

BEFORE THE UNITED STATES DEPARTMENT OF ENERGY

Federal Power Act Section 202(c)     )  
Emergency Order: Midcontinent     )  
Independent System Operator     )  
(MISO)     )  
\_\_\_\_\_

Order No. 202-25-7

Exhibit to  
Motion to Intervene and Request for Rehearing and Stay of  
Public Interest Organizations

Filed September 5, 2025

Exhibit 101  
Consumers June Responses  
to AG

**From:** [Bret A. Totoraitis](#)  
**To:** [Moody, Michael \(AG\)](#)  
**Subject:** RE: AG's first discovery request to Consumers Energy in U-21870  
**Date:** Friday, June 13, 2025 3:16:08 PM  
**Attachments:** [Informal Response to AG Campbell Questions.pdf](#)

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Good afternoon, Mike. Thank you for your consideration of Consumers Energy interest in keeping these issues separate from its electric rate case. Attached are the Company's informal responses to the questions posed by the Attorney General related to the Campbell extension. I'm still working internally to figure out if there is additional information from the Company's annual capacity demonstration filing for this year that the Company can share. I hope to have an answer for you on that early next week.

Bret

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**From:** Moody, Michael (AG) <moodym2@michigan.gov>  
**Sent:** Thursday, June 12, 2025 4:01 PM  
**To:** Bret A. Totoraitis <Bret.Totoraitis@cmsenergy.com>  
**Subject:** AG's first discovery request to Consumers Energy in U-21870

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before clicking links/attachments.**

Bret,

The AG agrees to not seek a response from Consumers Energy on the first discovery request in U-21870 in return for an informal narrative response to the discovery as well as the 6w capacity filing information (understanding that there may be some redactions) that we discussed on the call earlier today. The agreement is obviously conditioned on receiving the informal narratives and 6w materials and the agreement doesn't bar the AG from ever asking again in the future, if necessary. Thanks for being available and helping to work on this information with me. Let me know if you have any questions.

Michael

**Michael Moody**  
Division Chief, Special Litigation Division  
Michigan Department of Attorney General

**Question:**

1. Will any capital expenditures be required to operate the Campbell Plant<sup>1</sup> for the period covered by the Secretary of Energy's Order<sup>2</sup> to continue operating the Campbell Plant?<sup>3</sup> If so, describe the required investments and provide the estimated costs.

**Response:**

The Company has not yet determined whether it will incur any costs which would be eligible for classification as capital expenditures. In accordance with the Company's capitalization guidelines, for an asset to be listed as a retirement unit and capitalized it must have a useful life of two years or more. As such, the Company does not anticipate recording any costs as capital expenditures and, in fact, has not recorded any capital expenditures at the Campbell plant in the two-year period prior to May 31, 2025.

The Company is complying with the Order from the Secretary of Energy and will coordinate appropriate cost recovery with MISO. The Order was issued for the benefit of all of MISO and, as such, it is the Company's position that any cost recovery should be received from all MISO market participants, similar to cost recovery afforded through a MISO-designated system support resource.

**Date:** June 10, 2025

**Question:**

2. To the extent not produced in response to Question No. 1 above, identify all amounts for the following categories of expenditures and costs Consumers anticipates it would make or incur as a result of operating the Campbell Plant for the period covered by the Secretary of Energy's Order, and produce any analyses, calculations, and assumptions for each such amount:

- a. All capital expenditure amounts and working capital amounts, including all such amounts the Company anticipates it would include in a requested cost recovery;
- b. Any other categories of expenditures or costs the Company anticipates it would include in a requested cost recovery.
- c. All operation-and-maintenance costs;
- d. All permitting costs;
- e. All emissions-related costs.
- f. All other categories of expenditures and costs Consumers anticipates it would include in a requested revenue requirement.

**Response:**

- a. See the response to question 1. The Company has not performed any calculations to determine any amounts it could or would include in a request for cost recovery.
- b. The Company has not yet determined the projected amounts.
- c. The Company has not yet determined the projected amounts.
- d. The Company has not yet determined the projected amounts.
- e. The Company has not yet determined the projected amounts. Campbell Unit 2 and Campbell Unit 3 selective catalytic reduction catalysts are at end of life; both systems are expected to perform adequately for the next 90 days, however additional extensions beyond this will eventually require catalyst addition. Rough estimate for one layer catalyst at Campbell Unit 2 is \$3M and at Campbell Unit 3 is \$5M. Catalyst purchases typically require six-to-twelve-month lead time. See also the response to questions 11, 12, 13, 14, & 15.
- f. The Company has not yet determined the projected amounts.

**Date:** June 10, 2025



**Question:**

3. To the extent not identified in response to Questions No. 1-2 above, explain how the Company intends to account for any expenditures and costs it anticipates it would make or incur as a result of operating the Campbell Plant for the period covered by the Secretary of Energy's Order, including the extent to which it anticipates accounting for all or part of such expenditures and costs as part of this proceeding and the extent to which it anticipates to account for all or part of such expenditures and costs as part of a filing with the Federal Energy Regulatory Commission.

**Response:**

The Company plans to record any expenditures and costs it incurs as a result of operating the Campbell Plant during the period covered by the Secretary of Energy's Order in a FERC regulatory asset.

**Date:** June 10, 2025

**Question:**

4. Will any planned outages be required to maintain the Campbell Plant as an operational plant for the period covered by the Secretary of Energy's Order to continue operating the Campbell Plant? If so, approximately when and for what duration?

**Response:**

The Company does not have any planned outages for Campbell Units 1 through 3 during the period covered by the Secretary of Energy's Order. Campbell Unit 2 is currently out of service due to needed boiler tube repairs and other balance of plant work. The estimated return to service is June 27, 2025.

**Date:** June 10, 2025

**Question:**

5. What is the lead time to bring the Campbell Plant units from an off condition to readiness for generation? What is the time required to turn the Campbell Plant units off after a period of generation?

**Response:**

Unit 1 – Plant startup from a cold condition takes approximately 24 hours and shutdown takes approximately 12 hours.

Unit 2 – Plant startup from a cold condition takes approximately 36 hours and shutdown takes approximately 12 hours.

Unit 3 – Plant startup from a cold condition takes approximately 72 hours and shutdown takes approximately 18 hours.

**Date:** June 10, 2025

**Question:**

7. What are the current heat rates of Campbell Plant Units 1, 2, and 3?

**Response:**

Heat rate analysis for May of 2025:

- Campbell 1 has a heat rate of 10,907.1 Btu/kWh
- Campbell 2 has a heat rate of 11,525.8 Btu/kWh
- Campbell 3 has a heat rate of 10,114.8 Btu/kWh

**Date:** June 10, 2025

**Question:**

8. What quantity of coal remained on hand at the Campbell Plant as of May 31, 2025, and what is the heat content of that coal?

**Response:**

At the time the Department of Energy (DOE) issued its order, the Company had nearly depleted the usable coal inventory at the Campbell site. Just prior to this, samples were collected to assess the usability of any remaining coal resins. Testing indicated that approximately 150,000 tons of resins remained, with an average heat content of about 5,294 Btu/lb.

Following the DOE's order on May 23, 2025, and before May 31, 2025, the Company began rebuilding a small amount of usable inventory. As of May 31, 2025, the Campbell Plant had approximately 9,000 tons of usable coal on hand, with an average heat content of 8,869 Btu/lb. – consistent with the historical specifications used by the Campbell units.

**Date:** June 19, 2025

**Question:**

9. How does the Company intend to acquire and manage coal for the Campbell Plant for the period covered by the Secretary of Energy's Order to continue operating the Campbell Plant?

- a. Will the Company enter a supply contract or make "spot" purchases?
- b. What coal sources are compatible with the Campbell Plant units? What is their expected heat content?
- c. What does the Company expect coal for the Campbell Plant to cost per unit weight and per unit heat content?
- d. What quantity of coal does the Company expect to need to comply with the Order to continue operating the Campbell Plant?
- e. How will the Company transport coal to operate the Campbell Plant for the period covered by the Secretary of Energy's recent Order to continue operating the Campbell Plant? What is the expected cost of such coal transportation?
- f. What does the Company project as the as-burned coal costs for the period covered by the Secretary of Energy's Order to continue operating the Campbell Plant?

**Response:**

- a) The Company intends to continue its normal practice of procuring coal through this short period using spot purchases.
- b) The Campbell Plant units are compatible with sub-bituminous coal, primarily sourced from the Powder River Basin (PRB). The expected heat content of compatible coal is approximately 8,400–8,800 Btu/lb. (PRB).
- c) The expected cost of coal for the Campbell Plant is approximately \$13.89/ton and \$0.78/MMBtu.
- d) The Company currently estimates that approximately 1.25M tons of coal will be required to meet operational demands for the period defined under the Department of Energy's Order.
- e) Coal will be transported to the Campbell Plant via rail, using existing transportation agreements with rail carriers. The expected transportation cost is approximately \$36.83/ton and \$2.08/MMBtu.
- f) The projected as-burned coal cost for the Campbell Plant during this period is projected to be approximately \$55M.

**Date:** June 10, 2025

**Question:**

15. Will the Company continue to use Pulse Jet Fabric Filters at the Campbell Plant to reduce emissions, consistent with past practices, during the period covered by the Secretary of Energy's Order to continue operating the Campbell Plant?

- a. If so, what is the stock of Pulse Jet Fabric Filters at the Plant as of May 31, 2025?
- b. What is the expected quantity and cost of Pulse Jet Fabric Filters required to operate the air emissions controls at the plant during this period?

**Response:**

Yes. The Company will continue to use Pulse Jet Fabric Filters ("PJFF") at the Campbell Plant to reduce emissions. See also the response to question 11.

- a. The stock of PJFF bags is shown on line 5 in the table below.
- b. The expected quantity and cost of PJFF bags is shown on line 5 in the table below. PJFF bags are replaced individually on an as needed basis or for periodic testing at a rate of about 4-12 bags per year, which is a minor maintenance cost.

PJFF bags are changed out in their entirety about every six to eight years as indicated by test results. All Campbell Unit 1 and Campbell Unit 2 PJFF bags were replaced in 2021. Campbell Unit 3 is overdue for PJFF bag changeout, but the project was cancelled due to expected site closure. The Campbell Unit 3 PJFF is expected to perform adequately with existing bags for 90-days, but further life extension may negatively impact PJFF performance. A rough estimate for Campbell Unit 3 PJFF full bag changeout (24 compartments with 28,272 bags total) is \$7M-\$10M. Campbell Unit 1 and Campbell Unit 2 PJFF are expected to perform as designed until at least mid-2028.

|   | Consumable       | Purpose | On Hand<br>5/23/25<br>(ton) | On Hand<br>5/31/25<br>(ton) | Forecast<br>90-day usage<br>(ton) | Estimated<br>unit rate<br>(\$/ton) | Forecast<br>90-day cost<br>(\$M) |
|---|------------------|---------|-----------------------------|-----------------------------|-----------------------------------|------------------------------------|----------------------------------|
| 1 | Urea             | NOx     | 100                         | 100                         | 1250                              | 638                                | 0.800                            |
| 2 | Act Carbon       | Hg      | 80                          | 90                          | 210                               | 2590                               | 0.550                            |
| 3 | Hydrated<br>Lime | SOx     | 280                         | 420                         | 3790                              | 379                                | 1.440                            |
| 4 | Pebble Lime      | SOx     | 170                         | 90                          | 5260                              | 241                                | 1.270                            |
| 5 | PJFF bags        | PM      | 33+<br>bag <sup>1</sup>     | 33+ bag                     | 0 bag                             | \$113/bag                          | n/a                              |
|   |                  |         |                             |                             |                                   | TOTAL                              | 4.060                            |

**Date:** June 10, 2025

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<sup>1</sup> 33 PJFF bags in stock plus one full compartment set (1178) available non-stock. JHC1 PJFF has 8 compartments, JHC2 has 10 compartments, JHC3 has 24 compartments.

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Federal Power Act Section 202(c) )  
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Order No. 202-25-7

Exhibit to  
Motion to Intervene and Request for Rehearing and Stay of  
Public Interest Organizations

Filed September 5, 2025

Exhibit 102  
CAMPD Campbell Daily  
Emissions Data



| State | Facility Name | Facility ID | Unit ID | Associated Stacks | Date      | Operating Time Count | Sum of the Operating Time | Gross Load (MWh) | Steam Load (1000 lb) | SO2 Mass (short tons) | SO2 Rate (lbs/mmBtu) | CO2 Mass (short tons) | CO2 Rate (short tons/mmBtu) | NOx Mass (short tons) | NOx Rate (lbs/mmBtu) | Heat Input (mmBtu) | Primary Fuel Type | Secondary Fuel Type | Unit Type          | SO2 Controls          | NOx Controls                                              | PM Controls | Hg Controls                       | Program Code                       |
|-------|---------------|-------------|---------|-------------------|-----------|----------------------|---------------------------|------------------|----------------------|-----------------------|----------------------|-----------------------|-----------------------------|-----------------------|----------------------|--------------------|-------------------|---------------------|--------------------|-----------------------|-----------------------------------------------------------|-------------|-----------------------------------|------------------------------------|
| MI    | J H Campbell  | 1710        | 1       |                   | 6/1/2025  | 24                   | 24                        | 4034             |                      | 5.342                 | 0.2497               | 4486.7                | 0.105                       | 2.637                 | 0.1233               | 42777.6            | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/2/2025  | 24                   | 24                        | 4035             |                      | 5.483                 | 0.2515               | 4570.9                | 0.105                       | 2.763                 | 0.1268               | 43579.9            | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/3/2025  | 24                   | 24                        | 5116             |                      | 6.607                 | 0.2484               | 5573.4                | 0.105                       | 3.621                 | 0.1357               | 53140.9            | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/4/2025  | 24                   | 24                        | 5499             |                      | 7.116                 | 0.2524               | 5911.5                | 0.105                       | 3.984                 | 0.1412               | 56364              | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/5/2025  | 24                   | 24                        | 5633             |                      | 7.158                 | 0.2494               | 6019.4                | 0.105                       | 4.211                 | 0.1468               | 57392.3            | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/6/2025  | 24                   | 24                        | 4565             |                      | 6.034                 | 0.2515               | 5032.4                | 0.105                       | 3.451                 | 0.143                | 47981.3            | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/7/2025  | 24                   | 24                        | 3964             |                      | 5.366                 | 0.2511               | 4483.2                | 0.105                       | 2.866                 | 0.1341               | 42746.4            | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/8/2025  | 24                   | 24                        | 3964             |                      | 5.261                 | 0.2477               | 4455                  | 0.105                       | 2.98                  | 0.1403               | 42477.7            | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/9/2025  | 24                   | 24                        | 4255             |                      | 6.004                 | 0.2702               | 4683.2                | 0.105                       | 3.28                  | 0.1468               | 44650.6            | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/10/2025 | 24                   | 24                        | 5571             |                      | 7.394                 | 0.2619               | 5925.7                | 0.105                       | 4.222                 | 0.1494               | 56500.7            | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/11/2025 | 24                   | 24                        | 5587             |                      | 7.478                 | 0.2633               | 5957.3                | 0.105                       | 4.163                 | 0.1466               | 56801.6            | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/12/2025 | 24                   | 24                        | 5046             |                      | 6.86                  | 0.2588               | 5562.2                | 0.105                       | 3.665                 | 0.1369               | 53034.6            | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/13/2025 | 24                   | 24                        | 5562             |                      | 7.182                 | 0.2512               | 5994.8                | 0.105                       | 4.117                 | 0.144                | 57157.6            | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/14/2025 | 24                   | 24                        | 5561             |                      | 7.369                 | 0.2594               | 5958.5                | 0.105                       | 4.094                 | 0.1441               | 56812.4            | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/15/2025 | 24                   | 24                        | 5562             |                      | 7.186                 | 0.252                | 5980.3                | 0.105                       | 4.112                 | 0.1442               | 57022              | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/16/2025 | 24                   | 24                        | 5563             |                      | 7.353                 | 0.2571               | 6001.2                | 0.105                       | 4.188                 | 0.1464               | 57220.3            | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/17/2025 | 24                   | 24                        | 5500             |                      | 7.458                 | 0.2649               | 5911.9                | 0.105                       | 4.209                 | 0.1493               | 56369.9            | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/18/2025 | 24                   | 24                        | 5646             |                      | 7.91                  | 0.2708               | 6127.9                | 0.105                       | 4.399                 | 0.1506               | 58428.5            | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/19/2025 | 24                   | 24                        | 5965             |                      | 8.321                 | 0.2722               | 6413.1                | 0.105                       | 4.616                 | 0.151                | 61145.4            | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/20/2025 | 24                   | 24                        | 6138             |                      | 9.075                 | 0.2918               | 6524.5                | 0.105                       | 4.693                 | 0.1509               | 62210.3            | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/21/2025 | 24                   | 24                        | 6137             |                      | 12.777                | 0.4044               | 6623.1                | 0.105                       | 5.018                 | 0.1589               | 63148.5            | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/22/2025 | 24                   | 24                        | 6105             |                      | 10.32                 | 0.3241               | 6674.8                | 0.105                       | 4.795                 | 0.1506               | 63645.2            | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/23/2025 | 15                   | 14.85                     | 3645.2           |                      | 5.101                 | 0.2651               | 4026.2                | 0.105                       | 2.788                 | 0.1448               | 38388.825          | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/24/2025 | 0                    | 0                         |                  |                      |                       |                      |                       |                             |                       |                      |                    | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/25/2025 | 0                    | 0                         |                  |                      |                       |                      |                       |                             |                       |                      |                    | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/26/2025 | 0                    | 0                         |                  |                      |                       |                      |                       |                             |                       |                      |                    | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/27/2025 | 0                    | 0                         |                  |                      |                       |                      |                       |                             |                       |                      |                    | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/28/2025 | 0                    | 0                         |                  |                      |                       |                      |                       |                             |                       |                      |                    | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/29/2025 | 0                    | 0                         |                  |                      |                       |                      |                       |                             |                       |                      |                    | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/30/2025 | 0                    | 0                         |                  |                      |                       |                      |                       |                             |                       |                      |                    | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | 6/1/2025  | 0                    | 0                         |                  |                      |                       |                      |                       |                             |                       |                      |                    | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner   Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | 6/2/2025  | 0                    | 0                         |                  |                      |                       |                      |                       |                             |                       |                      |                    | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner   Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | 6/3/2025  | 0                    | 0                         |                  |                      |                       |                      |                       |                             |                       |                      |                    | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner   Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | 6/4/2025  | 0                    | 0                         |                  |                      |                       |                      |                       |                             |                       |                      |                    | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner   Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | 6/5/2025  | 0                    | 0                         |                  |                      |                       |                      |                       |                             |                       |                      |                    | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner   Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | 6/6/2025  | 0                    | 0                         |                  |                      |                       |                      |                       |                             |                       |                      |                    | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner   Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | 6/7/2025  | 0                    | 0                         |                  |                      |                       |                      |                       |                             |                       |                      |                    | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner   Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | 6/8/2025  | 0                    | 0                         |                  |                      |                       |                      |                       |                             |                       |                      |                    | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner   Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | 6/9/2025  | 0                    | 0                         |                  |                      |                       |                      |                       |                             |                       |                      |                    | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner   Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | 6/10/2025 | 0                    | 0                         |                  |                      |                       |                      |                       |                             |                       |                      |                    | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner   Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | 6/11/2025 | 0                    | 0                         |                  |                      |                       |                      |                       |                             |                       |                      |                    | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner   Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | 6/12/2025 | 0                    | 0                         |                  |                      |                       |                      |                       |                             |                       |                      |                    | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner   Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | 6/13/2025 | 0                    | 0                         |                  |                      |                       |                      |                       |                             |                       |                      |                    | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner   Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | 6/14/2025 | 0                    | 0                         |                  |                      |                       |                      |                       |                             |                       |                      |                    | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner   Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | 6/15/2025 | 0                    | 0                         |                  |                      |                       |                      |                       |                             |                       |                      |                    | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner   Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | 6/16/2025 | 0                    | 0                         |                  |                      |                       |                      |                       |                             |                       |                      |                    | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner   Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | 6/17/2025 | 0                    | 0                         |                  |                      |                       |                      |                       |                             |                       |                      |                    | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner   Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | 6/18/2025 | 0                    | 0                         |                  |                      |                       |                      |                       |                             |                       |                      |                    | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner   Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | 6/19/2025 | 0                    | 0                         |                  |                      |                       |                      |                       |                             |                       |                      |                    | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner   Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | 6/20/2025 | 0                    | 0                         |                  |                      |                       |                      |                       |                             |                       |                      |                    | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner   Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | 6/21/2025 | 0                    | 0                         |                  |                      |                       |                      |                       |                             |                       |                      |                    | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner   Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | 6/22/2025 | 0                    | 0                         |                  |                      |                       |                      |                       |                             |                       |                      |                    | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner   Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | 6/23/2025 | 0                    | 0                         |                  |                      |                       |                      |                       |                             |                       |                      |                    | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner   Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | 6/24/2025 | 0                    | 0                         |                  |                      |                       |                      |                       |                             |                       |                      |                    | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner   Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | 6/25/2025 | 4                    | 3.43                      | 0                |                      | 0                     |                      | 52.718                | 0.105                       | 0                     | 0.001                | 502.164            | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner   Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | 6/26/2025 | 18                   | 16.57                     | 0                |                      | 0.093                 | 0.0338               | 451.21                | 0.1051                      | 0.2                   | 0.0747               | 4301.58            | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner   Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | 6/27/2025 | 16                   | 15.15                     | 128              |                      | 0.186                 | 0.0552               | 559.31                | 0.1049                      | 0.434                 | 0.1348               | 5333.855           | Coal              |                     |                    |                       |                                                           |             |                                   |                                    |

BEFORE THE UNITED STATES DEPARTMENT OF ENERGY

Federal Power Act Section 202(c) )  
Emergency Order: Midcontinent )  
Independent System Operator )  
(MISO) )  
\_\_\_\_\_ )

Order No. 202-25-7

Exhibit to  
Motion to Intervene and Request for Rehearing and Stay of  
Public Interest Organizations

Filed September 5, 2025

Exhibit 103

July 17 Email from  
Consumers to EGLE

**From:** Joseph J. Firlit <JOSEPH.FIRLIT@cmsenergy.com>  
**Sent:** 7/17/2025 11:19:40 AM  
**To:** "Lazzaro, April (EGLE)" <LazzaroA1@michigan.gov>  
**Subject:** RE: Update to MATS Part 63 PM/HCI Test Notification - Consumers Energy, J.H. Campbell Generating Complex (ORIS Code 1710), Unit 2

**CAUTION: This is an External email. Please send suspicious emails to [abuse@michigan.gov](mailto:abuse@michigan.gov)**

Good Morning, April –

Unit 2 was offline on May 19, 2025 and there was no immediate plan as of May 27, 2025 to bring it back online. But after further evaluation and interpretation of the DOE order issued to MISO and Consumers Energy under section 202(c) of the Federal Power Act (FPA) , 16 U. S. C. 824a(c) and section 302(b) of the Department of Energy Organization Act, 42 U. S. C. 7151(b) it has been determined that it is necessary to attempt to repair and operate Unit 2 to address the energy shortage identified in this order. Unit 2 operated briefly between June 25-July 4, 2025 before coming back offline to address a water intake issue. The order states the facility is to remain available for dispatch through August 21, 2025.

Regards,

**Joseph J. Firlit, PMP**

**Manager Engineering Support**

Consumers Energy

J H Campbell Generating Station

17000 Croswell | West Olive, Michigan 49460

Office: 616-738-3260 | Cell: 616-836-9900 | Fax: 616-738-3215

[joseph.firlit@cmsenergy.com](mailto:joseph.firlit@cmsenergy.com) | [www.ConsumersEnergy.com](http://www.ConsumersEnergy.com)



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**From:** Lazzaro, April (EGLE) <LazzaroA1@michigan.gov>  
**Sent:** Thursday, July 17, 2025 7:04 AM  
**To:** Joseph J. Firlit <JOSEPH.FIRLIT@cmsenergy.com>  
**Subject:** RE: Update to MATS Part 63 PM/HCI Test Notification - Consumers Energy, J.H. Campbell Generating Complex (ORIS Code 1710), Unit 2

**##CAUTION##: This email originated from outside of CMS/CE.  
Remember your security awareness training: Stop, think, and use  
caution before clicking links/attachments.**

Hi Joe,

Last we knew (May 27 email), EUBOILER2 went offline on May 19<sup>th</sup> and there were no plans to bring the unit back on-line. Has EUBOILER2 operated since it went down on May 19<sup>th</sup>?

Thanks,  
April

April Lazzaro  
Senior Environmental Quality Analyst  
Air Quality Division  
Grand Rapids District Office  
Michigan Department of Environment, Great Lakes, and Energy  
616-558-1092

[Connect with us \[cms.michigan.gov\]](https://cms.michigan.gov) | [Michigan.gov/EGLE \[michigan.gov\]](https://Michigan.gov/EGLE)



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**From:** Joseph J. Firlit <[JOSEPH.FIRLIT@cmsenergy.com](mailto:JOSEPH.FIRLIT@cmsenergy.com)>

**Sent:** Wednesday, July 16, 2025 3:51 PM

**To:** [compheer.michael@epa.gov](mailto:compheer.michael@epa.gov); Howe, Jeremy (EGLE) <[HoweJ1@michigan.gov](mailto:HoweJ1@michigan.gov)>; Hollenbach, Heidi (EGLE) <[HOLLENBACHHH@michigan.gov](mailto:HOLLENBACHHH@michigan.gov)>; Lazzaro, April (EGLE) <[LazzaroA1@michigan.gov](mailto:LazzaroA1@michigan.gov)>; R5AirEnforcement <[r5airenforcement@epa.gov](mailto:r5airenforcement@epa.gov)>

**Cc:** Michael E. Gruber II <[Michael.GruberII@cmsenergy.com](mailto:Michael.GruberII@cmsenergy.com)>; Jason M. Prentice <[jason.prentice@cmsenergy.com](mailto:jason.prentice@cmsenergy.com)>; Thomas R. Schmelter <[Thomas.Schmelter@cmsenergy.com](mailto:Thomas.Schmelter@cmsenergy.com)>; Roger D. Vargo <[ROGER.VARGO@cmsenergy.com](mailto:ROGER.VARGO@cmsenergy.com)>; Joe Mason <[Joe.MASON@cmsenergy.com](mailto:Joe.MASON@cmsenergy.com)>

**Subject:** Update to MATS Part 63 PM/HCI Test Notification - Consumers Energy, J.H. Campbell Generating Complex (ORIS Code 1710), Unit 2

**CAUTION: This is an External email. Please send suspicious emails to  
[abuse@michigan.gov](mailto:abuse@michigan.gov)**

All,

On June 19, 2025, Consumers Energy's J.H. Campbell Plant (JHC) SRN B2835 submitted a test protocol of a triennial HCl and PM test for Mercury Air Toxics Rule (MATS) 40 CFR Part 63 Subpart UUUUU. The MATS RATA test protocol was submitted to both MiEnviro (Submission #: HQD-F4PF-ZY9CT) and to [r5airenforcement@epa.gov](mailto:r5airenforcement@epa.gov).

EUBOILER2 came offline unexpectedly due to a water intake issue. Therefore, the MATS testing at Unit 2 will not occur during the business week beginning July 21, 2025. A final return to service date for the unit has not yet been established. I will send another email with updates when a unit return to service date and proposed testing dates are known. Thank you!

Regards,

**Joseph J. Firlit, PMP**

**Manager Engineering Support**

Consumers Energy

J H Campbell Generating Station

17000 Croswell | West Olive, Michigan 49460

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**From:** Joseph J. Firlit

**Sent:** Thursday, June 19, 2025 3:14 PM

**To:** [r5airenforcement@epa.gov](mailto:r5airenforcement@epa.gov)

**Cc:** Michael E. Gruber II <[Michael.GruberII@cmsenergy.com](mailto:Michael.GruberII@cmsenergy.com)>; Jason M. Prentice

<[JASON.PRENTICE@cmsenergy.com](mailto:JASON.PRENTICE@cmsenergy.com)>; Thomas R. Schmelter <[Thomas.Schmelter@cmsenergy.com](mailto:Thomas.Schmelter@cmsenergy.com)>;

David M. Kawasaki <[David.Kawasaki@cmsenergy.com](mailto:David.Kawasaki@cmsenergy.com)>; Roger D. Vargo <[roger.vargo@cmsenergy.com](mailto:roger.vargo@cmsenergy.com)>

**Subject:** Submittal of MATS PM/HCI Test Notice and Protocol for the Consumers Energy, J.H. Campbell Generating Complex (ORIS Code 1710), Unit 2

To Whom It May Concern:

Consumers Energy is respectfully submitting the attached test notice and protocol for a planned Mercury Air Toxics (MATS) Rule PM/HCI Test at our J.H. Campbell Unit 2 to commence on July 22, 2025. The same submittal has been provided to the Michigan Department of Environment, Great Lakes, and Energy (EGLE) Technical Programs Unit (TPU) and EGLE-AQD District Office today, via their MiEnviro Air Portal. Please let me know if there are any questions or concerns regarding this test notice.

Regards,

**Joseph J. Firlit, PMP**

**Manager Engineering Support**

Consumers Energy

J H Campbell Generating Station

17000 Croswell | West Olive, Michigan 49460

Office: 616-738-3260 | Cell: 616-836-9900 | Fax: 616-738-3215

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**Consumers Energy**  
*Count on Us*

BEFORE THE UNITED STATES DEPARTMENT OF ENERGY

Federal Power Act Section 202(c) )  
Emergency Order: Midcontinent )  
Independent System Operator )  
(MISO) )  
\_\_\_\_\_ )

Order No. 202-25-7

Exhibit to  
Motion to Intervene and Request for Rehearing and Stay of  
Public Interest Organizations

Filed September 5, 2025

Exhibit 104  
CAMPD Campbell Hourly  
Emissions Data



| State | Facility Name | Facility ID | Unit ID | Associated Stacks | Date     | Hour | Operating Time | Gross Load (MW) | Steam Load (1000 lb/hr) | SO2 Mass (lbs) | SO2 Mass Measure Indicator | SO2 Rate (lbs/mmBtu) | SO2 Rate Measure Indicator | CO2 Mass (short tons) | CO2 Mass Measure Indicator | CO2 Rate (short tons/mmBtu) | CO2 Rate Measure Indicator | NOx Mass (lbs) | NOx Mass Measure Indicator | NOx Rate (lbs/mmBtu) | NOx Rate Measure Indicator | Heat Input (mmBtu) | Heat Input Measure Indicator | Primary Fuel Type | Secondary Fuel Type | Unit Type | SO2 Controls       | NOx Controls          | PM Controls                                               | Hg Controls | Program Code                      |                                    |
|-------|---------------|-------------|---------|-------------------|----------|------|----------------|-----------------|-------------------------|----------------|----------------------------|----------------------|----------------------------|-----------------------|----------------------------|-----------------------------|----------------------------|----------------|----------------------------|----------------------|----------------------------|--------------------|------------------------------|-------------------|---------------------|-----------|--------------------|-----------------------|-----------------------------------------------------------|-------------|-----------------------------------|------------------------------------|
| MI    | J H Campbell  | 1710        | 1       |                   | 6/1/2025 | 0    | 1              | 168             | 485.4                   | Measured       | 0.275                      | Calculated           | 185.2                      | Measured              | 185.2                      | Measured                    | 0.105                      | Calculated     | 215.4                      | Measured             | 0.122                      | Measured           | 1765.9                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/1/2025 | 1    | 2              | 168             | 450.9                   | Measured       | 0.254                      | Calculated           | 186.2                      | Measured              | 186.2                      | Measured                    | 0.105                      | Calculated     | 216.6                      | Measured             | 0.122                      | Measured           | 1775.3                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/1/2025 | 2    | 3              | 168             | 426.1                   | Measured       | 0.238                      | Calculated           | 187.6                      | Measured              | 187.6                      | Measured                    | 0.105                      | Calculated     | 220                        | Measured             | 0.123                      | Measured           | 1788.7                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/1/2025 | 3    | 4              | 168             | 449.2                   | Measured       | 0.26                       | Calculated           | 188.6                      | Measured              | 188.6                      | Measured                    | 0.105                      | Calculated     | 219.1                      | Measured             | 0.122                      | Measured           | 1795.7                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/1/2025 | 4    | 5              | 168             | 448                     | Measured       | 0.25                       | Calculated           | 189.6                      | Measured              | 189.6                      | Measured                    | 0.105                      | Calculated     | 206.6                      | Measured             | 0.12                       | Measured           | 1721.9                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/1/2025 | 5    | 6              | 168             | 473.6                   | Measured       | 0.263                      | Calculated           | 188.6                      | Measured              | 188.6                      | Measured                    | 0.105                      | Calculated     | 215.8                      | Measured             | 0.12                       | Measured           | 1796.6                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/1/2025 | 6    | 7              | 168             | 457                     | Measured       | 0.253                      | Calculated           | 189.6                      | Measured              | 189.6                      | Measured                    | 0.105                      | Calculated     | 220.5                      | Measured             | 0.122                      | Measured           | 1807.6                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/1/2025 | 7    | 8              | 168             | 459.2                   | Measured       | 0.257                      | Calculated           | 187.5                      | Measured              | 187.5                      | Measured                    | 0.105                      | Calculated     | 218.1                      | Measured             | 0.122                      | Measured           | 1787.4                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/1/2025 | 8    | 9              | 168             | 482                     | Measured       | 0.272                      | Calculated           | 185.8                      | Measured              | 185.8                      | Measured                    | 0.105                      | Calculated     | 219.6                      | Measured             | 0.124                      | Measured           | 1771.2                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/1/2025 | 9    | 10             | 168             | 488.7                   | Measured       | 0.275                      | Calculated           | 186.1                      | Measured              | 186.1                      | Measured                    | 0.105                      | Calculated     | 212.9                      | Measured             | 0.12                       | Measured           | 1774.4                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/1/2025 | 10   | 11             | 168             | 451.7                   | Measured       | 0.254                      | Calculated           | 186.6                      | Measured              | 186.6                      | Measured                    | 0.105                      | Calculated     | 215.2                      | Measured             | 0.121                      | Measured           | 1778.9                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/1/2025 | 11   | 12             | 168             | 402.1                   | Measured       | 0.225                      | Calculated           | 187.2                      | Measured              | 187.2                      | Measured                    | 0.105                      | Calculated     | 216                        | Measured             | 0.121                      | Measured           | 1784.9                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/1/2025 | 12   | 13             | 168             | 396.1                   | Measured       | 0.222                      | Calculated           | 187.2                      | Measured              | 187.2                      | Measured                    | 0.105                      | Calculated     | 219.5                      | Measured             | 0.123                      | Measured           | 1784.5                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/1/2025 | 13   | 14             | 169             | 425.1                   | Measured       | 0.238                      | Calculated           | 187.1                      | Measured              | 187.1                      | Measured                    | 0.105                      | Calculated     | 217.6                      | Measured             | 0.122                      | Measured           | 1783.7                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/1/2025 | 14   | 15             | 168             | 433.3                   | Measured       | 0.244                      | Calculated           | 186.2                      | Measured              | 186.2                      | Measured                    | 0.105                      | Calculated     | 218.3                      | Measured             | 0.123                      | Measured           | 1775.1                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/1/2025 | 15   | 16             | 169             | 434.7                   | Measured       | 0.245                      | Calculated           | 186.4                      | Measured              | 186.4                      | Measured                    | 0.105                      | Calculated     | 220.4                      | Measured             | 0.124                      | Measured           | 1777.1                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/1/2025 | 16   | 17             | 168             | 428.1                   | Measured       | 0.241                      | Calculated           | 186.1                      | Measured              | 186.1                      | Measured                    | 0.105                      | Calculated     | 221.8                      | Measured             | 0.125                      | Measured           | 1774                         | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/1/2025 | 17   | 18             | 168             | 431.7                   | Measured       | 0.244                      | Calculated           | 186.5                      | Measured              | 186.5                      | Measured                    | 0.105                      | Calculated     | 219.3                      | Measured             | 0.124                      | Measured           | 1768.8                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/1/2025 | 18   | 19             | 168             | 440.9                   | Measured       | 0.248                      | Calculated           | 185.8                      | Measured              | 185.8                      | Measured                    | 0.105                      | Calculated     | 217                        | Measured             | 0.122                      | Measured           | 1778.7                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/1/2025 | 19   | 20             | 168             | 436.9                   | Measured       | 0.245                      | Calculated           | 187.1                      | Measured              | 187.1                      | Measured                    | 0.105                      | Calculated     | 217.6                      | Measured             | 0.122                      | Measured           | 1783.9                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/1/2025 | 20   | 21             | 168             | 428.7                   | Measured       | 0.24                       | Calculated           | 187.1                      | Measured              | 187.1                      | Measured                    | 0.105                      | Calculated     | 226.6                      | Measured             | 0.127                      | Measured           | 1784.4                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/1/2025 | 21   | 22             | 168             | 436.7                   | Measured       | 0.243                      | Calculated           | 188.3                      | Measured              | 188.3                      | Measured                    | 0.105                      | Calculated     | 231.6                      | Measured             | 0.129                      | Measured           | 1795                         | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/1/2025 | 22   | 23             | 168             | 453.7                   | Measured       | 0.25                       | Calculated           | 190.3                      | Measured              | 190.3                      | Measured                    | 0.105                      | Calculated     | 232.5                      | Measured             | 0.128                      | Measured           | 1816.2                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/1/2025 | 23   | 24             | 168             | 464.6                   | Measured       | 0.257                      | Calculated           | 189.4                      | Measured              | 189.4                      | Measured                    | 0.105                      | Calculated     | 236.5                      | Measured             | 0.131                      | Measured           | 1805.7                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/2/2025 | 0    | 1              | 168             | 460.9                   | Measured       | 0.254                      | Calculated           | 190.6                      | Measured              | 190.6                      | Measured                    | 0.105                      | Calculated     | 230.8                      | Measured             | 0.127                      | Measured           | 1817.4                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/2/2025 | 1    | 2              | 168             | 464.2                   | Measured       | 0.255                      | Calculated           | 191.1                      | Measured              | 191.1                      | Measured                    | 0.105                      | Calculated     | 227.8                      | Measured             | 0.125                      | Measured           | 1822.4                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/2/2025 | 2    | 3              | 168             | 449.1                   | Measured       | 0.248                      | Calculated           | 189.6                      | Measured              | 189.6                      | Measured                    | 0.105                      | Calculated     | 225.9                      | Measured             | 0.125                      | Measured           | 1807.4                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/2/2025 | 3    | 4              | 168             | 461.4                   | Measured       | 0.253                      | Calculated           | 191                        | Measured              | 191                        | Measured                    | 0.105                      | Calculated     | 218.5                      | Measured             | 0.12                       | Measured           | 1821.2                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/2/2025 | 4    | 5              | 168             | 446.8                   | Measured       | 0.249                      | Calculated           | 188.2                      | Measured              | 188.2                      | Measured                    | 0.105                      | Calculated     | 222.5                      | Measured             | 0.124                      | Measured           | 1794.3                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/2/2025 | 5    | 6              | 168             | 443                     | Measured       | 0.243                      | Calculated           | 191.2                      | Measured              | 191.2                      | Measured                    | 0.105                      | Calculated     | 237                        | Measured             | 0.13                       | Measured           | 1823                         | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/2/2025 | 6    | 7              | 168             | 457.2                   | Measured       | 0.251                      | Calculated           | 190.7                      | Measured              | 190.7                      | Measured                    | 0.105                      | Calculated     | 238.2                      | Measured             | 0.131                      | Measured           | 1818.2                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/2/2025 | 7    | 8              | 168             | 452.1                   | Measured       | 0.252                      | Calculated           | 188.2                      | Measured              | 188.2                      | Measured                    | 0.105                      | Calculated     | 233.3                      | Measured             | 0.13                       | Measured           | 1794.3                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/2/2025 | 8    | 9              | 168             | 453.7                   | Measured       | 0.252                      | Calculated           | 188.6                      | Measured              | 188.6                      | Measured                    | 0.105                      | Calculated     | 233.8                      | Measured             | 0.13                       | Measured           | 1798.4                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/2/2025 | 9    | 10             | 168             | 437.6                   | Measured       | 0.241                      | Calculated           | 190.6                      | Measured              | 190.6                      | Measured                    | 0.105                      | Calculated     | 232.6                      | Measured             | 0.128                      | Measured           | 1817                         | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/2/2025 | 10   | 11             | 168             | 398.3                   | Measured       | 0.222                      | Calculated           | 188.2                      | Measured              | 188.2                      | Measured                    | 0.105                      | Calculated     | 218.9                      | Measured             | 0.122                      | Measured           | 1794                         | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/2/2025 | 11   | 12             | 168             | 409.5                   | Measured       | 0.225                      | Calculated           | 190.6                      | Measured              | 190.6                      | Measured                    | 0.105                      | Calculated     | 220.1                      | Measured             | 0.121                      | Measured           | 1819.4                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/2/2025 | 12   | 13             | 168             | 434.9                   | Measured       | 0.241                      | Calculated           | 189.6                      | Measured              | 189.6                      | Measured                    | 0.105                      | Calculated     | 222.4                      | Measured             | 0.123                      | Measured           | 1807.8                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/2/2025 | 13   | 14             | 168             | 451.1                   | Measured       | 0.249                      | Calculated           | 190.1                      | Measured              | 190.1                      | Measured                    | 0.105                      | Calculated     | 228.3                      | Measured             | 0.126                      | Measured           | 1812.1                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/2/2025 | 14   | 15             | 168             | 457.3                   | Measured       | 0.251                      | Calculated           | 190.8                      | Measured              | 190.8                      | Measured                    | 0.105                      | Calculated     | 234.7                      | Measured             | 0.129                      | Measured           | 1819.3                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/2/2025 | 15   | 16             | 168             | 455.7                   | Measured       | 0.248                      | Calculated           | 192.4                      | Measured              | 192.4                      | Measured                    | 0.105                      | Calculated     | 236.6                      | Measured             | 0.129                      | Measured           | 1834.4                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/2/2025 | 16   | 17             | 169             | 457.3                   | Measured       | 0.25                       | Calculated           | 191.6                      | Measured              | 191.6                      | Measured                    | 0.105                      | Calculated     | 235.7                      | Measured             | 0.129                      | Measured           | 1826.9                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSSO62E, CSSO2G1       |



| State | Facility Name | Facility ID | Unit ID | Associated Stacks | Date     | Hour | Operating Time | Gross Load (MW) | Steam Load (1000 lb/hr) | SO2 Mass (lbs) | SO2 Mass Measure Indicator | SO2 Rate (lbs/mmBtu) | SO2 Rate Measure Indicator | CO2 Mass (short tons) | CO2 Mass Measure Indicator | CO2 Rate (short tons/mmBtu) | CO2 Rate Measure Indicator | NOx Mass (lbs) | NOx Mass Measure Indicator | NOx Rate (lbs/mmBtu) | NOx Rate Measure Indicator | Heat Input (mmBtu) | Heat Input Measure Indicator | Primary Fuel | Secondary Fuel Type | Unit Type          | SO2 Controls          | NOx Controls                                              | PM Controls | Hg Controls                       | Program Code                       |
|-------|---------------|-------------|---------|-------------------|----------|------|----------------|-----------------|-------------------------|----------------|----------------------------|----------------------|----------------------------|-----------------------|----------------------------|-----------------------------|----------------------------|----------------|----------------------------|----------------------|----------------------------|--------------------|------------------------------|--------------|---------------------|--------------------|-----------------------|-----------------------------------------------------------|-------------|-----------------------------------|------------------------------------|
| MI    | J H Campbell  | 1710        | 1       |                   | 6/5/2025 | 10   | 1              | 235             |                         | 607.2          | Measured                   | 0.253                | Calculated                 | 251.9                 | Measured                   | 0.105                       | Calculated                 | 343.4          | Measured                   | 0.143                | Measured                   | 240.1              | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/5/2025 | 11   | 1              | 235             |                         | 611.8          | Measured                   | 0.255                | Calculated                 | 251.4                 | Measured                   | 0.105                       | Calculated                 | 357.1          | Measured                   | 0.149                | Measured                   | 239.9              | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/5/2025 | 12   | 1              | 235             |                         | 608.4          | Measured                   | 0.253                | Calculated                 | 252.5                 | Measured                   | 0.105                       | Calculated                 | 334.6          | Measured                   | 0.139                | Measured                   | 240.2              | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/5/2025 | 13   | 1              | 235             |                         | 593.5          | Measured                   | 0.247                | Calculated                 | 251.8                 | Measured                   | 0.105                       | Calculated                 | 345.8          | Measured                   | 0.144                | Measured                   | 240.2              | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/5/2025 | 14   | 1              | 235             |                         | 586.5          | Measured                   | 0.245                | Calculated                 | 251.5                 | Measured                   | 0.105                       | Calculated                 | 347.6          | Measured                   | 0.145                | Measured                   | 239.5              | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/5/2025 | 15   | 1              | 235             |                         | 597.7          | Measured                   | 0.249                | Calculated                 | 251.8                 | Measured                   | 0.105                       | Calculated                 | 348.1          | Measured                   | 0.145                | Measured                   | 240.8              | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/5/2025 | 16   | 1              | 234             |                         | 572.4          | Measured                   | 0.24                 | Calculated                 | 250.2                 | Measured                   | 0.105                       | Calculated                 | 345.9          | Measured                   | 0.145                | Measured                   | 238.5              | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/5/2025 | 17   | 1              | 235             |                         | 588.8          | Measured                   | 0.247                | Calculated                 | 250.4                 | Measured                   | 0.105                       | Calculated                 | 346.1          | Measured                   | 0.145                | Measured                   | 238.1              | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/5/2025 | 18   | 1              | 234             |                         | 605.1          | Measured                   | 0.255                | Calculated                 | 248.7                 | Measured                   | 0.105                       | Calculated                 | 348.5          | Measured                   | 0.147                | Measured                   | 237.1              | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/5/2025 | 19   | 1              | 235             |                         | 564.8          | Measured                   | 0.237                | Calculated                 | 249.5                 | Measured                   | 0.105                       | Calculated                 | 349.7          | Measured                   | 0.147                | Measured                   | 2379               | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/5/2025 | 20   | 1              | 235             |                         | 556.4          | Measured                   | 0.233                | Calculated                 | 250.4                 | Measured                   | 0.105                       | Calculated                 | 358.1          | Measured                   | 0.15                 | Measured                   | 2387.6             | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/5/2025 | 21   | 1              | 235             |                         | 576.9          | Measured                   | 0.241                | Calculated                 | 250.8                 | Measured                   | 0.105                       | Calculated                 | 363.5          | Measured                   | 0.152                | Measured                   | 2391.2             | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/5/2025 | 22   | 1              | 235             |                         | 637.1          | Measured                   | 0.263                | Calculated                 | 253.6                 | Measured                   | 0.105                       | Calculated                 | 365.1          | Measured                   | 0.151                | Measured                   | 2418.2             | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/5/2025 | 23   | 1              | 234             |                         | 643.3          | Measured                   | 0.268                | Calculated                 | 251.5                 | Measured                   | 0.105                       | Calculated                 | 362.1          | Measured                   | 0.151                | Measured                   | 2398.3             | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/6/2025 | 0    | 1              | 234             |                         | 624.4          | Measured                   | 0.261                | Calculated                 | 251.1                 | Measured                   | 0.105                       | Calculated                 | 357.1          | Measured                   | 0.149                | Measured                   | 2396.7             | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/6/2025 | 1    | 1              | 234             |                         | 599            | Measured                   | 0.25                 | Calculated                 | 251.3                 | Measured                   | 0.105                       | Calculated                 | 354.6          | Measured                   | 0.148                | Measured                   | 2396               | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/6/2025 | 2    | 1              | 235             |                         | 605.5          | Measured                   | 0.253                | Calculated                 | 251.5                 | Measured                   | 0.105                       | Calculated                 | 359.6          | Measured                   | 0.15                 | Measured                   | 2397.6             | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/6/2025 | 3    | 1              | 235             |                         | 600.4          | Measured                   | 0.251                | Calculated                 | 251.1                 | Measured                   | 0.105                       | Calculated                 | 361.6          | Measured                   | 0.151                | Measured                   | 2394.4             | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/6/2025 | 4    | 1              | 234             |                         | 601.4          | Measured                   | 0.256                | Calculated                 | 246.6                 | Measured                   | 0.105                       | Calculated                 | 357.3          | Measured                   | 0.152                | Measured                   | 2350.8             | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/6/2025 | 5    | 1              | 235             |                         | 605.9          | Measured                   | 0.254                | Calculated                 | 249.7                 | Measured                   | 0.105                       | Calculated                 | 361.9          | Measured                   | 0.152                | Measured                   | 2381.2             | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/6/2025 | 6    | 1              | 235             |                         | 591.8          | Measured                   | 0.248                | Calculated                 | 250.3                 | Measured                   | 0.105                       | Calculated                 | 358            | Measured                   | 0.15                 | Measured                   | 2386.8             | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/6/2025 | 7    | 1              | 235             |                         | 594.3          | Measured                   | 0.251                | Calculated                 | 248.8                 | Measured                   | 0.105                       | Calculated                 | 355.8          | Measured                   | 0.15                 | Measured                   | 2371.9             | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/6/2025 | 8    | 1              | 223             |                         | 563.6          | Measured                   | 0.249                | Calculated                 | 237.3                 | Measured                   | 0.105                       | Calculated                 | 353            | Measured                   | 0.156                | Measured                   | 2262.8             | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/6/2025 | 9    | 1              | 161             |                         | 416.4          | Measured                   | 0.239                | Calculated                 | 182.8                 | Measured                   | 0.105                       | Calculated                 | 256.2          | Measured                   | 0.147                | Measured                   | 1743               | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/6/2025 | 10   | 1              | 163             |                         | 424.3          | Measured                   | 0.24                 | Calculated                 | 185.4                 | Measured                   | 0.105                       | Calculated                 | 242.2          | Measured                   | 0.137                | Measured                   | 1767.6             | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/6/2025 | 11   | 1              | 163             |                         | 414            | Measured                   | 0.235                | Calculated                 | 185.2                 | Measured                   | 0.105                       | Calculated                 | 254.2          | Measured                   | 0.144                | Measured                   | 1765.4             | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/6/2025 | 12   | 1              | 162             |                         | 431.5          | Measured                   | 0.244                | Calculated                 | 185.8                 | Measured                   | 0.105                       | Calculated                 | 256.9          | Measured                   | 0.145                | Measured                   | 1771.7             | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/6/2025 | 13   | 1              | 163             |                         | 458.4          | Measured                   | 0.258                | Calculated                 | 186.4                 | Measured                   | 0.105                       | Calculated                 | 261.3          | Measured                   | 0.147                | Measured                   | 1777.5             | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/6/2025 | 14   | 1              | 166             |                         | 487.4          | Measured                   | 0.272                | Calculated                 | 188.2                 | Measured                   | 0.105                       | Calculated                 | 245.8          | Measured                   | 0.137                | Measured                   | 1794.3             | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/6/2025 | 15   | 1              | 165             |                         | 469.5          | Measured                   | 0.263                | Calculated                 | 186.9                 | Measured                   | 0.105                       | Calculated                 | 242.4          | Measured                   | 0.136                | Measured                   | 1782               | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/6/2025 | 16   | 1              | 165             |                         | 444.8          | Measured                   | 0.25                 | Calculated                 | 186.6                 | Measured                   | 0.105                       | Calculated                 | 238.4          | Measured                   | 0.134                | Measured                   | 1778.8             | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/6/2025 | 17   | 1              | 165             |                         | 448.2          | Measured                   | 0.251                | Calculated                 | 187.5                 | Measured                   | 0.105                       | Calculated                 | 243.2          | Measured                   | 0.136                | Measured                   | 1788.2             | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/6/2025 | 18   | 1              | 166             |                         | 451            | Measured                   | 0.254                | Calculated                 | 186.5                 | Measured                   | 0.105                       | Calculated                 | 236.5          | Measured                   | 0.133                | Measured                   | 1778.1             | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/6/2025 | 19   | 1              | 165             |                         | 450.8          | Measured                   | 0.254                | Calculated                 | 186.4                 | Measured                   | 0.105                       | Calculated                 | 241.7          | Measured                   | 0.136                | Measured                   | 1777.4             | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/6/2025 | 20   | 1              | 165             |                         | 444            | Measured                   | 0.25                 | Calculated                 | 186.2                 | Measured                   | 0.105                       | Calculated                 | 243.2          | Measured                   | 0.137                | Measured                   | 1775.2             | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/6/2025 | 21   | 1              | 165             |                         | 442.5          | Measured                   | 0.248                | Calculated                 | 187                   | Measured                   | 0.105                       | Calculated                 | 244.3          | Measured                   | 0.137                | Measured                   | 1783.1             | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/6/2025 | 22   | 1              | 165             |                         | 448.5          | Measured                   | 0.252                | Calculated                 | 186.9                 | Measured                   | 0.105                       | Calculated                 | 238.8          | Measured                   | 0.134                | Measured                   | 1782.1             | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/6/2025 | 23   | 1              | 165             |                         | 450.5          | Measured                   | 0.253                | Calculated                 | 186.6                 | Measured                   | 0.105                       | Calculated                 | 238.3          | Measured                   | 0.134                | Measured                   | 1778.7             | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/7/2025 | 0    | 1              | 165             |                         | 443.1          | Measured                   | 0.25                 | Calculated                 | 185.6                 | Measured                   | 0.105                       | Calculated                 | 237.2          | Measured                   | 0.134                | Measured                   | 1770               | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/7/2025 | 1    | 1              | 166             |                         | 438.1          | Measured                   | 0.247                | Calculated                 | 185.8                 | Measured                   | 0.105                       | Calculated                 | 232.1          | Measured                   | 0.131                | Measured                   | 1771.4             | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/7/2025 | 2    | 1              | 165             |                         | 422.1          | Measured                   | 0.238                | Calculated                 | 185.9                 | Measured                   | 0.105                       | Calculated                 | 233.9          | Measured                   | 0.132                | Measured                   | 1772.3             | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/7/2025 | 3    | 1              | 165             |                         | 439.9          | Measured                   | 0.248                | Calculated                 | 185.9                 | Measured                   | 0.105                       | Calculated                 | 237.5          | Measured                   | 0.134                | Measured                   | 1772.7             | Measured                     | Coal         |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/7/2025 | 4    | 1              | 165             |                         | 435.1          | Measured                   | 0.251                | Calculated                 | 182                   | Measured                   | 0.105                       | Calculated                 | 234.3          | Measured                   | 0.135                | Measured                   | 1795.5             |                              |              |                     |                    |                       |                                                           |             |                                   |                                    |



