	Delta
1	119.45%	120.63%	1.18%
2	113.49%	117.88%	4.39%
3	131.84%	132.38%	0.54%
4	127.99%	127.83%	-0.16%
5	130.10%	130.29%	0.19%
6	126.18%	128.12%	1.94%
7	113.80%	114.24%	0.45%
8	135.03%	133.95%	-1.08%
9	113.56%	115.22%	1.66%
10	144.71%	144.98%	0.28%

Winter 2025-2026

LRZ	Zonal Maintenance LRR%	System Maintenance LRR%	Delta
1	126.65%	131.77%	5.12%
2	135.29%	142.75%	7.46%
3	163.19%	168.24%	5.05%
4	118.58%	125.83%	7.25%
5	125.39%	127.30%	1.91%
6	124.75%	127.27%	2.52%
7	144.74%	147.84%	3.10%
8	156.58%	157.70%	1.12%
9	129.72%	135.58%	5.86%
10	162.79%	167.48%	4.69%

Values in the zonal maintenance columns represent the final Local Reliability Requirements per zone that were identified for PY 2025-2026 in the LOLE study. Values in the system maintenance columns represent what the LRR percentages would have been, if the planned maintenance schedule determined for the MISO system-wide was enforced in these LRR analyses.

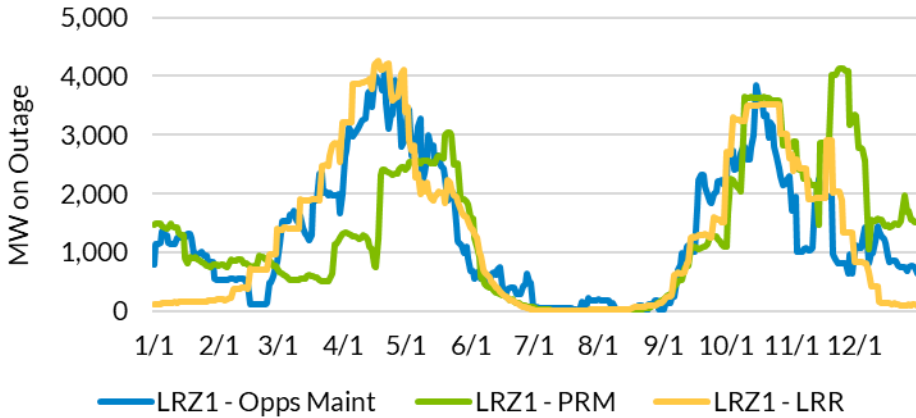
Next Steps for Planned Maintenance

- Moving forward with this analysis, MISO will fine tune the results of sensitivity 1 to determine the full impacts on the UCAP PRM value with this new planned maintenance schedule.
 - Results will be presented at the April LOLEWG.
- MISO will also revisit the 80/20 distribution of planned maintenance.
 - This currently plans 80% of all the maintenance needed based on the average peak net loads across all 30 weather years while holding the remaining 20% of maintenance to plan based on case specific peak net load.