| State | Facility Name | Facility ID | Unit ID | Associated Stacks | Date     | Hour | Operating Time | Gross Load (MW) | Steam Load (1000 lbs/hr) | SO2 Mass (lbs) | SO2 Mass Measure Indicator | SO2 Rate (lbs/mmBtu) | SO2 Rate Measure Indicator | CO2 Mass (short tons) | CO2 Mass Measure Indicator | CO2 Rate (short tons/mmBtu) | CO2 Rate Measure Indicator | NOx Mass (lbs) | NOx Mass Measure Indicator | NOx Rate (lbs/mmBtu) | NOx Rate Measure Indicator | Heat Input Measure Indicator | Primary Fuel Type | Secondary Fuel Type | Unit Type | SO2 Controls       | NOx Controls          | PM Controls                                               | Hg Controls | Program Code                      |                                    |
|-------|---------------|-------------|---------|-------------------|----------|------|----------------|-----------------|--------------------------|----------------|----------------------------|----------------------|----------------------------|-----------------------|----------------------------|-----------------------------|----------------------------|----------------|----------------------------|----------------------|----------------------------|------------------------------|-------------------|---------------------|-----------|--------------------|-----------------------|-----------------------------------------------------------|-------------|-----------------------------------|------------------------------------|
| MI    | J H Campbell  | 1710        | 1       |                   | 6/9/2025 | 20   | 1              | 233             | 568.4                    | Measured       | 0.242                      | Calculated           | 246.1                      | Measured              | 247.7                      | Measured                    | 0.105                      | Calculated     | 349.6                      | Measured             | 0.149                      | Measured                     | 2346.4            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/9/2025 | 21   | 1              | 234             | 591.8                    | Measured       | 0.251                      | Calculated           | 247.7                      | Measured              | 247.7                      | Measured                    | 0.105                      | Calculated     | 354.3                      | Measured             | 0.15                       | Measured                     | 2361.9            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/9/2025 | 22   | 1              | 222             | 574.8                    | Measured       | 0.255                      | Calculated           | 236.8                      | Measured              | 236.8                      | Measured                    | 0.105                      | Calculated     | 352.2                      | Measured             | 0.156                      | Measured                     | 2257.7            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 6/9/2025 | 23   | 1              | 171             | 509                      | Measured       | 0.276                      | Calculated           | 193.2                      | Measured              | 193.2                      | Measured                    | 0.105                      | Calculated     | 267.2                      | Measured             | 0.145                      | Measured                     | 1842.8            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 0    | 1              | 222             | 639.2                    | Measured       | 0.263                      | Calculated           | 237.5                      | Measured              | 237.5                      | Measured                    | 0.105                      | Calculated     | 347                        | Measured             | 0.14                       | Measured                     | 2264.3            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 1    | 1              | 232             | 620.2                    | Measured       | 0.263                      | Calculated           | 247.3                      | Measured              | 247.3                      | Measured                    | 0.105                      | Calculated     | 363.2                      | Measured             | 0.154                      | Measured                     | 2358.2            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 2    | 1              | 232             | 607.1                    | Measured       | 0.258                      | Calculated           | 247.2                      | Measured              | 247.2                      | Measured                    | 0.105                      | Calculated     | 363                        | Measured             | 0.154                      | Measured                     | 2357.3            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 3    | 1              | 233             | 609.2                    | Measured       | 0.257                      | Calculated           | 248.4                      | Measured              | 248.4                      | Measured                    | 0.105                      | Calculated     | 360                        | Measured             | 0.152                      | Measured                     | 2368.7            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 4    | 1              | 232             | 560.1                    | Measured       | 0.24                       | Calculated           | 244.8                      | Measured              | 244.8                      | Measured                    | 0.105                      | Calculated     | 359.5                      | Measured             | 0.154                      | Measured                     | 2334.5            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 5    | 1              | 233             | 578.9                    | Measured       | 0.244                      | Calculated           | 248.7                      | Measured              | 248.7                      | Measured                    | 0.105                      | Calculated     | 365.2                      | Measured             | 0.154                      | Measured                     | 2371.6            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 6    | 1              | 233             | 609.7                    | Measured       | 0.258                      | Calculated           | 247.9                      | Measured              | 247.9                      | Measured                    | 0.105                      | Calculated     | 361.6                      | Measured             | 0.153                      | Measured                     | 2363.5            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 7    | 1              | 233             | 603.1                    | Measured       | 0.255                      | Calculated           | 248.2                      | Measured              | 248.2                      | Measured                    | 0.105                      | Calculated     | 355                        | Measured             | 0.15                       | Measured                     | 2368.4            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 8    | 1              | 232             | 598                      | Measured       | 0.254                      | Calculated           | 247.3                      | Measured              | 247.3                      | Measured                    | 0.105                      | Calculated     | 353.7                      | Measured             | 0.15                       | Measured                     | 2358.1            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 9    | 1              | 233             | 597.8                    | Measured       | 0.253                      | Calculated           | 248                        | Measured              | 248                        | Measured                    | 0.105                      | Calculated     | 352.3                      | Measured             | 0.149                      | Measured                     | 2364.3            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 10   | 1              | 233             | 612.4                    | Measured       | 0.26                       | Calculated           | 247                        | Measured              | 247                        | Measured                    | 0.105                      | Calculated     | 353.3                      | Measured             | 0.15                       | Measured                     | 2355.2            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 11   | 1              | 233             | 619                      | Measured       | 0.262                      | Calculated           | 247.7                      | Measured              | 247.7                      | Measured                    | 0.105                      | Calculated     | 349.6                      | Measured             | 0.148                      | Measured                     | 2362              | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 12   | 1              | 232             | 632.2                    | Measured       | 0.268                      | Calculated           | 247.7                      | Measured              | 247.7                      | Measured                    | 0.105                      | Calculated     | 352                        | Measured             | 0.149                      | Measured                     | 2362.1            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 13   | 1              | 233             | 628.6                    | Measured       | 0.265                      | Calculated           | 248.4                      | Measured              | 248.4                      | Measured                    | 0.105                      | Calculated     | 360                        | Measured             | 0.152                      | Measured                     | 2368.7            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 14   | 1              | 233             | 632.4                    | Measured       | 0.268                      | Calculated           | 247.5                      | Measured              | 247.5                      | Measured                    | 0.105                      | Calculated     | 354                        | Measured             | 0.15                       | Measured                     | 2360.1            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 15   | 1              | 232             | 635.8                    | Measured       | 0.271                      | Calculated           | 246.5                      | Measured              | 246.5                      | Measured                    | 0.105                      | Calculated     | 347.8                      | Measured             | 0.148                      | Measured                     | 2350.3            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 16   | 1              | 233             | 618.7                    | Measured       | 0.264                      | Calculated           | 246.2                      | Measured              | 246.2                      | Measured                    | 0.105                      | Calculated     | 347.4                      | Measured             | 0.148                      | Measured                     | 2347.1            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 17   | 1              | 232             | 616.6                    | Measured       | 0.263                      | Calculated           | 245.6                      | Measured              | 245.6                      | Measured                    | 0.105                      | Calculated     | 344.2                      | Measured             | 0.147                      | Measured                     | 2341.3            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 18   | 1              | 233             | 618.9                    | Measured       | 0.264                      | Calculated           | 246.3                      | Measured              | 246.3                      | Measured                    | 0.105                      | Calculated     | 342.8                      | Measured             | 0.146                      | Measured                     | 2347.9            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 19   | 1              | 233             | 620.1                    | Measured       | 0.265                      | Calculated           | 245.8                      | Measured              | 245.8                      | Measured                    | 0.105                      | Calculated     | 344.5                      | Measured             | 0.147                      | Measured                     | 2343.3            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 20   | 1              | 232             | 611.8                    | Measured       | 0.26                       | Calculated           | 245.8                      | Measured              | 245.8                      | Measured                    | 0.105                      | Calculated     | 345.9                      | Measured             | 0.147                      | Measured                     | 2352.8            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 21   | 1              | 233             | 615.7                    | Measured       | 0.26                       | Calculated           | 248.6                      | Measured              | 248.6                      | Measured                    | 0.105                      | Calculated     | 350.8                      | Measured             | 0.148                      | Measured                     | 2370.4            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 22   | 1              | 232             | 643.1                    | Measured       | 0.272                      | Calculated           | 248.1                      | Measured              | 248.1                      | Measured                    | 0.105                      | Calculated     | 350.2                      | Measured             | 0.148                      | Measured                     | 2366              | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 23   | 1              | 233             | 659.7                    | Measured       | 0.279                      | Calculated           | 248.2                      | Measured              | 248.2                      | Measured                    | 0.105                      | Calculated     | 350.3                      | Measured             | 0.148                      | Measured                     | 2366.6            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 0    | 1              | 233             | 652.8                    | Measured       | 0.276                      | Calculated           | 247.7                      | Measured              | 247.7                      | Measured                    | 0.105                      | Calculated     | 349.5                      | Measured             | 0.148                      | Measured                     | 2361.6            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 1    | 1              | 233             | 637.6                    | Measured       | 0.271                      | Calculated           | 246.9                      | Measured              | 246.9                      | Measured                    | 0.105                      | Calculated     | 348.5                      | Measured             | 0.148                      | Measured                     | 2354.5            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 2    | 1              | 232             | 638.5                    | Measured       | 0.272                      | Calculated           | 245.9                      | Measured              | 245.9                      | Measured                    | 0.105                      | Calculated     | 340                        | Measured             | 0.145                      | Measured                     | 2346.4            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 3    | 1              | 233             | 626.4                    | Measured       | 0.264                      | Calculated           | 248.7                      | Measured              | 248.7                      | Measured                    | 0.105                      | Calculated     | 343.8                      | Measured             | 0.145                      | Measured                     | 2370.9            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 4    | 1              | 233             | 590.7                    | Measured       | 0.255                      | Calculated           | 243.4                      | Measured              | 243.4                      | Measured                    | 0.105                      | Calculated     | 338.8                      | Measured             | 0.146                      | Measured                     | 2320.7            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 5    | 1              | 233             | 582                      | Measured       | 0.248                      | Calculated           | 245.6                      | Measured              | 245.6                      | Measured                    | 0.105                      | Calculated     | 339.6                      | Measured             | 0.145                      | Measured                     | 2342.1            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 6    | 1              | 233             | 609.2                    | Measured       | 0.258                      | Calculated           | 247.5                      | Measured              | 247.5                      | Measured                    | 0.105                      | Calculated     | 344.5                      | Measured             | 0.146                      | Measured                     | 2359.4            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 7    | 1              | 232             | 631.8                    | Measured       | 0.269                      | Calculated           | 246.6                      | Measured              | 246.6                      | Measured                    | 0.105                      | Calculated     | 350.3                      | Measured             | 0.149                      | Measured                     | 2351.3            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 8    | 1              | 233             | 609.7                    | Measured       | 0.258                      | Calculated           | 247.6                      | Measured              | 247.6                      | Measured                    | 0.105                      | Calculated     | 344.6                      | Measured             | 0.146                      | Measured                     | 2360.3            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 9    | 1              | 233             | 619.1                    | Measured       | 0.261                      | Calculated           | 249                        | Measured              | 249                        | Measured                    | 0.105                      | Calculated     | 339.5                      | Measured             | 0.143                      | Measured                     | 2373.9            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 10   | 1              | 233             | 619.3                    | Measured       | 0.261                      | Calculated           | 248.8                      | Measured              | 248.8                      | Measured                    | 0.105                      | Calculated     | 344                        | Measured             | 0.145                      | Measured                     | 2372.6            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 11   | 1              | 232             | 641                      | Measured       | 0.27                       | Calculated           | 249.2                      | Measured              | 249.2                      | Measured                    | 0.105                      | Calculated     | 346.9                      | Measured             | 0.146                      | Measured                     | 2376              | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 12   | 1              | 233             | 642.4                    | Measured       | 0.272                      | Calculated           | 247.9                      | Measured              | 247.9                      | Measured                    | 0.105                      | Calculated     | 349.8                      | Measured             | 0.148                      | Measured                     | 2363.6            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 13   | 1              | 233             | 592.7                    | Measured       | 0.248                      | Calculated           | 250.2                      | Measured              | 250.2                      | Measured                    | 0.105                      | Calculated     | 350.7                      | Measured             | 0.147                      | Measured                     | 2385.4            | Measured            | Coal      | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | #####    | 14   | 1              | 233             | 563.7                    | Measured       | 0.237                      | Calculated           | 249.8                      | Measured              | 249.8                      | Measured                    | 0.105                      |                |                            |                      |                            |                              |                   |                     |           |                    |                       |                                                           |             |                                   |                                    |



| State | Facility Name | Facility ID | Unit ID | Associated Stacks | Date  | Hour | Operating Time | Gross Load (MW) | Steam Load (1000 lb/hr) | SO2 Mass (lbs) | SO2 Mass Measure Indicator | SO2 Rate (lbs/mmBtu) | SO2 Rate Measure Indicator | CO2 Mass (short tons) | CO2 Mass Measure Indicator | CO2 Rate (short tons/mmBtu) | CO2 Rate Measure Indicator | NOx Mass (lbs) | NOx Mass Measure Indicator | NOx Rate (lbs/mmBtu) | NOx Rate Measure Indicator | Heat Input (mmBtu) | Heat Input Measure Indicator | Primary Fuel Type | Secondary Fuel Type | Unit Type | SO2 Controls       | NOx Controls          | PM Controls                                               | Hg Controls | Program Code                      |                                    |
|-------|---------------|-------------|---------|-------------------|-------|------|----------------|-----------------|-------------------------|----------------|----------------------------|----------------------|----------------------------|-----------------------|----------------------------|-----------------------------|----------------------------|----------------|----------------------------|----------------------|----------------------------|--------------------|------------------------------|-------------------|---------------------|-----------|--------------------|-----------------------|-----------------------------------------------------------|-------------|-----------------------------------|------------------------------------|
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 6    | 1              | 232             | 580.8                   | Measured       | 0.254                      | Calculated           | 248.1                      | Measured              | 248.6                      | Measured                    | 0.105                      | Calculated     | 335.9                      | Measured             | 0.142                      | Measured           | 2365.2                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 7    | 1              | 232             | 584                     | Measured       | 0.246                      | Calculated           | 248.8                      | Measured              | 248.8                      | Measured                    | 0.105                      | Calculated     | 339                        | Measured             | 0.143                      | Measured           | 2370.2                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 8    | 1              | 232             | 589.3                   | Measured       | 0.248                      | Calculated           | 249.8                      | Measured              | 249.8                      | Measured                    | 0.105                      | Calculated     | 339.2                      | Measured             | 0.143                      | Measured           | 2373.2                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 9    | 1              | 232             | 593.7                   | Measured       | 0.249                      | Calculated           | 249.6                      | Measured              | 249.6                      | Measured                    | 0.105                      | Calculated     | 340.4                      | Measured             | 0.143                      | Measured           | 2380.3                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 10   | 1              | 232             | 619.2                   | Measured       | 0.261                      | Calculated           | 249.1                      | Measured              | 249.1                      | Measured                    | 0.105                      | Calculated     | 347.3                      | Measured             | 0.142                      | Measured           | 2375.5                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 11   | 1              | 231             | 603.2                   | Measured       | 0.255                      | Calculated           | 248                        | Measured              | 248                        | Measured                    | 0.105                      | Calculated     | 335.8                      | Measured             | 0.142                      | Measured           | 2365                         | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 12   | 1              | 231             | 601.8                   | Measured       | 0.254                      | Calculated           | 248.2                      | Measured              | 248.2                      | Measured                    | 0.105                      | Calculated     | 338.5                      | Measured             | 0.143                      | Measured           | 2368.8                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 13   | 1              | 232             | 602.6                   | Measured       | 0.251                      | Calculated           | 251.3                      | Measured              | 251.3                      | Measured                    | 0.105                      | Calculated     | 340.3                      | Measured             | 0.142                      | Measured           | 2396.2                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 14   | 1              | 232             | 590.3                   | Measured       | 0.249                      | Calculated           | 248.7                      | Measured              | 248.7                      | Measured                    | 0.105                      | Calculated     | 343.8                      | Measured             | 0.145                      | Measured           | 2371.1                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 15   | 1              | 232             | 595.6                   | Measured       | 0.253                      | Calculated           | 247.3                      | Measured              | 247.3                      | Measured                    | 0.105                      | Calculated     | 339.6                      | Measured             | 0.144                      | Measured           | 2358.1                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 16   | 1              | 232             | 607.8                   | Measured       | 0.258                      | Calculated           | 246.9                      | Measured              | 246.9                      | Measured                    | 0.105                      | Calculated     | 341.3                      | Measured             | 0.145                      | Measured           | 2353.9                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 17   | 1              | 231             | 601.1                   | Measured       | 0.256                      | Calculated           | 246.4                      | Measured              | 246.4                      | Measured                    | 0.105                      | Calculated     | 345.3                      | Measured             | 0.147                      | Measured           | 2349                         | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 18   | 1              | 232             | 588.9                   | Measured       | 0.251                      | Calculated           | 246.3                      | Measured              | 246.3                      | Measured                    | 0.105                      | Calculated     | 345.2                      | Measured             | 0.147                      | Measured           | 2348.3                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 19   | 1              | 232             | 611.1                   | Measured       | 0.259                      | Calculated           | 247.5                      | Measured              | 247.5                      | Measured                    | 0.105                      | Calculated     | 349.2                      | Measured             | 0.148                      | Measured           | 2398.6                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 20   | 1              | 231             | 602.3                   | Measured       | 0.255                      | Calculated           | 248.1                      | Measured              | 248.1                      | Measured                    | 0.105                      | Calculated     | 350.1                      | Measured             | 0.148                      | Measured           | 2365.3                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 21   | 1              | 231             | 597.6                   | Measured       | 0.252                      | Calculated           | 248.5                      | Measured              | 248.5                      | Measured                    | 0.105                      | Calculated     | 348.3                      | Measured             | 0.147                      | Measured           | 2369.3                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 22   | 1              | 232             | 651.1                   | Measured       | 0.273                      | Calculated           | 250.3                      | Measured              | 250.3                      | Measured                    | 0.105                      | Calculated     | 350.8                      | Measured             | 0.147                      | Measured           | 2386.1                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 23   | 1              | 231             | 957.9                   | Measured       | 0.404                      | Calculated           | 248.7                      | Measured              | 248.7                      | Measured                    | 0.105                      | Calculated     | 358                        | Measured             | 0.151                      | Measured           | 2370.9                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 0    | 1              | 232             | 689.4                   | Measured       | 0.291                      | Calculated           | 248.2                      | Measured              | 248.2                      | Measured                    | 0.105                      | Calculated     | 347.9                      | Measured             | 0.147                      | Measured           | 2366.6                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 1    | 1              | 232             | 637.5                   | Measured       | 0.268                      | Calculated           | 249.4                      | Measured              | 249.4                      | Measured                    | 0.105                      | Calculated     | 344.9                      | Measured             | 0.146                      | Measured           | 2378.4                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 2    | 1              | 232             | 641.5                   | Measured       | 0.272                      | Calculated           | 247.5                      | Measured              | 247.5                      | Measured                    | 0.105                      | Calculated     | 344.6                      | Measured             | 0.145                      | Measured           | 2360                         | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 3    | 1              | 231             | 613.6                   | Measured       | 0.258                      | Calculated           | 249.6                      | Measured              | 249.6                      | Measured                    | 0.105                      | Calculated     | 345                        | Measured             | 0.145                      | Measured           | 2379.6                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 4    | 1              | 232             | 571.7                   | Measured       | 0.243                      | Calculated           | 246.7                      | Measured              | 246.7                      | Measured                    | 0.105                      | Calculated     | 336.4                      | Measured             | 0.143                      | Measured           | 2352.1                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 5    | 1              | 232             | 573.7                   | Measured       | 0.241                      | Calculated           | 249.4                      | Measured              | 249.4                      | Measured                    | 0.105                      | Calculated     | 337.6                      | Measured             | 0.142                      | Measured           | 2377.7                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 6    | 1              | 232             | 573.6                   | Measured       | 0.241                      | Calculated           | 249.3                      | Measured              | 249.3                      | Measured                    | 0.105                      | Calculated     | 337.5                      | Measured             | 0.142                      | Measured           | 2377.1                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 7    | 1              | 232             | 602                     | Measured       | 0.255                      | Calculated           | 248                        | Measured              | 248                        | Measured                    | 0.105                      | Calculated     | 338.1                      | Measured             | 0.143                      | Measured           | 2364.5                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 8    | 1              | 231             | 588.2                   | Measured       | 0.248                      | Calculated           | 248.5                      | Measured              | 248.5                      | Measured                    | 0.105                      | Calculated     | 336.5                      | Measured             | 0.142                      | Measured           | 2369.7                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 9    | 1              | 232             | 594.9                   | Measured       | 0.251                      | Calculated           | 248.8                      | Measured              | 248.8                      | Measured                    | 0.105                      | Calculated     | 339.2                      | Measured             | 0.143                      | Measured           | 2372.2                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 10   | 1              | 231             | 583.9                   | Measured       | 0.246                      | Calculated           | 249.3                      | Measured              | 249.3                      | Measured                    | 0.105                      | Calculated     | 344.7                      | Measured             | 0.145                      | Measured           | 2377.2                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 11   | 1              | 232             | 602.4                   | Measured       | 0.252                      | Calculated           | 250.4                      | Measured              | 250.4                      | Measured                    | 0.105                      | Calculated     | 346.2                      | Measured             | 0.145                      | Measured           | 2387.4                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 12   | 1              | 231             | 596.1                   | Measured       | 0.25                       | Calculated           | 249.8                      | Measured              | 249.8                      | Measured                    | 0.105                      | Calculated     | 347.7                      | Measured             | 0.146                      | Measured           | 2381.8                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 13   | 1              | 232             | 608.7                   | Measured       | 0.254                      | Calculated           | 251.2                      | Measured              | 251.2                      | Measured                    | 0.105                      | Calculated     | 347.8                      | Measured             | 0.145                      | Measured           | 2398.7                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 14   | 1              | 232             | 585.6                   | Measured       | 0.244                      | Calculated           | 251.3                      | Measured              | 251.3                      | Measured                    | 0.105                      | Calculated     | 345.1                      | Measured             | 0.144                      | Measured           | 2396.5                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 15   | 1              | 232             | 585.6                   | Measured       | 0.244                      | Calculated           | 251.3                      | Measured              | 251.3                      | Measured                    | 0.105                      | Calculated     | 345.1                      | Measured             | 0.144                      | Measured           | 2396.5                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 16   | 1              | 232             | 581.9                   | Measured       | 0.245                      | Calculated           | 248.7                      | Measured              | 248.7                      | Measured                    | 0.105                      | Calculated     | 341.5                      | Measured             | 0.144                      | Measured           | 2371.4                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 17   | 1              | 232             | 578.8                   | Measured       | 0.245                      | Calculated           | 247.9                      | Measured              | 247.9                      | Measured                    | 0.105                      | Calculated     | 333.3                      | Measured             | 0.141                      | Measured           | 2368.3                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 18   | 1              | 231             | 608.4                   | Measured       | 0.257                      | Calculated           | 247.9                      | Measured              | 247.9                      | Measured                    | 0.105                      | Calculated     | 335.6                      | Measured             | 0.142                      | Measured           | 2363.2                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 19   | 1              | 232             | 599.5                   | Measured       | 0.253                      | Calculated           | 248.4                      | Measured              | 248.4                      | Measured                    | 0.105                      | Calculated     | 338.7                      | Measured             | 0.143                      | Measured           | 2368.8                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 20   | 1              | 231             | 593.5                   | Measured       | 0.249                      | Calculated           | 249.5                      | Measured              | 249.5                      | Measured                    | 0.105                      | Calculated     | 342.6                      | Measured             | 0.144                      | Measured           | 2379.1                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 21   | 1              | 232             | 585.7                   | Measured       | 0.247                      | Calculated           | 248.8                      | Measured              | 248.8                      | Measured                    | 0.105                      | Calculated     | 348.7                      | Measured             | 0.147                      | Measured           | 2372.1                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 22   | 1              | 232             | 591.5                   | Measured       | 0.248                      | Calculated           | 249.9                      | Measured              | 249.9                      | Measured                    | 0.105                      | Calculated     | 350.3                      | Measured             | 0.147                      | Measured           | 2383.1                       | Measured          | Coal                |           | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       | 1                 | ##### | 23   | 1              | 232             | 584.5                   | Measured       | 0.245                      | Calculated           | 250.1                      | Measured              | 250.1                      | Measured                    | 0.105                      | Calculated     | 348.1                      |                      |                            |                    |                              |                   |                     |           |                    |                       |                                                           |             |                                   |                                    |



| State | Facility Name | Facility ID | Unit ID | Associated Stacks | Date     | Hour | Operating Time | Gross Load (MW) | Steam Load (1000 lb/hr) | SO2 Mass (lbs) | SO2 Mass Measure Indicator | SO2 Rate (lbs/mmBtu) | SO2 Rate Measure Indicator | CO2 Mass (short tons) | CO2 Mass Measure Indicator | CO2 Rate (short tons/mmBtu) | CO2 Rate Measure Indicator | NOx Mass (lbs) | NOx Mass Measure Indicator | NOx Rate (lbs/mmBtu) | NOx Rate Measure Indicator | Heat Input (mmBtu) | Heat Input Measure Indicator | Primary Fuel Type | Secondary Fuel Type | Unit Type          | SO2 Controls          | NOx Controls                                              | PM Controls | Hg Controls                       | Program Code                       |
|-------|---------------|-------------|---------|-------------------|----------|------|----------------|-----------------|-------------------------|----------------|----------------------------|----------------------|----------------------------|-----------------------|----------------------------|-----------------------------|----------------------------|----------------|----------------------------|----------------------|----------------------------|--------------------|------------------------------|-------------------|---------------------|--------------------|-----------------------|-----------------------------------------------------------|-------------|-----------------------------------|------------------------------------|
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 16   | 1              | 235             | 666.3                   | Measured       | 0.271                      | Calculated           | 258.3                      | Measured              | 258.3                      | 0.105                       | Calculated                 | 369.4          | Measured                   | 0.15                 | Measured                   | 2462.4             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 17   | 1              | 235             | 680.9                   | Measured       | 0.276                      | Calculated           | 259                        | Measured              | 259                        | 0.105                       | Calculated                 | 363.1          | Measured                   | 0.147                | Measured                   | 2469.8             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 18   | 1              | 235             | 673.4                   | Measured       | 0.273                      | Calculated           | 258.8                      | Measured              | 258.8                      | 0.105                       | Calculated                 | 365.2          | Measured                   | 0.148                | Measured                   | 2467.7             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 19   | 1              | 235             | 680.6                   | Measured       | 0.269                      | Calculated           | 257.3                      | Measured              | 257.3                      | 0.105                       | Calculated                 | 372.9          | Measured                   | 0.152                | Measured                   | 2453.2             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 20   | 1              | 235             | 652.5                   | Measured       | 0.265                      | Calculated           | 258.3                      | Measured              | 258.3                      | 0.105                       | Calculated                 | 379.2          | Measured                   | 0.154                | Measured                   | 2462.5             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 21   | 1              | 236             | 651.6                   | Measured       | 0.265                      | Calculated           | 258.1                      | Measured              | 258.1                      | 0.105                       | Calculated                 | 376.5          | Measured                   | 0.153                | Measured                   | 2460.8             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 22   | 1              | 235             | 684.6                   | Measured       | 0.278                      | Calculated           | 258.6                      | Measured              | 258.6                      | 0.105                       | Calculated                 | 379.7          | Measured                   | 0.154                | Measured                   | 2465.8             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 23   | 1              | 235             | 875.9                   | Measured       | 0.358                      | Calculated           | 256.3                      | Measured              | 256.3                      | 0.105                       | Calculated                 | 386.2          | Measured                   | 0.158                | Measured                   | 2444.2             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 0    | 1              | 235             | 709.4                   | Measured       | 0.291                      | Calculated           | 255.9                      | Measured              | 255.9                      | 0.105                       | Calculated                 | 375.8          | Measured                   | 0.154                | Measured                   | 2440.4             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 1    | 1              | 235             | 665.6                   | Measured       | 0.274                      | Calculated           | 254.7                      | Measured              | 254.7                      | 0.105                       | Calculated                 | 369.1          | Measured                   | 0.152                | Measured                   | 2428               | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 2    | 1              | 235             | 659.4                   | Measured       | 0.27                       | Calculated           | 256.5                      | Measured              | 256.5                      | 0.105                       | Calculated                 | 359.5          | Measured                   | 0.147                | Measured                   | 2445.8             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 3    | 1              | 235             | 667.8                   | Measured       | 0.272                      | Calculated           | 257.4                      | Measured              | 257.4                      | 0.105                       | Calculated                 | 365.7          | Measured                   | 0.149                | Measured                   | 2454.1             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 4    | 1              | 235             | 635.8                   | Measured       | 0.263                      | Calculated           | 253.5                      | Measured              | 253.5                      | 0.105                       | Calculated                 | 360.1          | Measured                   | 0.149                | Measured                   | 2416.7             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 5    | 1              | 235             | 650                     | Measured       | 0.267                      | Calculated           | 255.3                      | Measured              | 255.3                      | 0.105                       | Calculated                 | 367.6          | Measured                   | 0.151                | Measured                   | 2434.2             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 6    | 1              | 236             | 673                     | Measured       | 0.276                      | Calculated           | 255.6                      | Measured              | 255.6                      | 0.105                       | Calculated                 | 370.4          | Measured                   | 0.152                | Measured                   | 2436.9             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 7    | 1              | 235             | 668.5                   | Measured       | 0.276                      | Calculated           | 253.9                      | Measured              | 253.9                      | 0.105                       | Calculated                 | 365.5          | Measured                   | 0.151                | Measured                   | 2420.5             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 8    | 1              | 243             | 724.7                   | Measured       | 0.292                      | Calculated           | 260.7                      | Measured              | 260.7                      | 0.105                       | Calculated                 | 377.8          | Measured                   | 0.152                | Measured                   | 2485.4             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 9    | 1              | 257             | 692.6                   | Measured       | 0.262                      | Calculated           | 276.9                      | Measured              | 276.9                      | 0.105                       | Calculated                 | 390.8          | Measured                   | 0.148                | Measured                   | 2604.6             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 10   | 1              | 256             | 688.5                   | Measured       | 0.264                      | Calculated           | 273                        | Measured              | 273                        | 0.105                       | Calculated                 | 393.1          | Measured                   | 0.151                | Measured                   | 2603.4             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 11   | 1              | 256             | 701.2                   | Measured       | 0.267                      | Calculated           | 275.1                      | Measured              | 275.1                      | 0.105                       | Calculated                 | 396.1          | Measured                   | 0.151                | Measured                   | 2623.1             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 12   | 1              | 257             | 701.7                   | Measured       | 0.266                      | Calculated           | 276.9                      | Measured              | 276.9                      | 0.105                       | Calculated                 | 401.3          | Measured                   | 0.152                | Measured                   | 2640               | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 13   | 1              | 257             | 713.7                   | Measured       | 0.271                      | Calculated           | 276.6                      | Measured              | 276.6                      | 0.105                       | Calculated                 | 403.5          | Measured                   | 0.153                | Measured                   | 2637.4             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 14   | 1              | 257             | 718.9                   | Measured       | 0.271                      | Calculated           | 277.9                      | Measured              | 277.9                      | 0.105                       | Calculated                 | 408            | Measured                   | 0.154                | Measured                   | 2649.2             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 15   | 1              | 257             | 715.9                   | Measured       | 0.272                      | Calculated           | 275.7                      | Measured              | 275.7                      | 0.105                       | Calculated                 | 399.5          | Measured                   | 0.152                | Measured                   | 2625.5             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 16   | 1              | 257             | 733.5                   | Measured       | 0.278                      | Calculated           | 276.3                      | Measured              | 276.3                      | 0.105                       | Calculated                 | 400.4          | Measured                   | 0.152                | Measured                   | 2634               | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 17   | 1              | 256             | 721                     | Measured       | 0.275                      | Calculated           | 275.1                      | Measured              | 275.1                      | 0.105                       | Calculated                 | 393.4          | Measured                   | 0.15                 | Measured                   | 2622.8             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 18   | 1              | 257             | 704.8                   | Measured       | 0.268                      | Calculated           | 276.3                      | Measured              | 276.3                      | 0.105                       | Calculated                 | 403.1          | Measured                   | 0.153                | Measured                   | 2634.6             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 19   | 1              | 258             | 697.5                   | Measured       | 0.265                      | Calculated           | 275.8                      | Measured              | 275.8                      | 0.105                       | Calculated                 | 397.1          | Measured                   | 0.151                | Measured                   | 2630               | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 20   | 1              | 250             | 677.7                   | Measured       | 0.268                      | Calculated           | 265                        | Measured              | 265                        | 0.105                       | Calculated                 | 381.5          | Measured                   | 0.151                | Measured                   | 2526.8             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 21   | 1              | 256             | 720.6                   | Measured       | 0.28                       | Calculated           | 269.9                      | Measured              | 269.9                      | 0.105                       | Calculated                 | 388.5          | Measured                   | 0.151                | Measured                   | 2573               | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 22   | 1              | 255             | 706.4                   | Measured       | 0.274                      | Calculated           | 270.5                      | Measured              | 270.5                      | 0.105                       | Calculated                 | 384.3          | Measured                   | 0.149                | Measured                   | 2579.4             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 23   | 1              | 255             | 693.3                   | Measured       | 0.271                      | Calculated           | 268.6                      | Measured              | 268.6                      | 0.105                       | Calculated                 | 379            | Measured                   | 0.148                | Measured                   | 2560.6             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 0       |                   | 1/1/2011 | 0    | 1              | 256             | 702.9                   | Measured       | 0.274                      | Calculated           | 268.7                      | Measured              | 268.7                      | 0.105                       | Calculated                 | 386.8          | Measured                   | 0.151                | Measured                   | 2561.9             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 1    | 1              | 256             | 712.3                   | Measured       | 0.275                      | Calculated           | 271.5                      | Measured              | 271.5                      | 0.105                       | Calculated                 | 390.9          | Measured                   | 0.151                | Measured                   | 2588.7             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 2    | 1              | 256             | 699.2                   | Measured       | 0.27                       | Calculated           | 271.8                      | Measured              | 271.8                      | 0.105                       | Calculated                 | 386.2          | Measured                   | 0.149                | Measured                   | 2591.9             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 3    | 1              | 256             | 699.2                   | Measured       | 0.269                      | Calculated           | 272.3                      | Measured              | 272.3                      | 0.105                       | Calculated                 | 379.1          | Measured                   | 0.146                | Measured                   | 2596.3             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 4    | 1              | 256             | 703.3                   | Measured       | 0.282                      | Calculated           | 270.9                      | Measured              | 270.9                      | 0.105                       | Calculated                 | 382.2          | Measured                   | 0.148                | Measured                   | 2582.6             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 5    | 1              | 256             | 733.8                   | Measured       | 0.283                      | Calculated           | 272.3                      | Measured              | 272.3                      | 0.105                       | Calculated                 | 389.5          | Measured                   | 0.15                 | Measured                   | 2596.5             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 6    | 1              | 255             | 709.8                   | Measured       | 0.273                      | Calculated           | 272.8                      | Measured              | 272.8                      | 0.105                       | Calculated                 | 390.2          | Measured                   | 0.15                 | Measured                   | 2601.4             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 7    | 1              | 257             | 660                     | Measured       | 0.252                      | Calculated           | 274.4                      | Measured              | 274.4                      | 0.105                       | Calculated                 | 389.9          | Measured                   | 0.149                | Measured                   | 2616.7             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 8    | 1              | 256             | 646.1                   | Measured       | 0.25                       | Calculated           | 270.8                      | Measured              | 270.8                      | 0.105                       | Calculated                 | 384.7          | Measured                   | 0.149                | Measured                   | 2581.8             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | 1/1/2011 | 9    | 1              | 256             | 688.5                   | Measured       | 0.267                      | Calculated           | 270.5                      | Measured              | 270.5                      | 0.105                       | Calculated                 | 381.7          | Measured                   | 0.148                | Measured                   | 2579.3             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection |                                                           |             |                                   |                                    |



| State | Facility Name | Facility ID | Unit ID | Associated Stacks | Date  | Hour | Operating Time | Gross Load (MW) | Steam Load (1000 lb/hr) | SO2 Mass (lbs) | SO2 Mass Measure Indicator | SO2 Rate (lb/smmBtu) | SO2 Rate Measure Indicator | CO2 Mass (short tons) | CO2 Mass Measure Indicator | CO2 Rate (short tons/mmmBtu) | CO2 Rate Measure Indicator | NOx Mass (lbs) | NOx Mass Measure Indicator | NOx Rate (lb/smmBtu) | NOx Rate Measure Indicator | Heat Input (mmBtu) | Heat Input Measure Indicator | Primary Fuel Type | Secondary Fuel Type | Unit Type          | SO2 Controls          | NOx Controls                                              | PM Controls | Hg Controls                       | Program Code                       |
|-------|---------------|-------------|---------|-------------------|-------|------|----------------|-----------------|-------------------------|----------------|----------------------------|----------------------|----------------------------|-----------------------|----------------------------|------------------------------|----------------------------|----------------|----------------------------|----------------------|----------------------------|--------------------|------------------------------|-------------------|---------------------|--------------------|-----------------------|-----------------------------------------------------------|-------------|-----------------------------------|------------------------------------|
| MI    | J H Campbell  | 1710        | 1       |                   | ##### | 2    | 1              | 234             |                         | 657            | Measured                   | 0.268                | Calculated                 | 257.1                 | Measured                   | 0.105                        | Calculated                 | 330.9          | Measured                   | 0.135                | Measured                   | 245.12             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | ##### | 3    | 1              | 233             |                         | 584.5          | Measured                   | 0.241                | Calculated                 | 254.6                 | Measured                   | 0.105                        | Calculated                 | 330.2          | Measured                   | 0.136                | Measured                   | 242.77             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | ##### | 4    | 1              | 236             |                         | 572.6          | Measured                   | 0.235                | Calculated                 | 255.1                 | Measured                   | 0.105                        | Calculated                 | 332.5          | Measured                   | 0.133                | Measured                   | 243.27             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | ##### | 5    | 1              | 236             |                         | 622.5          | Measured                   | 0.254                | Calculated                 | 257.9                 | Measured                   | 0.105                        | Calculated                 | 332            | Measured                   | 0.135                | Measured                   | 245.93             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | ##### | 6    | 1              | 236             |                         | 649.6          | Measured                   | 0.262                | Calculated                 | 259.6                 | Measured                   | 0.105                        | Calculated                 | 336.7          | Measured                   | 0.136                | Measured                   | 247.53             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | ##### | 7    | 1              | 242             |                         | 704.8          | Measured                   | 0.277                | Calculated                 | 266.4                 | Measured                   | 0.105                        | Calculated                 | 355.7          | Measured                   | 0.14                 | Measured                   | 254.04             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | ##### | 8    | 1              | 257             |                         | 779.7          | Measured                   | 0.286                | Calculated                 | 268.4                 | Measured                   | 0.105                        | Calculated                 | 423.2          | Measured                   | 0.155                | Measured                   | 273.03             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | ##### | 9    | 1              | 257             |                         | 755.5          | Measured                   | 0.278                | Calculated                 | 265.1                 | Measured                   | 0.105                        | Calculated                 | 421.3          | Measured                   | 0.155                | Measured                   | 271.83             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | ##### | 10   | 1              | 258             |                         | 771.6          | Measured                   | 0.284                | Calculated                 | 285.1                 | Measured                   | 0.105                        | Calculated                 | 424.1          | Measured                   | 0.156                | Measured                   | 271.87             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | ##### | 11   | 1              | 258             |                         | 783.4          | Measured                   | 0.287                | Calculated                 | 285.9                 | Measured                   | 0.105                        | Calculated                 | 419.8          | Measured                   | 0.154                | Measured                   | 2726               | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | ##### | 12   | 1              | 257             |                         | 753.1          | Measured                   | 0.275                | Calculated                 | 286.8                 | Measured                   | 0.105                        | Calculated                 | 429.3          | Measured                   | 0.157                | Measured                   | 2734.8             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | ##### | 13   | 1              | 258             |                         | 702.9          | Measured                   | 0.255                | Calculated                 | 288.8                 | Measured                   | 0.105                        | Calculated                 | 432.3          | Measured                   | 0.157                | Measured                   | 2753.2             | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 1       |                   | ##### | 14   | 0.85           | 252             |                         | 581.7          | Measured                   | 0.248                | Calculated                 | 245.56                | Measured                   | 0.105                        | Calculated                 | 362.9          | Measured                   | 0.155                | Measured                   | 2341.325           | Measured                     | Coal              |                     | Tangentially-fired | Dry Sorbent Injection | Low NOx Burner Technology w/ Closed-coupled/Separated OFA | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | ##### | 20   | 0.43           | 0               |                         | 0              | Measured                   | 0                    | Calculated                 | 1.118                 | Measured                   | 0.105                        | Calculated                 | 0              | Measured                   | 0.001                | Measured                   | 10.664             | Measured                     | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | ##### | 21   | 1              | 0               |                         | 0              | Measured                   | 0                    | Calculated                 | 1.17                  | Measured                   | 0.105                        | Calculated                 | 0.2            | Measured                   | 0.001                | Substitute                 | 162.3              | Measured                     | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | ##### | 22   | 1              | 0               |                         | 0              | Measured                   | 0                    | Calculated                 | 17.2                  | Measured                   | 0.105                        | Calculated                 | 0.2            | Measured                   | 0.001                | Substitute                 | 163.8              | Measured                     | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | ##### | 23   | 1              | 0               |                         | 0              | Measured                   | 0                    | Calculated                 | 17.4                  | Measured                   | 0.105                        | Calculated                 | 0.2            | Measured                   | 0.001                | Substitute                 | 165.4              | Measured                     | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | ##### | 0    | 1              | 0               |                         | 0              | Measured                   | 0                    | Calculated                 | 17.1                  | Measured                   | 0.105                        | Calculated                 | 0.2            | Measured                   | 0.001                | Substitute                 | 163.3              | Measured                     | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | ##### | 1    | 1              | 0               |                         | 0              | Measured                   | 0                    | Calculated                 | 17                    | Measured                   | 0.105                        | Calculated                 | 0.2            | Measured                   | 0.001                | Substitute                 | 162                | Measured                     | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | ##### | 2    | 1              | 0               |                         | 0              | Measured                   | 0                    | Calculated                 | 16.9                  | Measured                   | 0.105                        | Calculated                 | 0.2            | Measured                   | 0.001                | Substitute                 | 160.9              | Measured                     | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | ##### | 3    | 1              | 0               |                         | 6.5            | Measured                   | 0.023                | Calculated                 | 30.2                  | Measured                   | 0.105                        | Calculated                 | 0.3            | Measured                   | 0.001                | Substitute                 | 287.7              | Measured                     | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | ##### | 4    | 1              | 0               |                         | 7.7            | Measured                   | 0.023                | Calculated                 | 34.4                  | Measured                   | 0.105                        | Calculated                 | 0.3            | Measured                   | 0.001                | Substitute                 | 328.4              | Measured                     | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | ##### | 5    | 1              | 0               |                         | 42.1           | Measured                   | 0.118                | Calculated                 | 37.3                  | Measured                   | 0.105                        | Calculated                 | 56.9           | Measured                   | 0.16                 | Measured                   | 355.7              | Measured                     | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | ##### | 6    | 1              | 0               |                         | 19.8           | Measured                   | 0.051                | Calculated                 | 40.4                  | Measured                   | 0.105                        | Calculated                 | 61.3           | Measured                   | 0.159                | Measured                   | 385.3              | Measured                     | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | ##### | 7    | 1              | 0               |                         | 33.8           | Measured                   | 0.093                | Calculated                 | 38.1                  | Measured                   | 0.105                        | Calculated                 | 54.5           | Measured                   | 0.15                 | Measured                   | 363.5              | Measured                     | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | ##### | 8    | 1              | 0               |                         | 12.4           | Measured                   | 0.041                | Calculated                 | 31.4                  | Measured                   | 0.105                        | Calculated                 | 37.1           | Measured                   | 0.124                | Measured                   | 299.5              | Measured                     | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | ##### | 9    | 1              | 0               |                         | 8.8            | Measured                   | 0.031                | Calculated                 | 30.1                  | Measured                   | 0.105                        | Calculated                 | 33             | Measured                   | 0.115                | Measured                   | 287.1              | Measured                     | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | ##### | 10   | 1              | 0               |                         | 21.3           | Measured                   | 0.064                | Calculated                 | 35                    | Measured                   | 0.105                        | Calculated                 | 44             | Measured                   | 0.132                | Measured                   | 333.4              | Measured                     | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | ##### | 11   | 0.35           | 0               |                         | 9.555          | Measured                   | 0.075                | Calculated                 | 13.33                 | Measured                   | 0.105                        | Calculated                 | 18.83          | Measured                   | 0.148                | Measured                   | 127.19             | Measured                     | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | ##### | 18   | 0.22           | 0               |                         | 0              | Measured                   | 0                    | Calculated                 | 0.572                 | Measured                   | 0.106                        | Calculated                 | 0.022          | Measured                   | 0.003                | Measured                   | 5.39               | Measured                     | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | ##### | 19   | 1              | 0               |                         | 0              | Measured                   | 0                    | Calculated                 | 10.4                  | Measured                   | 0.105                        | Calculated                 | 1              | Measured                   | 0.01                 | Measured                   | 99                 | Measured                     | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | ##### | 20   | 1              | 0               |                         | 0              | Measured                   | 0                    | Calculated                 | 11.9                  | Measured                   | 0.105                        | Calculated                 | 1.6            | Measured                   | 0.014                | Measured                   | 113.4              | Measured                     | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | ##### | 21   | 1              | 0               |                         | 0.9            | Measured                   | 0.003                | Calculated                 | 27.4                  | Measured                   | 0.105                        | Calculated                 | 23.8           | Measured                   | 0.091                | Measured                   | 261                | Measured                     | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | ##### | 22   | 1              | 0               |                         | 5.6            | Measured                   | 0.019                | Calculated                 | 31.7                  | Measured                   | 0.105                        | Calculated                 | 34.7           | Measured                   | 0.117                | Measured                   | 297                | Measured                     | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | ##### | 23   | 1              | 0               |                         | 18.4           | Measured                   | 0.068                | Calculated                 | 28.5                  | Measured                   | 0.105                        | Calculated                 | 31.5           | Measured                   | 0.116                | Measured                   | 271.8              | Measured                     | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | ##### | 0    | 1              | 0               |                         | 15             | Measured                   | 0.053                | Calculated                 | 29.7                  | Measured                   | 0.105                        | Calculated                 | 32.8           | Measured                   | 0.116                | Measured                   | 283.1              | Measured                     | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | ##### | 1    | 1              | 0               |                         | 32.8           | Measured                   | 0.096                | Calculated                 | 35.9                  | Measured                   | 0.105                        | Calculated                 | 51.1           | Measured                   | 0.149                | Measured                   | 342.7              | Measured                     | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | ##### | 2    | 1              | 0               |                         | 18.2           | Measured                   | 0.051                | Calculated                 | 37.5                  | Measured                   | 0.105                        | Calculated                 | 55.4           | Measured                   | 0.155                | Measured                   | 357.5              | Measured                     | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | ##### | 3    | 0.4            | 0               |                         | 13.2           | Measured                   | 0.086                | Calculated                 | 16.16                 | Measured                   | 0.105                        | Calculated                 | 26.8           | Measured                   | 0.174                | Measured                   | 154.08             | Measured                     | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | ##### | 12   | 0.75           | 0               |                         | 0              | Measured                   | 0                    | Calculated                 | 2.85                  | Measured                   | 0.104                        | Calculated                 | 0.15           | Measured                   | 0.005                | Measured                   | 27.375             | Measured                     | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | ##### | 13   | 1              | 0               |                         | 0              | Measured                   | 0                    | Calculated                 | 11.5                  | Measured                   | 0.105                        | Calculated                 | 1.4            | Measured                   | 0.013                | Measured                   | 109.8              | Measured                     | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | ##### | 14   | 1              | 0               |                         | 0.4            | Measured                   | 0.002                | Calculated                 | 26                    | Measured                   | 0.105                        | Calculated                 | 21.8           | Measured                   | 0.088                | Measured                   | 248.2              | Measured                     | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | ##### | 15   | 1              | 0               |                         | 3              | Measured                   | 0.011                | Calculated                 | 29.8                  | Measured                   | 0.105                        | Calculated                 | 33.8           | Measured                   | 0.119                | Measured                   | 284.2              | Measured                     | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | ##### | 16   | 1              | 0               |                         | 4.5            | Measured                   | 0.015                | Calculated                 | 31.2                  | Measured                   | 0.105                        | Calculated                 | 35.7           | Measured                   | 0.12                 | Measured                   | 297.4              | Measured                     | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | ##### | 17   | 1              | 0               |                         | 12.9           | Measured                   | 0.045                | Calculated                 | 30                    | Measured                   | 0.105                        | Calculated                 | 34.9           | Measured                   | 0.122                | Measured                   | 286.2              | Measured                     | Coal              |                     | Cell burner boiler | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction       | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | ##### | 18   | 1              | 0               |                         |                |                            |                      |                            |                       |                            |                              |                            |                |                            |                      |                            |                    |                              |                   |                     |                    |                       |                                                           |             |                                   |                                    |



| State | Facility Name | Facility ID | Unit ID | Associated Stacks | Date      | Hour | Operating Time | Gross Load (MW) | Steam Load (1000 lb/hr) | SO2 Mass (lbs) | SO2 Mass Measure Indicator | SO2 Rate (lbs/mmBtu) | SO2 Rate Measure Indicator | CO2 Mass (short tons) | CO2 Mass Measure Indicator | CO2 Rate (short tons/mmBtu) | CO2 Rate Measure Indicator | NOx Mass (lbs) | NOx Mass Measure Indicator | NOx Rate (lbs/mmBtu) | NOx Rate Measure Indicator | Heat Input (mmBtu) | Heat Input Measure Indicator | Primary Fuel | Secondary Fuel Type | Unit Type | SO2 Controls        | NOx Controls          | PM Controls                                                         | Hg Controls | Program Code                      |                                    |
|-------|---------------|-------------|---------|-------------------|-----------|------|----------------|-----------------|-------------------------|----------------|----------------------------|----------------------|----------------------------|-----------------------|----------------------------|-----------------------------|----------------------------|----------------|----------------------------|----------------------|----------------------------|--------------------|------------------------------|--------------|---------------------|-----------|---------------------|-----------------------|---------------------------------------------------------------------|-------------|-----------------------------------|------------------------------------|
| MI    | J H Campbell  | 1710        | 2       |                   | #####     | 7    | 1              | 200             | 617                     | Measured       | 0.311                      | Calculated           | 208.2                      | Measured              | 210                        | Measured                    | 0.105                      | Calculated     | 101.2                      | Measured             | 0.051                      | Measured           | 1964.9                       | Measured     | Coal                |           | Cell burner boiler  | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction                 | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | #####     | 8    | 1              | 200             | 563.9                   | Measured       | 0.282                      | Calculated           | 208.2                      | Measured              | 210                        | Measured                    | 0.105                      | Calculated     | 100.1                      | Measured             | 0.05                       | Measured           | 2001.9                       | Measured     | Coal                |           | Cell burner boiler  | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction                 | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | #####     | 9    | 1              | 199             | 503.3                   | Measured       | 0.253                      | Calculated           | 208.5                      | Measured              | 208.5                      | Measured                    | 0.105                      | Calculated     | 99.4                       | Measured             | 0.05                       | Measured           | 1988.4                       | Measured     | Coal                |           | Cell burner boiler  | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction                 | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | #####     | 10   | 1              | 200             | 485.1                   | Measured       | 0.246                      | Calculated           | 209.6                      | Measured              | 209.6                      | Measured                    | 0.105                      | Calculated     | 105.9                      | Measured             | 0.053                      | Measured           | 1999.5                       | Measured     | Coal                |           | Cell burner boiler  | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction                 | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | #####     | 11   | 1              | 200             | 525.3                   | Measured       | 0.263                      | Calculated           | 206.8                      | Measured              | 206.8                      | Measured                    | 0.105                      | Calculated     | 110.4                      | Measured             | 0.056                      | Measured           | 1972.2                       | Measured     | Coal                |           | Cell burner boiler  | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction                 | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | #####     | 12   | 1              | 200             | 554.8                   | Measured       | 0.278                      | Calculated           | 209.7                      | Measured              | 209.7                      | Measured                    | 0.105                      | Calculated     | 108                        | Measured             | 0.054                      | Measured           | 1999.2                       | Measured     | Coal                |           | Cell burner boiler  | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction                 | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | #####     | 13   | 1              | 200             | 583.8                   | Measured       | 0.291                      | Calculated           | 210.1                      | Measured              | 210.1                      | Measured                    | 0.105                      | Calculated     | 110.2                      | Measured             | 0.055                      | Measured           | 2003.1                       | Measured     | Coal                |           | Cell burner boiler  | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction                 | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | #####     | 14   | 1              | 200             | 547.5                   | Measured       | 0.273                      | Calculated           | 210.1                      | Measured              | 210.1                      | Measured                    | 0.105                      | Calculated     | 110.2                      | Measured             | 0.055                      | Measured           | 2003.4                       | Measured     | Coal                |           | Cell burner boiler  | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction                 | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | #####     | 15   | 1              | 199             | 423.1                   | Measured       | 0.212                      | Calculated           | 209.8                      | Measured              | 209.8                      | Measured                    | 0.105                      | Calculated     | 106                        | Measured             | 0.053                      | Measured           | 2000.1                       | Measured     | Coal                |           | Cell burner boiler  | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction                 | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | #####     | 16   | 1              | 200             | 461.6                   | Measured       | 0.232                      | Calculated           | 208.7                      | Measured              | 208.7                      | Measured                    | 0.105                      | Calculated     | 107.4                      | Measured             | 0.054                      | Measured           | 1989.5                       | Measured     | Coal                |           | Cell burner boiler  | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction                 | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | #####     | 17   | 1              | 201             | 607.1                   | Measured       | 0.307                      | Calculated           | 207.6                      | Measured              | 207.6                      | Measured                    | 0.105                      | Calculated     | 112.8                      | Measured             | 0.057                      | Measured           | 1979.4                       | Measured     | Coal                |           | Cell burner boiler  | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction                 | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | #####     | 18   | 1              | 200             | 613.5                   | Measured       | 0.31                       | Calculated           | 207.6                      | Measured              | 207.6                      | Measured                    | 0.105                      | Calculated     | 114.8                      | Measured             | 0.058                      | Measured           | 1979.2                       | Measured     | Coal                |           | Cell burner boiler  | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction                 | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | #####     | 19   | 1              | 201             | 557.7                   | Measured       | 0.281                      | Calculated           | 208.1                      | Measured              | 208.1                      | Measured                    | 0.105                      | Calculated     | 113.1                      | Measured             | 0.057                      | Measured           | 1984.3                       | Measured     | Coal                |           | Cell burner boiler  | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction                 | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | #####     | 20   | 1              | 199             | 495.5                   | Measured       | 0.25                       | Calculated           | 208.2                      | Measured              | 208.2                      | Measured                    | 0.105                      | Calculated     | 107.2                      | Measured             | 0.054                      | Measured           | 1985.5                       | Measured     | Coal                |           | Cell burner boiler  | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction                 | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | #####     | 21   | 1              | 200             | 468.6                   | Measured       | 0.235                      | Calculated           | 209.1                      | Measured              | 209.1                      | Measured                    | 0.105                      | Calculated     | 107.7                      | Measured             | 0.054                      | Measured           | 1993.6                       | Measured     | Coal                |           | Cell burner boiler  | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction                 | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | #####     | 22   | 1              | 200             | 468.7                   | Measured       | 0.234                      | Calculated           | 209.7                      | Measured              | 209.7                      | Measured                    | 0.105                      | Calculated     | 112                        | Measured             | 0.056                      | Measured           | 1999.9                       | Measured     | Coal                |           | Cell burner boiler  | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction                 | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 2       |                   | #####     | 23   | 1              | 200             | 499.1                   | Measured       | 0.25                       | Calculated           | 209                        | Measured              | 209                        | Measured                    | 0.105                      | Calculated     | 111.6                      | Measured             | 0.056                      | Measured           | 1992.6                       | Measured     | Coal                |           | Cell burner boiler  | Dry Sorbent Injection | Low NOx Cell Burner / Selective Catalytic Reduction                 | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/12/2025 | 0    | 1              | 599             | 413.7                   | Measured       | 0.064                      | Calculated           | 676.5                      | Measured              | 676.5                      | Measured                    | 0.105                      | Calculated     | 290.3                      | Measured             | 0.045                      | Measured           | 6450.4                       | Measured     | Coal                |           | Dry bottom wall-fir | Dry Lime FGD          | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/12/2025 | 1    | 1              | 599             | 484.7                   | Measured       | 0.075                      | Calculated           | 675.6                      | Measured              | 675.6                      | Measured                    | 0.105                      | Calculated     | 270.6                      | Measured             | 0.042                      | Measured           | 6441.8                       | Measured     | Coal                |           | Dry bottom wall-fir | Dry Lime FGD          | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/12/2025 | 2    | 1              | 599             | 410.5                   | Measured       | 0.064                      | Calculated           | 671.2                      | Measured              | 671.2                      | Measured                    | 0.105                      | Calculated     | 262.4                      | Measured             | 0.041                      | Measured           | 6400.1                       | Measured     | Coal                |           | Dry bottom wall-fir | Dry Lime FGD          | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/12/2025 | 3    | 1              | 598             | 433.1                   | Measured       | 0.067                      | Calculated           | 673.2                      | Measured              | 673.2                      | Measured                    | 0.105                      | Calculated     | 269.6                      | Measured             | 0.042                      | Measured           | 6418.8                       | Measured     | Coal                |           | Dry bottom wall-fir | Dry Lime FGD          | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/12/2025 | 4    | 1              | 598             | 543.7                   | Measured       | 0.085                      | Calculated           | 673.3                      | Measured              | 673.3                      | Measured                    | 0.105                      | Calculated     | 256.8                      | Measured             | 0.04                       | Measured           | 6420.2                       | Measured     | Coal                |           | Dry bottom wall-fir | Dry Lime FGD          | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/12/2025 | 5    | 1              | 598             | 1190                    | Measured       | 0.185                      | Calculated           | 673.1                      | Measured              | 673.1                      | Measured                    | 0.105                      | Calculated     | 256.7                      | Measured             | 0.04                       | Measured           | 6418                         | Measured     | Coal                |           | Dry bottom wall-fir | Dry Lime FGD          | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/12/2025 | 6    | 1              | 598             | 1327                    | Measured       | 0.207                      | Calculated           | 670.7                      | Measured              | 670.7                      | Measured                    | 0.105                      | Calculated     | 236.6                      | Measured             | 0.037                      | Measured           | 6395.1                       | Measured     | Coal                |           | Dry bottom wall-fir | Dry Lime FGD          | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/12/2025 | 7    | 1              | 599             | 1292                    | Measured       | 0.201                      | Calculated           | 672.8                      | Measured              | 672.8                      | Measured                    | 0.105                      | Calculated     | 256.6                      | Measured             | 0.04                       | Measured           | 6414.7                       | Measured     | Coal                |           | Dry bottom wall-fir | Dry Lime FGD          | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/12/2025 | 8    | 1              | 599             | 970.2                   | Measured       | 0.149                      | Calculated           | 682.1                      | Measured              | 682.1                      | Measured                    | 0.105                      | Calculated     | 240.6                      | Measured             | 0.037                      | Measured           | 6503.6                       | Measured     | Coal                |           | Dry bottom wall-fir | Dry Lime FGD          | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/12/2025 | 9    | 1              | 599             | 380.8                   | Measured       | 0.06                       | Calculated           | 684.6                      | Measured              | 684.6                      | Measured                    | 0.105                      | Calculated     | 241.5                      | Measured             | 0.037                      | Measured           | 6527.4                       | Measured     | Coal                |           | Dry bottom wall-fir | Dry Lime FGD          | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/12/2025 | 10   | 1              | 599             | 324.2                   | Measured       | 0.05                       | Calculated           | 686.5                      | Measured              | 686.5                      | Measured                    | 0.105                      | Calculated     | 320.7                      | Measured             | 0.049                      | Measured           | 6545.9                       | Measured     | Coal                |           | Dry bottom wall-fir | Dry Lime FGD          | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/12/2025 | 11   | 1              | 598             | 319.5                   | Measured       | 0.049                      | Calculated           | 688.1                      | Measured              | 688.1                      | Measured                    | 0.105                      | Calculated     | 242.8                      | Measured             | 0.037                      | Measured           | 6560.9                       | Measured     | Coal                |           | Dry bottom wall-fir | Dry Lime FGD          | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/12/2025 | 12   | 1              | 598             | 271.8                   | Measured       | 0.041                      | Calculated           | 690.6                      | Measured              | 690.6                      | Measured                    | 0.105                      | Calculated     | 263.4                      | Measured             | 0.04                       | Measured           | 6585.1                       | Measured     | Coal                |           | Dry bottom wall-fir | Dry Lime FGD          | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/12/2025 | 13   | 1              | 600             | 250.8                   | Measured       | 0.038                      | Calculated           | 692.7                      | Measured              | 692.7                      | Measured                    | 0.105                      | Calculated     | 264.2                      | Measured             | 0.04                       | Measured           | 6604.3                       | Measured     | Coal                |           | Dry bottom wall-fir | Dry Lime FGD          | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/12/2025 | 14   | 1              | 600             | 335.7                   | Measured       | 0.051                      | Calculated           | 695.4                      | Measured              | 695.4                      | Measured                    | 0.105                      | Calculated     | 258.6                      | Measured             | 0.039                      | Measured           | 6630.7                       | Measured     | Coal                |           | Dry bottom wall-fir | Dry Lime FGD          | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/12/2025 | 15   | 1              | 597             | 369.9                   | Measured       | 0.056                      | Calculated           | 698                        | Measured              | 698                        | Measured                    | 0.105                      | Calculated     | 246.3                      | Measured             | 0.037                      | Measured           | 6655.5                       | Measured     | Coal                |           | Dry bottom wall-fir | Dry Lime FGD          | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/12/2025 | 16   | 1              | 598             | 517.2                   | Measured       | 0.077                      | Calculated           | 701.1                      | Measured              | 701.1                      | Measured                    | 0.105                      | Calculated     | 267.5                      | Measured             | 0.04                       | Measured           | 6688.4                       | Measured     | Coal                |           | Dry bottom wall-fir | Dry Lime FGD          | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/12/2025 | 17   | 1              | 598             | 468.8                   | Measured       | 0.07                       | Calculated           | 700.7                      | Measured              | 700.7                      | Measured                    | 0.105                      | Calculated     | 253.9                      | Measured             | 0.038                      | Measured           | 6681.1                       | Measured     | Coal                |           | Dry bottom wall-fir | Dry Lime FGD          | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/12/2025 | 18   | 1              | 599             | 521.6                   | Measured       | 0.078                      | Calculated           | 702.5                      | Measured              | 702.5                      | Measured                    | 0.105                      | Calculated     | 267.9                      | Measured             | 0.04                       | Measured           | 6697.7                       | Measured     | Coal                |           | Dry bottom wall-fir | Dry Lime FGD          | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/12/2025 | 19   | 1              | 600             | 452.8                   | Measured       | 0.068                      | Calculated           | 695.8                      | Measured              | 695.8                      | Measured                    | 0.105                      | Calculated     | 258.7                      | Measured             | 0.039                      | Measured           | 6634.6                       | Measured     | Coal                |           | Dry bottom wall-fir | Dry Lime FGD          | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/12/2025 | 20   | 1              | 598             | 476.8                   | Measured       | 0.072                      | Calculated           | 693.6                      | Measured              | 693.6                      | Measured                    | 0.105                      | Calculated     | 257.9                      | Measured             | 0.039                      | Measured           | 6613.2                       | Measured     | Coal                |           | Dry bottom wall-fir | Dry Lime FGD          | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/12/2025 | 21   | 1              | 599             | 467.7                   | Measured       | 0.071                      | Calculated           | 693.7                      | Measured              | 693.7                      | Measured                    | 0.105                      | Calculated     | 257.9                      | Measured             | 0.039                      | Measured           | 6614                         | Measured     | Coal                |           | Dry bottom wall-fir | Dry Lime FGD          | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/12/2025 | 22   | 1              | 600             | 461.3                   | Measured       | 0.07                       | Calculated           | 692.2                      | Measured              | 692.2                      | Measured                    | 0.105                      | Calculated     | 270.6                      | Measured             | 0.041                      | Measured           | 6599.7                       | Measured     | Coal                |           | Dry bottom wall-fir | Dry Lime FGD          | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/12/2025 | 23   | 1              | 599             | 450                     | Measured       | 0.069                      | Calculated           | 688.8                      | Measured              | 688.8                      | Measured                    | 0.105                      | Calculated     | 269.3                      | Measured             | 0.041                      | Measured           | 6567.1                       | Measured     | Coal                |           | Dry bottom wall-fir | Dry Lime FGD          | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/2/2025  | 0    | 1              | 598             | 491.8                   | Measured       | 0.075                      | Calculated           | 68                         |                       |                            |                             |                            |                |                            |                      |                            |                    |                              |              |                     |           |                     |                       |                                                                     |             |                                   |                                    |



| State | Facility Name | Facility ID | Unit ID | Associated Stacks | Date     | Hour | Operating Time | Gross Load (MW) | Steam Load (1000 lb/hr) | SO2 Mass (lbs) | SO2 Mass Measure Indicator | SO2 Rate (lbs/mmBtu) | SO2 Rate Measure Indicator | CO2 Mass (short tons) | CO2 Mass Measure Indicator | CO2 Rate (short tons/mmBtu) | CO2 Rate Measure Indicator | NOx Mass (lbs) | NOx Mass Measure Indicator | NOx Rate (lbs/mmBtu) | NOx Rate Measure Indicator | Heat Input (mmBtu) | Heat Input Measure Indicator | Primary Fuel Type | Secondary Fuel Type | Unit Type | SO2 Controls        | NOx Controls | PM Controls                                                         | Hg Controls | Program Code                      |                                    |
|-------|---------------|-------------|---------|-------------------|----------|------|----------------|-----------------|-------------------------|----------------|----------------------------|----------------------|----------------------------|-----------------------|----------------------------|-----------------------------|----------------------------|----------------|----------------------------|----------------------|----------------------------|--------------------|------------------------------|-------------------|---------------------|-----------|---------------------|--------------|---------------------------------------------------------------------|-------------|-----------------------------------|------------------------------------|
| MI    | J H Campbell  | 1710        | 3       |                   | 6/4/2025 | 17   | 1              | 701             | 188.1                   | Measured       | 0.025                      | Calculated           | 783.5                      | Measured              | 792                        | Measured                    | 0.105                      | Calculated     | 373.5                      | Measured             | 0.05                       | Measured           | 7470.3                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/4/2025 | 18   | 1              | 703             | 240.7                   | Measured       | 0.032                      | Calculated           | 792                        | Measured              | 792                        | Measured                    | 0.105                      | Calculated     | 370                        | Measured             | 0.049                      | Measured           | 7551.7                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/4/2025 | 19   | 1              | 702             | 270.6                   | Measured       | 0.036                      | Calculated           | 791.5                      | Measured              | 791.5                      | Measured                    | 0.105                      | Calculated     | 377.4                      | Measured             | 0.05                       | Measured           | 7477.1                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/4/2025 | 20   | 1              | 702             | 540                     | Measured       | 0.072                      | Calculated           | 784                        | Measured              | 784                        | Measured                    | 0.105                      | Calculated     | 366.3                      | Measured             | 0.048                      | Measured           | 7474.7                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/4/2025 | 21   | 1              | 701             | 285.3                   | Measured       | 0.038                      | Calculated           | 782.2                      | Measured              | 782.2                      | Measured                    | 0.105                      | Calculated     | 350.5                      | Measured             | 0.047                      | Measured           | 7458.3                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/4/2025 | 22   | 1              | 701             | 266.4                   | Measured       | 0.035                      | Calculated           | 791.1                      | Measured              | 791.1                      | Measured                    | 0.105                      | Calculated     | 347                        | Measured             | 0.046                      | Measured           | 7542.4                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/4/2025 | 23   | 1              | 702             | 349                     | Measured       | 0.046                      | Calculated           | 792.1                      | Measured              | 792.1                      | Measured                    | 0.105                      | Calculated     | 400.3                      | Measured             | 0.053                      | Measured           | 7552                         | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/5/2025 | 0    | 1              | 703             | 380.8                   | Measured       | 0.05                       | Calculated           | 791.3                      | Measured              | 791.3                      | Measured                    | 0.105                      | Calculated     | 392.4                      | Measured             | 0.052                      | Measured           | 7543.3                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/5/2025 | 1    | 1              | 702             | 367.8                   | Measured       | 0.049                      | Calculated           | 789.2                      | Measured              | 789.2                      | Measured                    | 0.105                      | Calculated     | 376.3                      | Measured             | 0.05                       | Measured           | 7525.1                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/5/2025 | 2    | 1              | 702             | 351.1                   | Measured       | 0.046                      | Calculated           | 792.2                      | Measured              | 792.2                      | Measured                    | 0.105                      | Calculated     | 377.7                      | Measured             | 0.05                       | Measured           | 7553.2                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/5/2025 | 3    | 1              | 702             | 331.1                   | Measured       | 0.044                      | Calculated           | 792.5                      | Measured              | 792.5                      | Measured                    | 0.105                      | Calculated     | 385.4                      | Measured             | 0.051                      | Measured           | 7556                         | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/5/2025 | 4    | 1              | 702             | 447                     | Measured       | 0.059                      | Calculated           | 791.5                      | Measured              | 791.5                      | Measured                    | 0.105                      | Calculated     | 422.6                      | Measured             | 0.056                      | Measured           | 7546.7                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/5/2025 | 5    | 1              | 703             | 321.3                   | Measured       | 0.042                      | Calculated           | 793                        | Measured              | 793                        | Measured                    | 0.105                      | Calculated     | 438.5                      | Measured             | 0.058                      | Measured           | 7561.2                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/5/2025 | 6    | 1              | 702             | 381.3                   | Measured       | 0.05                       | Calculated           | 793.3                      | Measured              | 793.3                      | Measured                    | 0.105                      | Calculated     | 434.4                      | Measured             | 0.057                      | Measured           | 7620.8                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/5/2025 | 7    | 1              | 702             | 309.5                   | Measured       | 0.041                      | Calculated           | 793.6                      | Measured              | 793.6                      | Measured                    | 0.105                      | Calculated     | 423.8                      | Measured             | 0.056                      | Measured           | 7567.1                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/5/2025 | 8    | 1              | 702             | 326.6                   | Measured       | 0.043                      | Calculated           | 798.1                      | Measured              | 798.1                      | Measured                    | 0.105                      | Calculated     | 464.2                      | Measured             | 0.061                      | Measured           | 7609.9                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/5/2025 | 9    | 1              | 703             | 393.3                   | Measured       | 0.052                      | Calculated           | 799.2                      | Measured              | 799.2                      | Measured                    | 0.105                      | Calculated     | 495.3                      | Measured             | 0.065                      | Measured           | 7620.1                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/5/2025 | 10   | 1              | 702             | 544.7                   | Measured       | 0.072                      | Calculated           | 790.8                      | Measured              | 790.8                      | Measured                    | 0.105                      | Calculated     | 505.2                      | Measured             | 0.067                      | Measured           | 7540.1                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/5/2025 | 11   | 1              | 704             | 454.2                   | Measured       | 0.06                       | Calculated           | 796.9                      | Measured              | 796.9                      | Measured                    | 0.105                      | Calculated     | 577.5                      | Measured             | 0.076                      | Measured           | 7598.4                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/5/2025 | 12   | 1              | 737             | 320.7                   | Measured       | 0.041                      | Calculated           | 826                        | Measured              | 826                        | Measured                    | 0.105                      | Calculated     | 763.9                      | Measured             | 0.097                      | Measured           | 7875.3                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/5/2025 | 13   | 1              | 732             | 392.9                   | Measured       | 0.051                      | Calculated           | 815.2                      | Measured              | 815.2                      | Measured                    | 0.105                      | Calculated     | 761.7                      | Measured             | 0.098                      | Measured           | 7772.3                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/5/2025 | 14   | 1              | 731             | 488.6                   | Measured       | 0.063                      | Calculated           | 811                        | Measured              | 811                        | Measured                    | 0.105                      | Calculated     | 788.7                      | Measured             | 0.102                      | Measured           | 7732.3                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/5/2025 | 15   | 1              | 731             | 588.1                   | Measured       | 0.076                      | Calculated           | 811.9                      | Measured              | 811.9                      | Measured                    | 0.105                      | Calculated     | 472.2                      | Measured             | 0.061                      | Measured           | 7741.4                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/5/2025 | 16   | 1              | 749             | 494                     | Measured       | 0.063                      | Calculated           | 826.9                      | Measured              | 826.9                      | Measured                    | 0.105                      | Calculated     | 417.9                      | Measured             | 0.053                      | Measured           | 7884.7                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/5/2025 | 17   | 1              | 739             | 341.9                   | Measured       | 0.044                      | Calculated           | 822.6                      | Measured              | 822.6                      | Measured                    | 0.105                      | Calculated     | 415.7                      | Measured             | 0.053                      | Measured           | 7843.1                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/5/2025 | 18   | 1              | 756             | 293                     | Measured       | 0.037                      | Calculated           | 834.8                      | Measured              | 834.8                      | Measured                    | 0.105                      | Calculated     | 453.7                      | Measured             | 0.057                      | Measured           | 7959.2                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/5/2025 | 19   | 1              | 757             | 348.4                   | Measured       | 0.044                      | Calculated           | 833.2                      | Measured              | 833.2                      | Measured                    | 0.105                      | Calculated     | 413.1                      | Measured             | 0.052                      | Measured           | 7944.4                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/5/2025 | 20   | 1              | 756             | 499.5                   | Measured       | 0.063                      | Calculated           | 825.5                      | Measured              | 825.5                      | Measured                    | 0.105                      | Calculated     | 425                        | Measured             | 0.054                      | Measured           | 7870.7                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/5/2025 | 21   | 1              | 757             | 440.4                   | Measured       | 0.056                      | Calculated           | 827.5                      | Measured              | 827.5                      | Measured                    | 0.105                      | Calculated     | 434                        | Measured             | 0.055                      | Measured           | 7890.3                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/5/2025 | 22   | 1              | 756             | 347.5                   | Measured       | 0.044                      | Calculated           | 828.9                      | Measured              | 828.9                      | Measured                    | 0.105                      | Calculated     | 403                        | Measured             | 0.051                      | Measured           | 7902.9                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/5/2025 | 23   | 1              | 757             | 368.3                   | Measured       | 0.047                      | Calculated           | 828.8                      | Measured              | 828.8                      | Measured                    | 0.105                      | Calculated     | 426.7                      | Measured             | 0.054                      | Measured           | 7902.4                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/6/2025 | 0    | 1              | 757             | 382.4                   | Measured       | 0.048                      | Calculated           | 827.7                      | Measured              | 827.7                      | Measured                    | 0.105                      | Calculated     | 386.7                      | Measured             | 0.049                      | Measured           | 7892.2                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/6/2025 | 1    | 1              | 757             | 384.4                   | Measured       | 0.049                      | Calculated           | 827.6                      | Measured              | 827.6                      | Measured                    | 0.105                      | Calculated     | 347.2                      | Measured             | 0.044                      | Measured           | 7890.8                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/6/2025 | 2    | 1              | 756             | 409.3                   | Measured       | 0.052                      | Calculated           | 827.6                      | Measured              | 827.6                      | Measured                    | 0.105                      | Calculated     | 363                        | Measured             | 0.046                      | Measured           | 7891.2                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/6/2025 | 3    | 1              | 756             | 373.4                   | Measured       | 0.047                      | Calculated           | 826.2                      | Measured              | 826.2                      | Measured                    | 0.105                      | Calculated     | 362.4                      | Measured             | 0.046                      | Measured           | 7878                         | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/6/2025 | 4    | 1              | 756             | 341.9                   | Measured       | 0.043                      | Calculated           | 825.2                      | Measured              | 825.2                      | Measured                    | 0.105                      | Calculated     | 354.1                      | Measured             | 0.045                      | Measured           | 7868.4                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/6/2025 | 5    | 1              | 757             | 328.5                   | Measured       | 0.041                      | Calculated           | 835.2                      | Measured              | 835.2                      | Measured                    | 0.105                      | Calculated     | 358.4                      | Measured             | 0.045                      | Measured           | 7963.8                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/6/2025 | 6    | 1              | 757             | 363.4                   | Measured       | 0.046                      | Calculated           | 834.4                      | Measured              | 834.4                      | Measured                    | 0.105                      | Calculated     | 381.9                      | Measured             | 0.048                      | Measured           | 7953.3                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/6/2025 | 7    | 1              | 756             | 697                     | Measured       | 0.088                      | Calculated           | 830.9                      | Measured              | 830.9                      | Measured                    | 0.105                      | Calculated     | 404                        | Measured             | 0.051                      | Measured           | 7922.3                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/6/2025 | 8    | 1              | 717             | 419.4                   | Measured       | 0.055                      | Calculated           | 796.3                      | Measured              | 796.3                      | Measured                    | 0.105                      | Calculated     | 303.7                      | Measured             | 0.04                       | Measured           | 7592.6                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/6/2025 | 9    | 1              | 755             | 425.5                   | Measured       | 0.054                      | Calculated           | 826.7                      | Measured              | 826.7                      | Measured                    | 0.105                      | Calculated     | 402                        | Measured             | 0.051                      | Measured           | 7882.6                       | Measured          | Coal                |           | Dry bottom          |              |                                                                     |             |                                   |                                    |



| State | Facility Name | Facility ID | Unit ID | Associated Stacks | Date     | Hour | Operating Time | Gross Load (MW) | Steam Load (1000 lb/hr) | SO2 Mass (lbs) | SO2 Mass Measure Indicator | SO2 Rate (lbs/mmBtu) | SO2 Rate Measure Indicator | CO2 Mass (short tons) | CO2 Mass Measure Indicator | CO2 Rate (short tons/mmBtu) | CO2 Rate Measure Indicator | NOx Mass (lbs) | NOx Mass Measure Indicator | NOx Rate (lbs/mmBtu) | NOx Rate Measure Indicator | Heat Input (mmBtu) | Heat Input Measure Indicator | Primary Fuel Type | Secondary Fuel Type | Unit Type | SO2 Controls        | NOx Controls | PM Controls                                                         | Hg Controls | Program Code                      |                                    |
|-------|---------------|-------------|---------|-------------------|----------|------|----------------|-----------------|-------------------------|----------------|----------------------------|----------------------|----------------------------|-----------------------|----------------------------|-----------------------------|----------------------------|----------------|----------------------------|----------------------|----------------------------|--------------------|------------------------------|-------------------|---------------------|-----------|---------------------|--------------|---------------------------------------------------------------------|-------------|-----------------------------------|------------------------------------|
| MI    | J H Campbell  | 1710        | 3       |                   | 6/9/2025 | 3    | 1              | 756             | 428.7                   | Measured       | 0.056                      | Calculated           | 810.1                      | Measured              | 809                        | Measured                    | 0.105                      | Calculated     | 370.7                      | Measured             | 0.048                      | Measured           | 7723.8                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/9/2025 | 4    | 1              | 756             | 403.6                   | Measured       | 0.052                      | Calculated           | 809                        | Measured              | 809                        | Measured                    | 0.105                      | Calculated     | 378                        | Measured             | 0.049                      | Measured           | 7714                         | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/9/2025 | 5    | 1              | 757             | 417.7                   | Measured       | 0.054                      | Calculated           | 815.6                      | Measured              | 815.6                      | Measured                    | 0.105                      | Calculated     | 373.3                      | Measured             | 0.048                      | Measured           | 7776.5                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/9/2025 | 6    | 1              | 756             | 391.2                   | Measured       | 0.05                       | Calculated           | 815.9                      | Measured              | 389                        | Measured                    | 0.105                      | Calculated     | 389                        | Measured             | 0.05                       | Measured           | 7792.2                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/9/2025 | 7    | 1              | 757             | 307.5                   | Measured       | 0.04                       | Calculated           | 816.4                      | Measured              | 816.4                      | Measured                    | 0.105                      | Calculated     | 365.9                      | Measured             | 0.047                      | Measured           | 7784.6                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/9/2025 | 8    | 1              | 757             | 451.8                   | Measured       | 0.058                      | Calculated           | 816                        | Measured              | 816                        | Measured                    | 0.105                      | Calculated     | 366.6                      | Measured             | 0.047                      | Measured           | 7799                         | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/9/2025 | 9    | 1              | 757             | 1165                    | Measured       | 0.15                       | Calculated           | 816.7                      | Measured              | 816.7                      | Measured                    | 0.105                      | Calculated     | 358.2                      | Measured             | 0.046                      | Measured           | 7786.7                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/9/2025 | 10   | 1              | 757             | 1264                    | Measured       | 0.163                      | Calculated           | 815.3                      | Measured              | 815.3                      | Measured                    | 0.105                      | Calculated     | 373.2                      | Measured             | 0.048                      | Measured           | 7774                         | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/9/2025 | 11   | 1              | 756             | 832                     | Measured       | 0.106                      | Calculated           | 821.3                      | Measured              | 810                        | Measured                    | 0.105                      | Calculated     | 430.7                      | Measured             | 0.055                      | Substitute         | 7830.5                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/9/2025 | 12   | 1              | 757             | 833.4                   | Measured       | 0.106                      | Calculated           | 822.6                      | Measured              | 810                        | Measured                    | 0.105                      | Calculated     | 431.4                      | Measured             | 0.055                      | Substitute         | 7843.6                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/9/2025 | 13   | 1              | 758             | 389.2                   | Measured       | 0.05                       | Calculated           | 818.7                      | Measured              | 818.7                      | Measured                    | 0.105                      | Calculated     | 359.1                      | Measured             | 0.046                      | Measured           | 7806.3                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/9/2025 | 14   | 1              | 758             | 531.6                   | Measured       | 0.068                      | Calculated           | 818.3                      | Measured              | 818.3                      | Measured                    | 0.105                      | Calculated     | 351.1                      | Measured             | 0.045                      | Measured           | 7802.1                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/9/2025 | 15   | 1              | 757             | 487.7                   | Measured       | 0.063                      | Calculated           | 809.4                      | Measured              | 809.4                      | Measured                    | 0.105                      | Calculated     | 339.6                      | Measured             | 0.044                      | Measured           | 7717.5                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/9/2025 | 16   | 1              | 757             | 314.6                   | Measured       | 0.04                       | Calculated           | 820.7                      | Measured              | 820.7                      | Measured                    | 0.105                      | Calculated     | 320.8                      | Measured             | 0.041                      | Measured           | 7825.5                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/9/2025 | 17   | 1              | 757             | 349.8                   | Measured       | 0.045                      | Calculated           | 821.9                      | Measured              | 821.9                      | Measured                    | 0.105                      | Calculated     | 384                        | Measured             | 0.049                      | Measured           | 7836.1                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/9/2025 | 18   | 1              | 758             | 382.1                   | Measured       | 0.049                      | Calculated           | 820.8                      | Measured              | 820.8                      | Measured                    | 0.105                      | Calculated     | 399.1                      | Measured             | 0.051                      | Measured           | 7826.4                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/9/2025 | 19   | 1              | 758             | 355.2                   | Measured       | 0.045                      | Calculated           | 822.3                      | Measured              | 822.3                      | Measured                    | 0.105                      | Calculated     | 422.3                      | Measured             | 0.054                      | Measured           | 7819.9                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/9/2025 | 20   | 1              | 757             | 322.5                   | Measured       | 0.041                      | Calculated           | 820.1                      | Measured              | 820.1                      | Measured                    | 0.105                      | Calculated     | 391                        | Measured             | 0.05                       | Measured           | 7819.5                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/9/2025 | 21   | 1              | 757             | 342.4                   | Measured       | 0.044                      | Calculated           | 823.6                      | Measured              | 823.6                      | Measured                    | 0.105                      | Calculated     | 353.4                      | Measured             | 0.045                      | Measured           | 7853.2                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/9/2025 | 22   | 1              | 758             | 377.5                   | Measured       | 0.048                      | Calculated           | 824.3                      | Measured              | 824.3                      | Measured                    | 0.105                      | Calculated     | 353.7                      | Measured             | 0.045                      | Measured           | 7859.6                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | 6/9/2025 | 23   | 1              | 757             | 461.4                   | Measured       | 0.059                      | Calculated           | 823.8                      | Measured              | 823.8                      | Measured                    | 0.105                      | Calculated     | 369.2                      | Measured             | 0.047                      | Measured           | 7854.8                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | #####    | 0    | 1              | 758             | 444.8                   | Measured       | 0.057                      | Calculated           | 823.4                      | Measured              | 823.4                      | Measured                    | 0.105                      | Calculated     | 392.6                      | Measured             | 0.05                       | Measured           | 7851.3                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | #####    | 1    | 1              | 759             | 436.6                   | Measured       | 0.056                      | Calculated           | 816.4                      | Measured              | 816.4                      | Measured                    | 0.105                      | Calculated     | 381.4                      | Measured             | 0.049                      | Measured           | 7783.9                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | #####    | 2    | 1              | 758             | 448.9                   | Measured       | 0.058                      | Calculated           | 816.4                      | Measured              | 816.4                      | Measured                    | 0.105                      | Calculated     | 381.4                      | Measured             | 0.049                      | Measured           | 7784.2                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | #####    | 3    | 1              | 758             | 349.6                   | Measured       | 0.045                      | Calculated           | 814.2                      | Measured              | 814.2                      | Measured                    | 0.105                      | Calculated     | 434.8                      | Measured             | 0.056                      | Measured           | 7763.6                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | #####    | 4    | 1              | 757             | 629.4                   | Measured       | 0.081                      | Calculated           | 818.3                      | Measured              | 818.3                      | Measured                    | 0.105                      | Calculated     | 444.7                      | Measured             | 0.057                      | Measured           | 7802.6                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | #####    | 5    | 1              | 756             | 483.6                   | Measured       | 0.062                      | Calculated           | 816.3                      | Measured              | 816.3                      | Measured                    | 0.105                      | Calculated     | 389.2                      | Measured             | 0.05                       | Measured           | 7783.4                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | #####    | 6    | 1              | 758             | 658.9                   | Measured       | 0.084                      | Calculated           | 821.5                      | Measured              | 821.5                      | Measured                    | 0.105                      | Calculated     | 391.6                      | Measured             | 0.05                       | Measured           | 7832.5                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | #####    | 7    | 1              | 757             | 392.8                   | Measured       | 0.05                       | Calculated           | 824.7                      | Measured              | 824.7                      | Measured                    | 0.105                      | Calculated     | 385.3                      | Measured             | 0.049                      | Measured           | 7863.2                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | #####    | 8    | 1              | 758             | 502.4                   | Measured       | 0.063                      | Calculated           | 830.6                      | Measured              | 830.6                      | Measured                    | 0.105                      | Calculated     | 411.9                      | Measured             | 0.052                      | Measured           | 7921.7                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | #####    | 9    | 1              | 758             | 567.5                   | Measured       | 0.072                      | Calculated           | 826.1                      | Measured              | 826.1                      | Measured                    | 0.105                      | Calculated     | 417.5                      | Measured             | 0.053                      | Measured           | 7876.7                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | #####    | 10   | 1              | 758             | 561.1                   | Measured       | 0.071                      | Calculated           | 829.7                      | Measured              | 829.7                      | Measured                    | 0.105                      | Calculated     | 371.8                      | Measured             | 0.047                      | Measured           | 7910.8                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | #####    | 11   | 1              | 757             | 519.9                   | Measured       | 0.065                      | Calculated           | 826.2                      | Measured              | 826.2                      | Measured                    | 0.105                      | Calculated     | 381.1                      | Measured             | 0.048                      | Measured           | 7938.6                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | #####    | 12   | 1              | 758             | 523.4                   | Measured       | 0.066                      | Calculated           | 834.9                      | Measured              | 834.9                      | Measured                    | 0.105                      | Calculated     | 406                        | Measured             | 0.051                      | Measured           | 7960.2                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | #####    | 13   | 1              | 759             | 515.5                   | Measured       | 0.065                      | Calculated           | 832.2                      | Measured              | 832.2                      | Measured                    | 0.105                      | Calculated     | 420.5                      | Measured             | 0.053                      | Measured           | 7934.4                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | #####    | 14   | 1              | 757             | 559                     | Measured       | 0.071                      | Calculated           | 822.6                      | Measured              | 822.6                      | Measured                    | 0.105                      | Calculated     | 415.7                      | Measured             | 0.053                      | Measured           | 7843                         | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | #####    | 15   | 1              | 758             | 768.8                   | Measured       | 0.098                      | Calculated           | 823.7                      | Measured              | 823.7                      | Measured                    | 0.105                      | Calculated     | 384.8                      | Measured             | 0.049                      | Measured           | 7853.6                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | #####    | 16   | 1              | 757             | 520.7                   | Measured       | 0.066                      | Calculated           | 826.8                      | Measured              | 826.8                      | Measured                    | 0.105                      | Calculated     | 386.3                      | Measured             | 0.049                      | Measured           | 7883.3                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | #####    | 17   | 1              | 758             | 379                     | Measured       | 0.048                      | Calculated           | 827.5                      | Measured              | 827.5                      | Measured                    | 0.105                      | Calculated     | 418.2                      | Measured             | 0.053                      | Measured           | 7890.3                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | #####    | 18   | 1              | 758             | 464.3                   | Measured       | 0.059                      | Calculated           | 825.4                      | Measured              | 825.4                      | Measured                    | 0.105                      | Calculated     | 495.8                      | Measured             | 0.063                      | Measured           | 7869.5                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | #####    | 19   | 1              | 759             | 401.9                   | Measured       | 0.051                      | Calculated           | 828.1                      | Measured              | 828.1                      | Measured                    | 0.105                      | Calculated     | 679                        | Measured             | 0.086                      | Measured           | 7895.4                       | Measured          | Coal                |           | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSOSG2E, CSSO2G1, MATS |
| MI    | J H Campbell  | 1710        | 3       |                   | #####    | 20   | 1              | 757             | 629.2                   | Measured       | 0.                         |                      |                            |                       |                            |                             |                            |                |                            |                      |                            |                    |                              |                   |                     |           |                     |              |                                                                     |             |                                   |                                    |



| State | Facility Name | Facility ID | Unit ID | Associated Stacks | Date | Hour | Operating Time | Gross Load (MW) | Steam Load (1000 lb/hr) | SO2 Mass (lbs) | SO2 Mass Measure Indicator | SO2 Rate (lbs/mmBtu) | SO2 Rate Measure Indicator | CO2 Mass (short tons) | CO2 Mass Measure Indicator | CO2 Rate (short tons/mmBtu) | CO2 Rate Measure Indicator | NOx Mass (lbs) | NOx Mass Measure Indicator | NOx Rate (lbs/mmBtu) | NOx Rate Measure Indicator | Heat Input (mmBtu) | Heat Input Measure Indicator | Primary Fuel Type | Secondary Fuel Type | Unit Type    | SO2 Controls                                                        | NOx Controls | PM Controls                       | Hg Controls                        | Program Code |
|-------|---------------|-------------|---------|-------------------|------|------|----------------|-----------------|-------------------------|----------------|----------------------------|----------------------|----------------------------|-----------------------|----------------------------|-----------------------------|----------------------------|----------------|----------------------------|----------------------|----------------------------|--------------------|------------------------------|-------------------|---------------------|--------------|---------------------------------------------------------------------|--------------|-----------------------------------|------------------------------------|--------------|
| MI    | J H Campbell  | 1710        | 3       | #####             | 13   | 1    | 758            |                 | 336.7                   | Measured       | 0.043                      | Calculated           | 826.8                      | Measured              | 0.105                      | Calculated                  | 386.3                      | Measured       | 0.049                      | Measured             | 7883.1                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 14   | 1    | 757            |                 | 388.2                   | Measured       | 0.049                      | Calculated           | 830.5                      | Measured              | 0.105                      | Calculated                  | 388                        | Measured       | 0.049                      | Measured             | 7818.8                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 15   | 1    | 757            |                 | 379.1                   | Measured       | 0.048                      | Calculated           | 832.7                      | Measured              | 0.105                      | Calculated                  | 404.9                      | Measured       | 0.051                      | Measured             | 7932.5                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 16   | 1    | 757            |                 | 464.2                   | Measured       | 0.059                      | Calculated           | 832                        | Measured              | 0.105                      | Calculated                  | 404.6                      | Measured       | 0.051                      | Measured             | 7932.5                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 17   | 1    | 758            |                 | 452.9                   | Measured       | 0.057                      | Calculated           | 829.8                      | Measured              | 0.105                      | Calculated                  | 403.5                      | Measured       | 0.051                      | Measured             | 7911.9                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 18   | 1    | 757            |                 | 376.9                   | Measured       | 0.048                      | Calculated           | 827.9                      | Measured              | 0.105                      | Calculated                  | 426.3                      | Measured       | 0.054                      | Measured             | 7893.9                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 19   | 1    | 757            |                 | 428.3                   | Measured       | 0.054                      | Calculated           | 829.5                      | Measured              | 0.105                      | Calculated                  | 427.1                      | Measured       | 0.054                      | Measured             | 7908.8                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 20   | 1    | 757            |                 | 469.9                   | Measured       | 0.06                       | Calculated           | 824                        | Measured              | 0.105                      | Calculated                  | 400.7                      | Measured       | 0.051                      | Measured             | 7858.8                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 21   | 1    | 758            |                 | 311.5                   | Measured       | 0.039                      | Calculated           | 831.9                      | Measured              | 0.105                      | Calculated                  | 412.5                      | Measured       | 0.052                      | Measured             | 7932.2                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 22   | 1    | 758            |                 | 334.5                   | Measured       | 0.042                      | Calculated           | 833.3                      | Measured              | 0.105                      | Calculated                  | 421.1                      | Measured       | 0.053                      | Measured             | 7945.4                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 23   | 1    | 758            |                 | 291.1                   | Measured       | 0.037                      | Calculated           | 831.9                      | Measured              | 0.105                      | Calculated                  | 420.4                      | Measured       | 0.053                      | Measured             | 7931.7                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 0    | 1    | 756            |                 | 492.6                   | Measured       | 0.062                      | Calculated           | 828.5                      | Measured              | 0.105                      | Calculated                  | 395                        | Measured       | 0.05                       | Measured             | 7899.3                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 1    | 1    | 756            |                 | 413.5                   | Measured       | 0.052                      | Calculated           | 827.2                      | Measured              | 0.105                      | Calculated                  | 370.7                      | Measured       | 0.047                      | Measured             | 7886.7                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 2    | 1    | 758            |                 | 609.7                   | Measured       | 0.077                      | Calculated           | 829.1                      | Measured              | 0.105                      | Calculated                  | 363.6                      | Measured       | 0.046                      | Measured             | 7903.3                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 3    | 1    | 756            |                 | 60.7                    | Measured       | 0.072                      | Calculated           | 831.7                      | Measured              | 0.105                      | Calculated                  | 372.7                      | Measured       | 0.047                      | Measured             | 7903                       | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 4    | 1    | 756            |                 | 396.3                   | Measured       | 0.05                       | Calculated           | 828.8                      | Measured              | 0.105                      | Calculated                  | 371.4                      | Measured       | 0.047                      | Measured             | 7902.5                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 5    | 1    | 756            |                 | 380.5                   | Measured       | 0.048                      | Calculated           | 829.5                      | Measured              | 0.105                      | Calculated                  | 363.8                      | Measured       | 0.046                      | Measured             | 7909.1                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 6    | 1    | 758            |                 | 393.8                   | Measured       | 0.05                       | Calculated           | 832.1                      | Measured              | 0.105                      | Calculated                  | 365                        | Measured       | 0.046                      | Measured             | 7934                       | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 7    | 1    | 757            |                 | 356.7                   | Measured       | 0.045                      | Calculated           | 830.4                      | Measured              | 0.105                      | Calculated                  | 364.2                      | Measured       | 0.046                      | Measured             | 7917.3                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 8    | 1    | 758            |                 | 420.8                   | Measured       | 0.053                      | Calculated           | 833.5                      | Measured              | 0.105                      | Calculated                  | 365.6                      | Measured       | 0.046                      | Measured             | 7947.6                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 9    | 1    | 758            |                 | 270.5                   | Measured       | 0.034                      | Calculated           | 825                        | Measured              | 0.105                      | Calculated                  | 361.8                      | Measured       | 0.046                      | Measured             | 7865.8                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 10   | 1    | 758            |                 | 285.3                   | Measured       | 0.036                      | Calculated           | 826.8                      | Measured              | 0.105                      | Calculated                  | 378.4                      | Measured       | 0.048                      | Measured             | 7883.6                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 11   | 1    | 757            |                 | 411                     | Measured       | 0.052                      | Calculated           | 827.2                      | Measured              | 0.105                      | Calculated                  | 370.7                      | Measured       | 0.047                      | Measured             | 7887.3                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 12   | 1    | 758            |                 | 369.8                   | Measured       | 0.047                      | Calculated           | 830.2                      | Measured              | 0.105                      | Calculated                  | 387.9                      | Measured       | 0.049                      | Measured             | 7916                       | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 13   | 1    | 757            |                 | 474.4                   | Measured       | 0.06                       | Calculated           | 828.3                      | Measured              | 0.105                      | Calculated                  | 394.9                      | Measured       | 0.05                       | Measured             | 7897.9                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 14   | 1    | 758            |                 | 305.7                   | Measured       | 0.039                      | Calculated           | 820.4                      | Measured              | 0.105                      | Calculated                  | 398.9                      | Measured       | 0.051                      | Measured             | 7822.1                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 15   | 1    | 757            |                 | 290.9                   | Measured       | 0.037                      | Calculated           | 824.4                      | Measured              | 0.105                      | Calculated                  | 393                        | Measured       | 0.05                       | Measured             | 7860.3                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 16   | 1    | 757            |                 | 513.7                   | Measured       | 0.065                      | Calculated           | 826.5                      | Measured              | 0.105                      | Calculated                  | 378.2                      | Measured       | 0.048                      | Measured             | 7880.2                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 17   | 1    | 757            |                 | 229.5                   | Measured       | 0.029                      | Calculated           | 822.3                      | Measured              | 0.105                      | Calculated                  | 368.8                      | Measured       | 0.047                      | Measured             | 7845.8                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 18   | 1    | 758            |                 | 224.6                   | Measured       | 0.028                      | Calculated           | 827.4                      | Measured              | 0.105                      | Calculated                  | 362.9                      | Measured       | 0.046                      | Measured             | 7888.8                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 19   | 1    | 758            |                 | 632.1                   | Measured       | 0.08                       | Calculated           | 825.7                      | Measured              | 0.105                      | Calculated                  | 369.8                      | Measured       | 0.047                      | Measured             | 7867.6                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 20   | 1    | 757            |                 | 309.1                   | Measured       | 0.039                      | Calculated           | 823.7                      | Measured              | 0.105                      | Calculated                  | 369.2                      | Measured       | 0.047                      | Measured             | 7855.3                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 21   | 1    | 758            |                 | 322.8                   | Measured       | 0.041                      | Calculated           | 827.7                      | Measured              | 0.105                      | Calculated                  | 386.7                      | Measured       | 0.049                      | Measured             | 7892.3                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 22   | 1    | 758            |                 | 303.6                   | Measured       | 0.039                      | Calculated           | 825.5                      | Measured              | 0.105                      | Calculated                  | 409.3                      | Measured       | 0.052                      | Measured             | 7870.8                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 23   | 1    | 758            |                 | 323.8                   | Measured       | 0.041                      | Calculated           | 825.1                      | Measured              | 0.105                      | Calculated                  | 393.3                      | Measured       | 0.05                       | Measured             | 7866.6                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 0    | 1    | 758            |                 | 308                     | Measured       | 0.039                      | Calculated           | 826.3                      | Measured              | 0.105                      | Calculated                  | 393.9                      | Measured       | 0.05                       | Measured             | 7878.9                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 1    | 1    | 757            |                 | 333.2                   | Measured       | 0.042                      | Calculated           | 828.2                      | Measured              | 0.105                      | Calculated                  | 402.7                      | Measured       | 0.051                      | Measured             | 7896.3                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 2    | 1    | 758            |                 | 367.5                   | Measured       | 0.047                      | Calculated           | 827.3                      | Measured              | 0.105                      | Calculated                  | 402.3                      | Measured       | 0.051                      | Measured             | 7888.2                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 3    | 1    | 757            |                 | 360.5                   | Measured       | 0.046                      | Calculated           | 829.8                      | Measured              | 0.105                      | Calculated                  | 403.5                      | Measured       | 0.051                      | Measured             | 7912.3                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 4    | 1    | 757            |                 | 404.6                   | Measured       | 0.051                      | Calculated           | 827.9                      | Measured              | 0.105                      | Calculated                  | 394.7                      | Measured       | 0.05                       | Measured             | 7893.9                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 5    | 1    | 757            |                 | 393.6                   | Measured       | 0.05                       | Calculated           | 826.3                      | Measured              | 0.105                      | Calculated                  | 386.1                      | Measured       | 0.049                      | Measured             | 7879                       | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 6    | 1    | 758            |                 | 373.9                   | Measured       | 0.047                      | Calculated           | 835                        | Measured              | 0.105                      | Calculated                  | 366.2                      | Measured       | 0.046                      | Measured             | 7961.1                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 7    | 1    | 758            |                 | 328.7                   | Measured       | 0.041                      | Calculated           | 834.3                      | Measured              | 0.105                      | Calculated                  | 389.8                      | Measured       | 0.049                      | Measured             | 7955                       | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    | J H Campbell  | 1710        | 3       | #####             | 8    | 1    | 758            |                 | 333.1                   | Measured       | 0.042                      | Calculated           | 834.9                      | Measured              | 0.105                      | Calculated                  | 374.1                      | Measured       | 0.047                      | Measured             | 7960.6                     | Measured           | Coal                         |                   | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |              |
| MI    |               |             |         |                   |      |      |                |                 |                         |                |                            |                      |                            |                       |                            |                             |                            |                |                            |                      |                            |                    |                              |                   |                     |              |                                                                     |              |                                   |                                    |              |