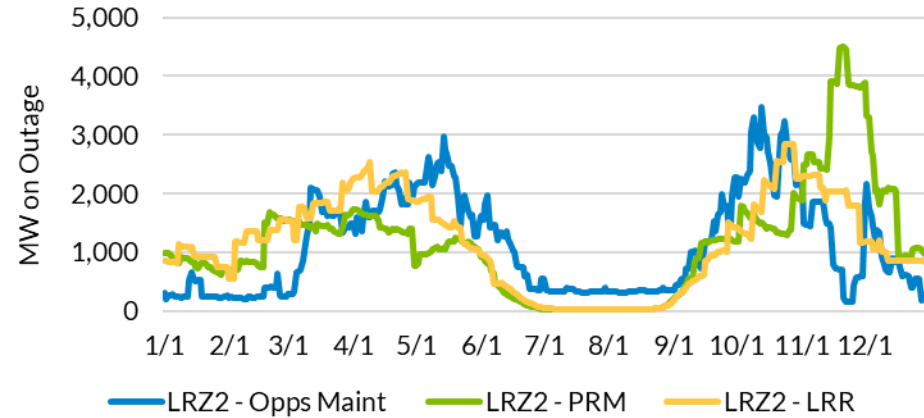
Appendix

Sensitivity 1: Operational, PRM, and LRR Maintenance Shapes by LRZ, 1-4

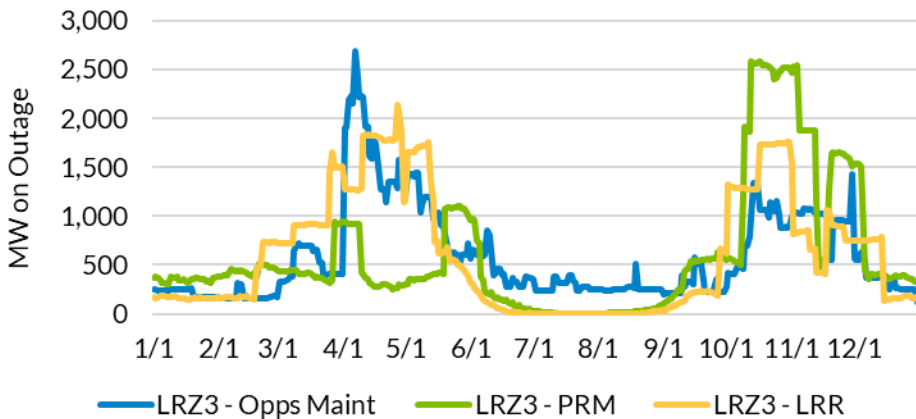
LRZ1 Maintenance Shape



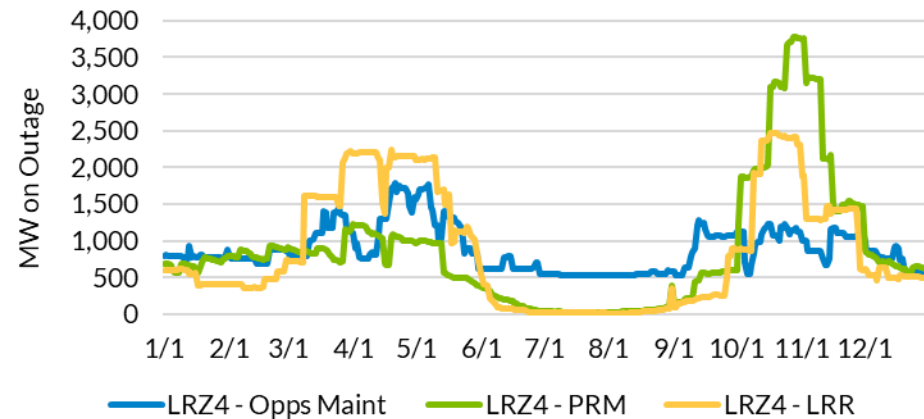
LRZ2 Maintenance Shapes



LRZ3 Maintenance Shapes

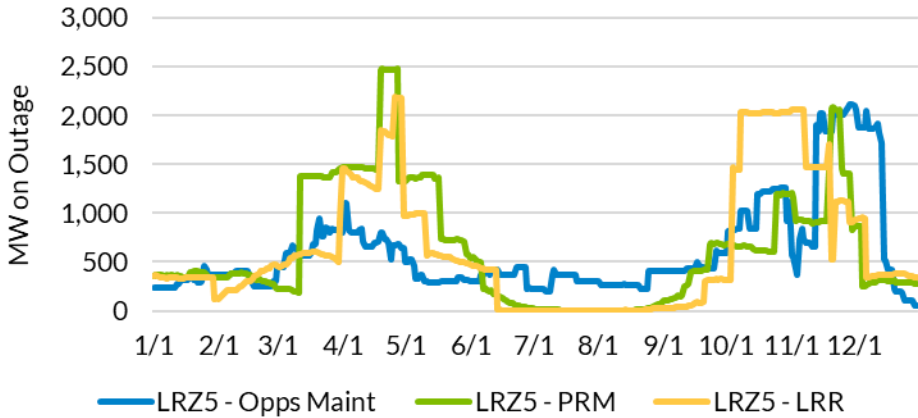


LRZ4 Maintenance Shapes

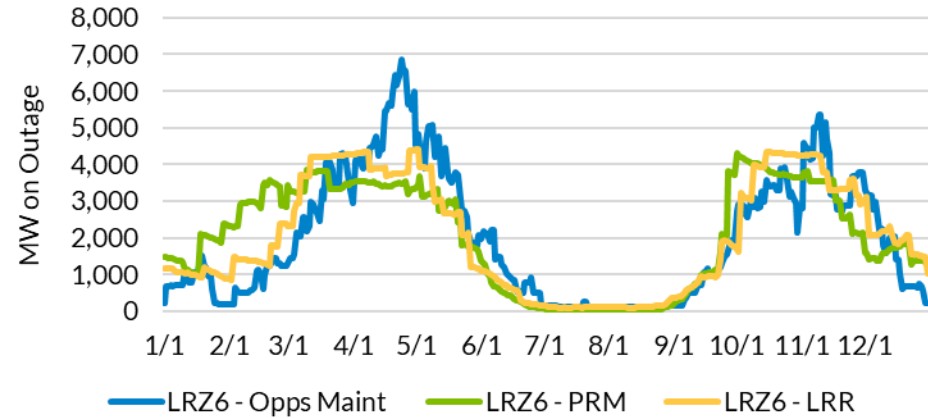


Sensitivity 1: Operational, PRM, and LRR Maintenance Shapes by LRZ, 5-7

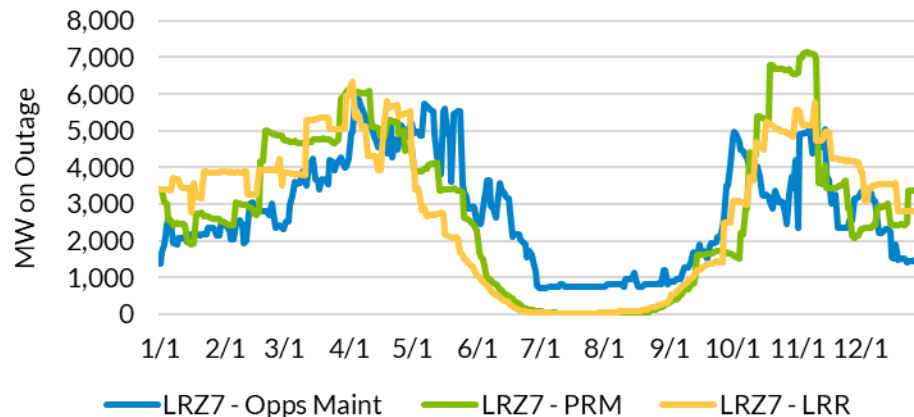
LRZ5 Maintenance Shapes



LRZ6 Maintenance Shapes

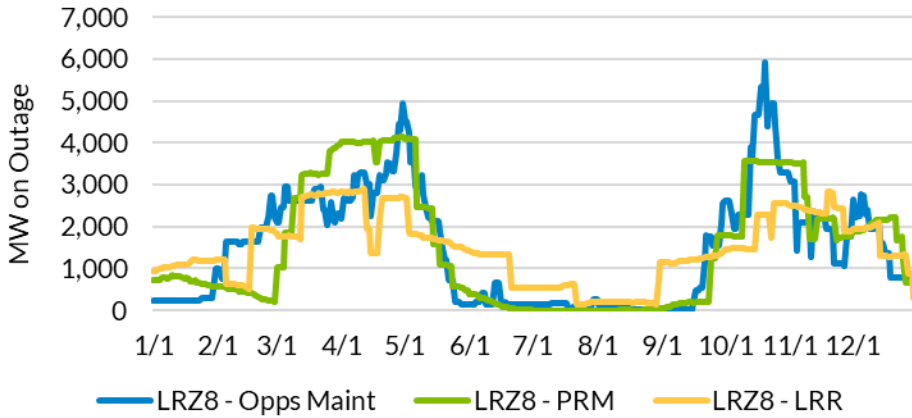


LRZ7 Maintenance Shapes

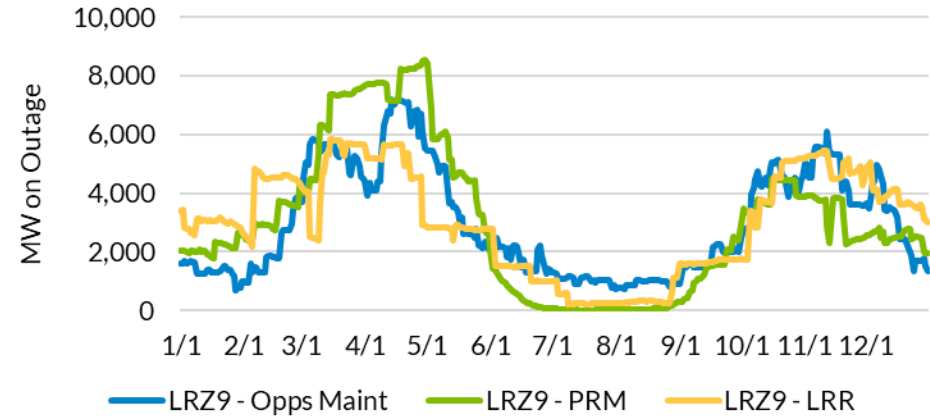