| State | Facility Name | Facility ID | Unit ID | Associated Stacks | Date | Hour | Operating Time | Gross Load (MW) | Steam Load (1000 lb/hr) | SO2 Mass (lbs) | SO2 Mass Measure Indicator | SO2 Rate (lbs/mmBtu) | SO2 Rate Measure Indicator | CO2 Mass (short tons) | CO2 Mass Measure Indicator | CO2 Rate (short tons/mmBtu) | CO2 Rate Measure Indicator | NOx Mass (lbs) | NOx Mass Measure Indicator | NOx Rate (lbs/mmBtu) | NOx Rate Measure Indicator | Heat Input (mmBtu) | Heat Input Measure Indicator | Primary Fuel Type | Secondary Fuel Type | Unit Type           | SO2 Controls | NOx Controls                                                        | PM Controls | Hg Controls                       | Program Code                       |
|-------|---------------|-------------|---------|-------------------|------|------|----------------|-----------------|-------------------------|----------------|----------------------------|----------------------|----------------------------|-----------------------|----------------------------|-----------------------------|----------------------------|----------------|----------------------------|----------------------|----------------------------|--------------------|------------------------------|-------------------|---------------------|---------------------|--------------|---------------------------------------------------------------------|-------------|-----------------------------------|------------------------------------|
| MI    | J H Campbell  | 1710        | 3       | #####             | 23   | 1    | 617            | 74.8            | Measured                | 0.011          | Calculated                 | 695.2                | Measured                   | 695.2                 | Measured                   | 0.105                       | Calculated                 | 464            | Measured                   | 0.07                 | Measured                   | 6628.8             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 0    | 1    | 600            | 158.1           | Measured                | 0.024          | Calculated                 | 692.7                | Measured                   | 692.7                 | Measured                   | 0.105                       | Calculated                 | 264.2          | Measured                   | 0.04                 | Measured                   | 6604.8             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 1    | 1    | 599            | 179.8           | Measured                | 0.027          | Calculated                 | 692.4                | Measured                   | 692.4                 | Measured                   | 0.105                       | Calculated                 | 231.1          | Measured                   | 0.035                | Measured                   | 6601.8             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 2    | 1    | 600            | 208.1           | Measured                | 0.031          | Calculated                 | 695.7                | Measured                   | 695.7                 | Measured                   | 0.105                       | Calculated                 | 238.8          | Measured                   | 0.036                | Measured                   | 6633.2             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 3    | 1    | 599            | 212             | Measured                | 0.032          | Calculated                 | 696.5                | Measured                   | 696.5                 | Measured                   | 0.105                       | Calculated                 | 252.3          | Measured                   | 0.038                | Measured                   | 6640.6             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 4    | 1    | 620            | 222.9           | Measured                | 0.032          | Calculated                 | 720.4                | Measured                   | 720.4                 | Measured                   | 0.105                       | Calculated                 | 267.9          | Measured                   | 0.039                | Measured                   | 6686.4             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 5    | 1    | 675            | 277.4           | Measured                | 0.038          | Calculated                 | 771.4                | Measured                   | 771.4                 | Measured                   | 0.105                       | Calculated                 | 331            | Measured                   | 0.045                | Measured                   | 7355.1             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 6    | 1    | 754            | 519             | Measured                | 0.064          | Calculated                 | 848.6                | Measured                   | 848.6                 | Measured                   | 0.105                       | Calculated                 | 356            | Measured                   | 0.044                | Measured                   | 8091.5             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 7    | 1    | 756            | 336.7           | Measured                | 0.042          | Calculated                 | 840.8                | Measured                   | 840.8                 | Measured                   | 0.105                       | Calculated                 | 360.7          | Measured                   | 0.045                | Measured                   | 8016.4             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 8    | 1    | 754            | 238.7           | Measured                | 0.03           | Calculated                 | 833.5                | Measured                   | 833.5                 | Measured                   | 0.105                       | Calculated                 | 365.6          | Measured                   | 0.046                | Measured                   | 7947.4             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 9    | 1    | 755            | 520.8           | Measured                | 0.066          | Calculated                 | 824.9                | Measured                   | 824.9                 | Measured                   | 0.105                       | Calculated                 | 361.8          | Measured                   | 0.046                | Measured                   | 7865.1             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 10   | 1    | 754            | 321.5           | Measured                | 0.041          | Calculated                 | 824.1                | Measured                   | 824.1                 | Measured                   | 0.105                       | Calculated                 | 377.3          | Measured                   | 0.048                | Measured                   | 7860.5             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 11   | 1    | 754            | 412.9           | Measured                | 0.053          | Calculated                 | 824.2                | Measured                   | 824.2                 | Measured                   | 0.105                       | Calculated                 | 392.9          | Measured                   | 0.05                 | Measured                   | 7858.4             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 12   | 1    | 755            | 388.7           | Measured                | 0.049          | Calculated                 | 824.6                | Measured                   | 824.6                 | Measured                   | 0.105                       | Calculated                 | 377.4          | Measured                   | 0.048                | Measured                   | 7862.5             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 13   | 1    | 754            | 455.1           | Measured                | 0.058          | Calculated                 | 826.1                | Measured                   | 826.1                 | Measured                   | 0.105                       | Calculated                 | 362.5          | Measured                   | 0.046                | Measured                   | 7879.9             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 14   | 1    | 754            | 509.4           | Measured                | 0.065          | Calculated                 | 819                  | Measured                   | 819                   | Measured                   | 0.105                       | Calculated                 | 382.7          | Measured                   | 0.049                | Measured                   | 7809.3             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 15   | 1    | 754            | 373.6           | Measured                | 0.048          | Calculated                 | 822.8                | Measured                   | 822.8                 | Measured                   | 0.105                       | Calculated                 | 392.2          | Measured                   | 0.05                 | Measured                   | 7844.9             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 16   | 1    | 754            | 282             | Measured                | 0.036          | Calculated                 | 828                  | Measured                   | 828                   | Measured                   | 0.105                       | Calculated                 | 386.9          | Measured                   | 0.049                | Measured                   | 7895.1             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 17   | 1    | 754            | 366.1           | Measured                | 0.047          | Calculated                 | 821.6                | Measured                   | 821.6                 | Measured                   | 0.105                       | Calculated                 | 376            | Measured                   | 0.048                | Measured                   | 7833.8             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 18   | 1    | 755            | 375.6           | Measured                | 0.048          | Calculated                 | 820.2                | Measured                   | 820.2                 | Measured                   | 0.105                       | Calculated                 | 461.4          | Measured                   | 0.059                | Measured                   | 7820.3             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 19   | 1    | 754            | 427.5           | Measured                | 0.055          | Calculated                 | 818.6                | Measured                   | 818.6                 | Measured                   | 0.105                       | Calculated                 | 437.1          | Measured                   | 0.056                | Measured                   | 7805.2             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 20   | 1    | 755            | 390.1           | Measured                | 0.05           | Calculated                 | 822.1                | Measured                   | 822.1                 | Measured                   | 0.105                       | Calculated                 | 415.4          | Measured                   | 0.053                | Measured                   | 7838.1             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 21   | 1    | 755            | 406.5           | Measured                | 0.051          | Calculated                 | 829                  | Measured                   | 829                   | Measured                   | 0.105                       | Calculated                 | 450.6          | Measured                   | 0.057                | Measured                   | 7904.6             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 22   | 1    | 755            | 419.7           | Measured                | 0.054          | Calculated                 | 819.5                | Measured                   | 819.5                 | Measured                   | 0.105                       | Calculated                 | 422            | Measured                   | 0.054                | Measured                   | 7814.1             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 23   | 1    | 754            | 360.6           | Measured                | 0.046          | Calculated                 | 820.8                | Measured                   | 820.8                 | Measured                   | 0.105                       | Calculated                 | 422            | Measured                   | 0.054                | Measured                   | 7826.5             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 0    | 1    | 755            | 371.6           | Measured                | 0.047          | Calculated                 | 822.2                | Measured                   | 822.2                 | Measured                   | 0.105                       | Calculated                 | 399.8          | Measured                   | 0.051                | Measured                   | 7839.6             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 1    | 1    | 755            | 412.2           | Measured                | 0.053          | Calculated                 | 820.9                | Measured                   | 820.9                 | Measured                   | 0.105                       | Calculated                 | 427.7          | Measured                   | 0.054                | Measured                   | 7827.3             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 2    | 1    | 754            | 409.7           | Measured                | 0.052          | Calculated                 | 819.9                | Measured                   | 819.9                 | Measured                   | 0.105                       | Calculated                 | 390.9          | Measured                   | 0.05                 | Measured                   | 7818               | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 3    | 1    | 753            | 374.6           | Measured                | 0.048          | Calculated                 | 819.9                | Measured                   | 819.9                 | Measured                   | 0.105                       | Calculated                 | 390.9          | Measured                   | 0.05                 | Measured                   | 7817.8             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 4    | 1    | 754            | 375.5           | Measured                | 0.048          | Calculated                 | 828.8                | Measured                   | 828.8                 | Measured                   | 0.105                       | Calculated                 | 395.1          | Measured                   | 0.05                 | Measured                   | 7902.5             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 5    | 1    | 754            | 377.6           | Measured                | 0.048          | Calculated                 | 828                  | Measured                   | 828                   | Measured                   | 0.105                       | Calculated                 | 395.2          | Measured                   | 0.05                 | Measured                   | 7904.4             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 6    | 1    | 754            | 387.5           | Measured                | 0.049          | Calculated                 | 835.1                | Measured                   | 835.1                 | Measured                   | 0.105                       | Calculated                 | 390.2          | Measured                   | 0.049                | Measured                   | 7962.7             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 7    | 1    | 755            | 362.2           | Measured                | 0.045          | Calculated                 | 840.8                | Measured                   | 840.8                 | Measured                   | 0.105                       | Calculated                 | 384.8          | Measured                   | 0.048                | Measured                   | 8017.2             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 8    | 1    | 753            | 405.2           | Measured                | 0.05           | Calculated                 | 847.6                | Measured                   | 847.6                 | Measured                   | 0.105                       | Calculated                 | 387.9          | Measured                   | 0.048                | Measured                   | 8081.5             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 9    | 1    | 754            | 336.7           | Measured                | 0.042          | Calculated                 | 830.8                | Measured                   | 830.8                 | Measured                   | 0.105                       | Calculated                 | 400            | Measured                   | 0.05                 | Measured                   | 7999.3             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 10   | 1    | 756            | 335.5           | Measured                | 0.042          | Calculated                 | 841.1                | Measured                   | 841.1                 | Measured                   | 0.105                       | Calculated                 | 368.9          | Measured                   | 0.046                | Measured                   | 8019.4             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 11   | 1    | 757            | 362.3           | Measured                | 0.045          | Calculated                 | 841.1                | Measured                   | 841.1                 | Measured                   | 0.105                       | Calculated                 | 393            | Measured                   | 0.049                | Measured                   | 8019.8             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 12   | 1    | 757            | 374.9           | Measured                | 0.047          | Calculated                 | 841.7                | Measured                   | 841.7                 | Measured                   | 0.105                       | Calculated                 | 385.2          | Measured                   | 0.048                | Measured                   | 8025.2             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 13   | 1    | 757            | 672.7           | Measured                | 0.083          | Calculated                 | 845.1                | Measured                   | 845.1                 | Measured                   | 0.105                       | Calculated                 | 386.8          | Measured                   | 0.048                | Measured                   | 8058.1             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 14   | 1    | 757            | 596.1           | Measured                | 0.075          | Calculated                 | 838.3                | Measured                   | 838.3                 | Measured                   | 0.105                       | Calculated                 | 383.7          | Measured                   | 0.048                | Measured                   | 7992.8             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 15   | 1    | 757            | 279.9           | Measured                | 0.035          | Calculated                 | 848.1                | Measured                   | 848.1                 | Measured                   | 0.105                       | Calculated                 | 404.3          | Measured                   | 0.05                 | Measured                   | 8086.3             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 16   | 1    | 757            | 356.5           | Measured                | 0.044          | Calculated                 | 849.2                | Measured                   | 849.2                 | Measured                   | 0.105                       | Calculated                 | 386.6          | Measured                   | 0.048                | Measured                   | 8096.8             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air/ Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 17   | 1    | 757            | 377             |                         |                |                            |                      |                            |                       |                            |                             |                            |                |                            |                      |                            |                    |                              |                   |                     |                     |              |                                                                     |             |                                   |                                    |



| State | Facility Name | Facility ID | Unit ID | Associated Stacks | Date | Hour | Operating Time | Gross Load (MW) | Steam Load (1000 lb/hr) | SO2 Mass (lbs) | SO2 Mass Measure Indicator | SO2 Rate (lbs/mmBtu) | SO2 Rate Measure Indicator | CO2 Mass (short tons) | CO2 Mass Measure Indicator | CO2 Rate (short tons/mmBtu) | CO2 Rate Measure Indicator | NOx Mass (lbs) | NOx Mass Measure Indicator | NOx Rate (lbs/mmBtu) | NOx Rate Measure Indicator | Heat Input (mmBtu) | Heat Input Measure Indicator | Primary Fuel Type | Secondary Fuel Type | Unit Type           | SO2 Controls | NOx Controls                                                        | PM Controls | Hg Controls                       | Program Code                       |
|-------|---------------|-------------|---------|-------------------|------|------|----------------|-----------------|-------------------------|----------------|----------------------------|----------------------|----------------------------|-----------------------|----------------------------|-----------------------------|----------------------------|----------------|----------------------------|----------------------|----------------------------|--------------------|------------------------------|-------------------|---------------------|---------------------|--------------|---------------------------------------------------------------------|-------------|-----------------------------------|------------------------------------|
| MI    | J H Campbell  | 1710        | 3       | #####             | 9    | 1    | 759            | 527.6           | Measured                | 0.065          | Calculated                 | 845.9                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 363            | Measured                   | 0.045                | Measured                   | 806.5              | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 10   | 1    | 758            | 363.9           | Measured                | 0.045          | Calculated                 | 851.9                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 373.6          | Measured                   | 0.046                | Measured                   | 811.21             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 11   | 1    | 758            | 404.7           | Measured                | 0.05           | Calculated                 | 850.8                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 381.3          | Measured                   | 0.047                | Measured                   | 811.21             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 12   | 1    | 760            | 457.2           | Measured                | 0.057          | Calculated                 | 845.4                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 370.8          | Measured                   | 0.046                | Measured                   | 806.06             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 13   | 1    | 760            | 401.7           | Measured                | 0.05           | Calculated                 | 846                  | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 387.2          | Measured                   | 0.048                | Measured                   | 806.62             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 14   | 1    | 760            | 740.5           | Measured                | 0.092          | Calculated                 | 845.2                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 386.8          | Measured                   | 0.048                | Measured                   | 805.87             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 15   | 1    | 759            | 521.6           | Measured                | 0.065          | Calculated                 | 842.9                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 385.8          | Measured                   | 0.048                | Measured                   | 803.67             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 16   | 1    | 759            | 406.3           | Measured                | 0.05           | Calculated                 | 845.5                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 387            | Measured                   | 0.048                | Measured                   | 806.15             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 17   | 1    | 758            | 396.4           | Measured                | 0.049          | Calculated                 | 841.9                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 385.3          | Measured                   | 0.048                | Measured                   | 8027               | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 18   | 1    | 759            | 398.7           | Measured                | 0.05           | Calculated                 | 842.4                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 377.5          | Measured                   | 0.047                | Measured                   | 8032.5             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 19   | 1    | 759            | 356.7           | Measured                | 0.044          | Calculated                 | 844.7                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 378.5          | Measured                   | 0.047                | Measured                   | 8054.2             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 20   | 1    | 758            | 377.6           | Measured                | 0.047          | Calculated                 | 845.5                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 395            | Measured                   | 0.049                | Measured                   | 8061.5             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 21   | 1    | 758            | 415             | Measured                | 0.051          | Calculated                 | 846.5                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 379.3          | Measured                   | 0.047                | Measured                   | 8070.7             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 22   | 1    | 759            | 562.6           | Measured                | 0.07           | Calculated                 | 848.1                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 371.1          | Measured                   | 0.046                | Measured                   | 8067.3             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 23   | 1    | 758            | 482.3           | Measured                | 0.06           | Calculated                 | 849.2                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 372.5          | Measured                   | 0.046                | Measured                   | 8097.3             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 0    | 1    | 760            | 453.7           | Measured                | 0.056          | Calculated                 | 853.6                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 398.8          | Measured                   | 0.049                | Measured                   | 8139.2             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 1    | 1    | 759            | 403.5           | Measured                | 0.049          | Calculated                 | 857                  | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 400.4          | Measured                   | 0.049                | Measured                   | 8171.6             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 2    | 1    | 760            | 499.6           | Measured                | 0.062          | Calculated                 | 850.7                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 381.2          | Measured                   | 0.047                | Measured                   | 8111.5             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 3    | 1    | 758            | 490.1           | Measured                | 0.06           | Calculated                 | 855.5                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 367.1          | Measured                   | 0.045                | Measured                   | 8157.3             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 4    | 1    | 712            | 320.2           | Measured                | 0.041          | Calculated                 | 812.8                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 271.2          | Measured                   | 0.035                | Measured                   | 7749.6             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 5    | 1    | 662            | 352.5           | Measured                | 0.048          | Calculated                 | 776.2                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 325.6          | Measured                   | 0.044                | Measured                   | 7401.1             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 6    | 1    | 754            | 651.5           | Measured                | 0.08           | Calculated                 | 858.3                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 368.3          | Measured                   | 0.045                | Measured                   | 8183.5             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 7    | 1    | 760            | 559.9           | Measured                | 0.068          | Calculated                 | 858.4                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 376.5          | Measured                   | 0.046                | Measured                   | 8184.5             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 8    | 1    | 759            | 390.2           | Measured                | 0.05           | Calculated                 | 826.3                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 378.4          | Measured                   | 0.048                | Measured                   | 7882.5             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 9    | 1    | 760            | 345.7           | Measured                | 0.044          | Calculated                 | 822.7                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 384.2          | Measured                   | 0.049                | Measured                   | 7840.6             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 10   | 1    | 760            | 295.7           | Measured                | 0.038          | Calculated                 | 815.1                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 388.6          | Measured                   | 0.05                 | Measured                   | 7771.8             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 11   | 1    | 759            | 210.3           | Measured                | 0.027          | Calculated                 | 815.2                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 373.1          | Measured                   | 0.048                | Measured                   | 7772.8             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 12   | 1    | 760            | 266.5           | Measured                | 0.034          | Calculated                 | 822.1                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 368.4          | Measured                   | 0.047                | Measured                   | 7838.6             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 13   | 1    | 761            | 309.6           | Measured                | 0.04           | Calculated                 | 820.5                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 391.2          | Measured                   | 0.05                 | Measured                   | 7823.1             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 14   | 1    | 760            | 375.7           | Measured                | 0.049          | Calculated                 | 812.4                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 395.1          | Measured                   | 0.051                | Measured                   | 7746.2             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 15   | 1    | 761            | 549.3           | Measured                | 0.071          | Calculated                 | 812.3                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 402.8          | Measured                   | 0.052                | Measured                   | 7745.3             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 16   | 1    | 760            | 344.2           | Measured                | 0.044          | Calculated                 | 811.1                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 479.8          | Measured                   | 0.062                | Measured                   | 7739.4             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 17   | 1    | 760            | 289.6           | Measured                | 0.038          | Calculated                 | 809.6                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 478.6          | Measured                   | 0.062                | Measured                   | 7719.7             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 18   | 1    | 761            | 326.8           | Measured                | 0.043          | Calculated                 | 802.3                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 489.7          | Measured                   | 0.064                | Measured                   | 7652.1             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 19   | 1    | 761            | 465.8           | Measured                | 0.061          | Calculated                 | 803.3                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 490.2          | Measured                   | 0.064                | Measured                   | 7659.2             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 20   | 1    | 760            | 397.8           | Measured                | 0.052          | Calculated                 | 803.9                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 490.6          | Measured                   | 0.064                | Measured                   | 7665               | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 21   | 1    | 760            | 367.9           | Measured                | 0.047          | Calculated                 | 813.5                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 473.2          | Measured                   | 0.061                | Measured                   | 7756.8             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 22   | 1    | 761            | 388.9           | Measured                | 0.05           | Calculated                 | 814                  | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 457.9          | Measured                   | 0.059                | Measured                   | 7746.2             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 23   | 1    | 760            | 373.4           | Measured                | 0.048          | Calculated                 | 812                  | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 441.3          | Measured                   | 0.057                | Measured                   | 7761.2             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 0    | 1    | 760            | 398.5           | Measured                | 0.052          | Calculated                 | 805.4                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 453.1          | Measured                   | 0.059                | Measured                   | 7679.3             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 1    | 1    | 760            | 418.2           | Measured                | 0.054          | Calculated                 | 810.5                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 432.7          | Measured                   | 0.056                | Measured                   | 7727.5             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |
| MI    | J H Campbell  | 1710        | 3       | #####             | 2    | 1    | 760            | 464.4           | Measured                | 0.06           | Calculated                 | 811.5                | Measured                   | 812.28                | Measured                   | 0.105                       | Calculated                 | 479.7          | Measured                   | 0.062                | Measured                   | 7737.4             | Measured                     | Coal              |                     | Dry bottom wall-fir | Dry Lime FGD | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse    | Halogenated PAC Sorbent Injection | APP, CSNOX, CSO5G2E, CSS02G1, MATS |



| State | Facility Name | Facility ID | Unit ID | Associated Stacks | Date | Hour | Operating Time | Gross Load (MW) | Steam Load (1000 lb/hr) | SO2 Mass (lbs) | SO2 Mass Measure Indicator | SO2 Rate (lbs/mmBtu) | SO2 Rate Measure Indicator | CO2 Mass (short tons) | CO2 Mass Measure Indicator | CO2 Rate (short tons/mmBtu) | CO2 Rate Measure Indicator | NOx Mass (lbs) | NOx Mass Measure Indicator | NOx Rate (lbs/mmBtu) | NOx Rate Measure Indicator | Heat Input (mmBtu) | Heat Input Measure Indicator | Primary Fuel Type   | Secondary Fuel Type | Unit Type                                                           | SO2 Controls | NOx Controls                      | PM Controls                         | Hg Controls | Program Code |
|-------|---------------|-------------|---------|-------------------|------|------|----------------|-----------------|-------------------------|----------------|----------------------------|----------------------|----------------------------|-----------------------|----------------------------|-----------------------------|----------------------------|----------------|----------------------------|----------------------|----------------------------|--------------------|------------------------------|---------------------|---------------------|---------------------------------------------------------------------|--------------|-----------------------------------|-------------------------------------|-------------|--------------|
| MI    | J H Campbell  | 1710        | 3       | *****             | 19   | 1    | 757            | 332.8           | Measured                | 0.043          | Calculated                 | 811.1                | Measured                   | 0.105                 | Calculated                 | 788.9                       | Measured                   | 0.102          | Measured                   | 7734.1               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 20   | 1    | 760            | 378.7           | Measured                | 0.049          | Calculated                 | 810.2                | Measured                   | 0.105                 | Calculated                 | 818.8                       | Measured                   | 0.106          | Measured                   | 7724.4               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 21   | 1    | 760            | 396.1           | Measured                | 0.051          | Calculated                 | 811.8                | Measured                   | 0.105                 | Calculated                 | 797.2                       | Measured                   | 0.103          | Measured                   | 7740.1               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 22   | 1    | 760            | 384.4           | Measured                | 0.055          | Calculated                 | 813.4                | Measured                   | 0.105                 | Calculated                 | 527.4                       | Measured                   | 0.088          | Measured                   | 7755.7               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 23   | 1    | 759            | 377.2           | Measured                | 0.048          | Calculated                 | 818.5                | Measured                   | 0.105                 | Calculated                 | 429.2                       | Measured                   | 0.055          | Measured                   | 7803.8               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 0    | 1    | 760            | 409.2           | Measured                | 0.053          | Calculated                 | 813                  | Measured                   | 0.105                 | Calculated                 | 426.4                       | Measured                   | 0.055          | Measured                   | 7752.1               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 1    | 1    | 760            | 405.2           | Measured                | 0.053          | Calculated                 | 806.3                | Measured                   | 0.105                 | Calculated                 | 453.6                       | Measured                   | 0.059          | Measured                   | 7688.1               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 2    | 1    | 760            | 367.5           | Measured                | 0.048          | Calculated                 | 805.6                | Measured                   | 0.105                 | Calculated                 | 430.2                       | Measured                   | 0.056          | Measured                   | 7681.4               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 3    | 1    | 759            | 358.7           | Measured                | 0.047          | Calculated                 | 804.6                | Measured                   | 0.105                 | Calculated                 | 421.9                       | Measured                   | 0.055          | Measured                   | 7671.7               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 4    | 1    | 759            | 359.8           | Measured                | 0.047          | Calculated                 | 806.9                | Measured                   | 0.105                 | Calculated                 | 430.8                       | Measured                   | 0.056          | Measured                   | 7693.3               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 5    | 1    | 759            | 366.6           | Measured                | 0.047          | Calculated                 | 815.3                | Measured                   | 0.105                 | Calculated                 | 855.1                       | Measured                   | 0.11           | Measured                   | 7773.7               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 6    | 1    | 760            | 413.3           | Measured                | 0.053          | Calculated                 | 819                  | Measured                   | 0.105                 | Calculated                 | 472.9                       | Measured                   | 0.061          | Measured                   | 7752.1               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 7    | 1    | 760            | 752.4           | Measured                | 0.097          | Calculated                 | 811.8                | Measured                   | 0.105                 | Calculated                 | 410.2                       | Measured                   | 0.053          | Measured                   | 7740.4               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 8    | 1    | 759            | 392             | Measured                | 0.05           | Calculated                 | 814.8                | Measured                   | 0.105                 | Calculated                 | 404                         | Measured                   | 0.052          | Measured                   | 7768.4               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 9    | 1    | 760            | 376.6           | Measured                | 0.048          | Calculated                 | 817.1                | Measured                   | 0.105                 | Calculated                 | 405.1                       | Measured                   | 0.052          | Measured                   | 7790.4               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 10   | 1    | 760            | 394.1           | Measured                | 0.05           | Calculated                 | 819.1                | Measured                   | 0.105                 | Calculated                 | 421.8                       | Measured                   | 0.054          | Measured                   | 7810.3               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 11   | 1    | 760            | 380.2           | Measured                | 0.048          | Calculated                 | 823.1                | Measured                   | 0.105                 | Calculated                 | 423.8                       | Measured                   | 0.054          | Measured                   | 7846.2               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 12   | 1    | 760            | 472.4           | Measured                | 0.06           | Calculated                 | 825.3                | Measured                   | 0.105                 | Calculated                 | 385.6                       | Measured                   | 0.049          | Measured                   | 7869                 | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 13   | 1    | 760            | 360.2           | Measured                | 0.046          | Calculated                 | 817.4                | Measured                   | 0.105                 | Calculated                 | 413.1                       | Measured                   | 0.053          | Measured                   | 7793.8               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 14   | 1    | 760            | 382.2           | Measured                | 0.049          | Calculated                 | 815.7                | Measured                   | 0.105                 | Calculated                 | 404.4                       | Measured                   | 0.052          | Measured                   | 7777.6               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 15   | 1    | 760            | 380.4           | Measured                | 0.049          | Calculated                 | 816.3                | Measured                   | 0.105                 | Calculated                 | 412.5                       | Measured                   | 0.053          | Measured                   | 7783.6               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 16   | 1    | 759            | 353.2           | Measured                | 0.046          | Calculated                 | 808.4                | Measured                   | 0.105                 | Calculated                 | 439.4                       | Measured                   | 0.057          | Measured                   | 7708.2               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 17   | 1    | 759            | 375.3           | Measured                | 0.049          | Calculated                 | 807.2                | Measured                   | 0.105                 | Calculated                 | 469.5                       | Measured                   | 0.061          | Measured                   | 7696.7               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 18   | 1    | 760            | 388.8           | Measured                | 0.05           | Calculated                 | 809.6                | Measured                   | 0.105                 | Calculated                 | 470.9                       | Measured                   | 0.061          | Measured                   | 7718.9               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 19   | 1    | 761            | 346.1           | Measured                | 0.045          | Calculated                 | 811.3                | Measured                   | 0.105                 | Calculated                 | 433.2                       | Measured                   | 0.056          | Measured                   | 7735.5               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 20   | 1    | 760            | 358.5           | Measured                | 0.046          | Calculated                 | 811.1                | Measured                   | 0.105                 | Calculated                 | 456.3                       | Measured                   | 0.059          | Measured                   | 7733.4               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 21   | 1    | 760            | 336.9           | Measured                | 0.044          | Calculated                 | 809.1                | Measured                   | 0.105                 | Calculated                 | 455.1                       | Measured                   | 0.059          | Measured                   | 7714.1               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 22   | 1    | 760            | 340.4           | Measured                | 0.044          | Calculated                 | 807.6                | Measured                   | 0.105                 | Calculated                 | 500.5                       | Measured                   | 0.065          | Measured                   | 7700.4               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 23   | 1    | 759            | 327.4           | Measured                | 0.043          | Calculated                 | 806.1                | Measured                   | 0.105                 | Calculated                 | 476.5                       | Measured                   | 0.062          | Measured                   | 7685.7               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 0    | 1    | 760            | 364.7           | Measured                | 0.047          | Calculated                 | 806.6                | Measured                   | 0.105                 | Calculated                 | 476.9                       | Measured                   | 0.062          | Measured                   | 7691.2               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 1    | 1    | 760            | 353.3           | Measured                | 0.046          | Calculated                 | 804.2                | Measured                   | 0.105                 | Calculated                 | 444.7                       | Measured                   | 0.058          | Measured                   | 7667.4               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 2    | 1    | 760            | 406.6           | Measured                | 0.053          | Calculated                 | 803.8                | Measured                   | 0.105                 | Calculated                 | 429.2                       | Measured                   | 0.056          | Measured                   | 7664.1               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 3    | 1    | 759            | 394.4           | Measured                | 0.051          | Calculated                 | 804.2                | Measured                   | 0.105                 | Calculated                 | 414                         | Measured                   | 0.054          | Measured                   | 7667.5               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 4    | 1    | 759            | 349.7           | Measured                | 0.046          | Calculated                 | 805.2                | Measured                   | 0.105                 | Calculated                 | 437.6                       | Measured                   | 0.057          | Measured                   | 7677.8               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 5    | 1    | 759            | 361.5           | Measured                | 0.047          | Calculated                 | 804.1                | Measured                   | 0.105                 | Calculated                 | 429.3                       | Measured                   | 0.056          | Measured                   | 7666.9               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 6    | 1    | 758            | 363.7           | Measured                | 0.047          | Calculated                 | 804.3                | Measured                   | 0.105                 | Calculated                 | 444.8                       | Measured                   | 0.058          | Measured                   | 7669                 | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 7    | 1    | 759            | 485.1           | Measured                | 0.062          | Calculated                 | 815.3                | Measured                   | 0.105                 | Calculated                 | 443.1                       | Measured                   | 0.057          | Measured                   | 7773.5               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 8    | 1    | 759            | 921             | Measured                | 0.119          | Calculated                 | 809.7                | Measured                   | 0.105                 | Calculated                 | 440.1                       | Measured                   | 0.057          | Measured                   | 7720.2               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 9    | 1    | 759            | 925.4           | Measured                | 0.12           | Calculated                 | 811.7                | Measured                   | 0.105                 | Calculated                 | 456.6                       | Measured                   | 0.059          | Measured                   | 7739.7               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 10   | 1    | 758            | 1181            | Measured                | 0.155          | Calculated                 | 800                  | Measured                   | 0.105                 | Calculated                 | 472.9                       | Measured                   | 0.062          | Measured                   | 7628.2               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 11   | 1    | 757            | 1194            | Measured                | 0.158          | Calculated                 | 791.6                | Measured                   | 0.105                 | Calculated                 | 445.3                       | Measured                   | 0.059          | Measured                   | 7547.3               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 12   | 1    | 758            | 1219            | Measured                | 0.161          | Calculated                 | 794.6                | Measured                   | 0.105                 | Calculated                 | 439.4                       | Measured                   | 0.058          | Measured                   | 7576.3               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 13   | 1    | 759            | 1207            | Measured                | 0.159          | Calculated                 | 795.6                | Measured                   | 0.105                 | Calculated                 | 485.5                       | Measured                   | 0.064          | Measured                   | 7586.2               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 14   | 1    | 758            | 1313            | Measured                | 0.174          | Calculated                 | 792.7                | Measured                   | 0.105                 | Calculated                 | 438.4                       | Measured                   | 0.058          | Measured                   | 7557.8               | Measured                   | Coal               |                              | Dry bottom wall-fir | Dry Lime FGD        | Low NOx Burner Technology w/ Overfire Air  Selective Catalytic Redu | Baghouse     | Halogenated PAC Sorbent Injection | ARP, CSNOX, CSSO2G2E, CSSO2G1, MATS |             |              |
| MI    | J H Campbell  | 1710        | 3       | *****             | 15   | 1    | 757            | 1159            | Measured                | 0.154          | Calculated                 | 791.6                | Measured                   | 0.105                 | Calculated                 | 422.7                       | Measured                   | 0.056          | Measured                   | 7547.5               | Measured                   |                    |                              |                     |                     |                                                                     |              |                                   |                                     |             |              |

BEFORE THE UNITED STATES DEPARTMENT OF ENERGY

Federal Power Act Section 202(c)     )  
Emergency Order: Midcontinent     )  
Independent System Operator     )  
(MISO)     )  
\_\_\_\_\_

Order No. 202-25-7

Exhibit to  
Motion to Intervene and Request for Rehearing and Stay of  
Public Interest Organizations

Filed September 5, 2025

Exhibit 105

DOE Order No. 202-08-1



**The Secretary of Energy**  
Washington, DC 20585

Order No. 202-08-1

Pursuant to the authority vested in me by section 202(c) of the Federal Power Act (FPA), 16 U.S.C. 824a(c), and section 301(b) of the Department of Energy Organization Act, 42 U.S.C. 7151(b), and for the reasons set forth below, I hereby determine that an emergency exists in Texas due to a shortage of electric energy, a shortage of facilities for the generation of electric energy, a shortage of facilities for the transmission of electric energy and other causes, and that issuance of this order will serve to alleviate the emergency and serve the public interest.

As a result of the massive devastation caused by Hurricane Ike, large portions of the areas affected by the hurricane are without electricity, posing a threat to human life and health. It is my judgment that in these circumstances, the order I am issuing today will meet the emergency and serve the public interest because it will alleviate electricity shortages and protect the life and health of the people in the affected areas.

Based on my determination set forth above, I hereby order:

Effective immediately, CenterPoint Energy is authorized and directed to temporarily connect at distribution and transmission level voltages such as 12.5kV, 13.2kV, 25kV, 69kV, 138kV, and 230kV to restore power to Entergy Gulf States, Inc. as well as electric cooperatives and municipal customers within the State of Texas. Pursuant to section 202(d) of the FPA, 16 U.S.C. 824a(d), during the continuance of this order, any person engaged in the transmission and sale of electric energy and not otherwise subject to the jurisdiction of the Federal Energy Regulatory Commission (FERC) may, pursuant to this order, make such temporary connections with any public utility subject to the jurisdiction of FERC and shall not become subject to FERC jurisdiction as a result of that temporary connection.

This order shall be effective upon its issuance and shall expire at 12:01 a.m., November 1, 2008.

Issued in Washington, D.C. at 1600 this 14th day of September, 2008.

A handwritten signature in black ink, reading "Sam Bodman", is positioned above the printed name.

Samuel W. Bodman  
Secretary of Energy





BEFORE THE UNITED STATES DEPARTMENT OF ENERGY

Federal Power Act Section 202(c) )  
Emergency Order: Midcontinent )  
Independent System Operator )  
(MISO) )  
\_\_\_\_\_ )

Order No. 202-25-7

Exhibit to  
Motion to Intervene and Request for Rehearing and Stay of  
Public Interest Organizations

Filed September 5, 2025

Exhibit 106  
DOE Order No. 202-22-2  
Amendment No. 1



**Department of Energy**  
Washington, DC 20585

**Amendment Number 1 to Order No. 202-22-2**

On September 4, 2022, because of a shortage of currently operational electric generating facilities, high demand for electricity, and other adverse conditions resulting from the extreme heat event in California, I issued Order No. 202-22-2. Order No. 202-22-2 authorized the Balancing Authority of Northern California (BANC) to direct the identified electric generating resource (Covered Resources) to operate in BANC's Balancing Authority Area (BAA), under specified conditions, to prevent or mitigate potential power disruptions and provide relief to the bulk power system during stressed grid conditions caused by extreme heat until September 8, 2022. Order No. 202-22-2 expires at the end of the day on September 8, 2022, by its own terms.

On September 7, 2022, BANC submitted a *Request for Extension and Limited Amendment of Emergency Order Pursuant to Section 202(c) of the Federal Power Act* (Renewal Application) to the Department. In its Renewal Application, BANC requests an extension of Order 202-22-1 through September 11, 2022 and certain modifications to the run time hour limitations contained in Order No. 202-22-2. On September 8, 2022, BANC filed a Revised Request for *Request for Extension and Limited Amendment of Emergency Order Pursuant to Section 202(c) of the Federal Power Act* in response to questions from DOE.

*Emergency Situation*

In its Renewal Application, BANC states that "the actual heat event has been more severe and records loads have been experienced." The emergency conditions brought about by the ongoing extreme heat event in California have continued and worsened and the supply of electricity is at increased risk for meeting system demand. As stated in its Renewal Application, BANC established a new record peak of approximately 4943 MW on September 6. BANC entered into an EEA-2 as of 1330 hours that same day. During this period BANC had forced outages of significant generation but was able to return units to service in approximately 90 minutes. It is believed that BANC members Roseville and Modesto exceeded their all-time peaks. Consequently, BANC requests the expiration date of Order No. 202-22-2 be extended through September 11, 2022.

In addition to the extension of Order No. 202-22-2, BANC has requested that the Order be modified to remove the 2 PM to 10 PM run time limitation so as to allow additional operational flexibility. BANC specifically requests that the Covered Resource be allowed to run during anytime that they have received notice of an Energy Emergency Alert Level 2 (EEA2) condition or greater. The practical impact of this will be to allow the Covered Resource more notice to follow their protocols for ramping up their diesel-fired generator units. In addition, BANC has requested the ramp down of the Covered Resource could extend beyond the period in which the EEA 2 condition exists. Specifically, the ramp down would commence at the time the EEA 2 condition is declared ended and should be completed as soon as possible consistent with good utility and operational

*Consultation*

In considering renewal or reissuance of an order under FPA section 202(c) that may conflict with an environmental law or regulation, DOE is required to “consult with the primary Federal agency with expertise in the environmental interest protected by such law or regulation” and to include “conditions as such Federal agency determines necessary . . . to the extent practicable.” 16 U.S.C. § 824a(c)(4). The Environmental Protection Agency (EPA) is the primary federal agency in this case with expertise in the protected environmental interest, specifically Title V of the Clean Air Act and the Department consulted with EPA after receiving the Renewal Application and EPA did not request any additional conditions be included in this Order. Email from Acting Assistant Administrator Larry Starfield, EPA Office of Enforcement and Compliance Assurance to Kathleen Hogan, Acting Under Secretary for Infrastructure for DOE, September 7, 2022.

Based on the information submitted to the Department, I have determined that an emergency continues to exist in California due to a shortage of electric energy. I find that the issuance of this Order will help to meet the emergency conditions and serve the public interest as required by FPA section 202(c).

*ORDER*

For the reasons set forth above, pursuant to Section 202(c) of the FPA, I hereby grant BANC’s Renewal Application and issue this Order, with modifications as explained below, to extend the expiration date of Order No. 202-22-2 through September 11, 2022.

1. Ordering Paragraph A appearing on page 4 of Order No. 202-22-2 is hereby deleted and replaced in its entirety by the following:
  - A. From September 8, 2022, to September 11, 2022, in the event that BANC determines that generation from the Covered Resource is necessary to preserve the reliability of the bulk electric power system in California, I direct BANC to dispatch such unit or units and to order their operation solely under the following conditions: the notification of an Energy Emergency Alert Level 2<sup>1</sup> condition or greater after exhausting all reasonably and practically available resources, together with such reasonable and limited time as is necessary for a Covered Resource to ramp down following an Energy Emergency Alert Level 2 or greater, consistent with good utility practice as directed by the BANC with the goal of limited operation outside of an Energy Emergency Alert Level 2 or greater to the greatest extent possible.

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<sup>1</sup> For the purposes of this Order, “Energy Emergency Alert Level 2” has the meaning set forth in Section 3.6.3 of the California ISO System Emergency Operating Procedure, Procedure No. 4420, Version 14.0, Effective Date May 1, 2022 (CAISO Emergency Operating Procedure).



Department of Energy Amendment Number 1 to Order No. 202-22-2

2. The date September 8, 2022 where it appears in Ordering Paragraphs D and H of Order No. 202-22-2 is hereby replaced by the date September 11, 2022.
3. All other terms of Order No. 202-22-2 remain the same and in effect, including Ordering Paragraphs A-H, except as modified herein.
4. This Amendment Number 1 to Order No. 202-22-2 shall be effective upon its issuance, and shall expire at 23:59 Pacific Time on September 11, 2022.

Issued in Washington, D.C. at 16:38 Eastern Time on this 8<sup>th</sup> day of September, 2022.



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Kathleen Hogan  
Acting Under Secretary for  
Infrastructure

BEFORE THE UNITED STATES DEPARTMENT OF ENERGY

Federal Power Act Section 202(c) )  
Emergency Order: Midcontinent )  
Independent System Operator )  
(MISO) )  
\_\_\_\_\_ )

Order No. 202-25-7

Exhibit to  
Motion to Intervene and Request for Rehearing and Stay of  
Public Interest Organizations

Filed September 5, 2025

Exhibit 107

DOE Order No. 202-22-1  
Amendment No. 2



**Department of Energy**  
Washington, DC 20585

**Amendment Number 2 to Order No. 202-22-1**

On September 2, 2022, because of a shortage of currently operational electric generating facilities, high demand for electricity, and other adverse conditions resulting from the extreme heat event in California, I issued Order No. 202-22-1. Order No. 202-22-1 authorizes the California Independent System Operator Corporation (CAISO), to direct the operation of the Covered Resources identified in Order No. 202-22-1 and on the terms set forth therein. On September 7, 2022, because of the continuing shortage of electric energy and the need for continued operation of the two units at Calpine's Greenleaf Unit 1 site in Yuba City, California (Greenleaf Units), I issued Amendment No. 1 to Order No. 202-22-1. Amendment No. 1 to Order No. 202-22-1 added the Greenleaf Units as Covered Resources subject to the terms of Order No. 202-22-1, except that the Greenleaf Units may be operated through September 9, 2022. By its terms, Order No. 202-22-1 as amended by Amendment No. 1 expires at the end of the day on September 8, 2022 with respect to the Covered Resources other than the Greenleaf Units, and at the end of the day on September 9, 2022 with respect to the Greenleaf Units. Order No. 202-22-1 as amended by Amendment No. 1 is sometimes referred to herein as Amended Order No. 202-22-1.

On September 7, 2022, CAISO submitted a *Request for Extension of Emergency Order Pursuant to Section 202(c) of the Federal Power Act* (Renewal Application) to the Department. In its Renewal Application, CAISO requests an extension of the expiration date of Order No. 202-22-1 through September 12, 2022.

*Emergency Situation*

In its Renewal Application, CAISO states that California is experiencing extreme heat, which the CAISO forecasts to continue through at least September 9, 2022. Further, CAISO explains that unpredictable conditions could exacerbate grid reliability issues at any time. The threat of wildfire to the reliable operation of the bulk power system remains significant, and drought conditions are affecting the availability of hydroelectric power. Ambient conditions facing generating facilities are causing de-rates at some units and forcing other units offline. Wildfire threats arising from the extreme heat event are unpredictable and could force transmission and resources out of service. Consequently, the CAISO believes it prudent to ask that the expiration date of Order No. 202-22-1 be extended through September 12, 2022.

*Consultation*

In considering renewal or reissuance of an order under FPA section 202(c) that may conflict with an environmental law or regulation, DOE is required to "consult with the primary Federal agency with expertise in the environmental interest protected by such law or regulation" and to include "conditions as such Federal agency determines necessary . . . to the extent practicable." 16 U.S.C. § 824a(c)(4). The Environmental



Protection Agency (EPA) is the primary federal agency in this case with expertise in the protected environmental interest, specifically Title V of the Clean Air Act and the Department consulted with EPA after receiving the Renewal Application and EPA did not request any additional conditions be included in this Order. Email from Acting Assistant Administrator Larry Starfield, EPA Office of Enforcement and Compliance Assurance to Kathleen Hogan, Acting Under Secretary for Infrastructure for DOE, September 7, 2022.

Based on the information submitted to the Department, I have determined that an emergency continues to exist in California due to a shortage of electric energy. I find that the issuance of this Order will help to meet the emergency conditions and serve the public interest as required by FPA section 202(c).

*ORDER*

For the reasons set forth above, pursuant to Section 202(c) of the FPA, I hereby grant CAISO's Renewal Application and issue this Order to extend the expiration date of Amended Order No. 202-22-1 through September 12, 2022.

1. In accordance with the foregoing, (a) the date September 8, 2022 where it appears in Ordering Paragraphs A, D, and H of Order No. 202-22-1 is hereby replaced by the date September 12, 2022, and (b) the date September 9, 2022 where it appears in the Ordering Paragraph of Amendment No. 1 to Order No. 202-22-1 is hereby replaced by the date September 12, 2022.
2. All other terms of Amended Order No. 202-22-1 remain the same and in effect, including Ordering Paragraphs A-H, except as modified herein.
3. This Amendment Number 2 to Order No. 202-22-1 shall be effective upon its issuance and shall expire at 23:59 Pacific Time on September 12, 2022.

Issued in Washington, D.C. at 15:52 Eastern Time on this 8<sup>th</sup> day of September, 2022.



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Kathleen Hogan  
Acting Under Secretary for  
Infrastructure

BEFORE THE UNITED STATES DEPARTMENT OF ENERGY

Federal Power Act Section 202(c)     )  
Emergency Order: Midcontinent     )  
Independent System Operator     )  
(MISO)     )  
\_\_\_\_\_

Order No. 202-25-7

Exhibit to  
Motion to Intervene and Request for Rehearing and Stay of  
Public Interest Organizations

Filed September 5, 2025

Exhibit 108  
  
Starfield Email to  
Hoffman

**From:** Starfield, Lawrence <[Starfield.Lawrence@epa.gov](mailto:Starfield.Lawrence@epa.gov)>

**Date:** Monday, Sep 11, 2017, 11:27 AM

**To:** Hoffman, Patricia <[Pat.Hoffman@hq.doe.gov](mailto:Pat.Hoffman@hq.doe.gov)>

**Cc:** Lucas, John T. <[John.T.Lucas@hq.doe.gov](mailto:John.T.Lucas@hq.doe.gov)>, Minoli, Kevin <[Minoli.Kevin@epa.gov](mailto:Minoli.Kevin@epa.gov)>, Kelley, Rosemarie <[Kelley.Rosemarie@epa.gov](mailto:Kelley.Rosemarie@epa.gov)>, Chapman, Apple <[Chapman.Apple@epa.gov](mailto:Chapman.Apple@epa.gov)>

**Subject:** DOE section 202(c) order

To: Pat Hoffman, DOE Acting Under Secretary for Science and Energy

On August 24, 2017, PJM submitted a renewal application requesting a 90-day renewal of the Order issued on June 16, 2017, by the Secretary of Energy. This email confirms that the Department of Energy (DOE) consulted with the Environmental Protection Agency (EPA), the primary Federal agency with expertise in the Mercury and Air Toxics Standard and section 316(b) of the Clean Water Act, with respect to a renewal order under Section 202(c) of the Federal Power Act related to Virginia Electric and Power Company's Units 1 and 2 at its Yorktown Power Station, near Yorktown, Virginia. See 16 U.S.C. § 824a(c)(4)(B) (Federal Power Act, Section 202(c)(4)(B)). DOE's proposed operational conditions for the order are generally consistent with EPA's Administrative Compliance Order, AED-CAA-113(a)-2016-002, as amended.

Thank you for your coordination on this matter.

Larry Starfield

Acting Assistant Administrator

Office of Enforcement and Compliance Assurance

U.S. EPA

Washington, DC

(202) 564-2440 (office)

(202) 564-8179 (direct)



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Exhibit 109  
  
MISO ERAS News  
Release

[Careers](#) [Library](#) [Help Center](#) | [Login](#)[Home](#) > [Meet MISO](#) > [News Center](#) > [2025 - News Releases](#) > [Expedited Resource Addition Study attracts large, diverse applicant pool](#)

# Expedited Resource Addition Study attracts large, diverse applicant pool

*Projects tailored to address rapidly growing demand in specific areas*

## For Immediate Release

August 26, 2025

## Media Contact

[Brandon D. Morris](#)

CARMEL, Ind. — Today, MISO shared the list of applications submitted to date for the Expedited Resource Addition Study (ERAS) which includes 47 projects across 12 states, representing more than 26,500 megawatts of proposed new capacity. ERAS is a temporary process aimed at fast-tracking urgently needed generation projects across the region. The proposed projects include: 74% natural gas, 15% battery storage, 4% wind, 4% solar and 3% nuclear.

“This broad mix underscores MISO’s evolving energy landscape and the urgent need to bring new resources online to address growing reliability challenges,” said Aubrey Johnson, MISO’s vice president of system planning. “These projects are designed to meet localized and accelerating demand growth.”

The ERAS process will study up to 10 projects per quarter, with a maximum of 68 projects before the program sunsets on Aug. 31, 2027. ERAS was developed in close collaboration with stakeholders to address specific load growth and/or resource adequacy concern – through the Generator Interconnection process.

“ERAS is another tool in our toolbox to help maintain reliability while we continue to improve the interconnection process for the long term,” Johnson continues. “These projects must meet strict

requirements to ensure that only viable, needed projects are considered.”

MISO continues to evaluate the applications to ensure all requirements are met and will publish the approved ERAS projects after September 2, 2025. Eligible projects must demonstrate a clear resource adequacy or reliability need, be commercially operable within three to six years and have support from Relevant Electric Retail Regulatory Authority. More information, including the application guide and schedule, is available on the [MISO website](#).

###

### Media Contact:

[Brandon D. Morris](#)

### About MISO

Midcontinent Independent System Operator (MISO) is an independent, not-for-profit organization that delivers safe, cost-effective electric power across 15 U.S. states and the Canadian province of Manitoba. 42 million people depend on MISO to generate and transmit the right amount of electricity every minute of every day. MISO is committed to reliable, nondiscriminatory operation of the bulk power transmission system and collaborating with all stakeholders to create cost-effective and innovative solutions for our changing industry. MISO operates one of the world’s largest energy markets with more than \$22 billion in annual gross market energy transactions.

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Order No. 202-25-7

Exhibit to  
Motion to Intervene and Request for Rehearing and Stay of  
Public Interest Organizations

Filed September 5, 2025

Exhibit 110  
  
DOE Order No.  
202-24-1



Department of Energy  
Washington, DC 20585

### **Order No. 202-24-1**

Pursuant to the authority vested in the Secretary of Energy by section 202(c) of the Federal Power Act (FPA), 16 U.S.C. § 824a(c), and section 301(b) of the Department of Energy Organization Act, 42 U.S.C. § 7151(b), and for the reasons set forth below, I hereby determine that an emergency exists in Florida due to a shortage of electric energy, a shortage of facilities for the generation of electric energy, and other causes, and that issuance of this Order will meet the emergency and serve the public interest.

#### *Emergency Situation*

On October 9, 2024, Duke Energy Florida, LLC (Duke), an investor-owned utility, whose service territory includes electric customers in Florida, filed a *Request for Emergency Order Under Section 202(c) of the Federal Power Act* (Application) with the United States Department of Energy (Department) “to preserve the reliability of the bulk electric power system.” As of 4 PM EDT on October 9, 2024, Hurricane Milton is a Category 3 storm forecast to remain a major hurricane and expand in size as it approaches the west coast of Florida. The center is likely to make landfall along the west-central coast of Florida during the night on Wednesday, October 9, 2024, or in the early morning on Thursday, October 10, 2024, and move east-northeastward across central Florida through October 10, 2024. Hurricane Milton follows the landfall of Hurricane Helene in Florida on September 26, 2024, which resulted in over 230 deaths in the southeast United States and for which recovery and restoration efforts remain ongoing. As of 5:00 PM EDT on October 9, 2024, Florida was experiencing 118,000 outages related to the approaching Hurricane Milton, with the number increasing rapidly.

On October 7, 2024, President Biden declared that an emergency exists in the State of Florida and ordered Federal assistance to supplement State, tribal, and local response efforts due to the emergency conditions resulting from Hurricane Milton beginning on October 5, 2024, and continuing.

Duke has indicated that its service territory is being impacted by Hurricane Milton. Duke expects that Hurricane Milton will cause hurricane-force-gusts across the St. Petersburg/Tampa metropolitan region at the height of the storm overnight into early Thursday, October 10, 2024. Elsewhere, strong tropical-storm to near hurricane-force-gusts are projected to impact highly populated zones along the I-4 corridor served by Duke. The combination of damaging winds,

torrential rain and subsequent flooding, storm surge at the coast, and possible tornadoes, will result in major power outages, damaging distribution and transmission infrastructure, and threaten several generation stations along the path. Application at 1.

While many generating units in the Duke service territory continue to function adequately under these stressed conditions, several of Duke's generating units are expected to be forced to shut down due to facility limits on wind speeds and storm surge, as well as staffing issues caused by mandatory evacuations. Additionally, Crystal River Units 4 and 5 remain in forced outage from storm surge impacts from Hurricane Helene. Specifically, approximately 4,000 MW of generating units are currently offline and will remain offline during Hurricane Milton. Application at 2.

Additionally, several units at Citrus Combined Cycle, the subject of this Order, may be forced offline by conditions in its Title V operating permit. With projected outages and low demand, in order to keep the Citrus Combined Cycle units online, they would potentially need to operate at low load for an extended period of time, which could result in noncompliance with its Title V permit. If these units are brought offline due to these compliance requirements, they may not be able to ramp up quickly enough to meet demand as load increases following power restoration, particularly in light of the amount of generation predicted to be offline due to hurricane impacts. For example, ramp-up times from a cold start could be eight or nine hours, and could be further delayed by pre-generation start-up checks. Additionally, shutting down also increases the risk of equipment failure, as well as the risk of water intrusion due to thermal and pressure gradient changes. If equipment fails or is damaged by Hurricane Milton, units may not be able to start without additional maintenance. In that case, Duke may have to declare an Energy Emergency Alert (EEA) Level 3 and institute rotating load shed. Such impacts would hinder post-hurricane restoration and recovery activities and overall grid reliability. Although Duke would attempt to mitigate such impacts through alternative generation as well as power purchases, it is unknown what will be available following Hurricane Milton and whether the necessary transmission infrastructure will remain for this purpose. Application at 2.

The Florida Reliability Coordinating Council, Inc. (FRCC), the Reliability Coordinator for Duke's service territory and others, filed a formal endorsement on October 9, 2024, of Duke's Application, specifically the need to continue operation of the Specified Resources in Application Exhibit A at low load operation to help reduce the likelihood of any firm load shedding during the hurricane event. FRCC Letter at 1. The endorsement explains:

It is the FRCC's firm opinion that granting this relief request will provide an immeasurable benefit to this mission and in turn, the public served by the FRCC and its member entities. Allowing this relief will not only serve the reliability of [Duke's] service territory, but also the many local electric cooperatives served by [Duke] and other interconnected electric utilities and service providers.

FRCC Letter at 2.

*Description of Mitigation Measures*

Duke has indicated that it will attempt to keep the Citrus Combined Cycle units operating at a load level compliant with its Title V permit whenever possible, including attempting to sell power to keep load higher. Duke anticipates needing to continue these efforts through October 13, 2024. Subject to the exceptions included in this Order, Duke has committed to continuing to take such actions, including attempting to sell power, before operating any units in a manner that will result in a conflict with a requirement of any federal, state, or local environmental statute or regulation, including requirements in permits issued pursuant to such laws or regulations.

*Request for Order*

Duke requests that the Secretary issue an order immediately, effective October 9, 2024, through 00:00 EDT on October 13, 2024, authorizing “continued operation of the Specified Resources” in the Duke service territory. Application at 3. The generating units (Specified Resources) that this Order pertains to are listed on the Order 202-24-1 Resources List, as described below.

*ORDER*

Given the emergency nature of the expected load stress, the responsibility of Duke to ensure maximum reliability on its system, and the ability of Duke to identify and dispatch generation necessary to meet load requirements, I have determined that, under the conditions specified below, additional dispatch of the Specified Resources is necessary to best meet the emergency and serve the public interest for purposes of FPA section 202(c). This determination is based on, among other things:

- The emergency nature of the expected load stress caused by the current extreme weather event and its aftermath threatens to cause loss of power to homes and local businesses in the areas that may be affected by curtailments, presenting a risk to public health and safety.
- The expected shortage of electric energy, shortage of facilities for the generation of electric energy, and other causes in the State of Florida and within the region demonstrate the need for the Specified Resources to contribute to system reliability.
- Duke’s responsibility to ensure maximum reliability on its system, and, with the authority granted in this Order, its ability to identify and dispatch generation, including the Specified Resources, necessary to meet the load resulting from the extreme weather event and its aftermath.

In line with the anticipated circumstances precipitated by Hurricane Milton, this Order is limited to the period beginning with the issuance of this Order on October 9, 2024, through 00:00 EDT on October 13, 2024. Because the additional generation may result in a conflict with environmental standards and requirements, I am authorizing only the necessary additional generation on the conditions contained in this Order, with reporting requirements as described below.



FPA section 202(c)(2) requires the Secretary of Energy to ensure that any 202(c) order that may result in a conflict with a requirement of any environmental law be limited to the “hours necessary to meet the emergency and serve the public interest, and, to the maximum extent practicable,” be consistent with any applicable environmental law and minimize any adverse environmental impacts. Duke anticipates that this Order may result in exceedance of emissions of Volatile Organic Compounds (VOC), specifically formaldehyde. To minimize adverse environmental impacts, this Order limits operation of dispatched units to the times and within the parameters determined by Duke for reliability purposes.

Based on my determination of an emergency set forth above, I hereby order:

- A. From the time this Order is issued on October 9, 2024, to 00:00 EDT on October 13, 2024, in the event that Duke determines that generation from the Specified Resources is necessary to meet the electricity demand that Duke anticipates in Florida during and immediately following this event, I direct Duke to dispatch such unit or units and to order their operation only as needed to maintain the necessary expected generation in the Duke service territory. Specified Resources are those generating units set forth on the Order 202-24-1 Resource List, which the Department shall post on [www.energy.gov](http://www.energy.gov). Duke is directed to provide updates, if any, to Exhibit A to its Application with the anticipated category of environmental impact(s) (i.e., formaldehyde, sulfur dioxide, nitrogen oxide, mercury, carbon monoxide emissions, wastewater release, other air pollutants) by 21:00 EDT on October 10, 2024.
- B. To minimize adverse environmental impacts, this Order limits operation of dispatched units to the times and within the parameters determined by Duke for maintaining grid reliability to avoid adverse health and safety impacts to customers from shedding firm customer load. Duke shall exhaust all possible measures to run the Specified Units at a load level in compliance with permit requirements, including attempting to sell power. Duke shall provide a daily notification to the Department (via [AskCR@hq.doe.gov](mailto:AskCR@hq.doe.gov)) reporting each generating unit that has been designated to use the allowance and operated in reliance on the allowances contained in this Order.
- C. All operation of the Specified Resource must comply with applicable environmental requirements, including but not limited to monitoring, reporting, and recordkeeping requirements, to the maximum extent feasible while operating consistent with the emergency conditions. This Order does not provide relief from any obligation to pay fees or purchase offsets or allowances for emissions that occur during the emergency condition or to use other geographic or temporal flexibilities available to generators.
- D. Duke shall provide such additional information regarding the environmental impacts of this Order and its compliance with the conditions of this Order, in each case as requested by the Department of Energy from time to time. By October 20, 2024, Duke shall report all dates between October 9, 2024, and October 13, 2024, inclusive, on which the Specified Resources were operated, the hours of operation, and exceedance of permitting

limits, including formaldehyde, sulfur dioxide, nitrogen oxide, mercury, carbon monoxide, and other air pollutants, as well as exceedances of wastewater release limits. Duke shall submit a final report by November 20, 2024, with any revisions to the information reported on October 20, 2024. The environmental information submitted in the final report shall also include the following information:

- (i) Emissions data in pounds per hour for each Specified Resource unit, for each hour of the operational scenario, for CO, NO<sub>x</sub>, PM<sub>10</sub>, formaldehyde, VOC, and SO<sub>2</sub>;
- (ii) Emissions data must include emissions (lbs/hr) calculated consistent with reporting obligations pursuant to operating permits, permitted operating/emission limits, and the actual incremental emissions above the permit limits;
- (iii) The number and actual hours each day that each Specified Resource unit operated in excess of permit limits or conditions, e.g. "Generator #1; October 10, 2024; 4 hours; 04:00-08:00 EDT";
- (iv) Amount, type and formulation of any fuel used by each Specified Resource;
- (v) All reporting provided under the Specified Resource's operating permit requirements over the last three years to the United States Environmental Protection Agency or local Air Quality Management District for the location of a Specified Resource that operates pursuant to this Order;
- (vi) Additional information requested by DOE as it performs any environmental review relating to the issuance of this Order; and
- (vii) Information provided by the Specified Resource describing how the requirements in paragraph C above were met by the Specified Resource while operating under the provisions of this Order.

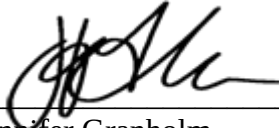
In addition, Duke shall provide information to the Department quantifying the net revenue associated with generation in excess of environmental limits accruing to the Specified Resources in connection with any order issued by the Department pursuant to Section 202(c) of the Federal Power Act.

- E. Duke shall take reasonable measures to inform affected communities where all Specified Resources operate that Duke has been issued this Order, in a manner that ensures that as many members of the community as possible are aware of the Order, and explains clearly what the Order allows Duke to do. At a minimum, Duke shall post a description of this Order on its website (with a link to this Order) and identify the name, municipality or other political subdivision, and zip code of any Specified Resource covered by this Order. In addition, in the event that a Specified Resource operates pursuant to this Order, a general description of the action authorized by this Order will be included in any press release issued by Duke with respect to the extreme weather event and will include a reference to the website posting required by the preceding sentence for further information. Duke shall describe the actions taken to comply with this paragraph in the

reports delivered to the Department pursuant to paragraph D above.

- F. This Order shall not preclude the need for the Specified Resource to comply with applicable state, local, or Federal law or regulations following the expiration of this Order.
- G. Duke shall be responsible for the reasonable third-party costs of performing analysis of the environmental and environmental justice impacts of this Order, including any analysis conducted pursuant to the National Environmental Policy Act.
- H. This Order shall be effective upon its issuance, and shall expire at 00:00 EDT on Sunday, October 13, 2024, with the exception of the reporting requirements in paragraph D. Renewal of this Order, should it be needed, must be requested before this Order expires.

Issued in Washington, D.C. at 8:00 PM Eastern Daylight Time on this 9<sup>th</sup> day of October 2024.



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Jennifer Granholm  
Secretary of Energy

BEFORE THE UNITED STATES DEPARTMENT OF ENERGY

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Order No. 202-25-7

Exhibit to  
Motion to Intervene and Request for Rehearing and Stay of  
Public Interest Organizations

Filed September 5, 2025

Exhibit 111  
  
MISO June  
Operations Report





# MISO Monthly Operations Report

June 2025

# Reliability, markets and operational functions performed as expected in June

AVERAGE & PEAK LOAD (GW)



SYSTEM-WIDE LOAD PEAK



**120 GW**

June 23, Hour Ending (HE) 16

SOLAR PEAK



**13.1 GW**

Jun 22, 2025, HE 11

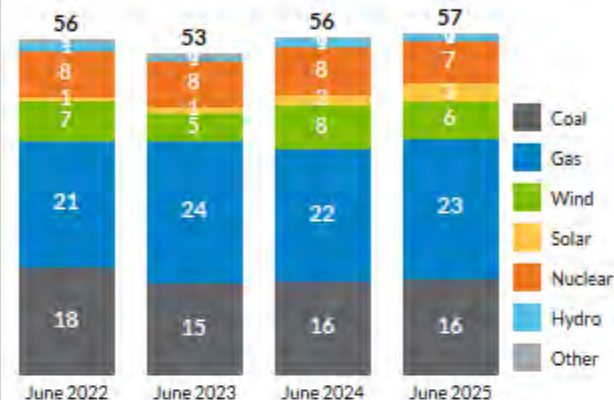
WIND PEAK



**21.5 GW**

Jun 20, 2025, HE 23

ENERGY FUEL MIX (TWh)



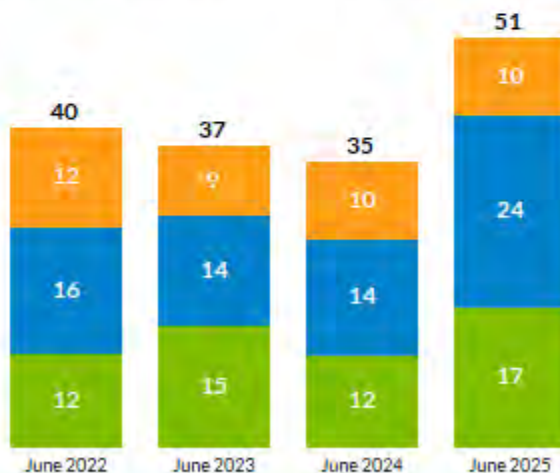
REAL-TIME LMP (\$/MWh)



AVERAGE FUEL PRICE (\$/MMBtu)



AVERAGE DAILY GENERATION OUTAGE (GW)



KEY OPERATING DECLARATIONS

JUNE 2025

|    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|
| 1  | 2  | 3  | 4  | 5  | 6  | 7  |
| 8  | 9  | 10 | 11 | 12 | 13 | 14 |
| 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| 29 | 30 |    |    |    |    |    |

**06/06-06/08 South:** Conservative Operations  
**06/12 South:** Severe Weather Alert  
**06/18 Central:** Severe Weather Alert  
**06/20-06/21 North:** Severe Weather Alert  
**06/21-06/24 N/C:** Hot Weather Alert  
**06/23 N/C:** Max Gen Event - Step 1b  
**06/24 N/C:** Max Gen Warning  
**06/21-06/27 System:** Conservative Operations

- All-Time Solar Peak: 13.5 GW on May 31, 2025, HE 13
- All-Time Wind Peak: 25.7 GW on Jan 12, 2024, HE 19
- All-Time Load Peak: 127.1 GW on Jul 20, 2011, HE17

- Awareness and Weather
- Alerts and Warnings
- Reliability Actions and Events

# Dashboard

| Metric                                                                              | Chart | June 2025 | May '25 | Apr '25 | Mar '25 | Metric                                                               | Chart | June 2025 | May '25 | Apr '25 | Mar '25 |
|-------------------------------------------------------------------------------------|-------|-----------|---------|---------|---------|----------------------------------------------------------------------|-------|-----------|---------|---------|---------|
| <a href="#">Market Efficiency Metric</a>                                            | D     | ▼         | ●       | ●       | ●       | <a href="#">Unit Commitment Efficiency</a>                           | H     | ●         | ●       | ●       | ●       |
| <a href="#">Percentage Price Deviation</a>                                          | A     | ■         | ■       | ■       | ●       | <a href="#">Day Ahead Wind Generation Forecast Error</a>             | K     | ●         | ●       | ●       | ●       |
| <a href="#">Monthly Average Gross Virtual Profitability</a>                         | B     | ●         | ●       | ●       | ●       | <a href="#">Day-Ahead Solar Generation Forecast Error</a>            | T     | ●         | ●       | ●       | ●       |
| <a href="#">FTR Funding</a>                                                         | C     | ●         | ●       | ●       | ●       | <a href="#">Tie Line Error</a>                                       | L     | ●         | ●       | ●       | ●       |
| <a href="#">RSG per MWh to Energy Price</a>                                         | E     | ●         | ●       | ●       | ●       | <a href="#">Control Performance – BAAL</a>                           | M     | ●         | ●       | ●       | ●       |
| <a href="#">Day Ahead Mid-Term Load Forecast</a>                                    | F     | ●         | ■       | ▼       | ▼       | <a href="#">Control Performance – CPS1 and CPS1 12-month rolling</a> | N     | ●         | ●       | ●       | ●       |
| <a href="#">Short-Term Load Forecast</a>                                            | G     | ●         | ●       | ■       | ●       | <a href="#">ARS Deployment</a>                                       | P     | ●         | ●       | ●       | ●       |
| <a href="#">Real-Time Obligation fulfilled by Day-Ahead Supply at the Peak Hour</a> | I     | ●         | ●       | ●       | ●       |                                                                      |       |           |         |         |         |
| <a href="#">System Impact Study Performance</a>                                     | Q     | ▼         | ●       | ▼       | ▼       | <a href="#">Settlement Disputes</a>                                  | S     | ●         | ●       | ●       | ●       |

● Expected ■ Concern/Monitor ▼ Review

# Three metrics fell outside of the expected range for this month

| Metric                          | Expected Criteria                                           | Actual                                           | Status  | Comments                                                                                                                                                                                                                                                                                                                                           |
|---------------------------------|-------------------------------------------------------------|--------------------------------------------------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Percentage Price Deviation      | Absolute DA-RT price difference divided by DA LMP<br>≤28.6% | 32.8%                                            | Monitor | Periods of congestion, especially on June 23 and June 24, and Real-Time ancillary service product scarcity pricing throughout the month resulted in some price divergence between the Day-Ahead and Real-Time markets.                                                                                                                             |
| Market Efficiency Metric        | ≥ 95%                                                       | 90.5%                                            | Review  | Excess Congestion Fund (ECF) performance for the month of June was largely impacted by the effects of the notable heat days (6/21-6/24) as well as outlier constraints. The high impact ECF constraints were driven by large Joint Operating Agreement payments to SPP, outages, Real-Time congestion management actions, and congestion forecast. |
| System Impact Study Performance | Studies completed in less than 60 days<br>≥85%              | Completed studies were done in more than 60 days | Review  | Resource constraints impacted study completion timing.                                                                                                                                                                                                                                                                                             |



# Appendix

# MISO has worked collaboratively with stakeholders to review and implement the following changes on the Monthly Operations Report

## Removed

- Price Duration Curve – Peak Hours
- Price Duration Curve – Off-Peak Hours
- MISO Hubs RT Price Duration – Peak Hours
- MISO Hubs RT Price Duration – Off-Peak Hours
- Load Duration Curve
- Solar Energy and Daily Peak

## Modified

- Add hours to Manual Redispatch/Cap summary on the Reliability slide
- Provided regional breakdown for Real-Time Congestion Dollars
- Consolidated load and temperature information

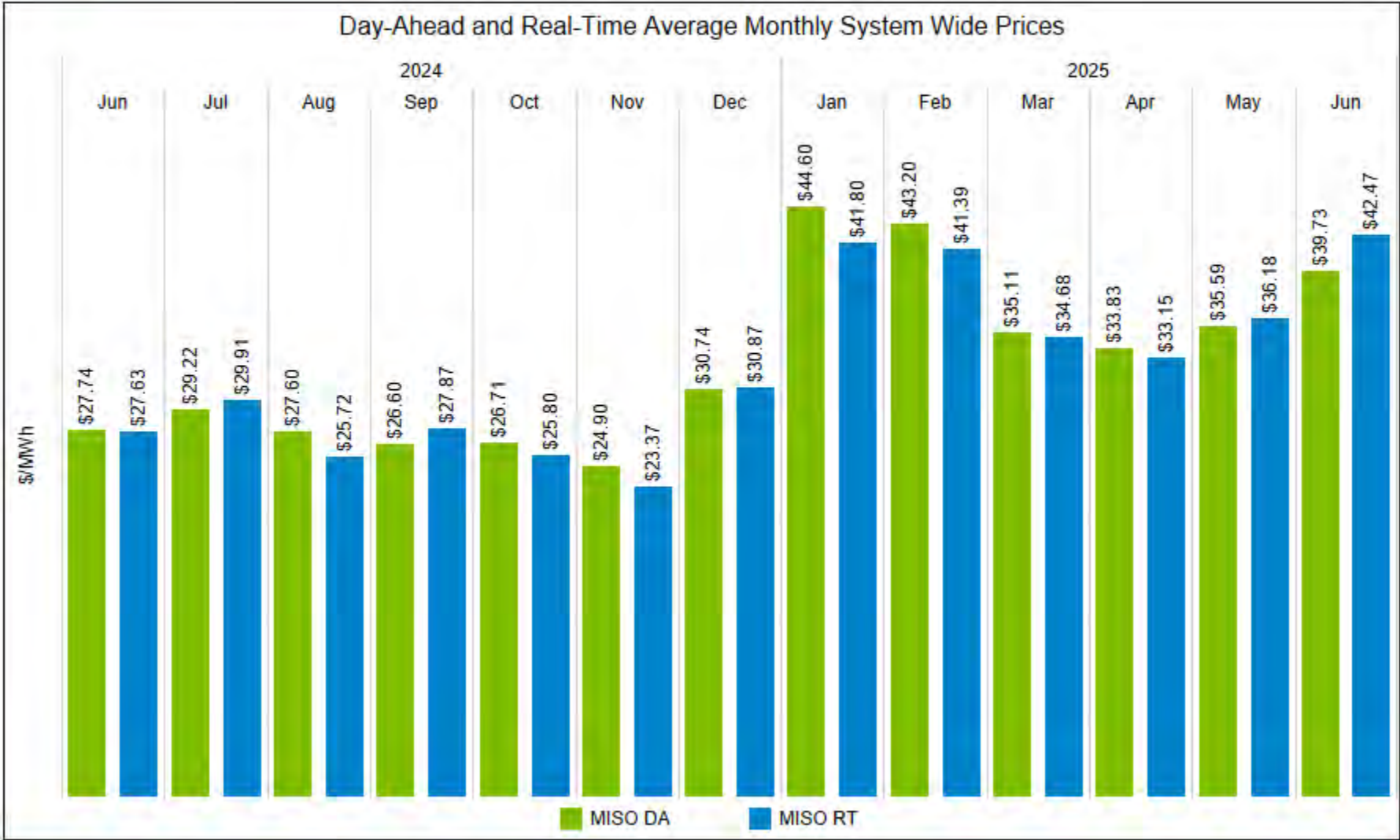
## Added

- Add an Operator Actions for congestion management slide with details on Manual Redispatches/Caps
- Added a monthly solar slide that resembles the monthly wind slide
- Added a daily solar slide that resembles the daily wind slide

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|                        | Short-Term Load Forecast                                    | <a href="#">25</a> |                              | Tie Line and BAAL Performance                       | <a href="#">51</a> |
|                        | Average Load by Region                                      | <a href="#">26</a> |                              | CPS1 Performance                                    | <a href="#">52</a> |
|                        | Market Participant Entered LMR Availability                 | <a href="#">27</a> |                              | Reliability – Other Metrics                         | <a href="#">53</a> |
|                        | Regional Directional Transfer                               | <a href="#">28</a> |                              | Operator Actions: Manual Redispatch and Caps        | <a href="#">54</a> |
| <b>Unit Commitment</b> | Unit Commitment Efficiency                                  | <a href="#">29</a> | <b>Transmission Planning</b> | Transmission Service Request                        | <a href="#">55</a> |
|                        | DA Supply and RT Obligation at the Peak Load Hour           | <a href="#">30</a> |                              | Generator Suspension/ Retirement – New and Resolved | <a href="#">56</a> |
|                        | Self-Committed and Economically Dispatched Energy           | <a href="#">31</a> |                              | Generation Suspension/Retirement – Overall          | <a href="#">57</a> |
|                        | Trend in Self Commitment and Economically Dispatched Energy | <a href="#">32</a> | <b>Customer Service</b>      | Settlements/Customer Service                        | <a href="#">58</a> |
|                        | Offered Capacity and RT Peak Load Obligation                | <a href="#">33</a> |                              | Market Operations IT Applications Availability      | <a href="#">59</a> |

# MISO System-wide Day-Ahead and Real-Time Locational Marginal Pricing

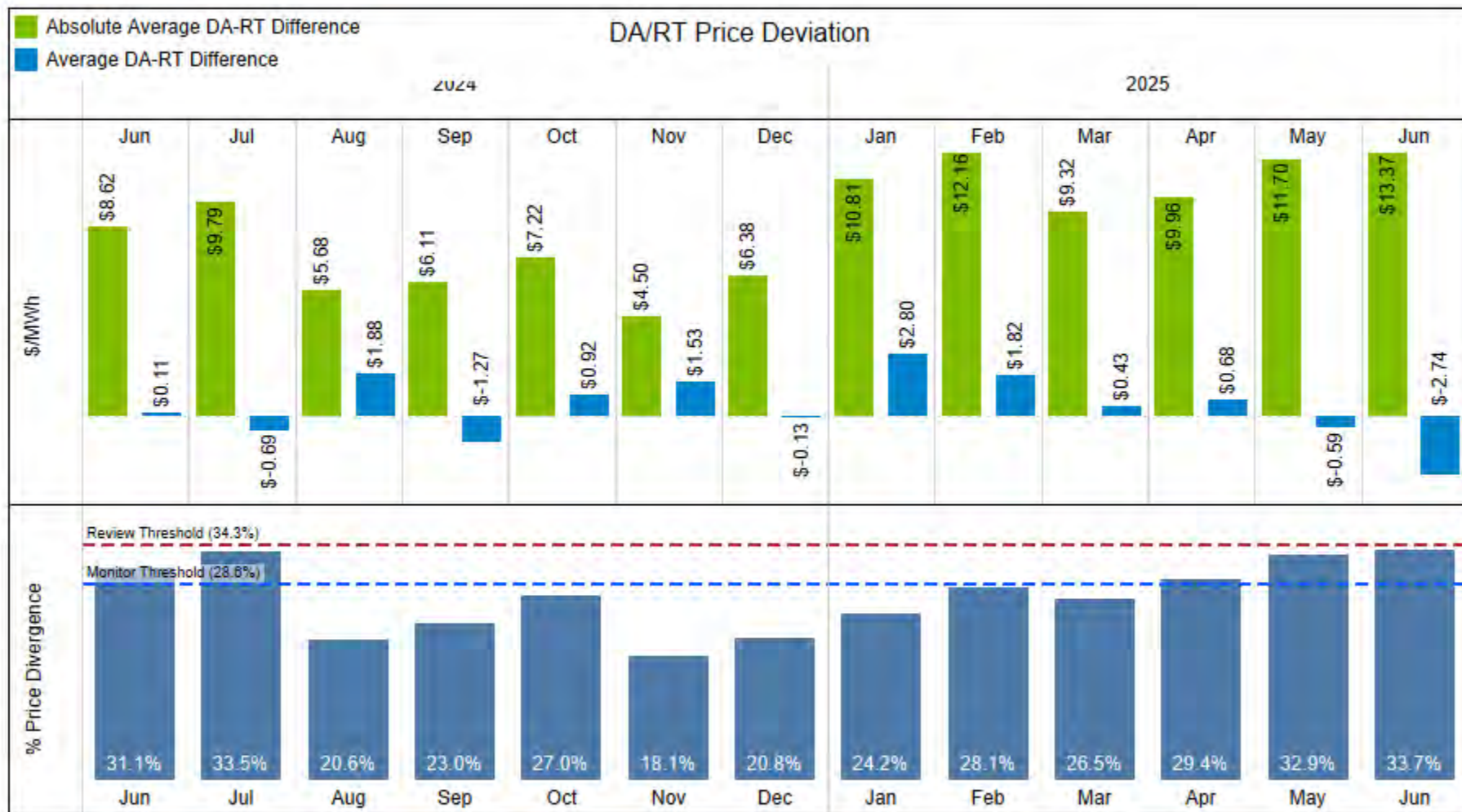


Note: MISO System-Wide price is based on the monthly hourly average of the active hubs  
Source: MISO Market and Operations Analytics Department



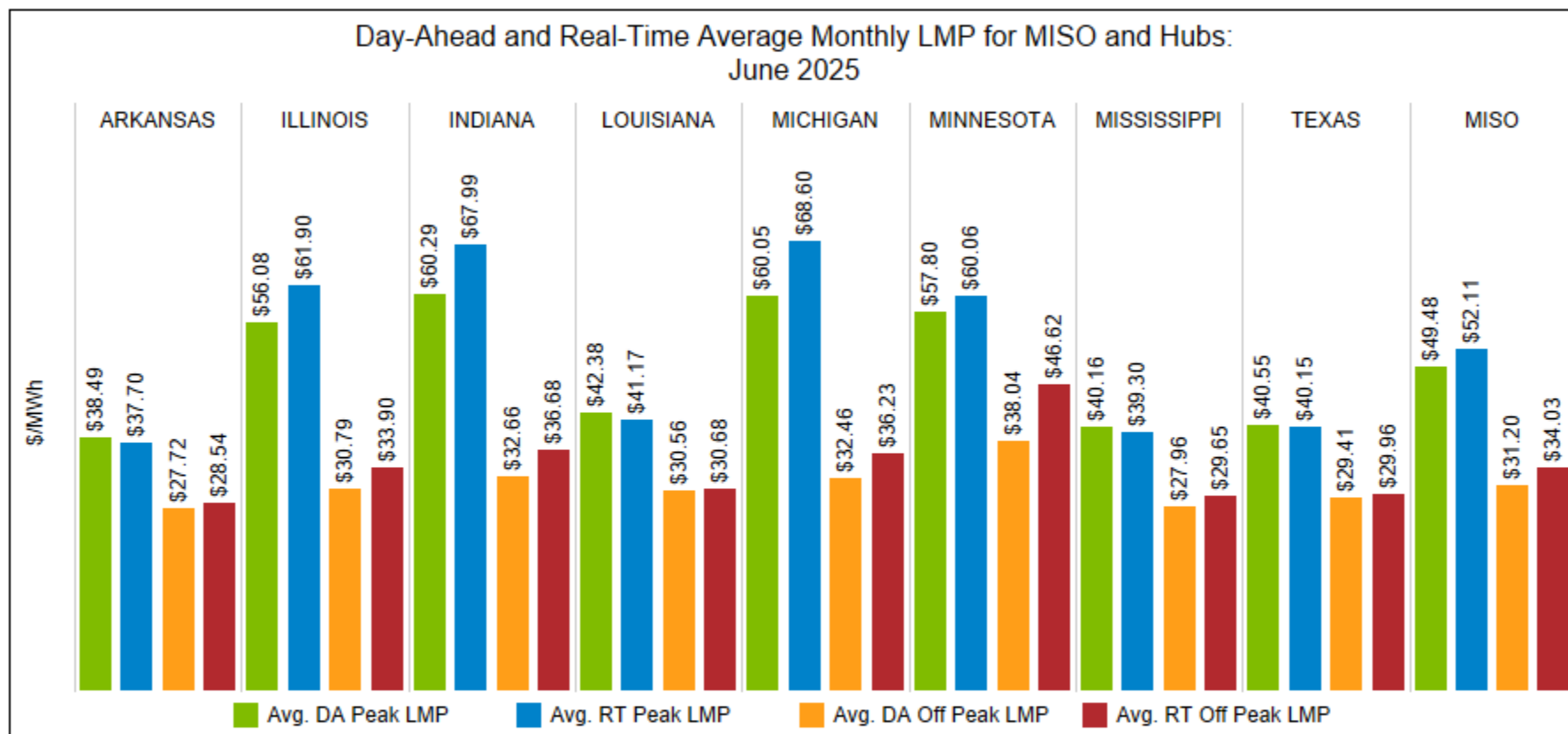
# Price Convergence: Day-Ahead and Real-Time Locational Marginal Pricing

A



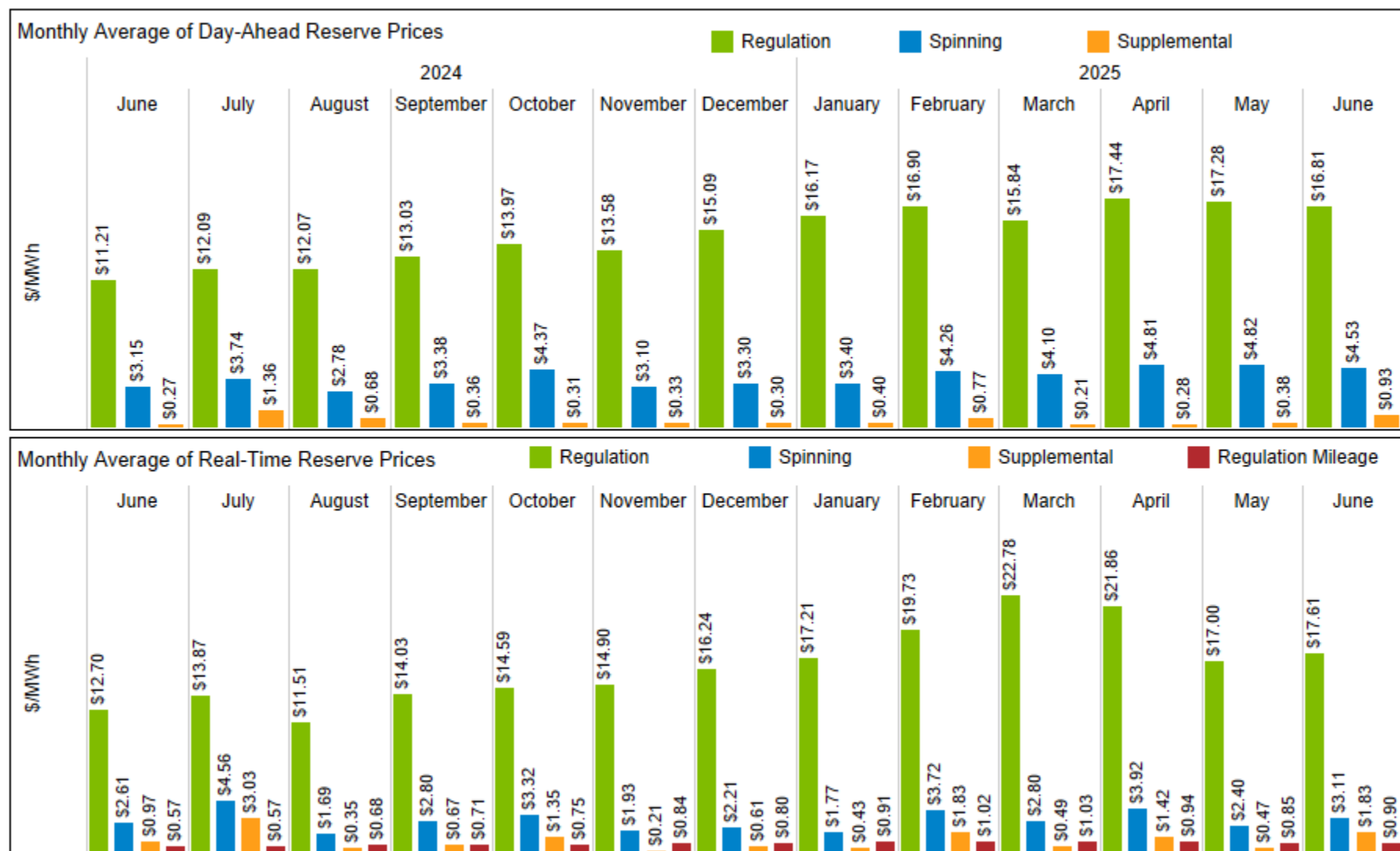
\*Monthly deviation, expressed as a percent of average DA LMP, is calculated as the average of hourly absolute (DA-RT) price difference divided by the average of hourly DA LMPs for the month

# MISO Day-Ahead and Real-Time Hub Locational Marginal Pricing

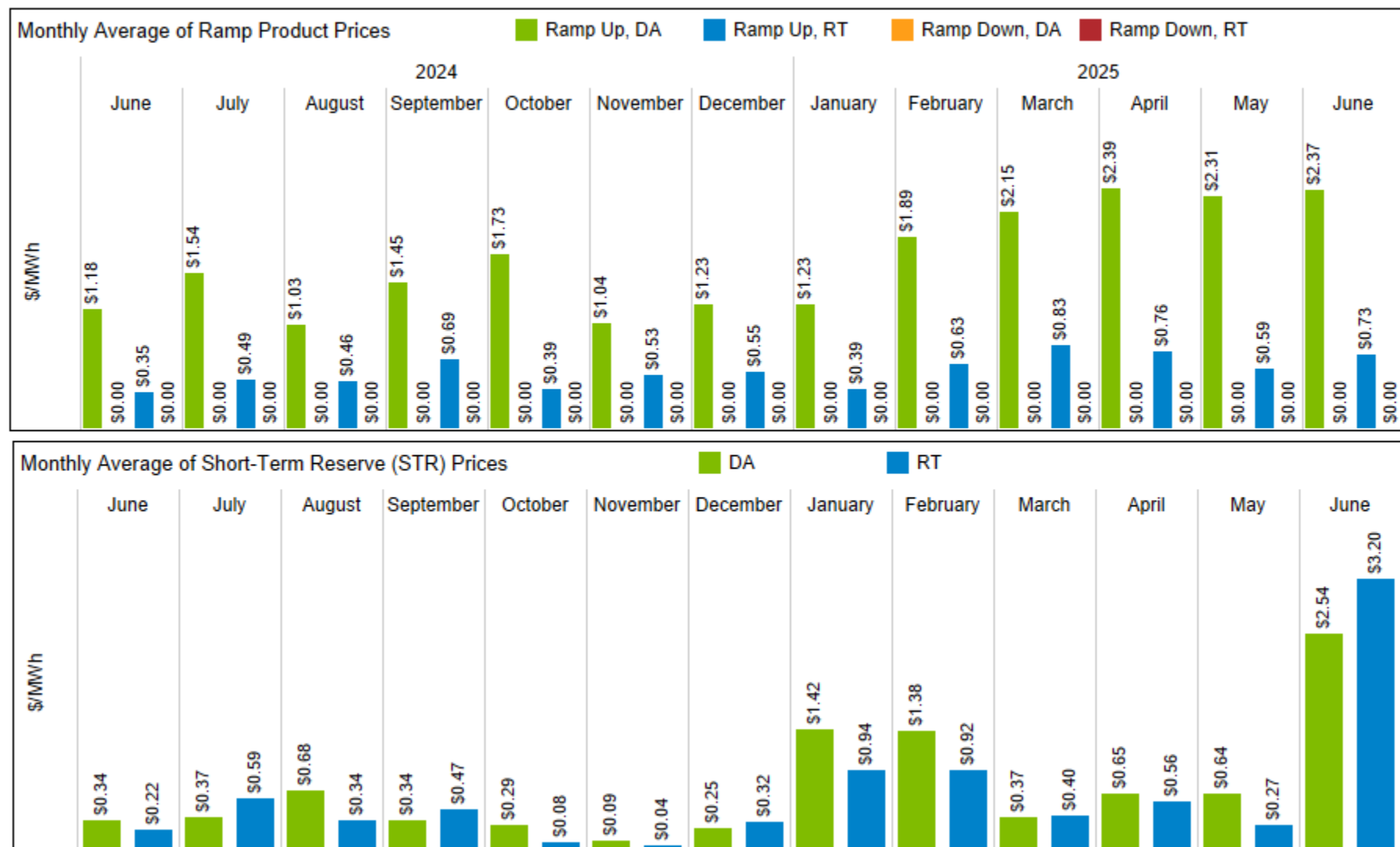


|                                               |             | ARKANSAS | ILLINOIS | INDIANA | LOUISIANA | MICHIGAN | MINNESOTA | MISSISSIPPI | TEXAS  | MISO   |
|-----------------------------------------------|-------------|----------|----------|---------|-----------|----------|-----------|-------------|--------|--------|
| Marginal Congestion Component of LMP (\$/MWh) | DA Peak     | -16.62   | -0.48    | 1.78    | -14.90    | 1.82     | -0.63     | -16.19      | -15.79 | -7.63  |
|                                               | RT Peak     | -23.91   | -1.42    | 2.06    | -22.70    | 2.91     | -2.36     | -23.51      | -23.17 | -11.51 |
|                                               | DA Off Peak | -3.55    | -0.81    | -0.24   | -2.16     | -0.23    | 5.13      | -3.96       | -2.61  | -1.06  |
|                                               | RT Off Peak | -5.71    | -0.78    | 0.54    | -5.11     | 0.35     | 10.78     | -5.28       | -5.53  | -1.34  |

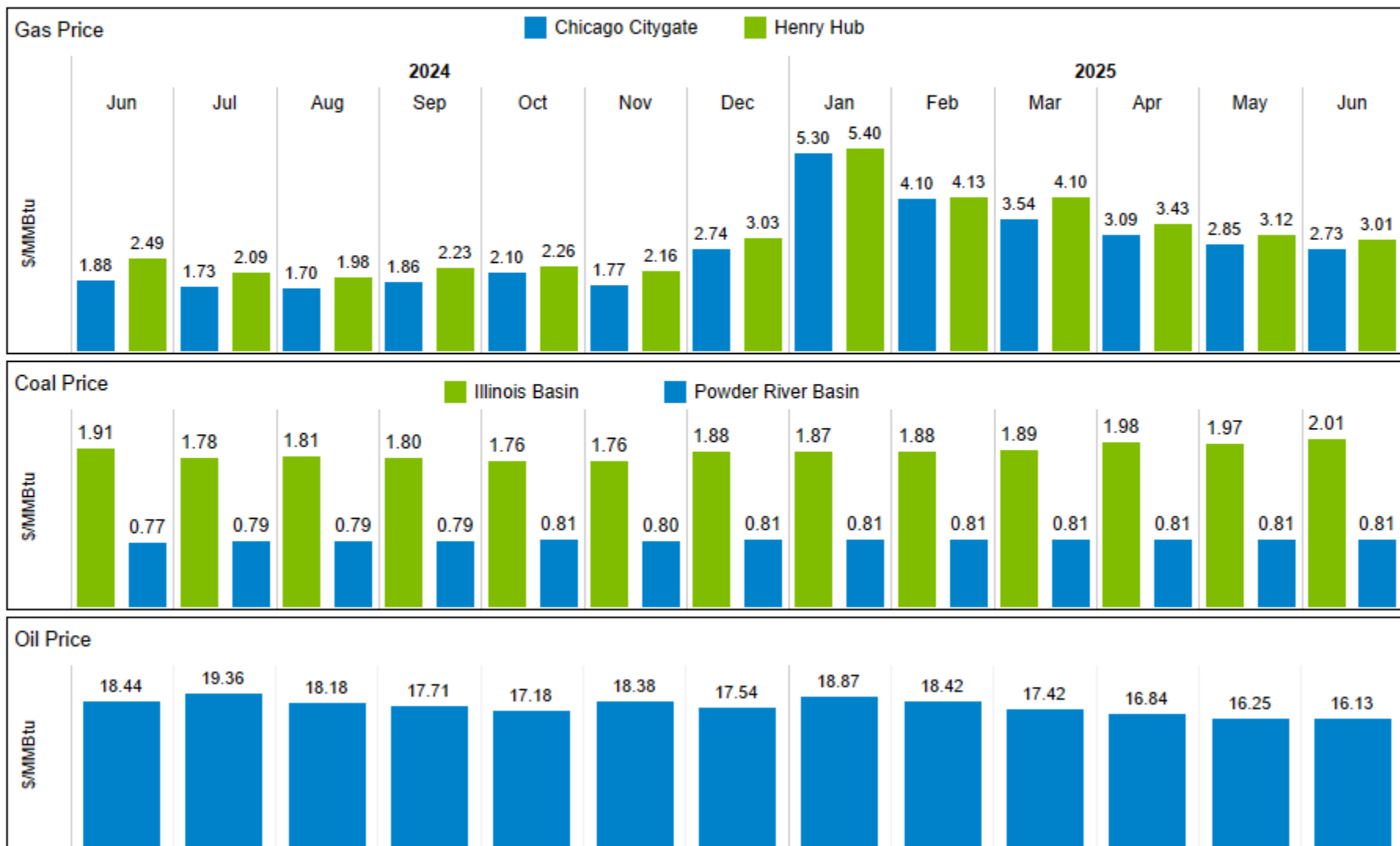
# Ancillary Services - Day-Ahead and Real-Time Market Clearing Prices



# Ancillary Services - Day-Ahead and Real-Time Market Clearing Prices



# Nominal Fuel Prices

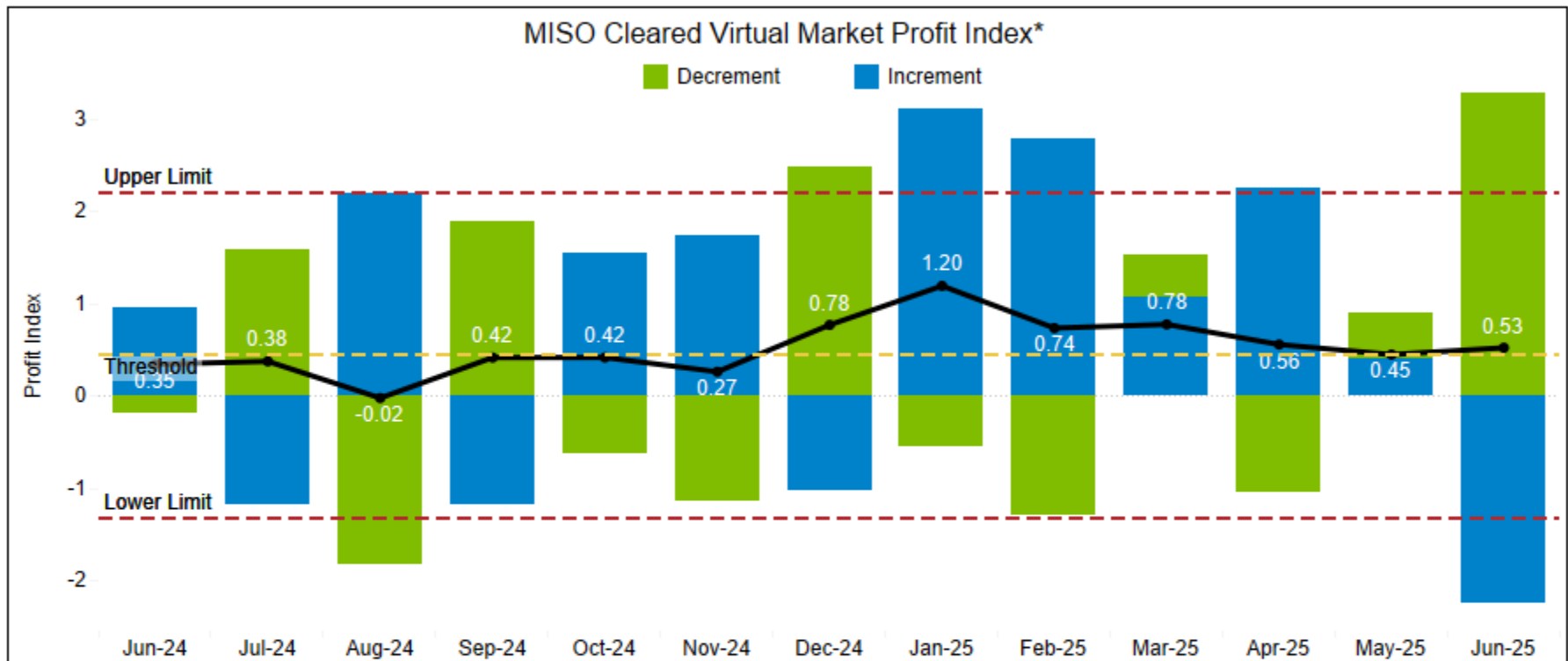


Monthly oil prices are estimates and subject to change upon finalization  
Source: EIA



# Monthly Average Gross Virtual Profitability

B



## Monthly Standard Deviation

| Jun-24 | Jul-24 | Aug-24 | Sep-24 | Oct-24 | Nov-24 | Dec-24 | Jan-25 | Feb-25 | Mar-25 | Apr-25 | May-25 | Jun-25 |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| 1.09   | 2.96   | 0.86   | 1.32   | 1.21   | 1.74   | 1.50   | 2.60   | 2.21   | 1.16   | 1.15   | 2.04   | 1.61   |

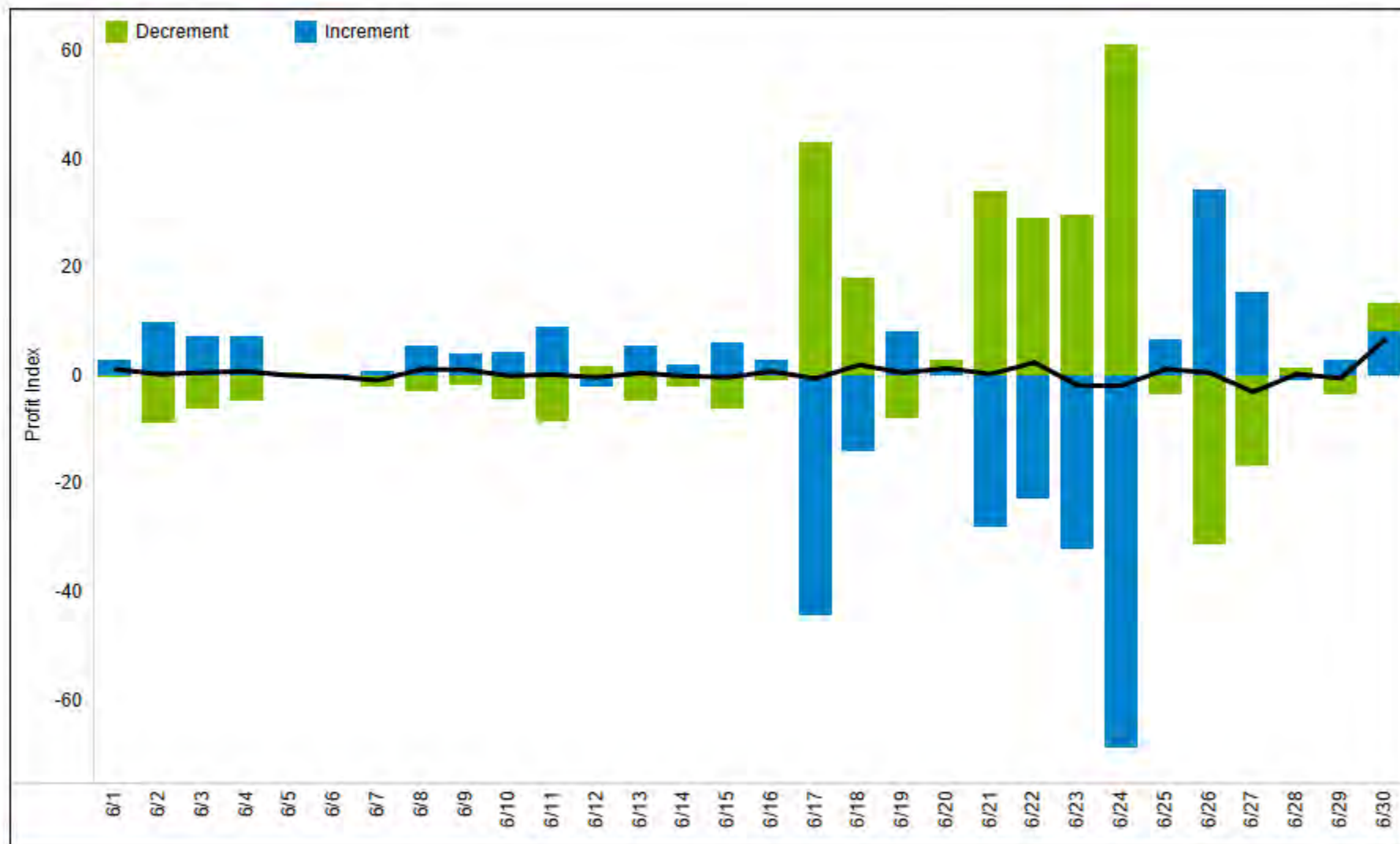
\* The virtual profitability market index is defined as the sum of profits/losses for all cleared virtual transactions divided by the volume (MWh) of total cleared transactions.

\* Virtual profits/losses are calculated by multiplying the cleared virtual MW and the imbalance between RT LMP and DA LMP for a cpnode, then summed across all cpnodes, all hours.

\* Upper Limit is Threshold (average of monthly indices from the previous year) plus Daily Average Standard Deviation for the previous 13 months (current reporting month inclusive)

\* Lower Limit is Threshold (average of monthly indices from the previous year) minus Daily Average Standard Deviation for the previous 13 months (current reporting month inclusive).

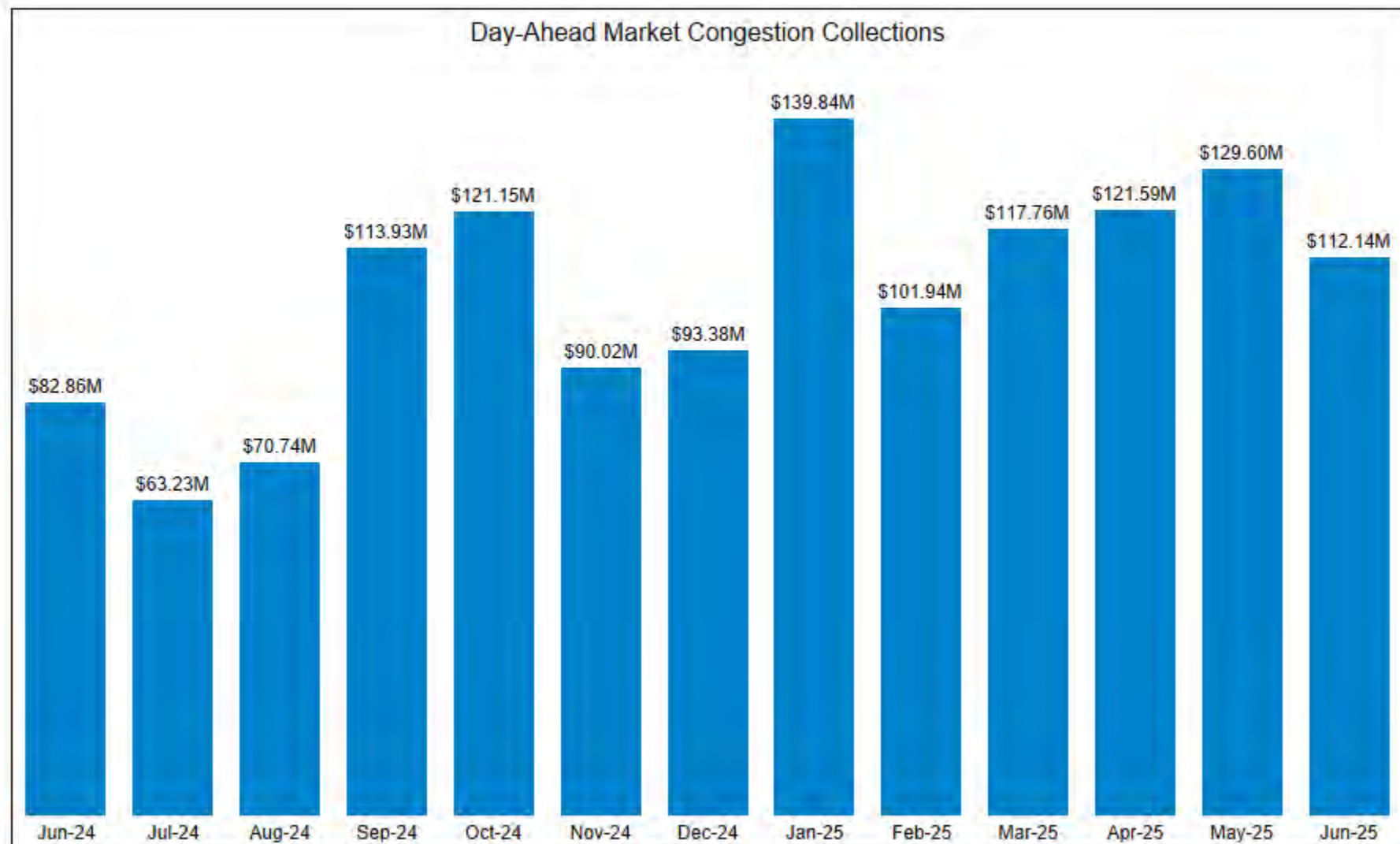
# Daily Gross Cleared Virtual Profitability



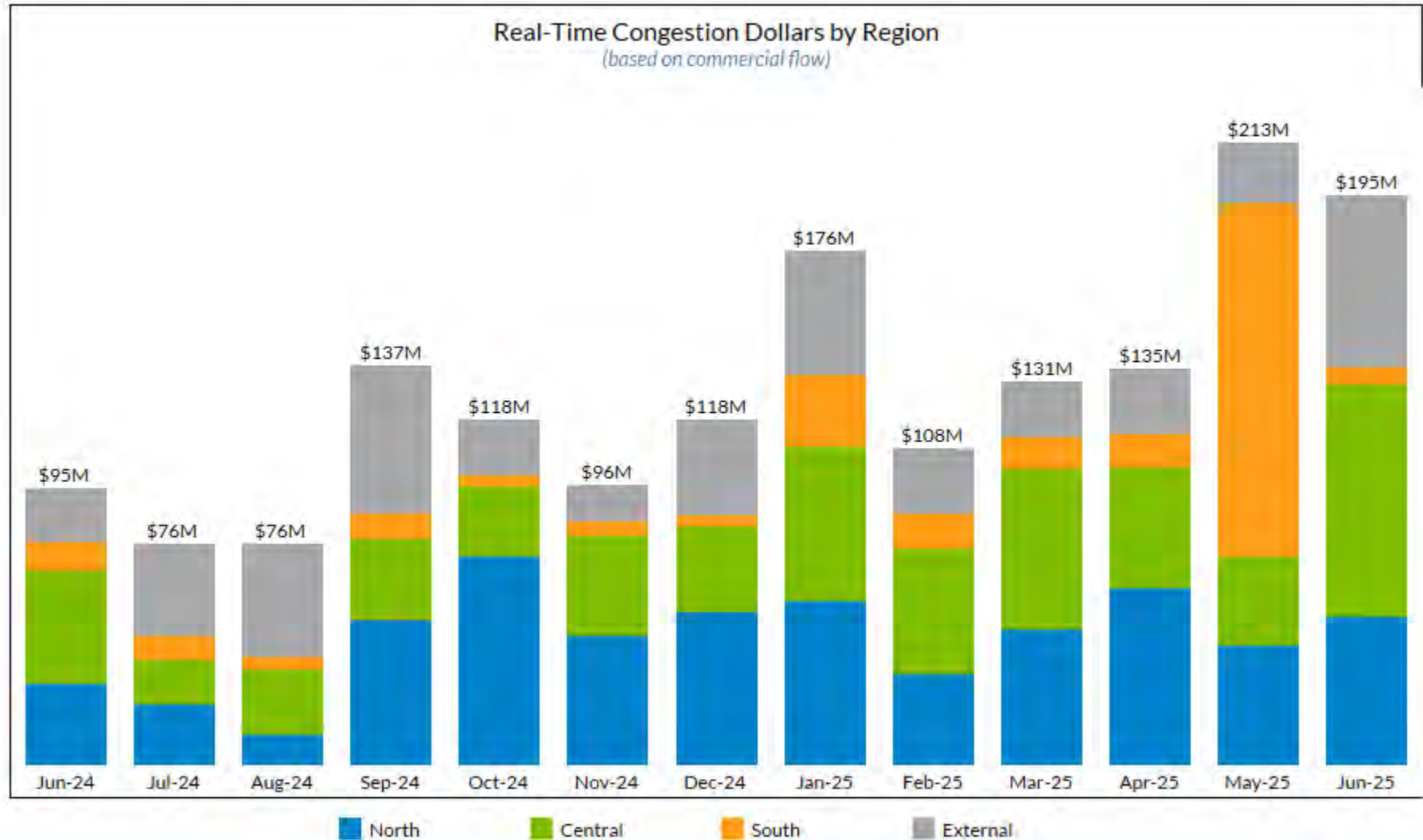
The virtual profitability market index is defined as the sum of profits/losses for all cleared virtual transactions divided by the volume (MWh) of total cleared transactions