Sensitivity 1: Operational, PRM, and LRR Maintenance Shapes by LRZ, 8-10

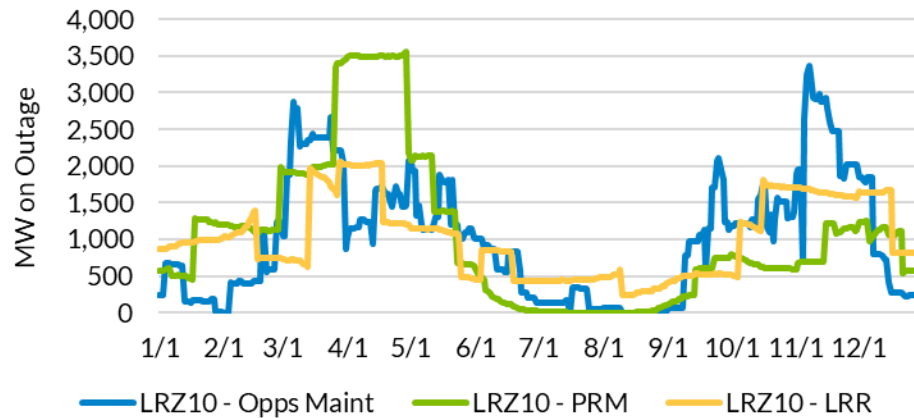
LRZ8 Maintenance Shapes



LRZ9 Maintenance Shapes



LRZ10 Maintenance Shapes



Sensitivity 2: System-wide determined maintenance input into the LRR analysis, Fall and Spring

Fall 2025

LRZ	Zonal Maintenance LRR%	System Maintenance LRR%	Delta
1	128.77%	139.33%	10.55%
2	122.20%	138.04%	15.84%
3	153.70%	159.63%	5.93%
4	131.98%	146.72%	14.74%
5	136.48%	140.06%	3.59%
6	131.19%	135.14%	3.95%
7	125.47%	129.72%	4.25%
8	146.89%	154.11%	7.22%
9	119.79%	126.74%	6.94%
10	155.73%	156.02%	0.30%

Spring 2026

LRZ	Zonal Maintenance LRR%	System Maintenance LRR%	Delta
1	128.25%	134.41%	6.16%
2	133.13%	135.08%	1.95%
3	158.79%	167.68%	8.89%
4	149.53%	151.47%	1.94%
5	145.88%	152.59%	6.71%
6	138.78%	141.38%	2.59%
7	131.90%	137.93%	6.03%
8	158.68%	176.53%	17.86%
9	129.20%	139.15%	9.94%
10	178.77%	179.10%	0.32%

Values in the zonal maintenance columns represent the final Local Reliability Requirements per zone that were identified for PY 2025-2026 in the LOLE study. Values in the system maintenance columns represent what the LRR percentages would have been, if the planned maintenance schedule determined for the MISO system-wide was enforced in these LRR analyses.



Contact

Savannah Miller

smiller@misoenergy.org