Source: MISO Market and Operations Analytics Department

# Day-Ahead Congestion Collections



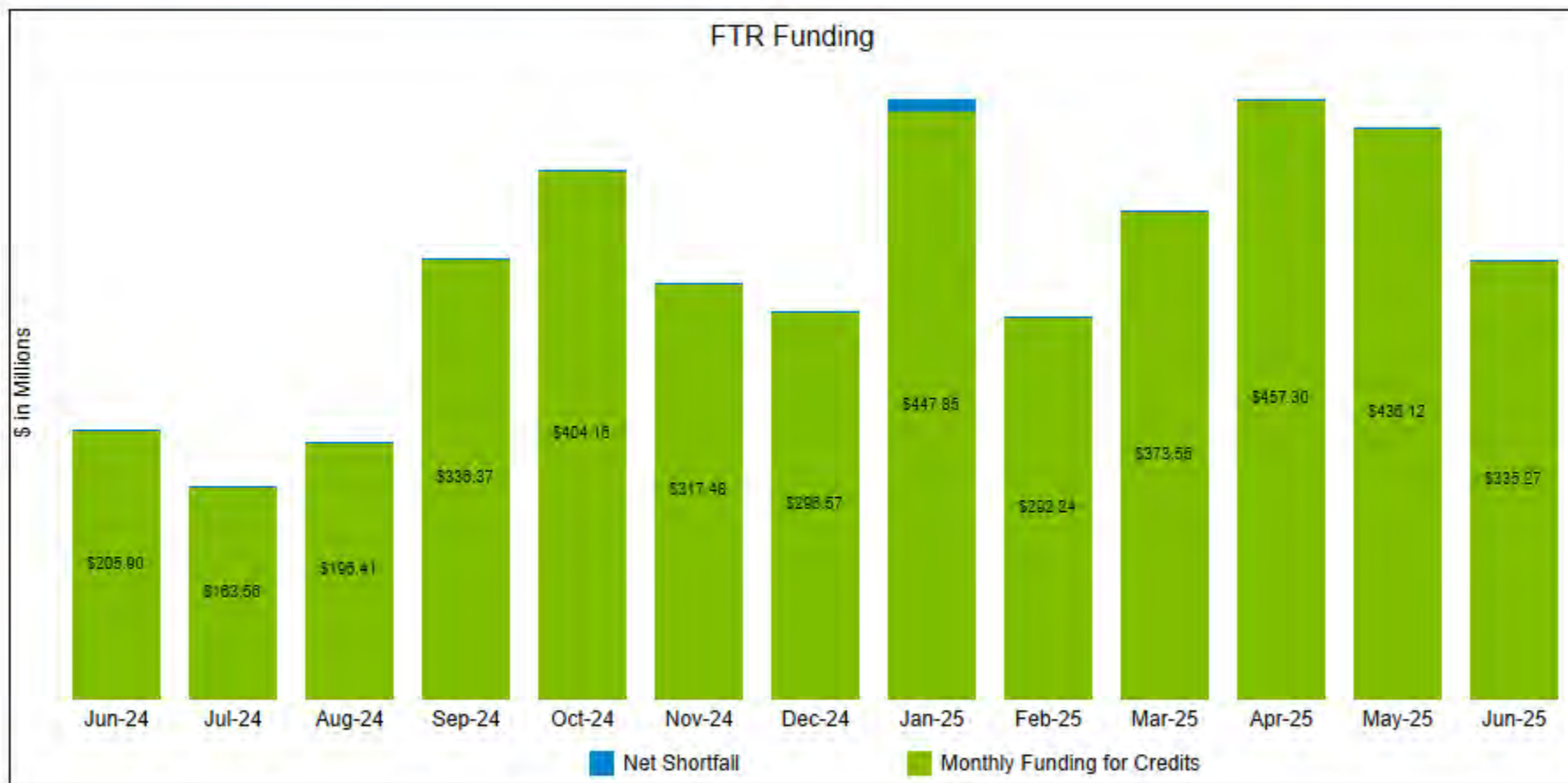
# Real-Time Congestion Dollars by Region



Includes External Constraints  
Commercial Flow excludes phase angle regulators and loop flows  
Source: MISO Market and Operations Analytics Department

# Financial Transmission Rights, Monthly and Rolling Year-to-Date Allocation Funding

C

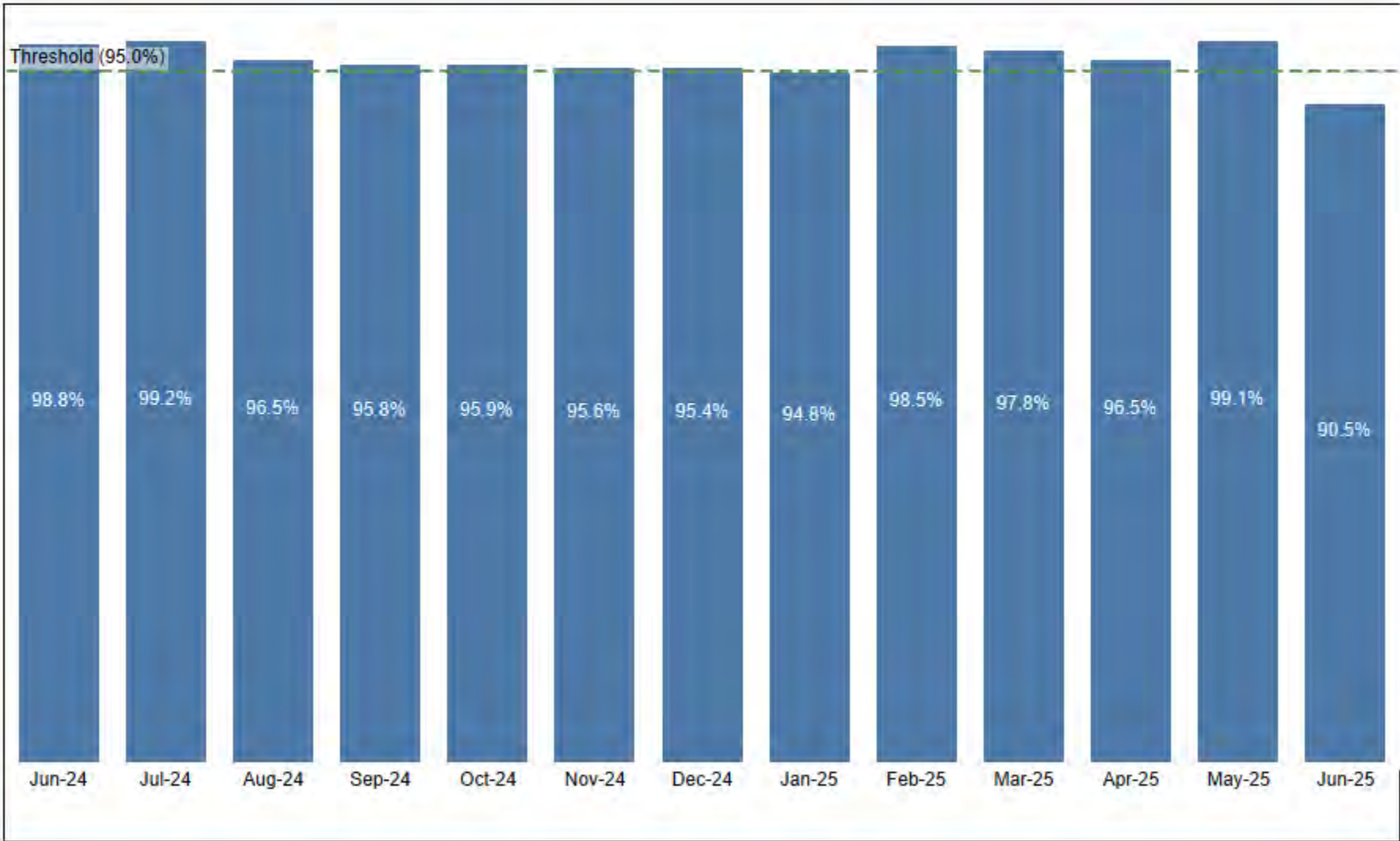


|                            | Jun-24 | Jul-24 | Aug-24 | Sep-24 | Oct-24 | Nov-24 | Dec-24 | Jan-25 | Feb-25 | Mar-25 | Apr-25 | May-25 | Jun-25 |
|----------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Monthly FTR Allocation (%) | 100.0% | 100.0% | 100.0% | 99.9%  | 100.0% | 100.0% | 100.0% | 97.8%  | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |
| YTD FTR Allocation (%)     | 95.6%  | 96.3%  | 96.7%  | 97.1%  | 97.5%  | 97.8%  | 98.0%  | NA     | NA     | NA     | 100.0% | 100.0% | 100.0% |

YTD metric is applied beginning April  
 Values may change due to resettlement  
 Source: MISO Market ECF Report

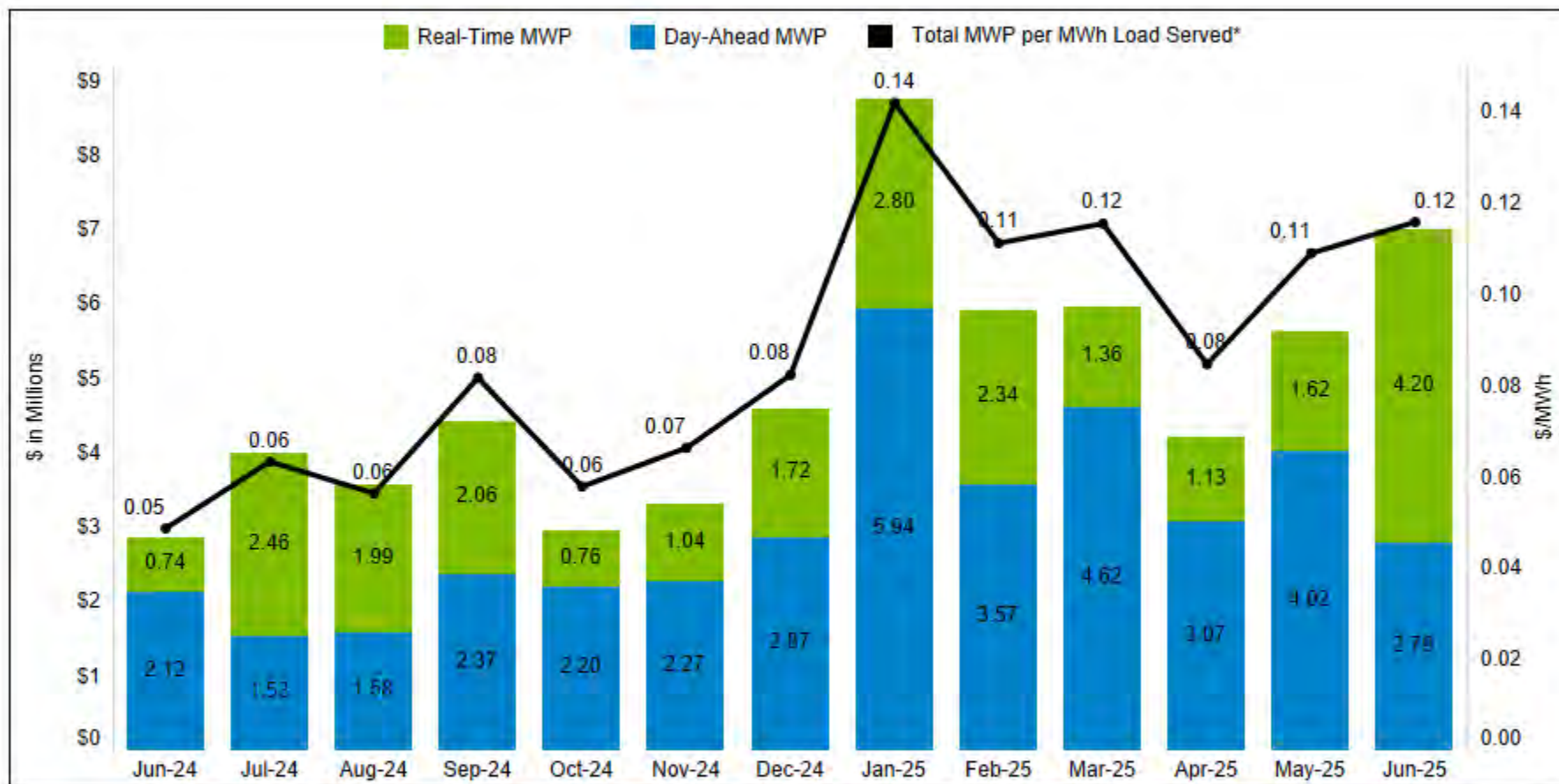


# Market Funding Efficiency



Values may change due to resettlement  
Source: MISO Market ECF Report

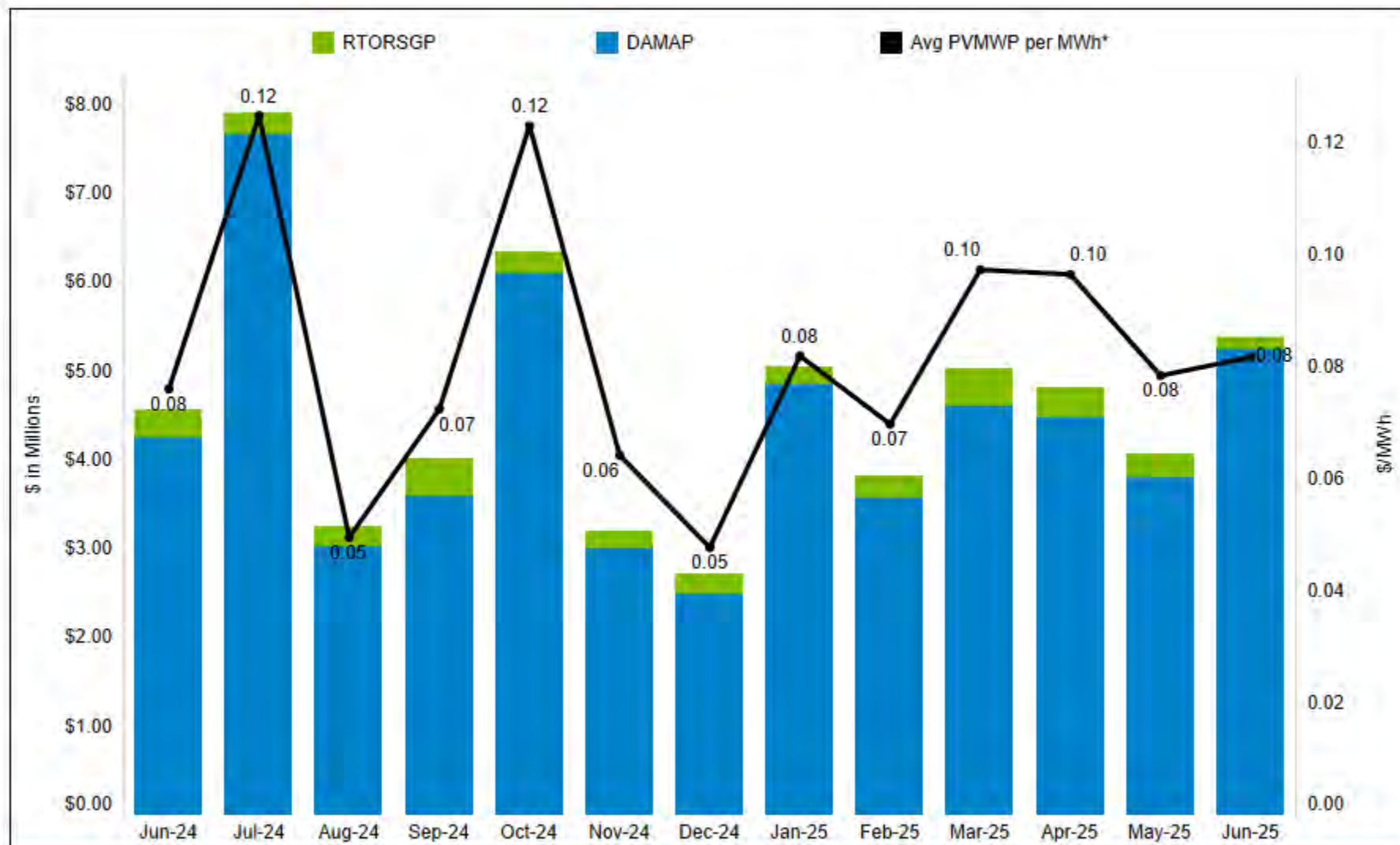
# Day-Ahead and Real-Time Revenue Sufficiency Guarantee E



|                                   | Jun-24 | Jul-24 | Aug-24 | Sep-24 | Oct-24 | Nov-24 | Dec-24 | Jan-25 | Feb-25 | Mar-25 | Apr-25 | May-25 | Jun-25 |
|-----------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Chicago Gas Prices (\$/MMBtu)     | 1.88   | 1.73   | 1.70   | 1.86   | 2.10   | 1.77   | 2.74   | 5.30   | 4.10   | 3.54   | 3.09   | 2.85   | 2.73   |
| Henry Gas Prices (\$/MMBtu)       | 2.49   | 2.09   | 1.98   | 2.23   | 2.26   | 2.16   | 3.03   | 5.40   | 4.13   | 4.10   | 3.43   | 3.12   | 3.01   |
| ^^RSG Per MWh to Energy Price (%) | 0.18   | 0.22   | 0.20   | 0.31   | 0.22   | 0.27   | 0.27   | 0.32   | 0.26   | 0.33   | 0.25   | 0.31   | 0.29   |

\*Based on hourly ICCP Data; ^^metric value  
 Values may change due to resettlement  
 Source: The Web-based Revenue Sufficiency Guarantee Report

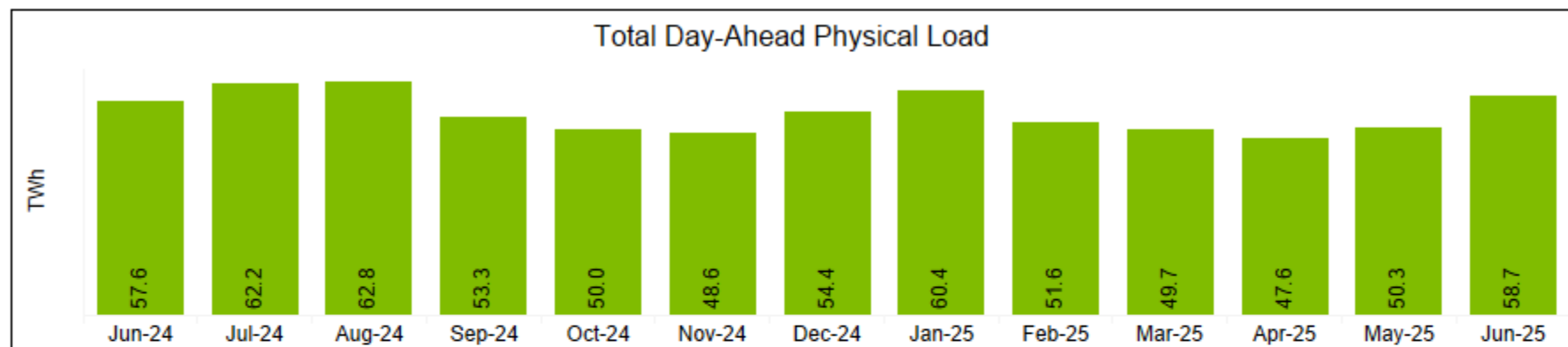
# Price Volatility Make Whole Payment



\*Hourly ICCP data

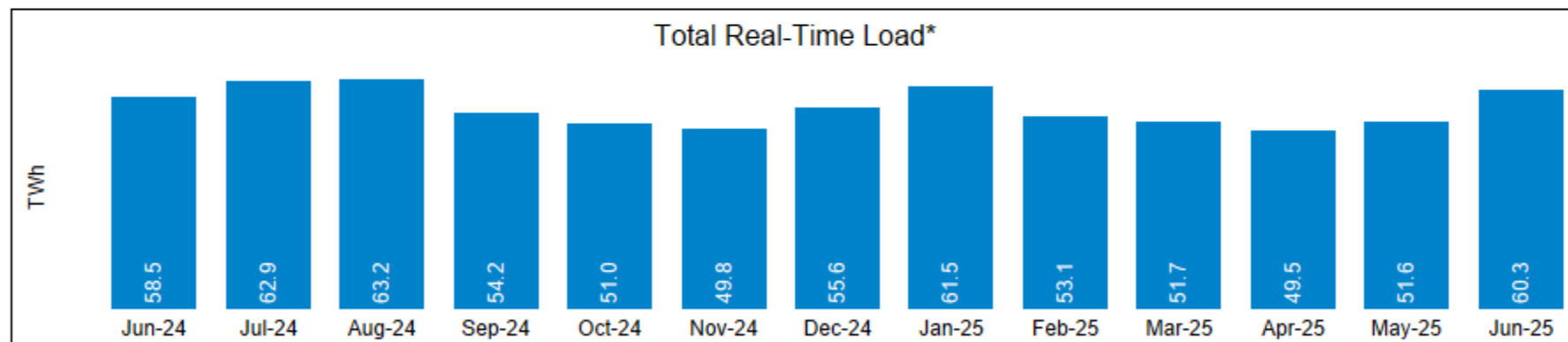
Source: Web-based Revenue Neutrality Uplift Report

# Day-Ahead and Real-Time Cleared Physical Energy



Day-Ahead Cleared Load Value (including Virtuals)

| Jun-24  | Jul-24  | Aug-24  | Sep-24  | Oct-24  | Nov-24  | Dec-24  | Jan-25  | Feb-25  | Mar-25  | Apr-25  | May-25  | Jun-25  |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| \$1.92B | \$2.37B | \$2.20B | \$1.74B | \$1.57B | \$1.44B | \$2.06B | \$3.20B | \$2.68B | \$1.93B | \$1.87B | \$2.14B | \$2.97B |

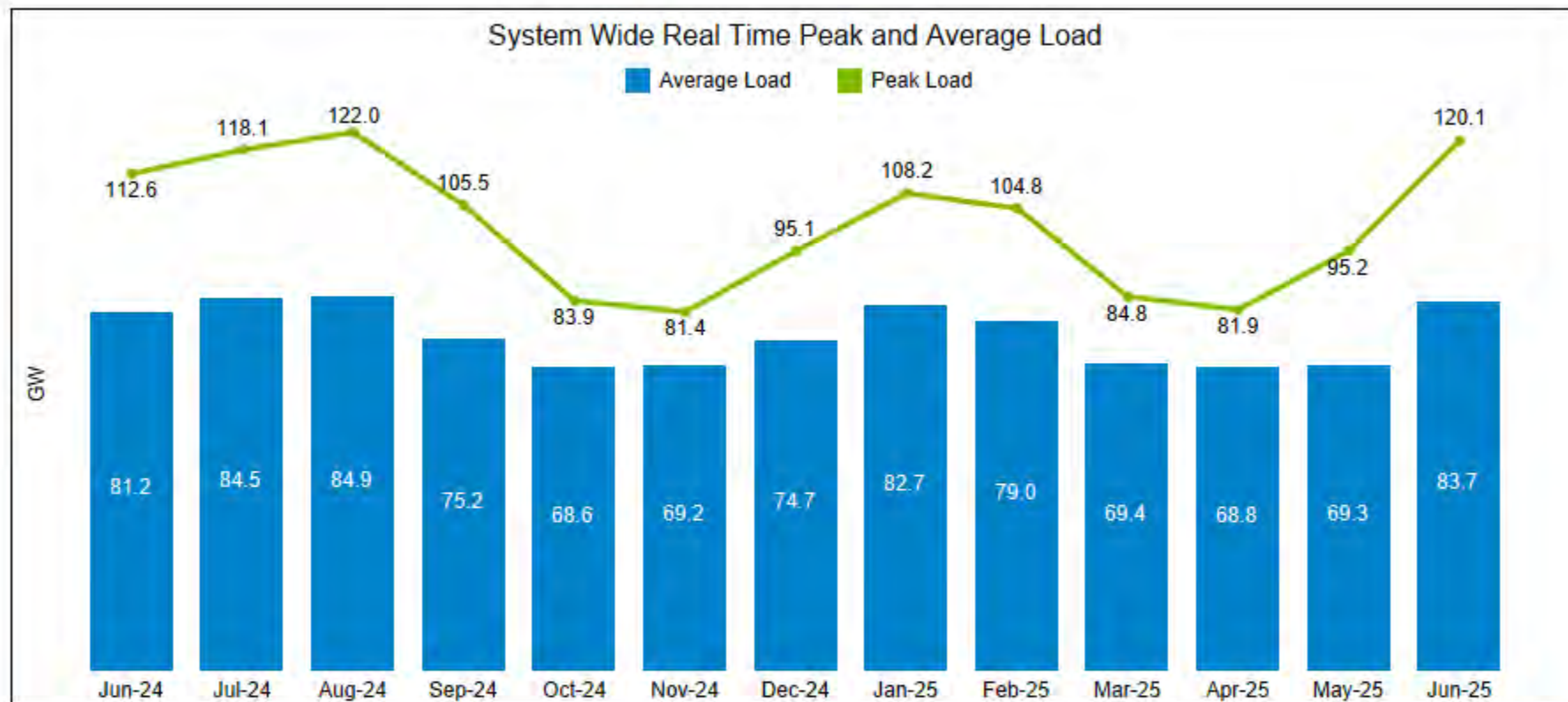


Real-Time Cleared Load Value (\$ in Billions)

| Jun-24  | Jul-24  | Aug-24  | Sep-24  | Oct-24  | Nov-24  | Dec-24  | Jan-25  | Feb-25  | Mar-25  | Apr-25  | May-25  | Jun-25  |
|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| \$1.66B | \$2.14B | \$1.81B | \$1.63B | \$1.29B | \$1.18B | \$1.83B | \$2.64B | \$2.21B | \$1.65B | \$1.55B | \$1.95B | \$3.00B |



# Monthly System Load and Temperature



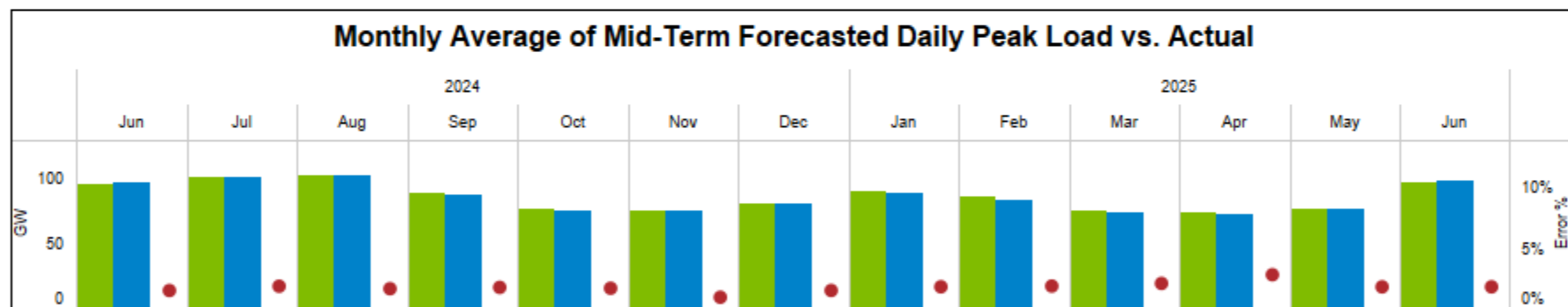
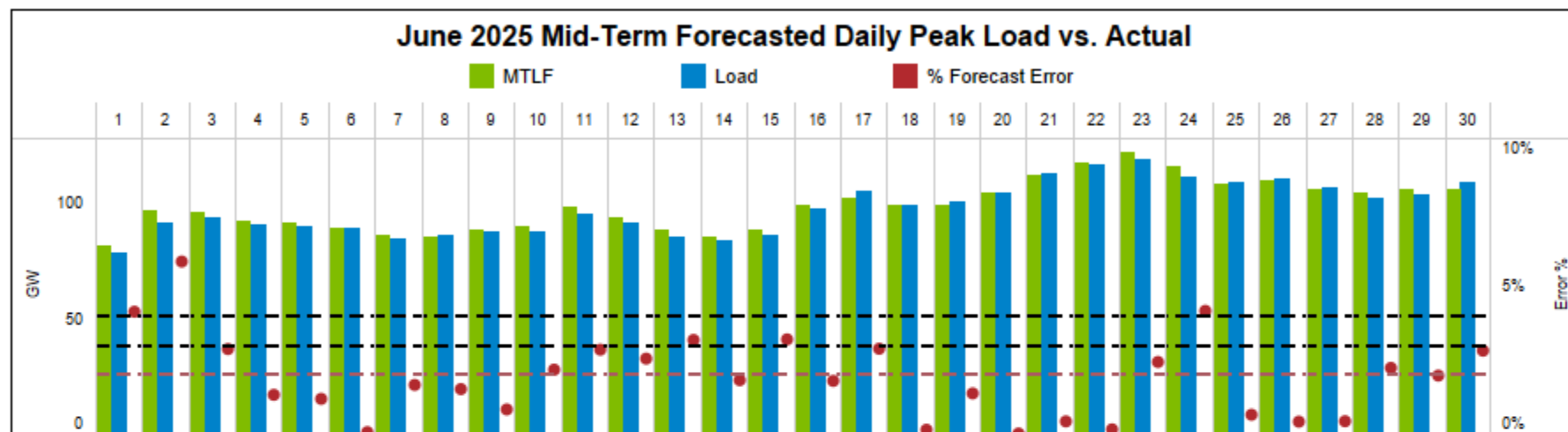
| System Wide Load Weighted Temperature |        |        |        | Load Weighted Heating & Cooling Degree Days |             |             |             |             | Hours with Load Greater than: |        |       |       |
|---------------------------------------|--------|--------|--------|---------------------------------------------|-------------|-------------|-------------|-------------|-------------------------------|--------|-------|-------|
|                                       | Jun-24 | May-25 | Jun-25 |                                             | Average HDD | Std Dev HDD | Average CDD | Std Dev CDD |                               | 100 GW | 80 GW | 60 GW |
| Average                               | 77°F   | 63°F   | 76°F   | Jun-25                                      | 0.14        | 0.94        | 14.60       | 8.60        | Jun-25                        | 110    | 415   | 709   |
| Maximum                               | 93°F   | 83°F   | 100°F  | May-25                                      | 2.30        | 3.41        | 3.73        | 4.90        | May-25                        | 0      | 62    | 653   |
| Minimum                               | 55°F   | 47°F   | 52°F   | Jun-24                                      | 0.07        | 0.56        | 14.60       | 7.77        | Jun-24                        | 67     | 364   | 695   |

\*Monthly data based on hourly ICCP Load Data; Hourly Integrated Peak Load Hour could differ from the Instantaneous Peak Load Hour.  
Source: MISO Market and Operations Analytics Department



# Day-Ahead Mid-Term Load Forecast\*

F



|                     | 2024  |       |       |       |       |        |       | 2025  |       |       |       |       |       |
|---------------------|-------|-------|-------|-------|-------|--------|-------|-------|-------|-------|-------|-------|-------|
|                     | Jun   | Jul   | Aug   | Sep   | Oct   | Nov    | Dec   | Jan   | Feb   | Mar   | Apr   | May   | Jun   |
| % Std of Error (CV) | 90.18 | 76.54 | 67.80 | 71.09 | 68.94 | 101.98 | 81.76 | 77.55 | 60.87 | 54.00 | 40.07 | 78.67 | 71.95 |
| Mean of Error (MW)  | 1,594 | 1,980 | 1,845 | 1,700 | 1,418 | 814    | 1,334 | 1,742 | 1,674 | 1,671 | 2,191 | 1,474 | 1,852 |
| Std of Error (MW)   | 1,437 | 1,515 | 1,251 | 1,209 | 978   | 830    | 1,090 | 1,351 | 1,019 | 902   | 878   | 1,159 | 1,332 |

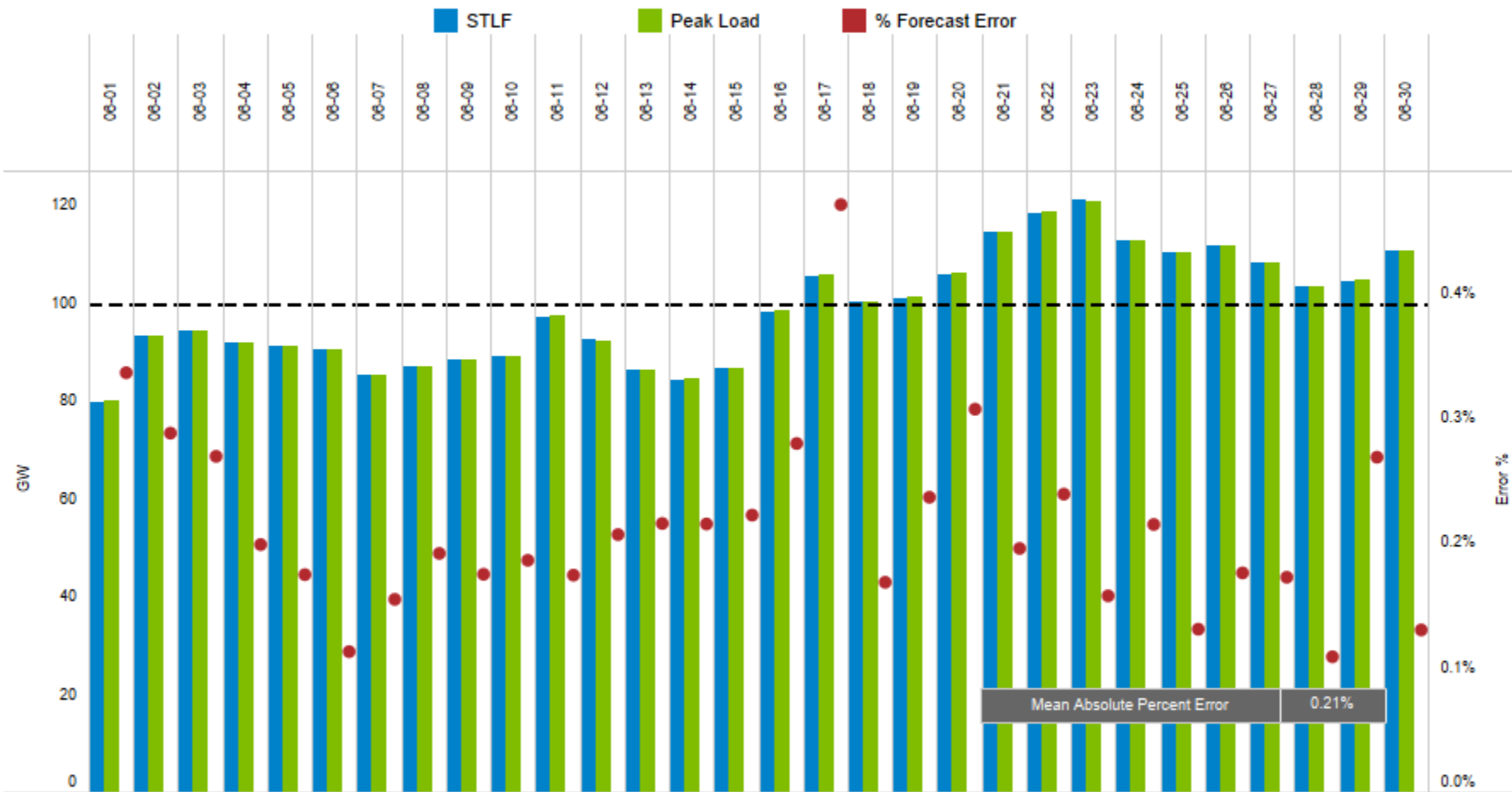
\* Monthly data based on the average of the daily integrated peak hours in the month

\* Daily data based on the integrated peak hour of the day

\* Peak Day and Hour End based on Hourly Integrated Peak Load Hour

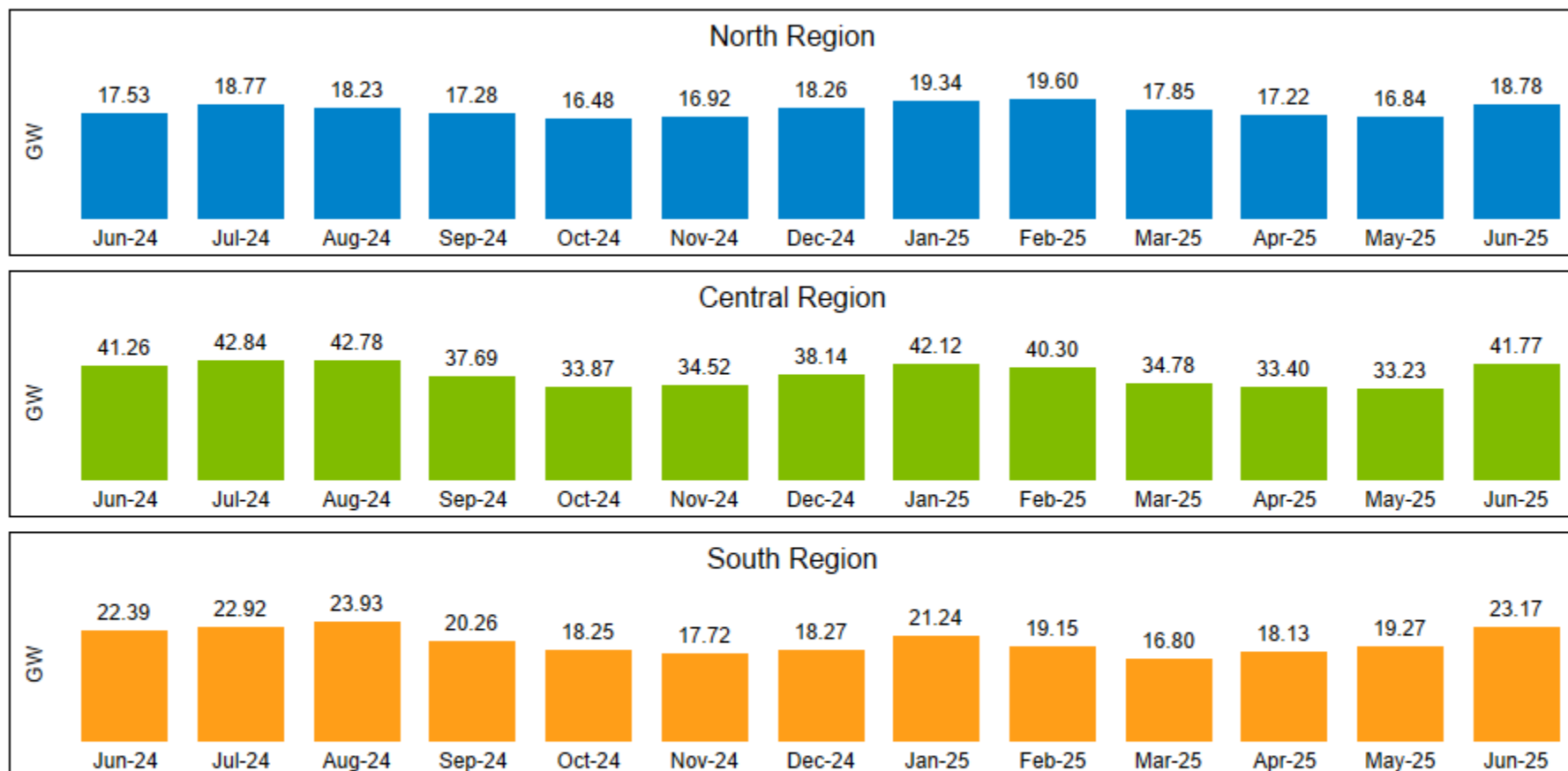
# Short-Term Load Forecast\*

June 2025 Short-Term Forecasted Daily Peak Load vs Actual



Daily data based on the average of five-minute interval data at the peak hour of the day  
Error Threshold calculated as 95% quantile of Forecast Error from Jan-Dec of the previous year  
Peak Day and Hour End based on Hourly Integrated Peak Load Hour

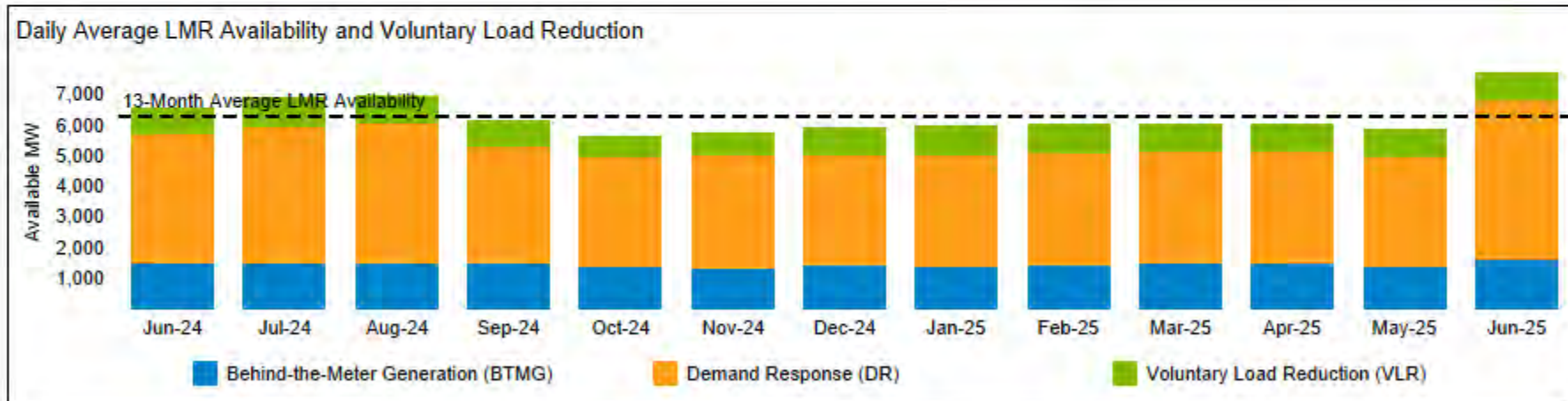
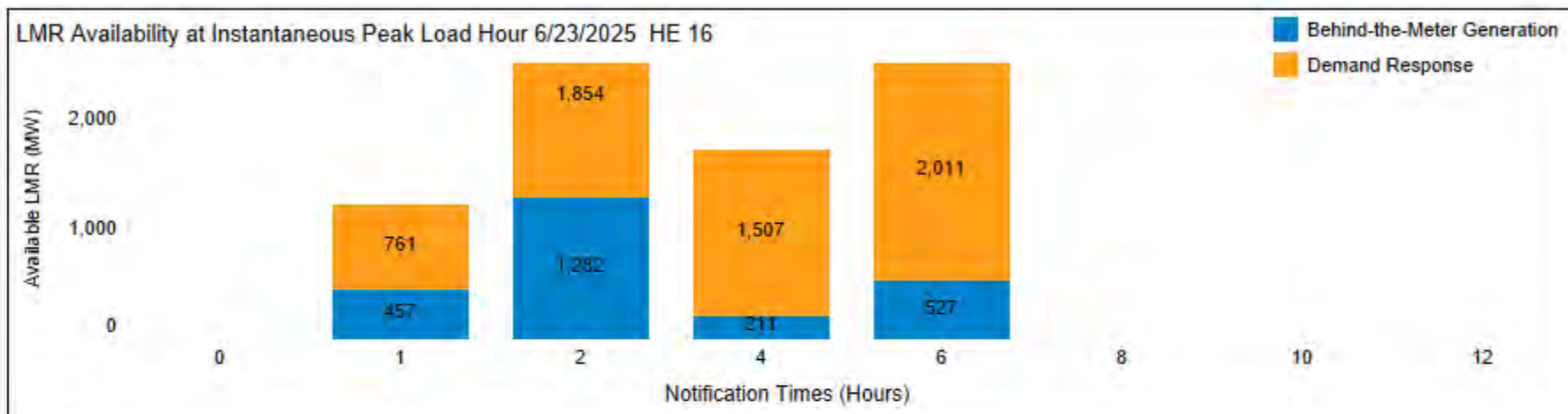
# Average Load by Region



Hourly Integrated System Load Peak Hour Ending: 06/23/2025 16 EST

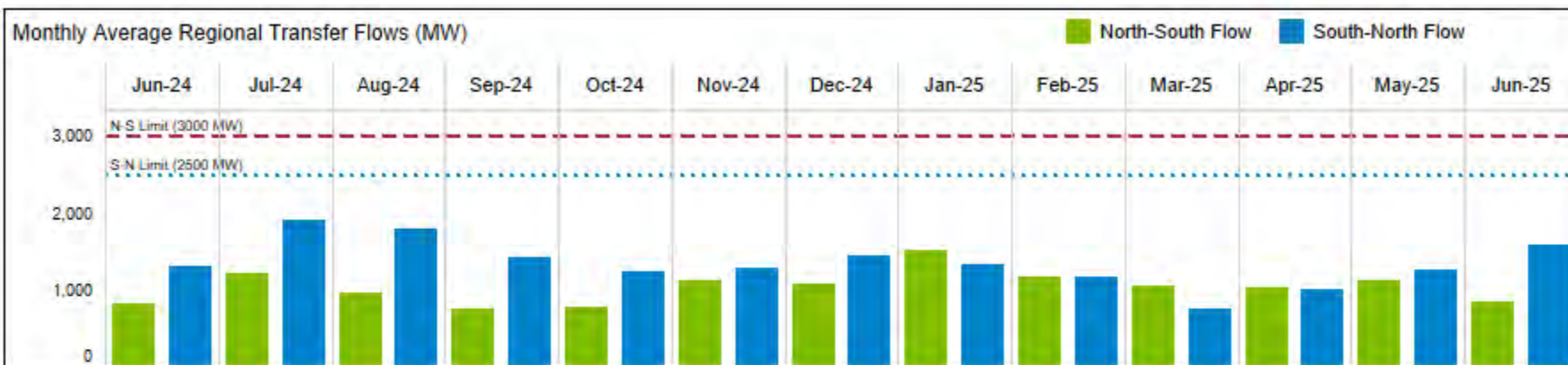
|         |           |
|---------|-----------|
| North   | 25.86 GW  |
| Central | 65.78 GW  |
| South   | 30.29 GW  |
| MISO    | 119.31 GW |

# Market Participant entered Load Modifying Resource (LMR) Availability



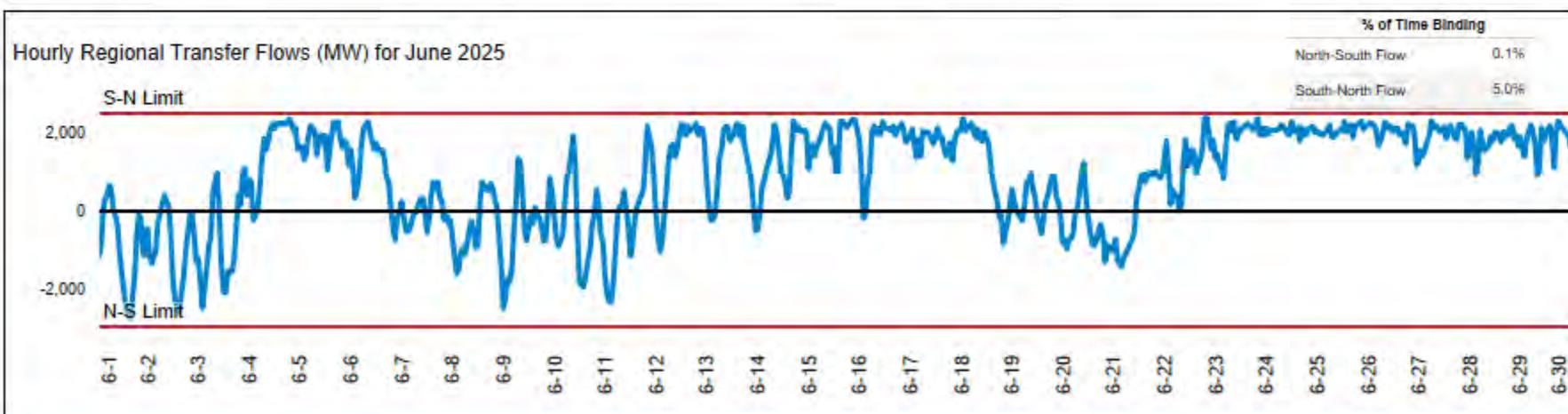
| PRA Auction | BTMG (MW) | DR (MW) | Total BTMG and DR (MW) |
|-------------|-----------|---------|------------------------|
| Summer 2024 | 4,144     | 8,109   | 12,253                 |
| Summer 2025 | 4,283     | 9,004   | 13,287                 |

# Regional Directional Transfer\*\*



Percentage of Time Regional Directional Flow

|                  | Jun-24 | Jul-24 | Aug-24 | Sep-24 | Oct-24 | Nov-24 | Dec-24 | Jan-25 | Feb-25 | Mar-25 | Apr-25 | May-25 | Jun-25 |
|------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| North-South Flow | 34%    | 8%     | 10%    | 21%    | 17%    | 23%    | 22%    | 29%    | 40%    | 61%    | 44%    | 49%    | 26%    |
| South-North Flow | 66%    | 92%    | 90%    | 79%    | 83%    | 78%    | 78%    | 71%    | 60%    | 39%    | 56%    | 51%    | 74%    |

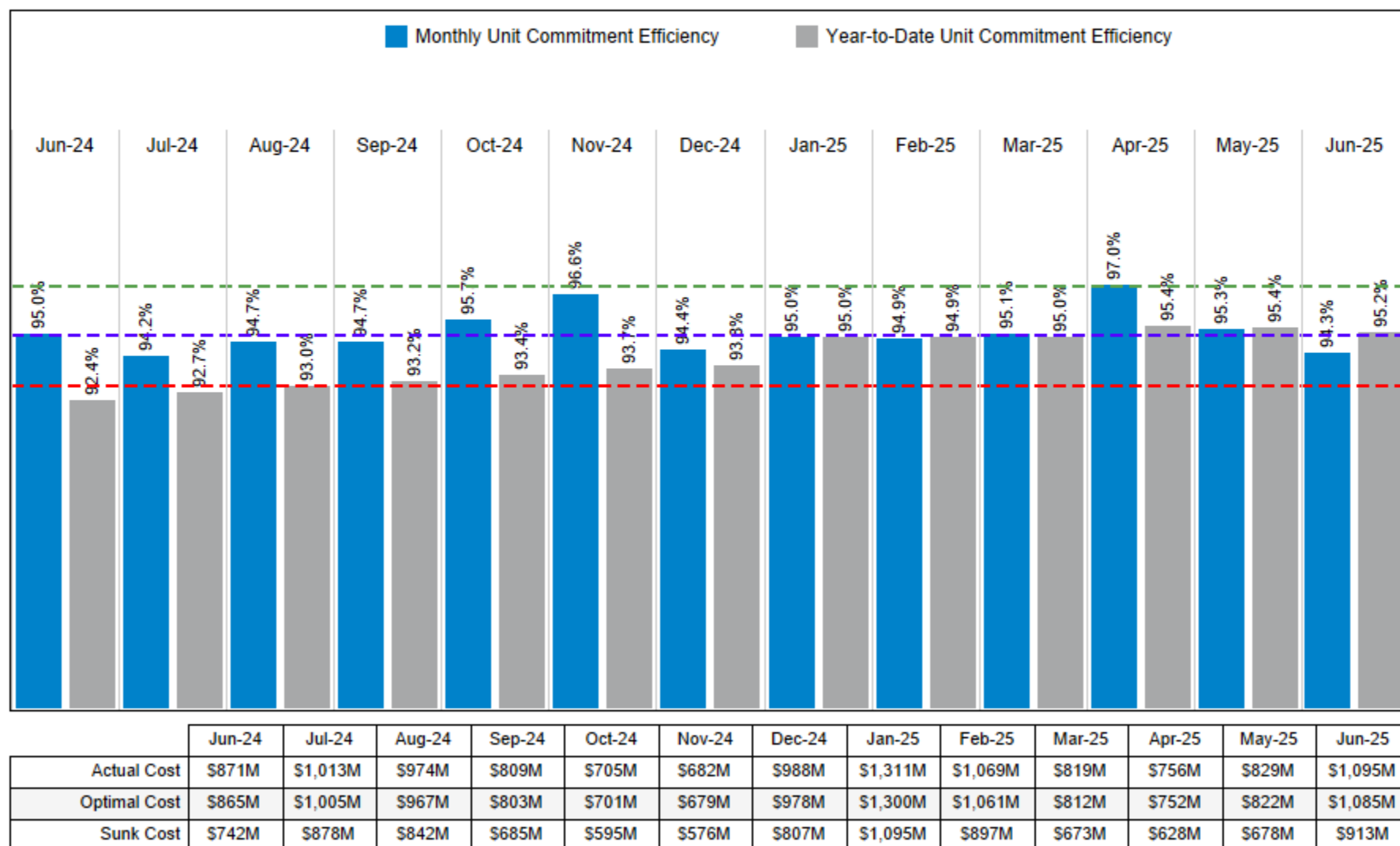




# Unit Commitment Efficiency

Effectively commit generation to meet demand obligations and mitigate constraints

H

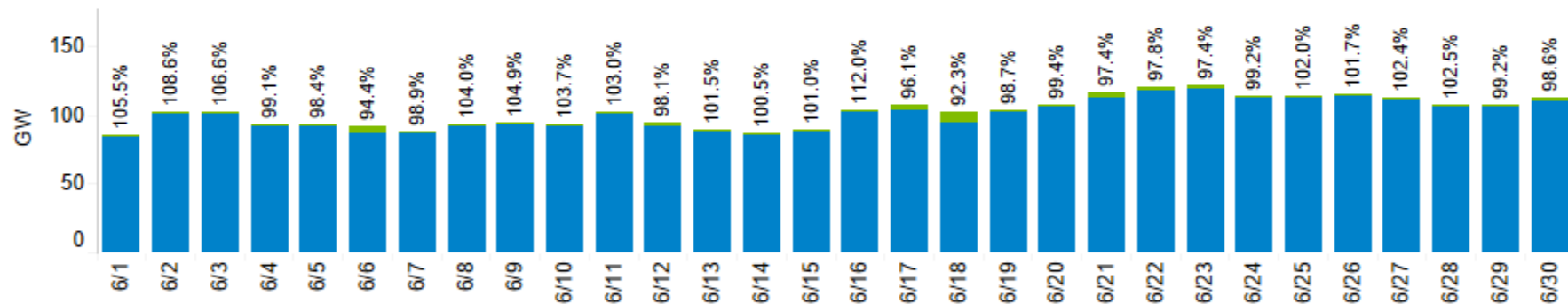
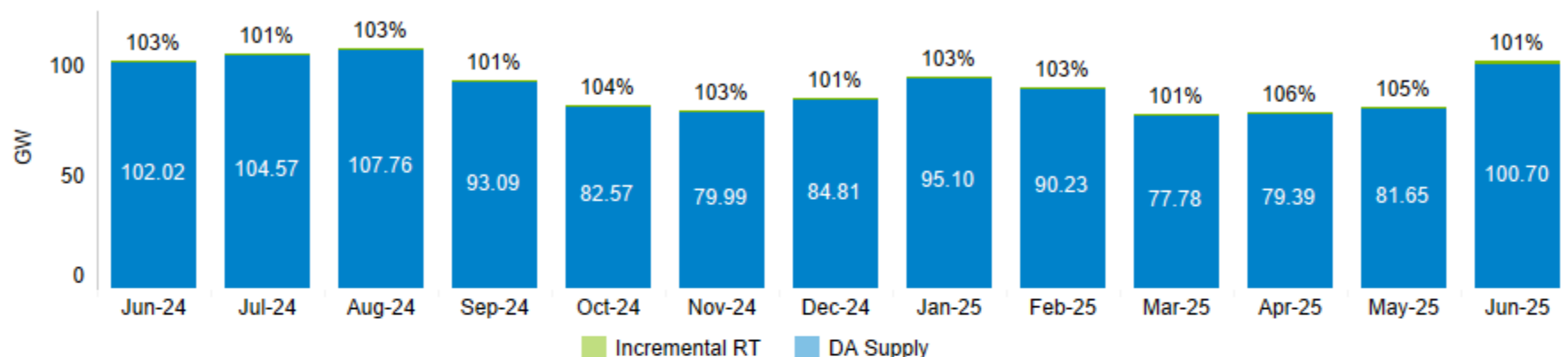


Source: MISO Optimal Dispatch Calculator (ODC)

Unit Commitment Efficiency =  $1 - ((\text{Actual cost} - \text{Optimal cost}) / (\text{Actual cost} - \text{Sunk cost}))$



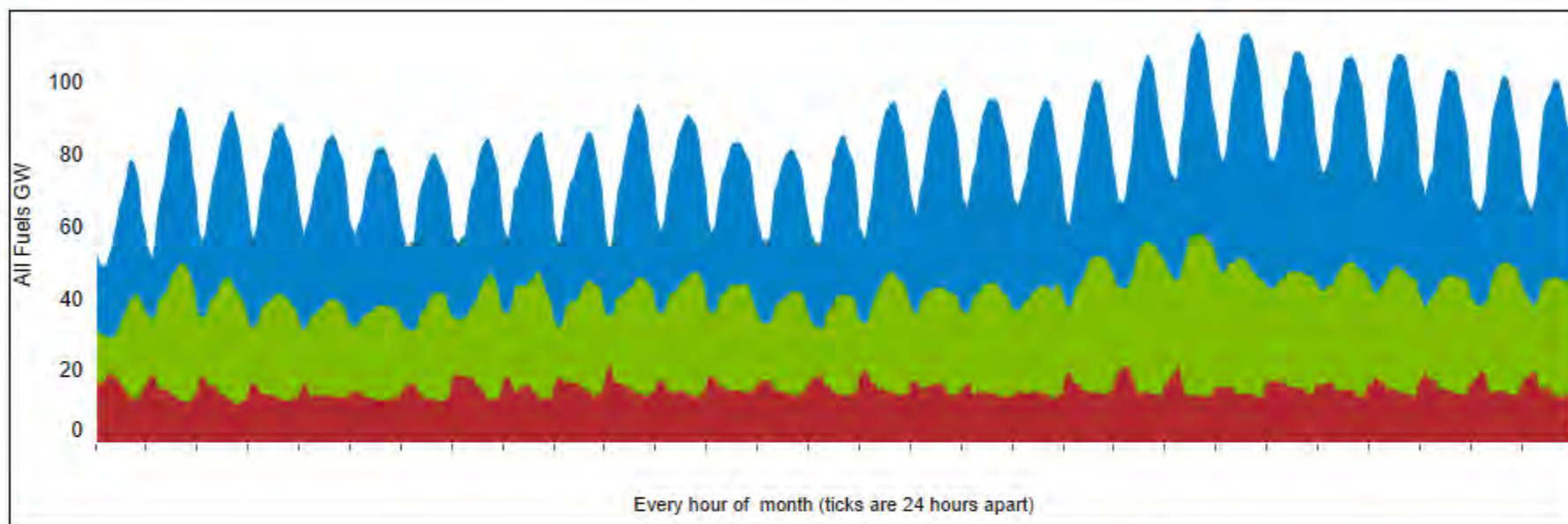
# Day-Ahead Supply and Real-Time Load Obligation at the Peak Load Hour



Incremental GW Committed in Real-Time

Day-Ahead Supply is the Day-Ahead Economic Maximum received in Real-Time plus Behind-the-Meter plus Day-Ahead NSI at the Peak Hour  
 Real-Time Obligation is the Real-Time ICCP Load plus Real-Time Regulation Requirement plus Real-Time Spinning Requirement at the Peak Hour  
 Real-Time Increment is the Real-Time Obligation less Day-Ahead Supply at the Peak Hour  
 Percents calculated as Day-Ahead Supply divided by Real-Time Obligation

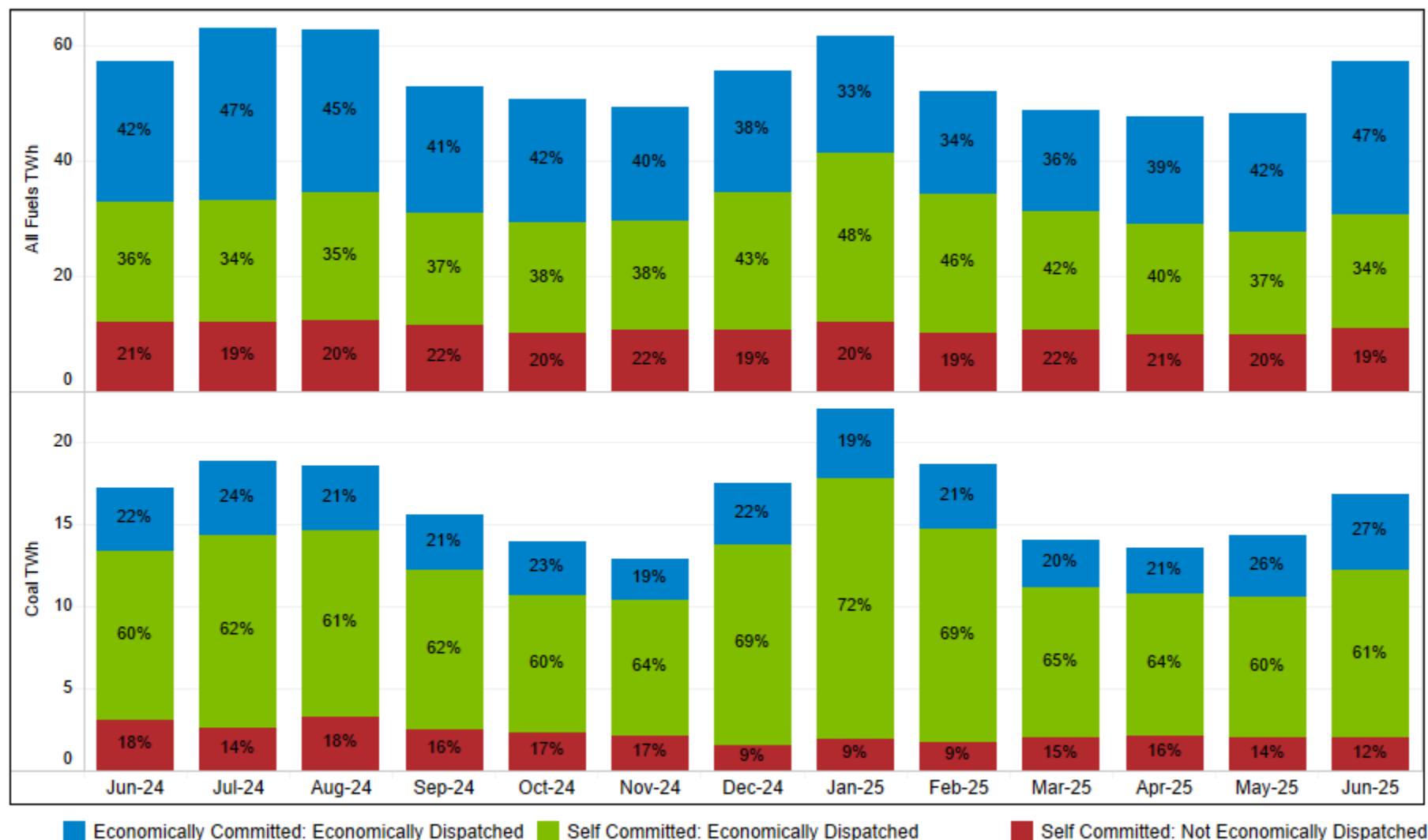
# Self Committed and Economically Dispatched Energy - June 2025



|                                                 | All Fuels   |             | Coal        |             | Gas         |             |
|-------------------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|
|                                                 | TWh         | %           | TWh         | %           | TWh         | %           |
| Economically Committed: Economically Dispatched | 26.8        | 47%         | 4.6         | 27%         | 17.8        | 75%         |
| Self Committed: Economically Dispatched         | 19.8        | 34%         | 10.2        | 61%         | 4.9         | 21%         |
| Self Committed: Not Economically Dispatched     | 10.9        | 19%         | 2.0         | 12%         | 1.0         | 4%          |
| <b>Grand Total</b>                              | <b>57.5</b> | <b>100%</b> | <b>16.8</b> | <b>100%</b> | <b>23.7</b> | <b>100%</b> |

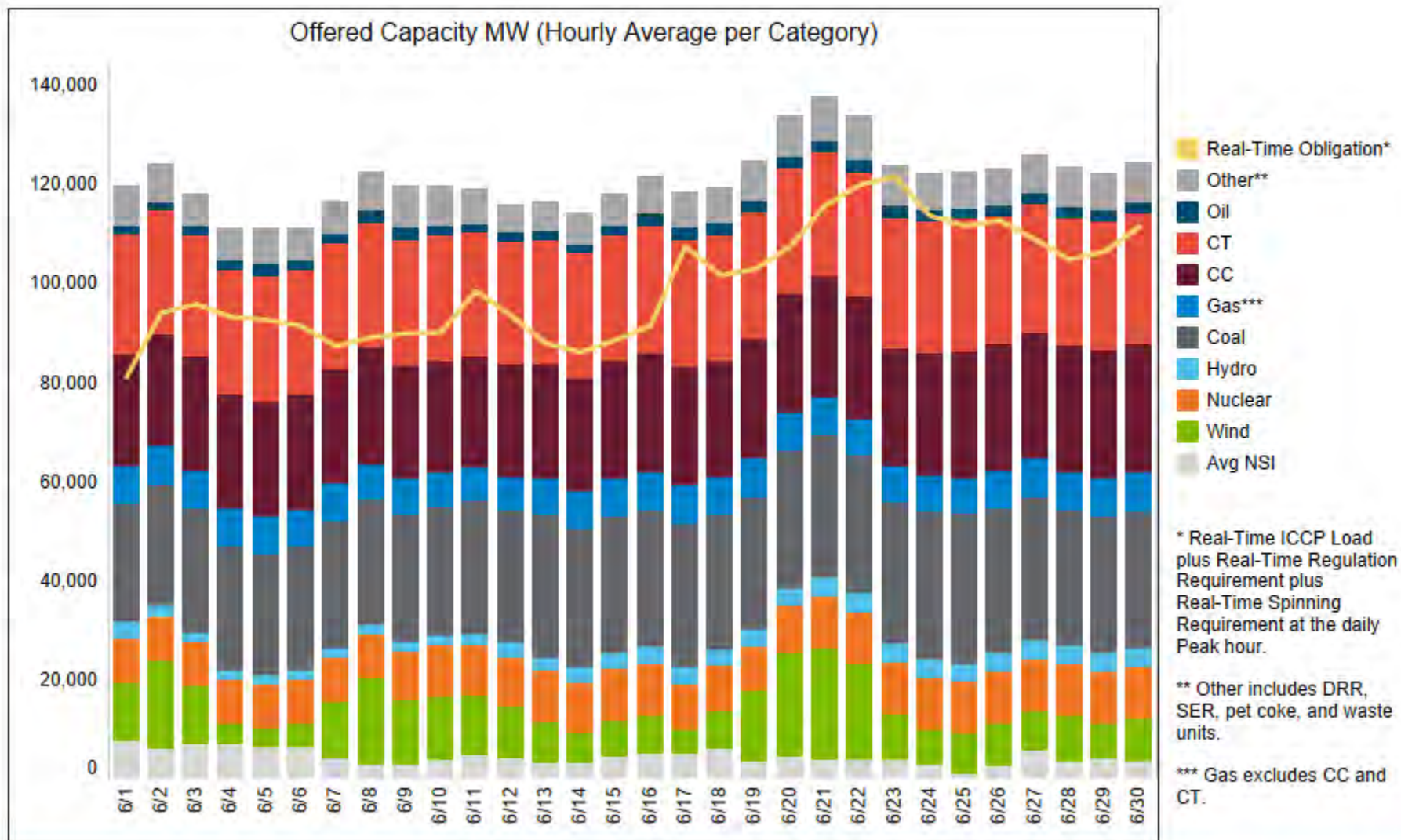
- Economically Committed: Economically Dispatched  
 Generation committed by MISO and dispatched on economic offers.
- Self Committed: Economically Dispatched  
 Generation that is self-committed, but Resource Owners allow MISO to dispatch economically after the self-schedule portion of their resource offer is satisfied. Self-commitments can be used to manage local reliability, operational constraints, and fuel contract constraints.
- Self Committed: Not Economically Dispatched  
 Energy from self-committed generation produced at its minimum level or is block-loaded and cannot be dispatched. Block Loaded energy is not necessarily uneconomic, but MISO has no ability to dispatch it based on economics.

# Monthly Trend - Self Committed and Economically Dispatched Energy



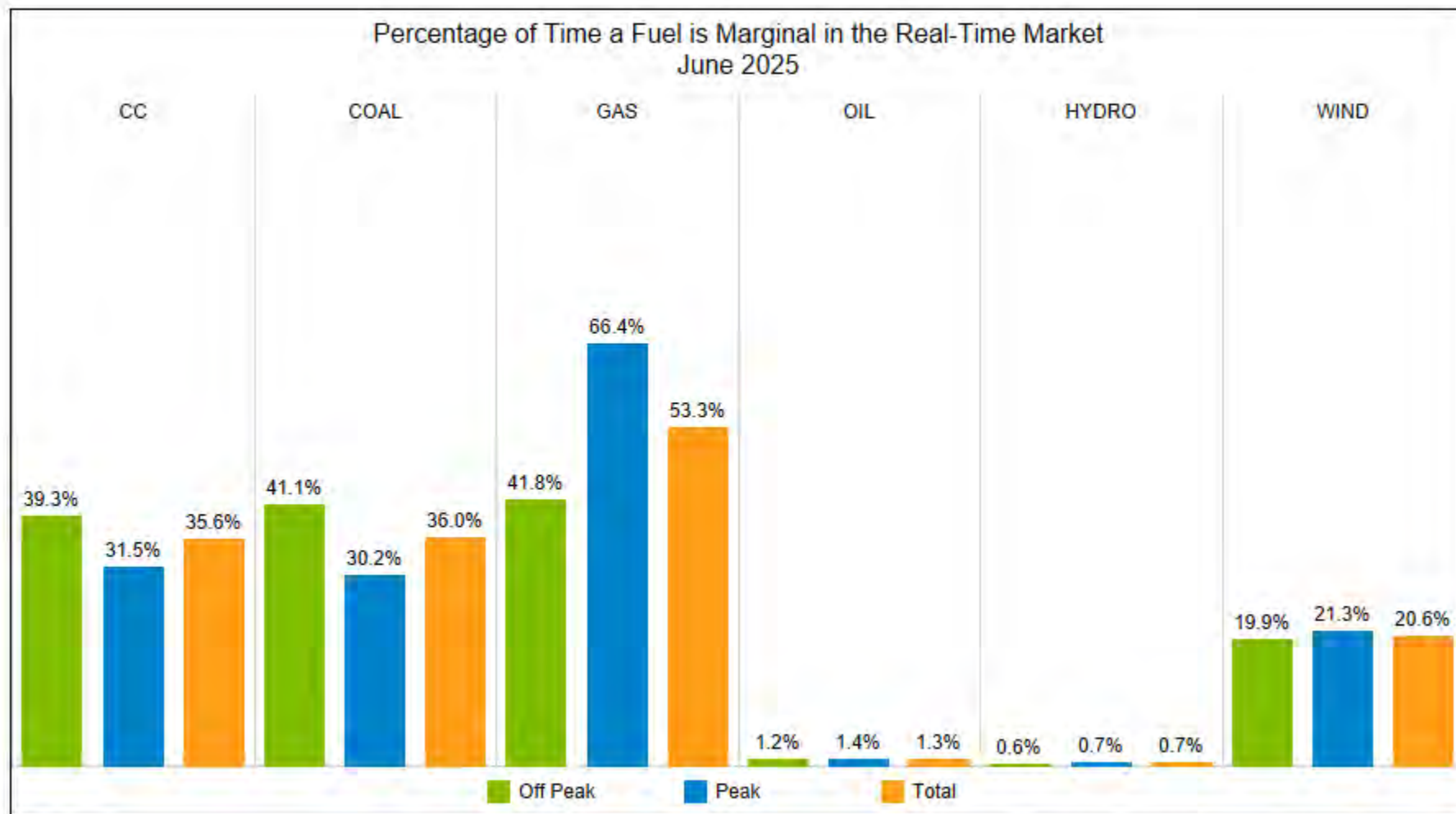


# Offered Capacity and Real-Time Peak Load Obligation



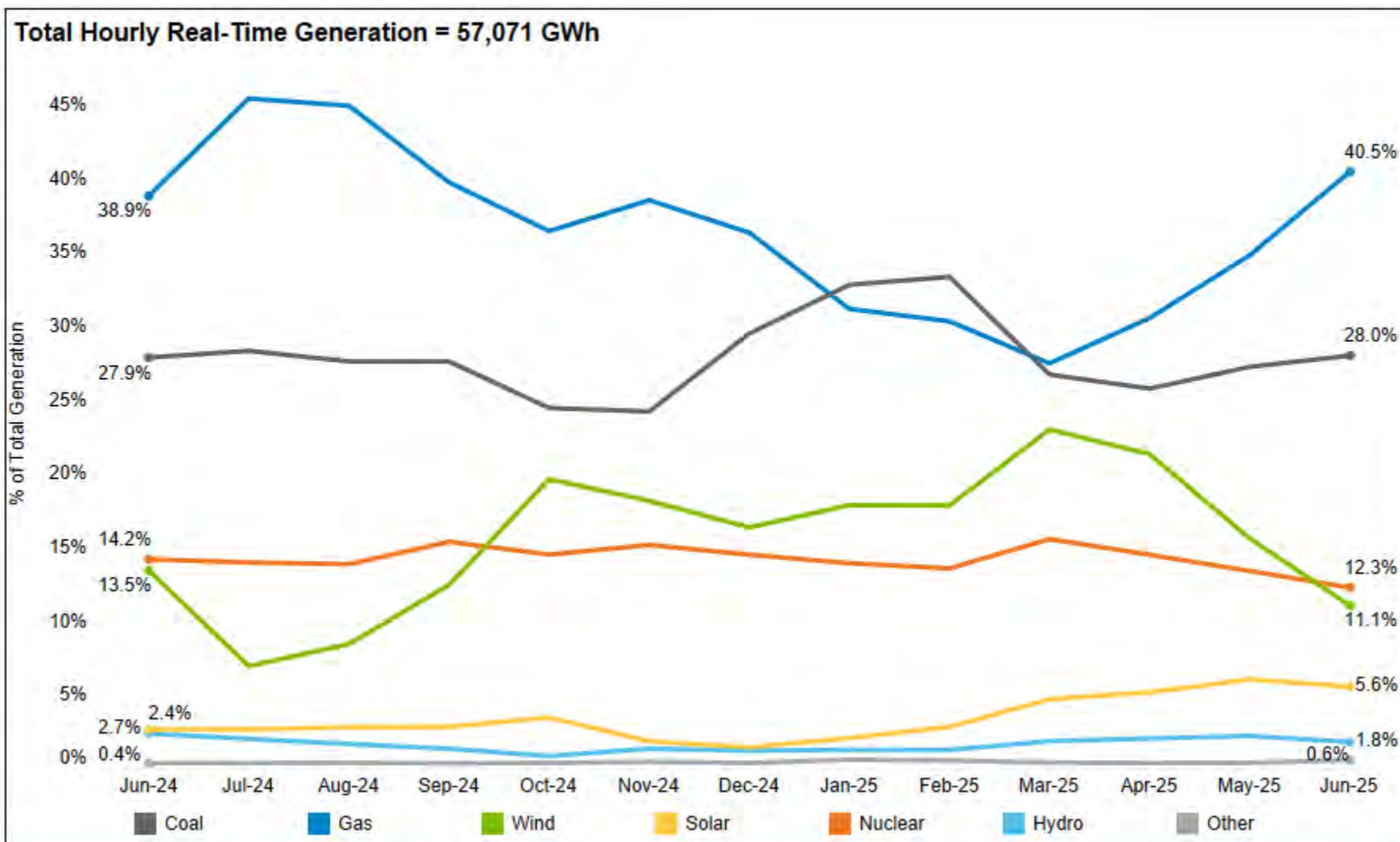


# Marginal Fuel



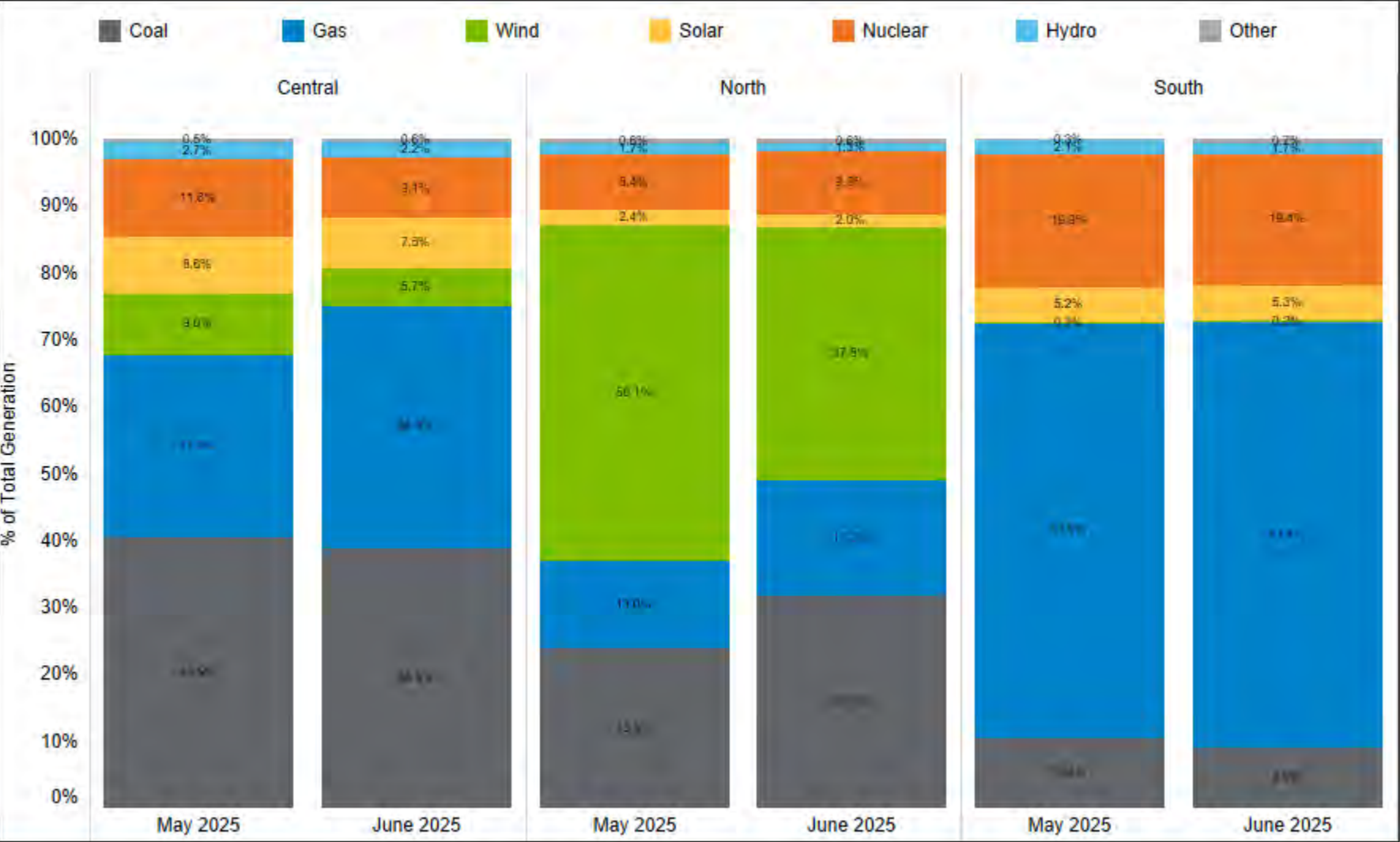
Note: Binding transmission constraints can produce instances where more than one unit is marginal in the system. Consequently, more than one fuel may be on the margin; and since each marginal unit is included in the analysis, the percentage may sum to more than 100%.

# Real-Time Generation Fuel Mix



Based on hourly unit level state estimator data  
 Other includes: Battery, Oil, Pet Coke, Waste and Other fuels  
 Source: MISO Market and Operations Analytics Department

# Real-Time Generation Fuel Mix by Region

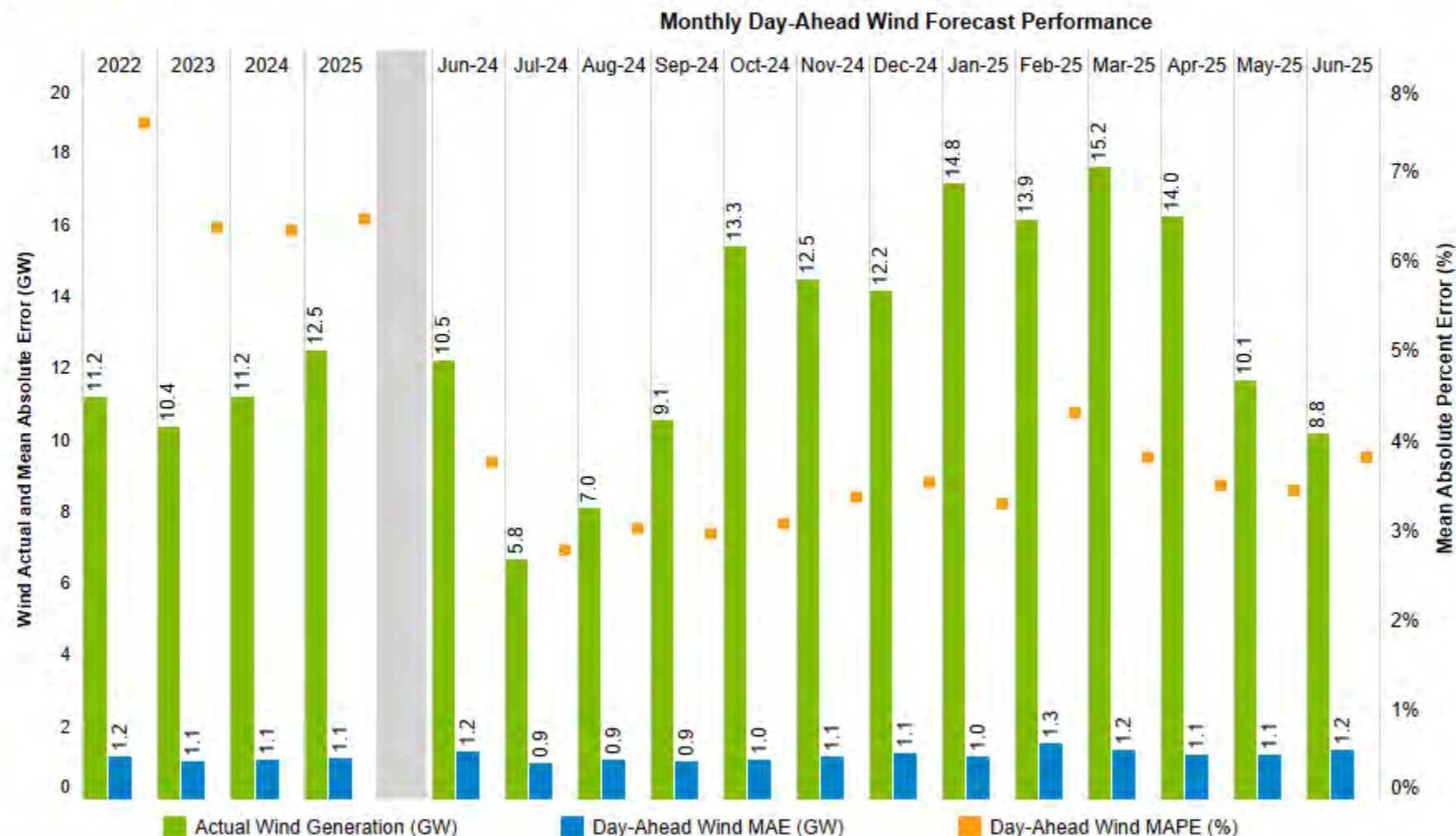


Based on hourly unit level state estimator data  
Other includes: Battery, Oil, Pet Coke, Waste and Other fuels  
Source: MISO Market and Operations Analytics Department

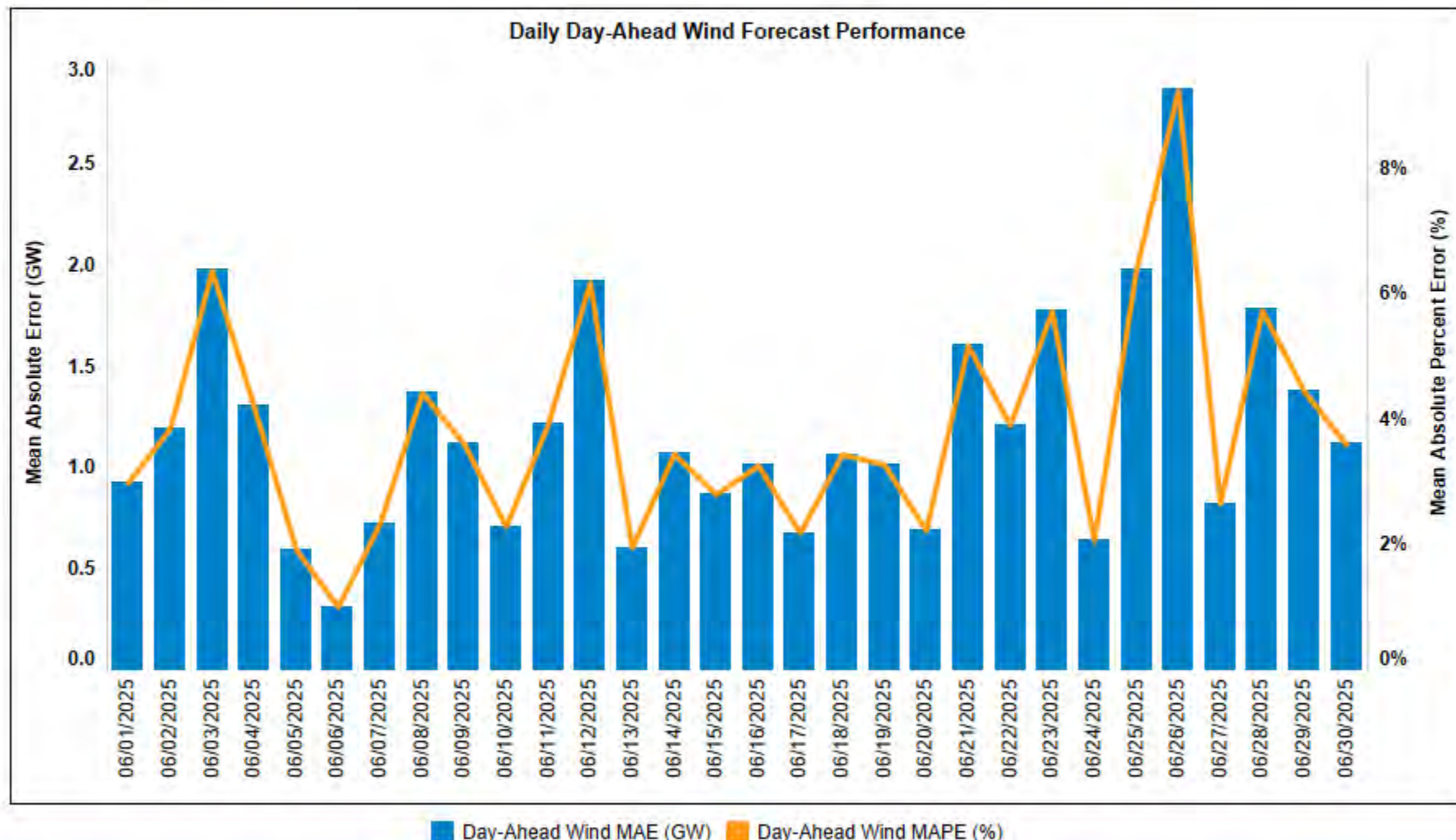


# Monthly Day-Ahead Wind Forecast Performance: Mean Absolute Error (MAE) and Mean Absolute Percent Error (MAPE)

K



# Daily Day-Ahead Wind Forecast Performance: Mean Absolute Error (MAE) and Mean Absolute Percent Error (MAPE)

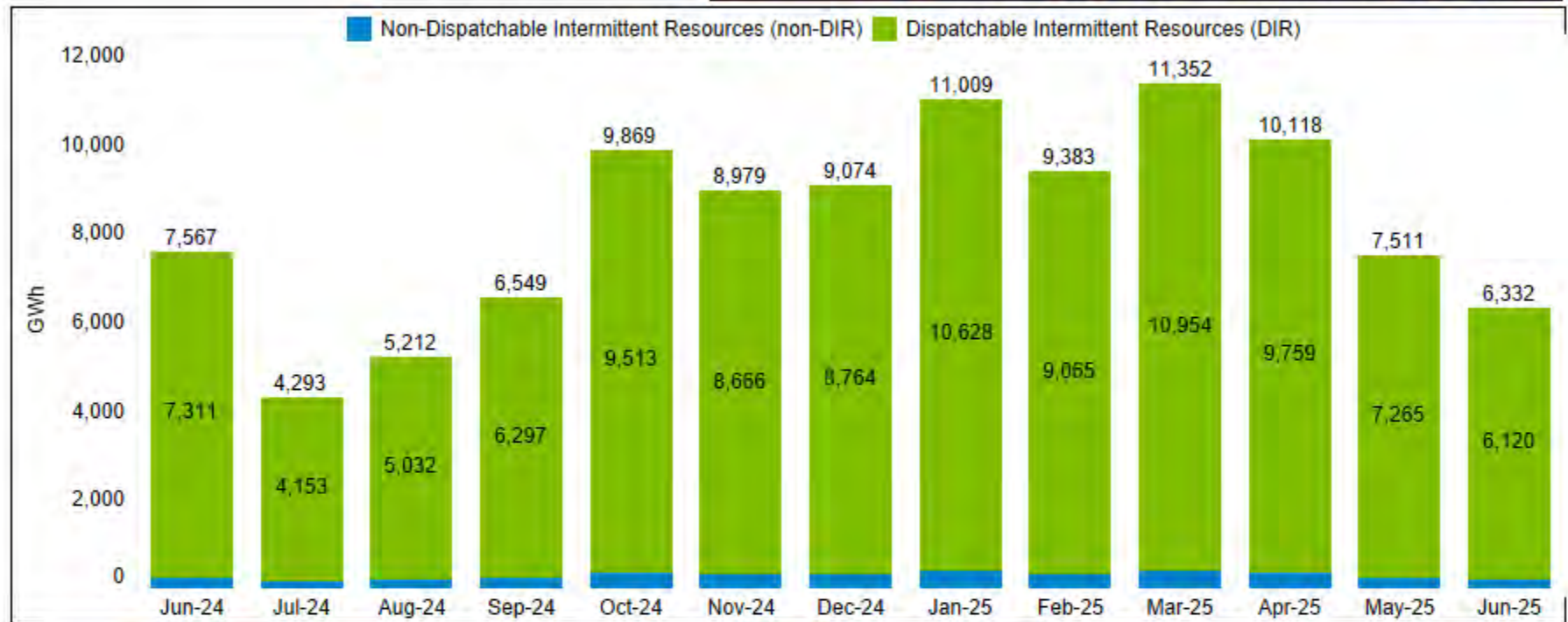




# Monthly Wind Energy Generation

As of 06/04/2025

Registered Wind Capacity = 31,650 MW; Inservice Wind Capacity = 31,315 MW  
Registered DIR Capacity = 30,122 MW; Inservice DIR Capacity = 29,787 MW

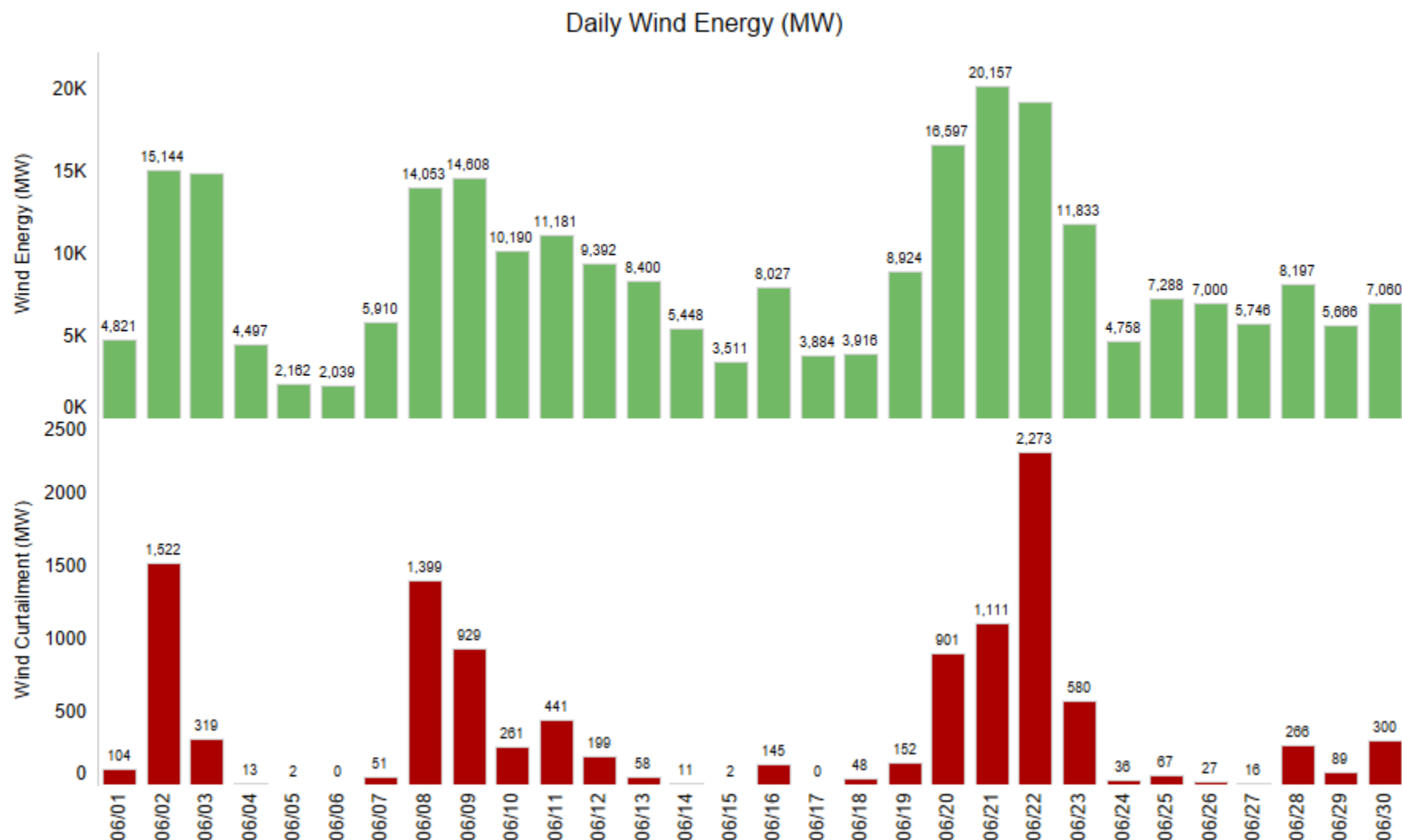


|                                                 | Jun-24 | Jul-24 | Aug-24 | Sep-24  | Oct-24  | Nov-24   | Dec-24  | Jan-25  | Feb-25  | Mar-25  | Apr-25  | May-25  | Jun-25  |
|-------------------------------------------------|--------|--------|--------|---------|---------|----------|---------|---------|---------|---------|---------|---------|---------|
| Peak Wind Date and Hour Ending                  | 6/6 17 | 7/1 23 | 8/6 4  | 9/12 24 | 10/30 2 | 11/20 18 | 12/4 11 | 1/28 21 | 2/28 22 | 3/23 15 | 4/28 19 | 5/16 21 | 6/21 15 |
| Peak hourly wind output (MW)                    | 21,341 | 18,465 | 15,418 | 16,944  | 22,683  | 21,272   | 24,044  | 25,218  | 24,646  | 24,172  | 23,582  | 22,803  | 21,086  |
| Peak wind output as % of MISO load in that hour | 24.1%  | 24.0%  | 21.2%  | 24.2%   | 36.1%   | 29.0%    | 28.7%   | 31.2%   | 34.1%   | 34.6%   | 28.6%   | 28.6%   | 19.3%   |
| Wind Energy as a percent of MISO Energy         | 13.7%  | 7.3%   | 8.8%   | 12.8%   | 19.9%   | 18.4%    | 16.3%   | 18.2%   | 18.1%   | 23.2%   | 21.5%   | 15.6%   | 11.3%   |
| DIR dispatch below Max as % of avail. DIR       | 3.0%   | 2.1%   | 2.7%   | 4.9%    | 4.0%    | 3.4%     | 2.3%    | 3.3%    | 2.0%    | 3.1%    | 4.3%    | 3.3%    | 3.3%    |

\*Hourly State Estimator data

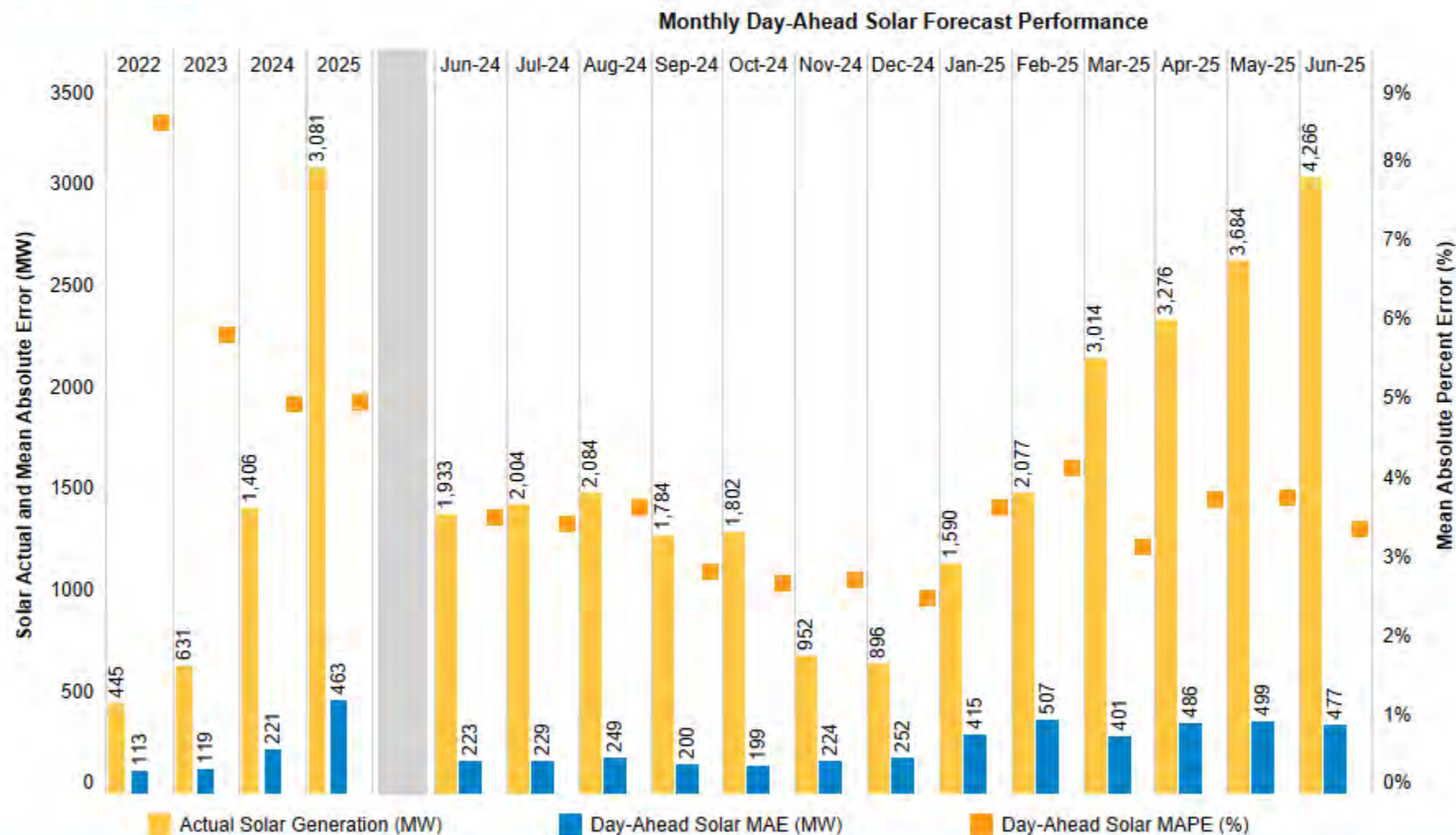
Source: MISO Market and Operations Analytics Department

# Daily Average Wind Energy and Curtailment



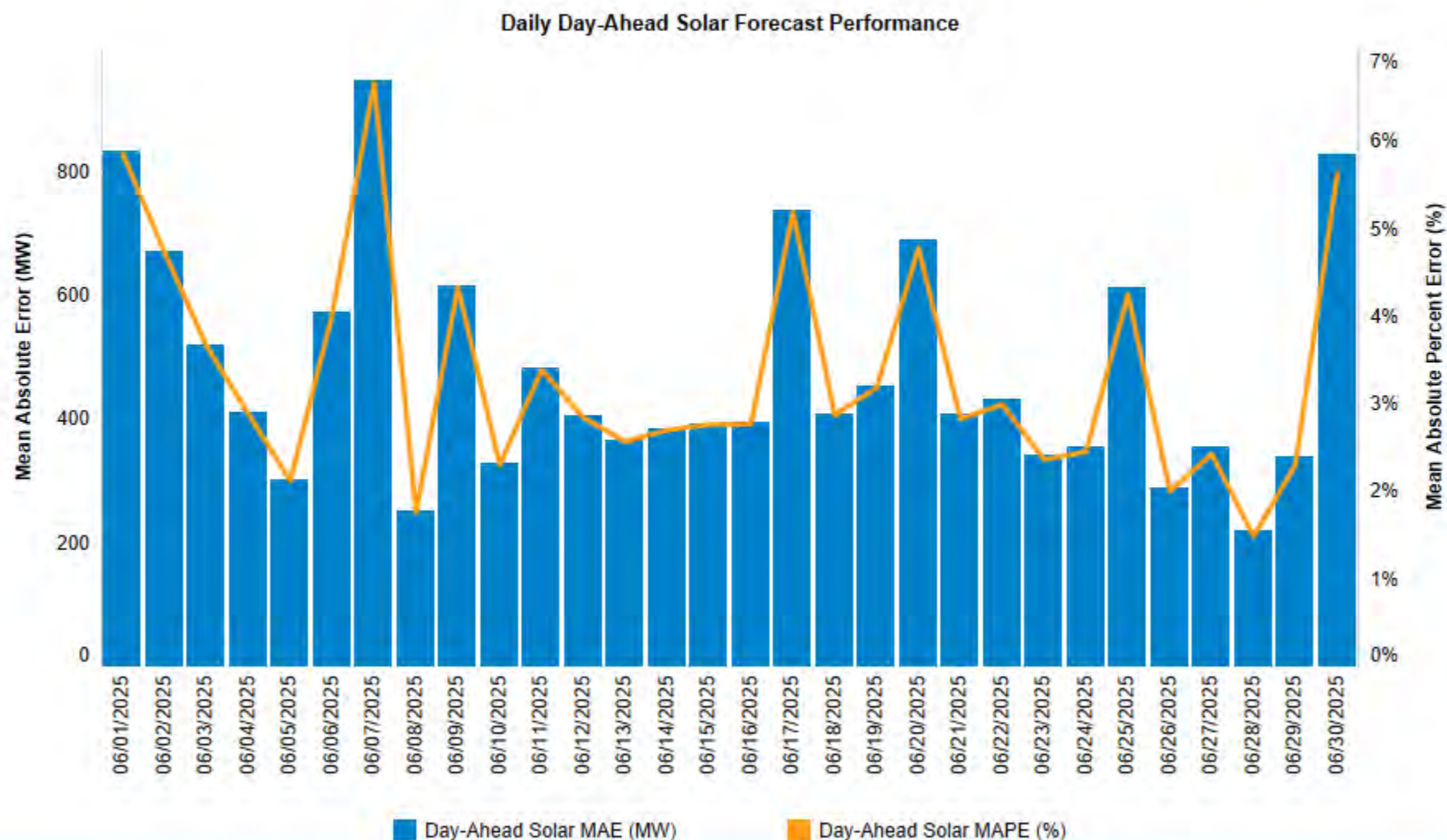
Source: MISO Market and Operations Analytics Department

# Monthly Day-Ahead Solar Forecast Performance: Mean Absolute Error (MAE) and Mean Absolute Percent Error (MAPE)





# Daily Day-Ahead Solar Forecast Performance: Mean Absolute Error (MAE) and Mean Absolute Percent Error (MAPE)

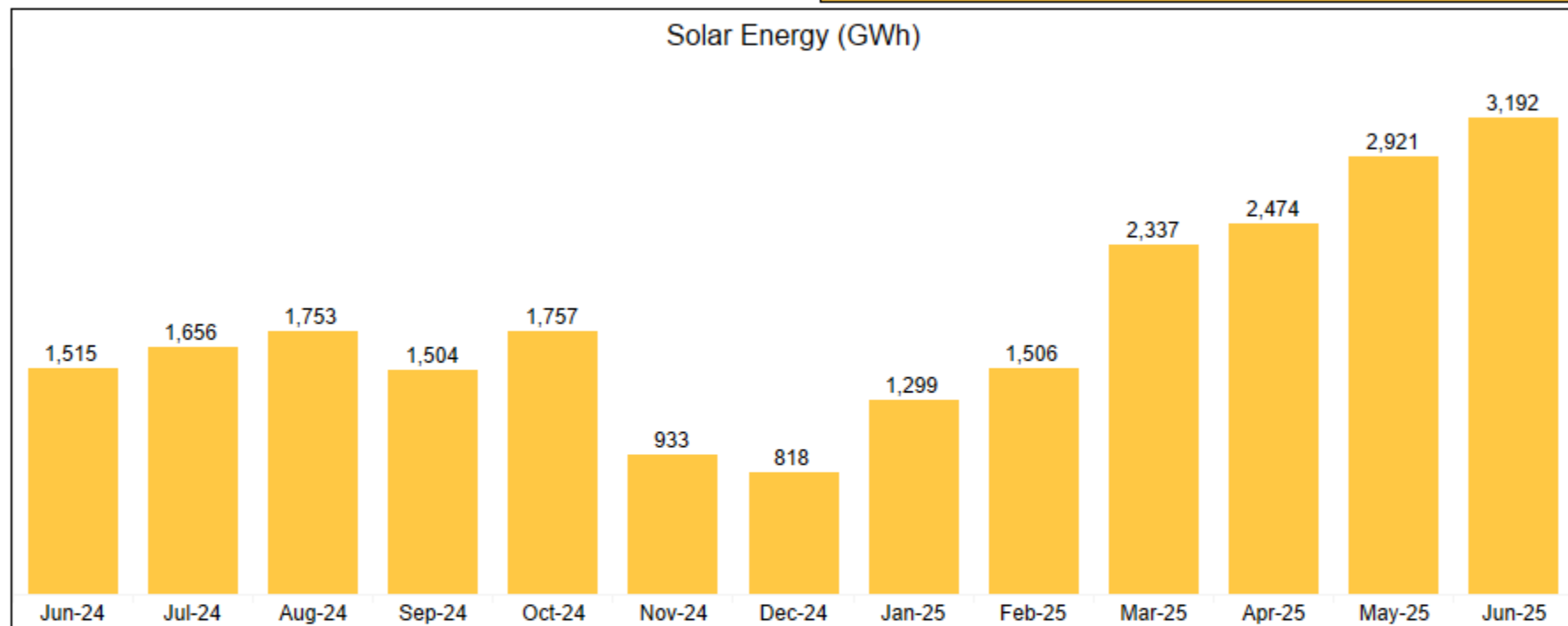




# Monthly Solar Energy

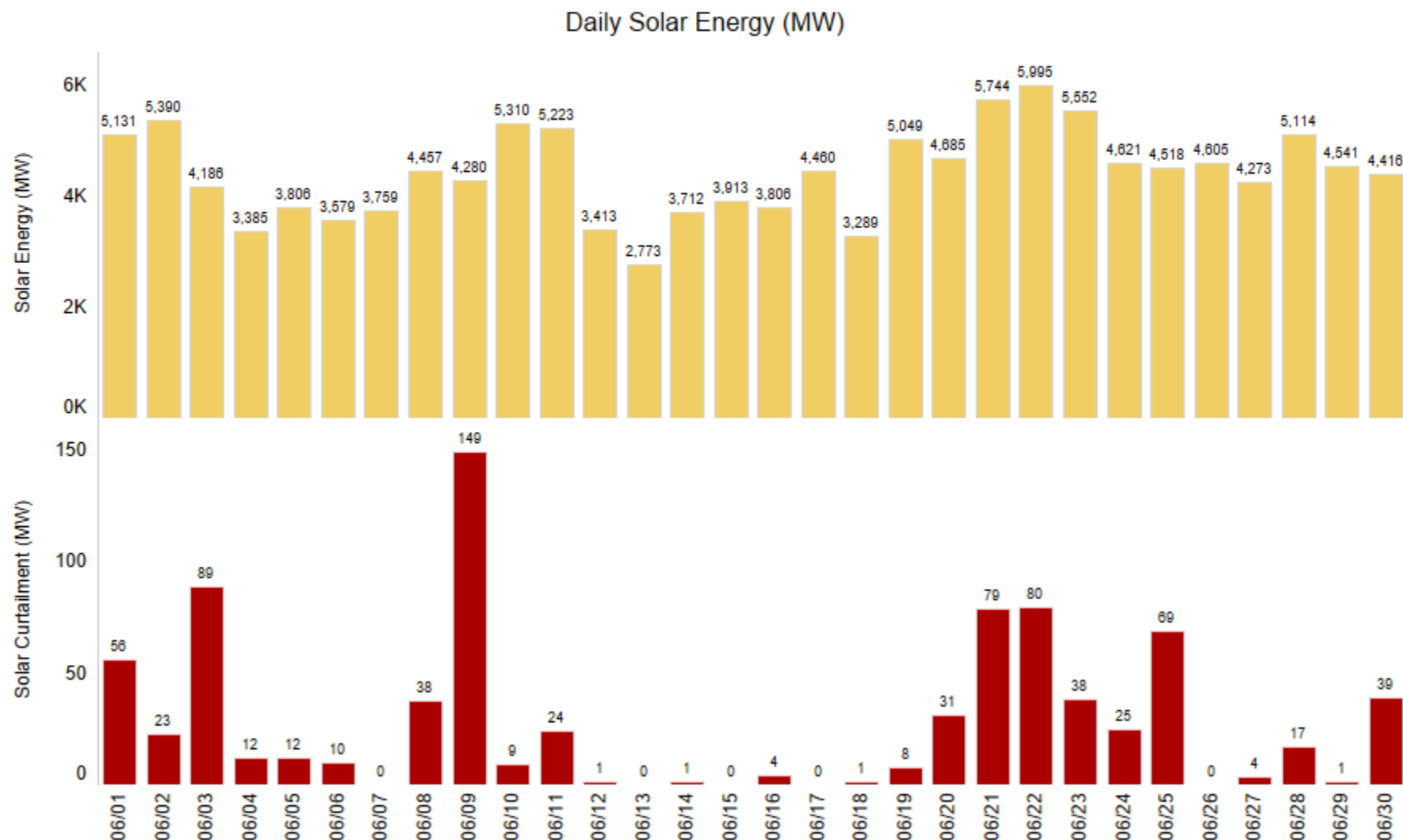
As of 06/04/2025  
 Registered Solar Capacity = 19,131 MW; Inservice Solar Capacity = 14,112 MW  
 Registered DIR Capacity = 18,959 MW; Inservice DIR Capacity = 13,940 MW

Solar Energy (GWh)

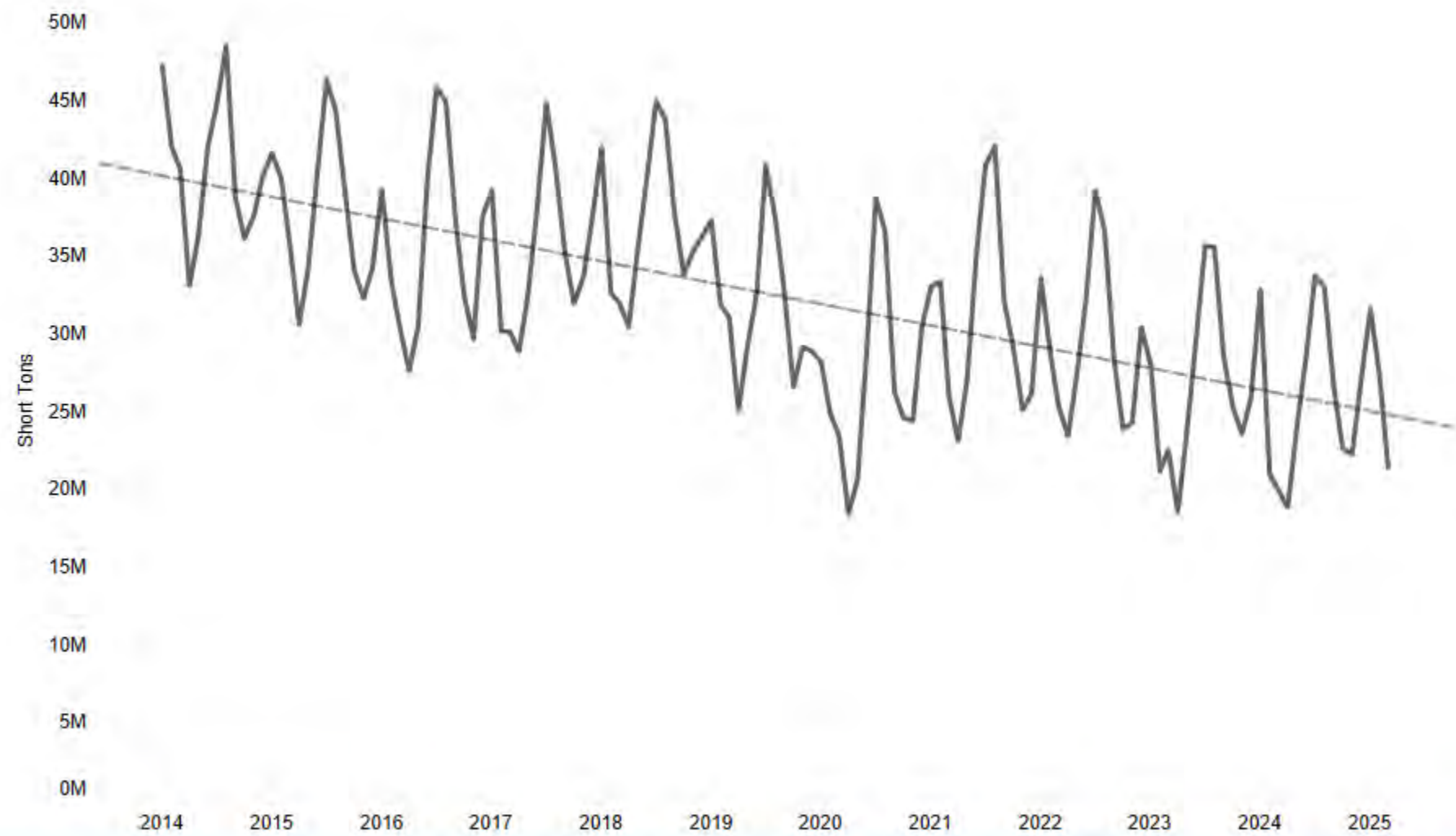


| Peak Solar Date and Hour Ending                    | Jun-24  | Jul-24  | Aug-24  | Sep-24  | Oct-24   | Nov-24   | Dec-24   | Jan-25  | Feb-25  | Mar-25  | Apr-25  | May-25  | Jun-25  |
|----------------------------------------------------|---------|---------|---------|---------|----------|----------|----------|---------|---------|---------|---------|---------|---------|
|                                                    | 6/14 11 | 7/13 12 | 8/22 12 | 9/26 12 | 10/16 16 | 11/12 16 | 12/21 12 | 1/20 12 | 2/21 12 | 3/22 15 | 4/16 14 | 5/31 13 | 6/22 11 |
| Peak Hour Solar Output (MW)                        | 6,016   | 6,168   | 6,835   | 7,054   | 7,919    | 6,813    | 6,898    | 8,308   | 11,360  | 12,061  | 12,342  | 13,366  | 12,872  |
| Peak Solar Output as a % of MISO Load in that hour | 6.9%    | 6.5%    | 8.3%    | 9.1%    | 11.5%    | 9.6%     | 8.7%     | 8.4%    | 12.4%   | 18.8%   | 18.0%   | 19.2%   | 12.9%   |
| Solar Energy as a % of MISO Energy                 | 3.4%    | 3.2%    | 3.8%    | 3.5%    | 4.7%     | 2.6%     | 2.0%     | 2.6%    | 3.5%    | 6.0%    | 5.4%    | 6.0%    | 6.0%    |
| DIR Dispatch below MAX as a % of avail. DIR        | -0.1%   | -0.5%   | -0.5%   | 0.4%    | -0.3%    | -0.6%    | -3.1%    | -1.9%   | 0.1%    | 1.1%    | 0.5%    | -0.1%   | -0.1%   |

# Daily Average Solar Energy and Curtailment

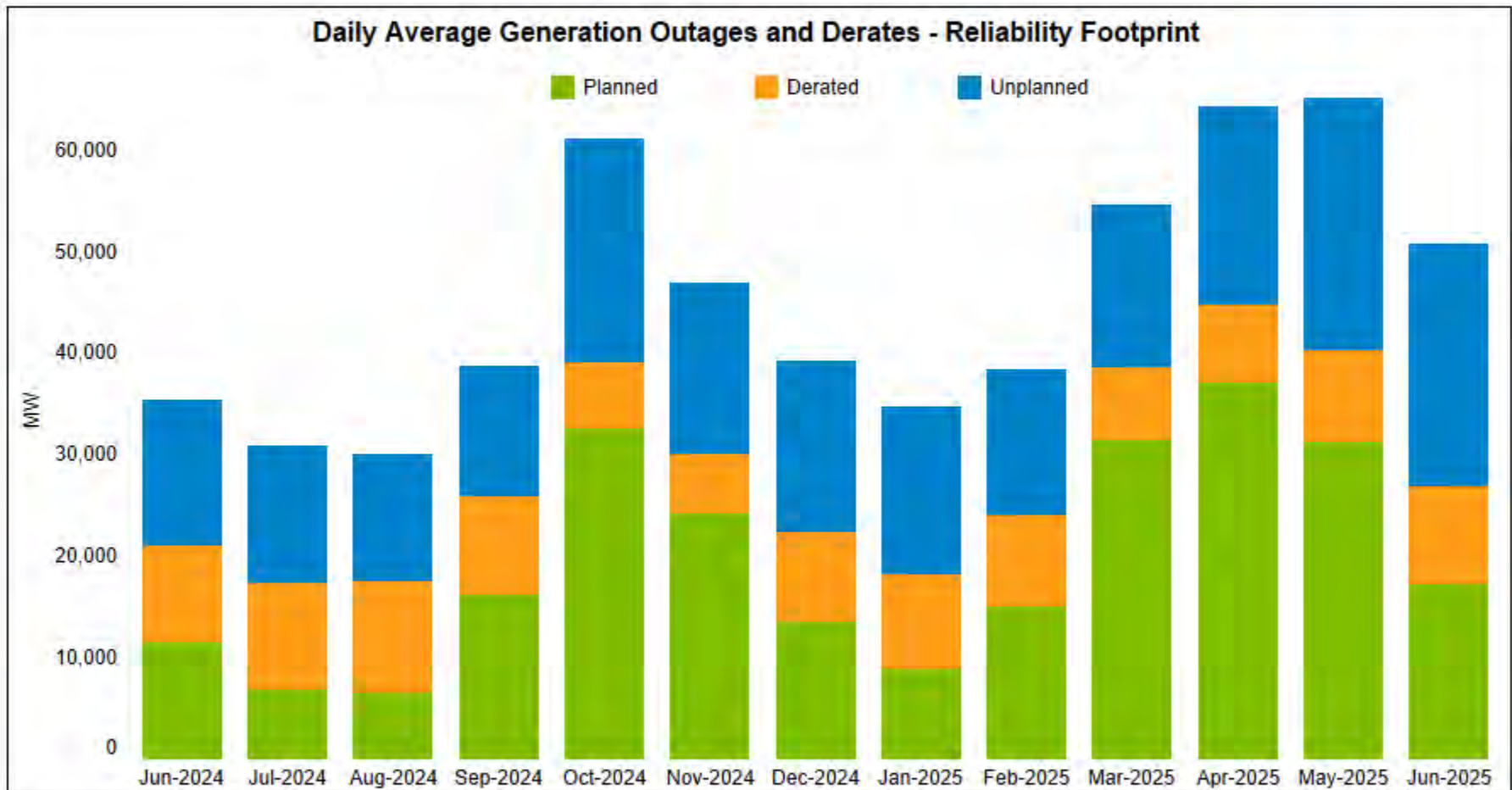


# Carbon Emissions



Data Source: EPA emissions through March 2025 and EPA EIA-860 2023  
Emissions generated from MISO generators and does not account for volume of imports or exports  
One Short Ton = 2000 lbs

# Generation Outages and Derates

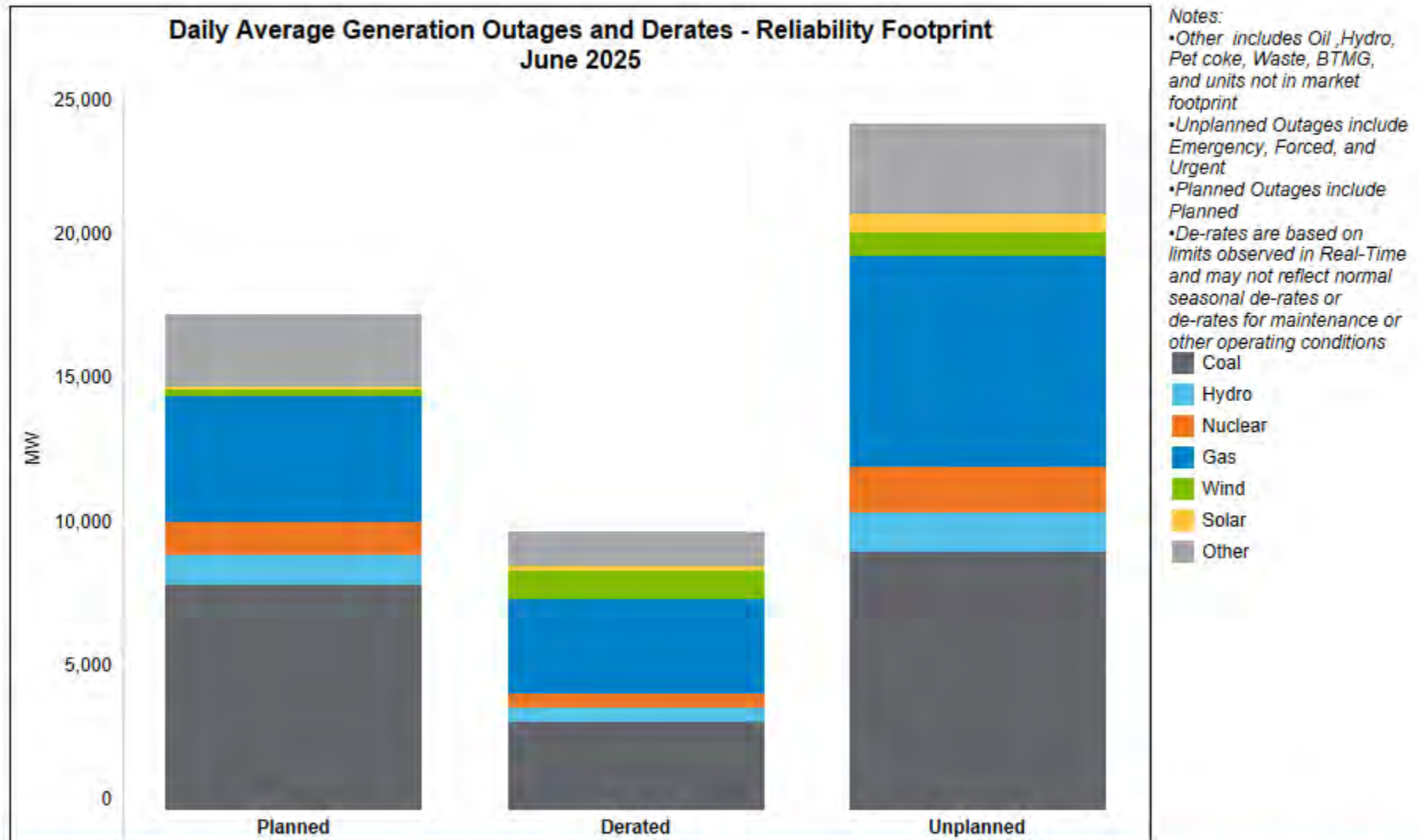


**Notes:**

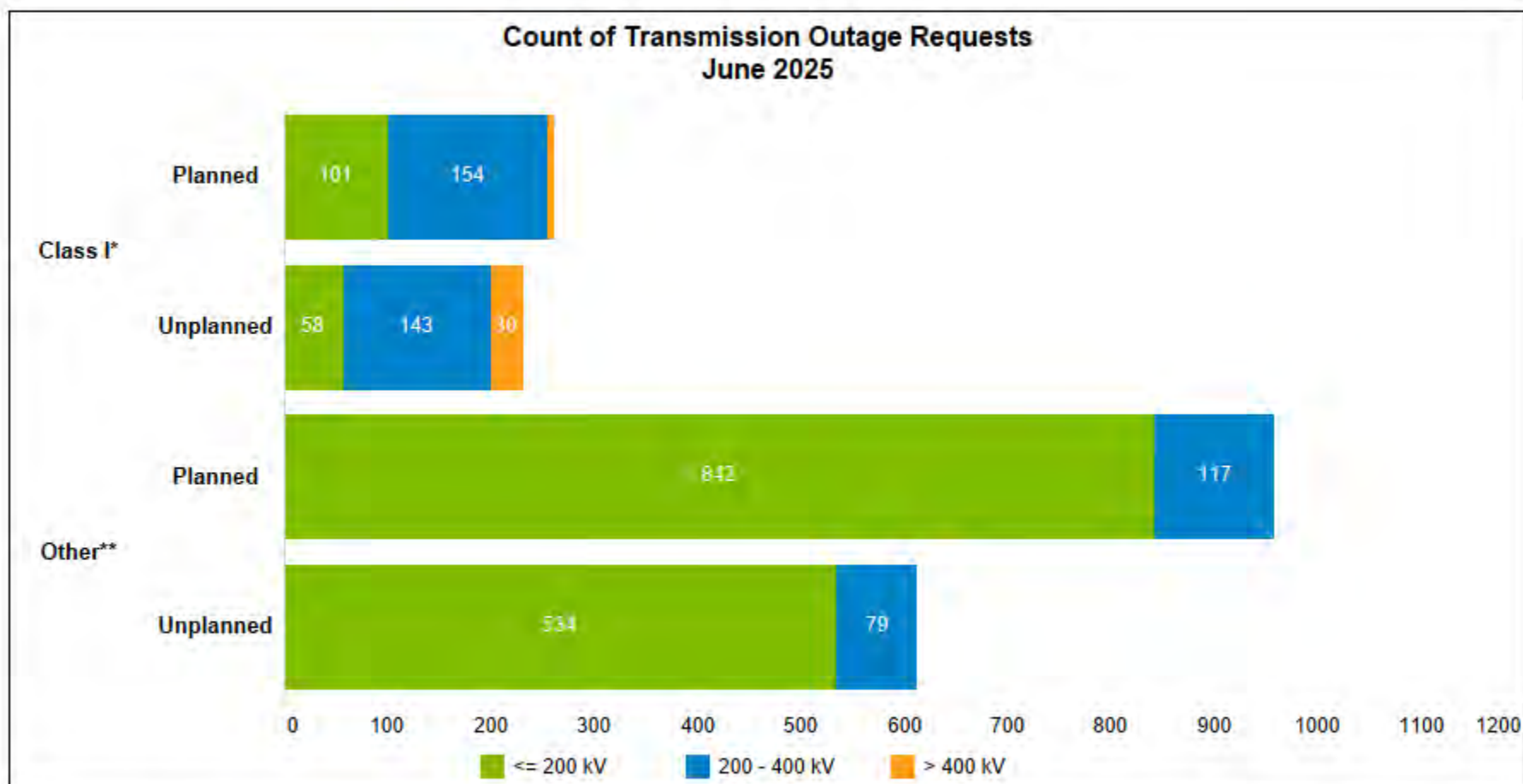
- Unplanned Outages include Emergency, Forced, and Urgent
- Planned Outages include Planned
- De-rates are based on limits observed in Real-Time and may not reflect normal seasonal de-rates or de-rates for maintenance or other operating conditions



# Generation Outages by Fuel



# Transmission Outages



**Notes:**

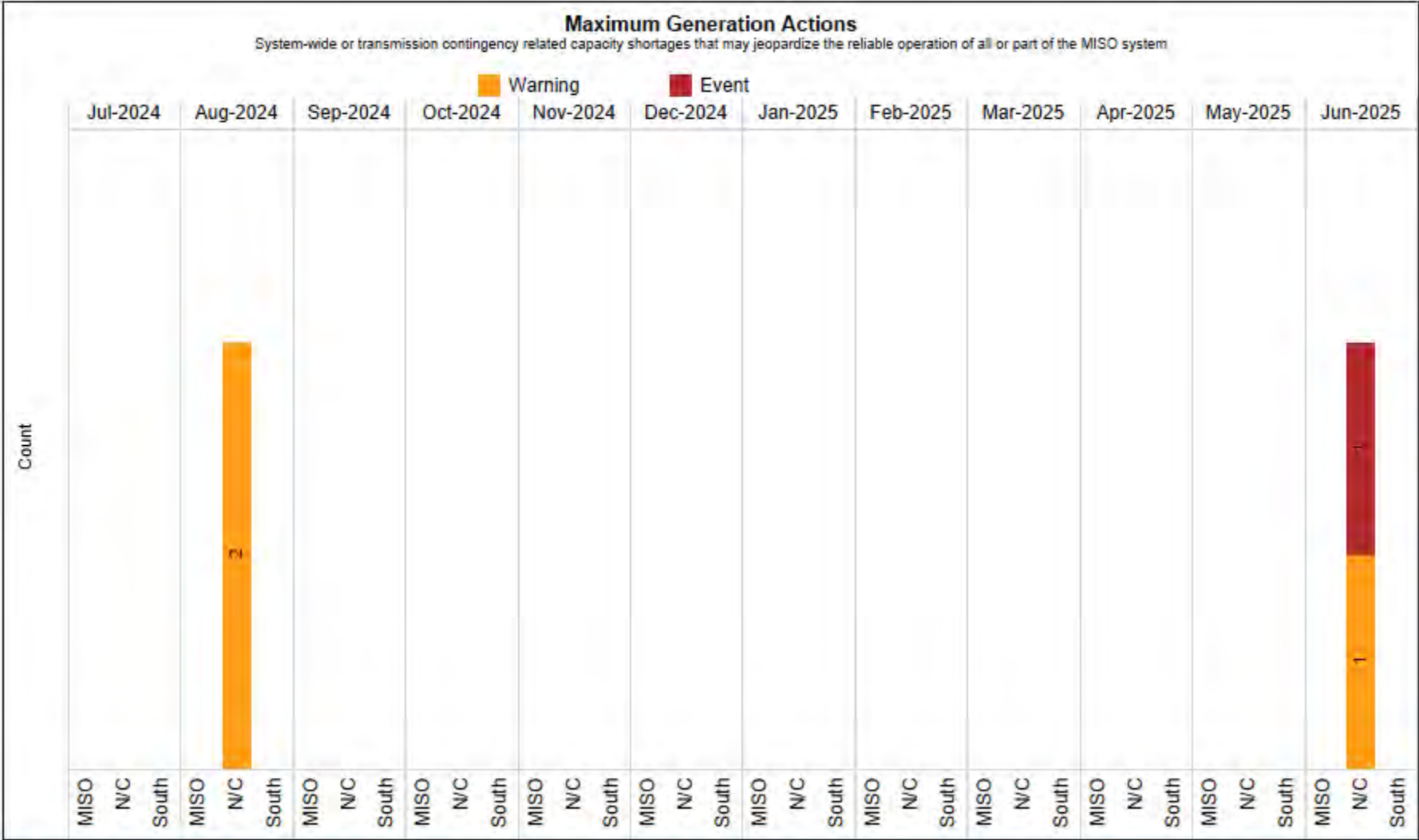
- Class 1 is any facility which has a reliability or market impact on transmission system operations
- Other is any facility which does NOT have a reliability or market impact on transmission system operations
- Unplanned Outages include Emergency, Forced, Discretionary and Urgent
- Planned Outages include Planned, Opportunity

# MISO Inadvertent Balance

| Month/Year              | Net     | On-Peak | Off-Peak |
|-------------------------|---------|---------|----------|
| 6/1/2024                | -21,123 | -10,382 | -10,741  |
| 7/1/2024                | -33,949 | -12,863 | -21,086  |
| 8/1/2024                | -39,602 | -15,448 | -24,154  |
| 9/1/2024                | -79,156 | -36,769 | -42,387  |
| 10/1/2024               | -37,833 | -17,446 | -20,387  |
| 11/1/2024               | -5,440  | -2,237  | -3,203   |
| 12/1/2024               | -1,006  | 624     | -1,630   |
| 1/1/2025                | 11,913  | 7,358   | 4,555    |
| 2/1/2025                |         |         |          |
| 3/1/2025                |         |         |          |
| 4/1/2025                |         |         |          |
| 5/1/2025                |         |         |          |
| 6/1/2025                |         |         |          |
| Running Total from 2009 | -95,937 | -88,521 | -7,416   |

Source: NERC Tool (As of May 10, 2025)

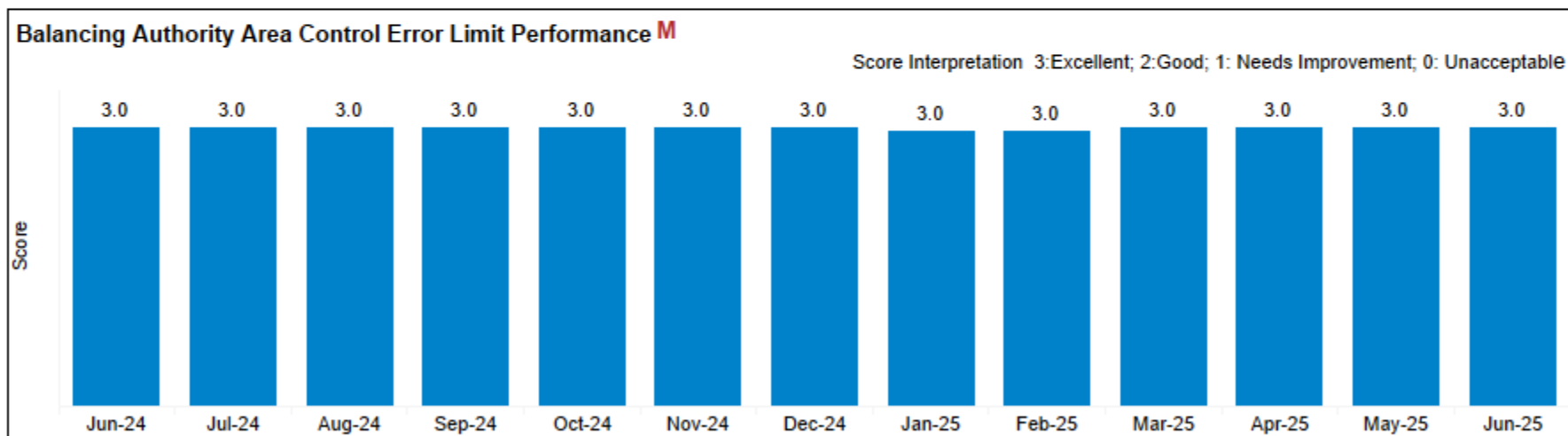
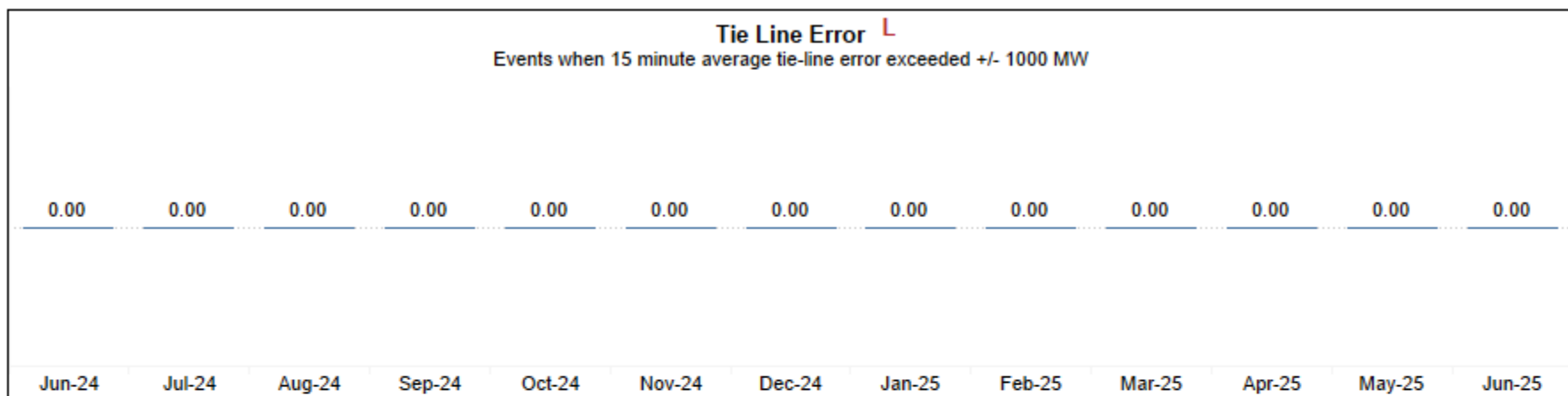
# Generation Notifications



\* Alerts – forecasting specific emergency situations in a future time-frame  
\* Warnings – experiencing initial stages of an emergency situation and taking action  
\* Events – experiencing an emergency situation and taking action



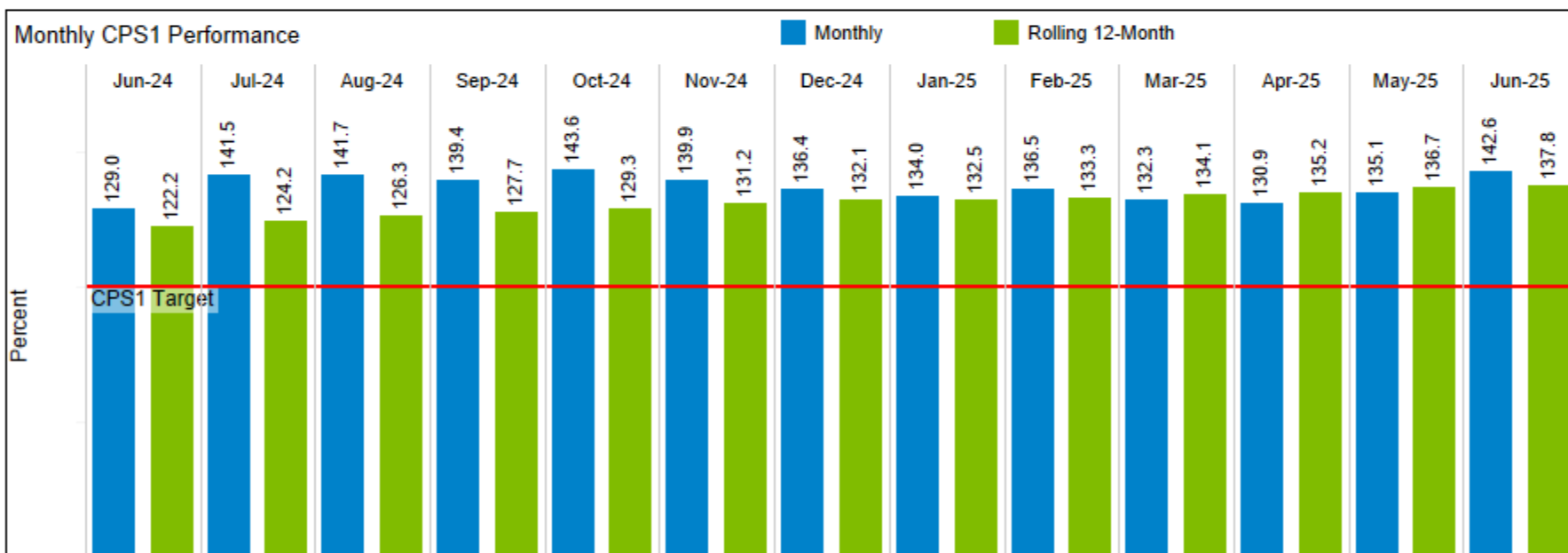
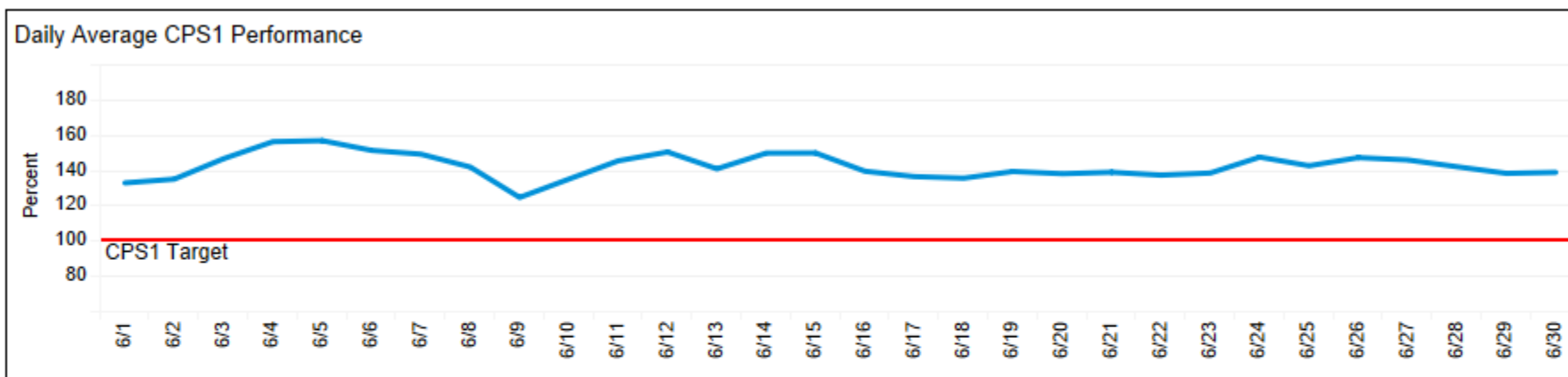
# Tie Line and BAAL Performance



The Balancing Authority Area Control Error Limit (BAAL) measures control performance over the short-term. Exceeding BAAL for a continuous time period greater than 30 minutes constitutes a non-compliant event. The daily MISO BAAL performance rating is the lowest scored incident of the day.

# CPS1 Performance

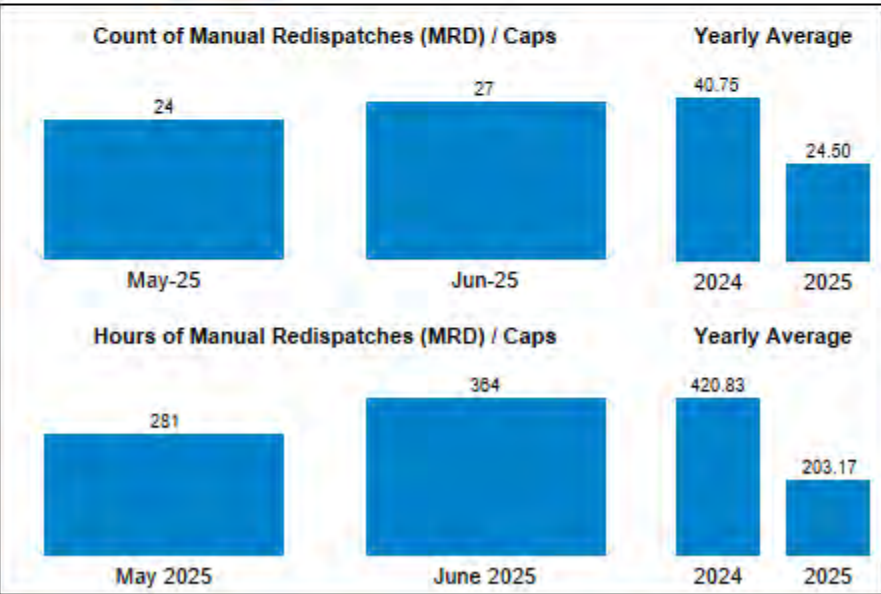
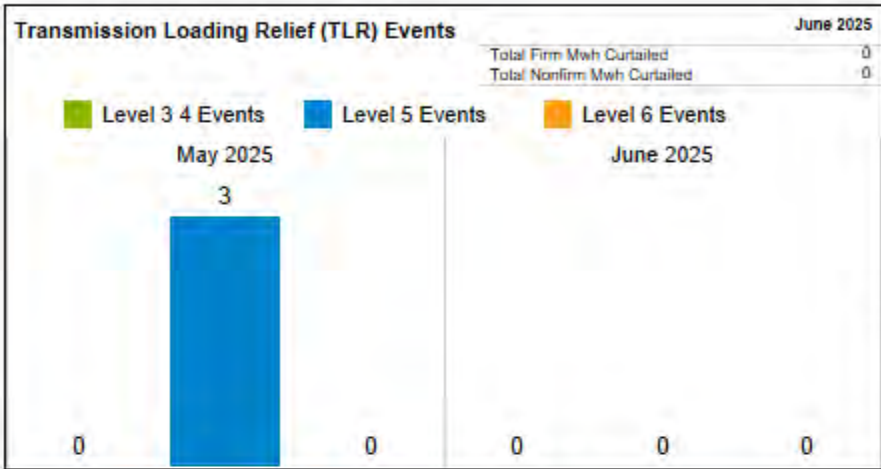
N



Per NERC Standard BAL-001-0 and MISO OP-044, the MISO will monitor CPS 1 performance and implement actions to ensure the MISO's rolling 12-month CPS 1 performance exceeds 100%  
Source: MISO Real-Time Operations Department



# Reliability — Other Metrics



**MISO deployed Contingency Reserves \*\***

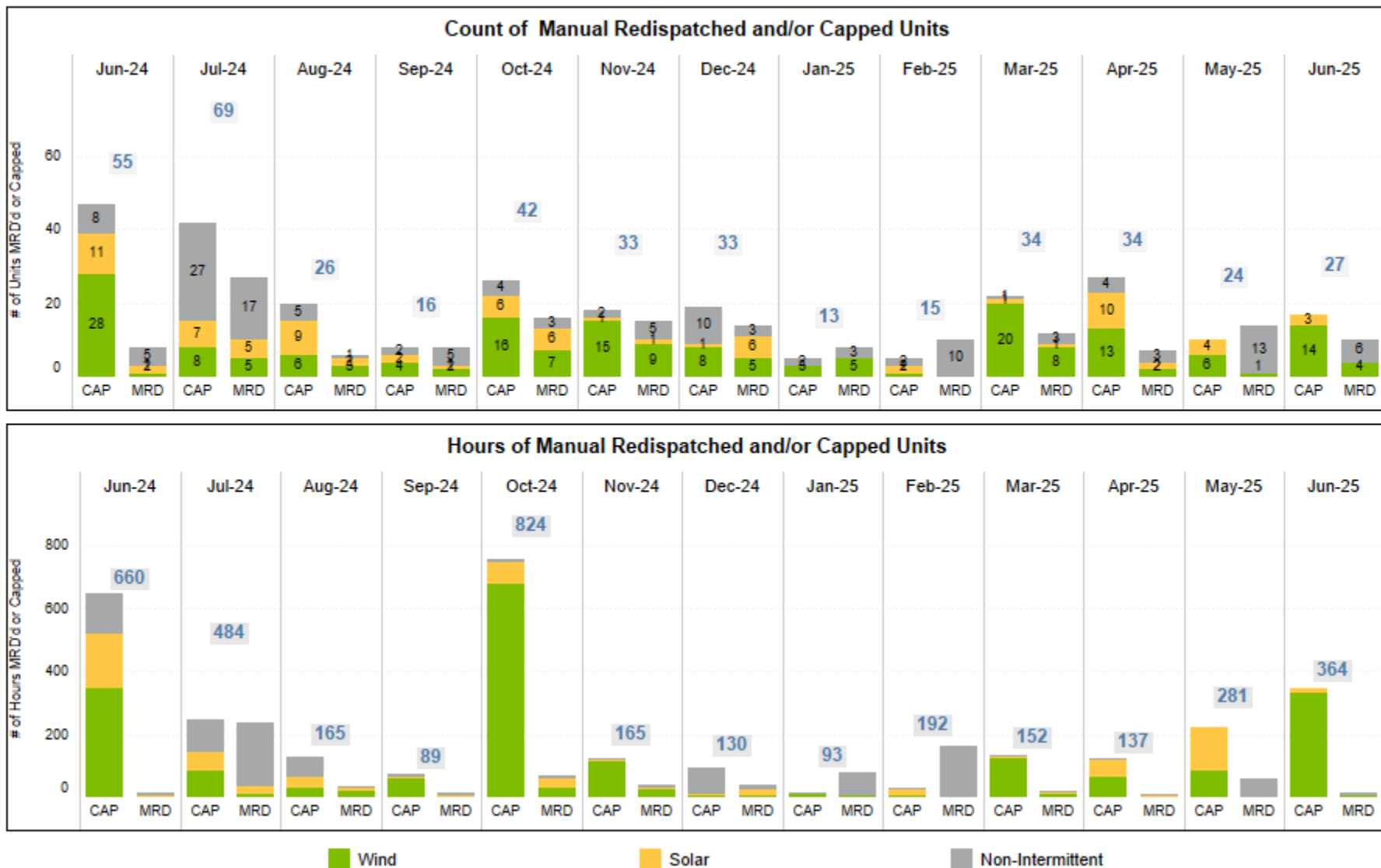
| Date      | HE | Deployment Type | MW    |
|-----------|----|-----------------|-------|
| 6/1/2025  | 19 | OFFLINE         | 79    |
|           |    | ONLINE          | 1,227 |
| 6/17/2025 | 5  | OFFLINE         | 338   |
|           |    | ONLINE          | 961   |
| 5/20/2025 | 9  | ONLINE          | 512   |

Source: MISO Real-Time Operations Department

53<sup>1</sup>Historical Contingency Deployment data located in Related Documents at <https://cdn.misoenergy.org/202001-202103%20Additonal%20Information%20Historical%20Contingency%20Deployment%20Data548221.pdf>

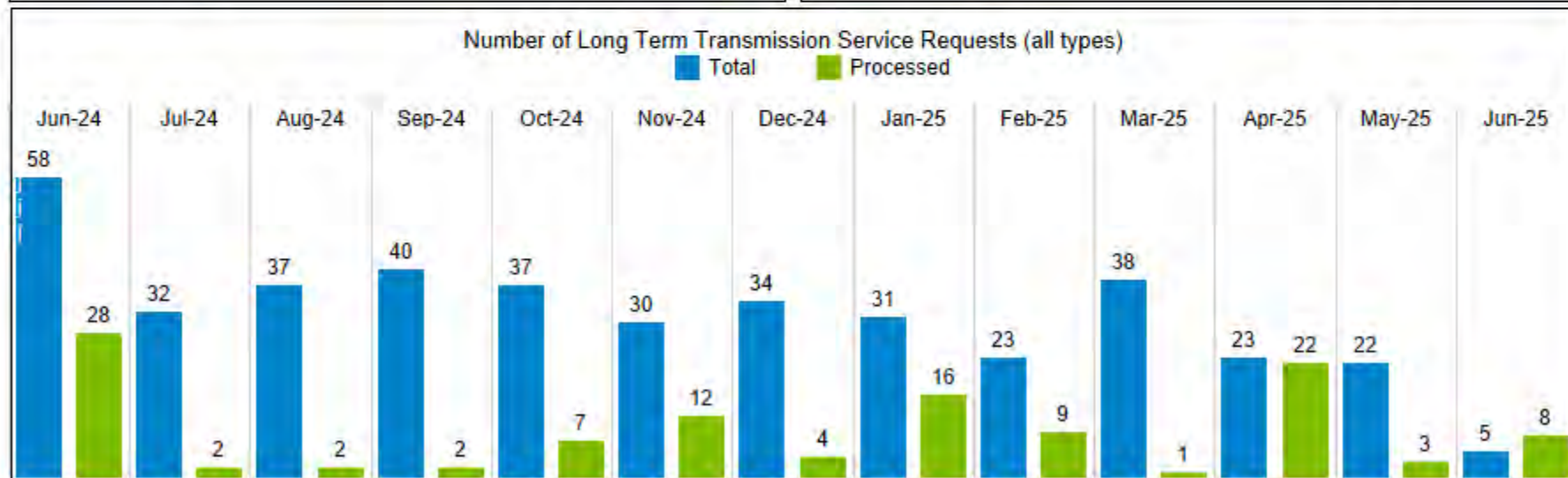
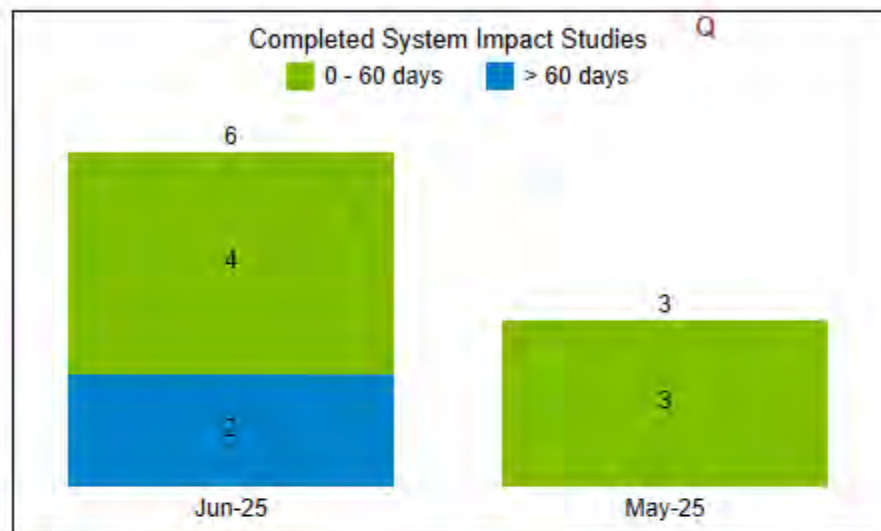
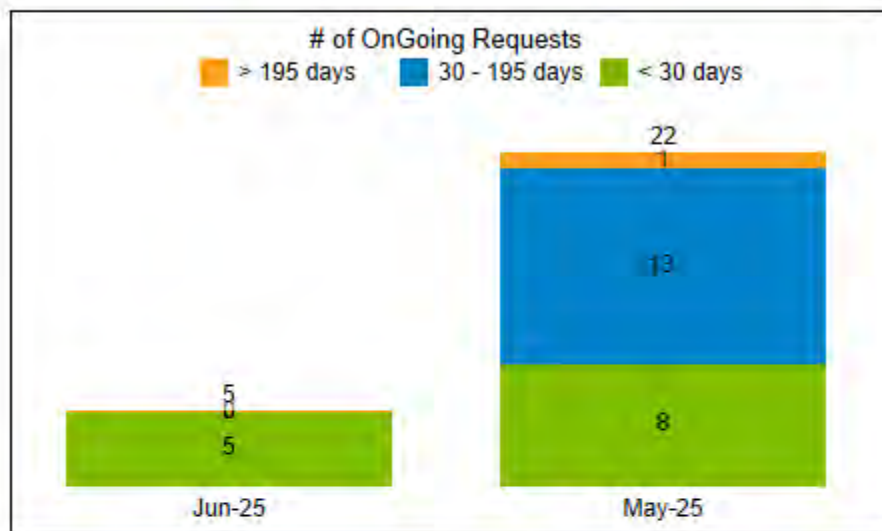


# Operator Actions - Manual Redispatch and Caps



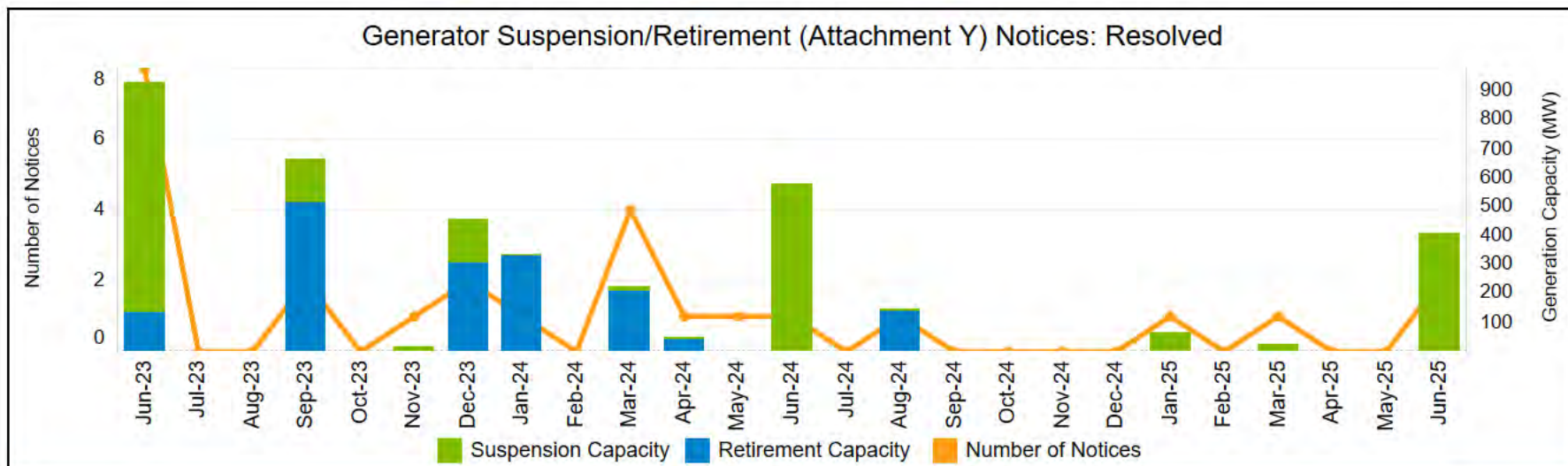
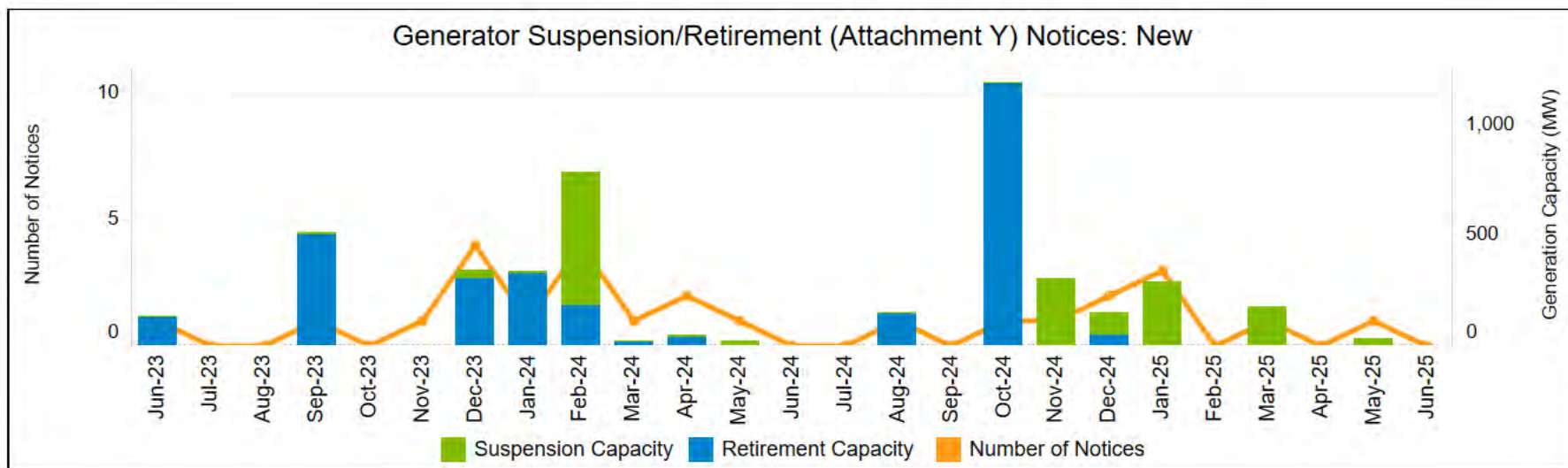


# Transmission Service Request

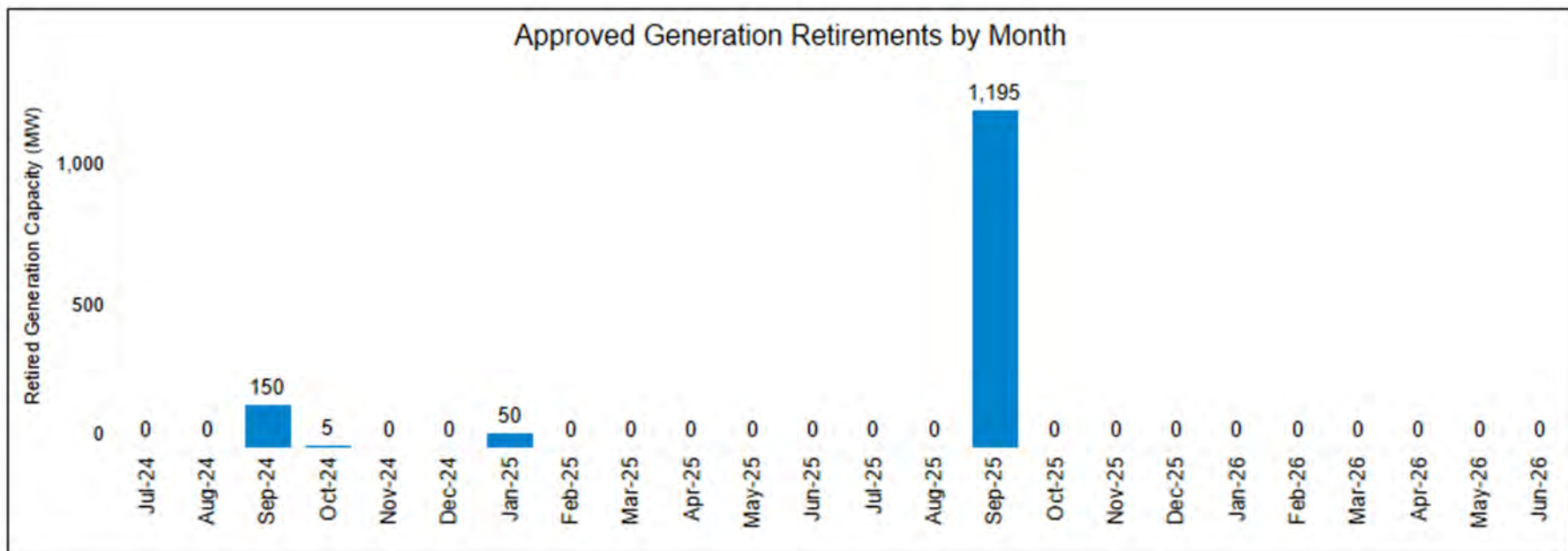


Source: MISO Resource Utilization

# Generator Suspension/Retirement - New and Resolved

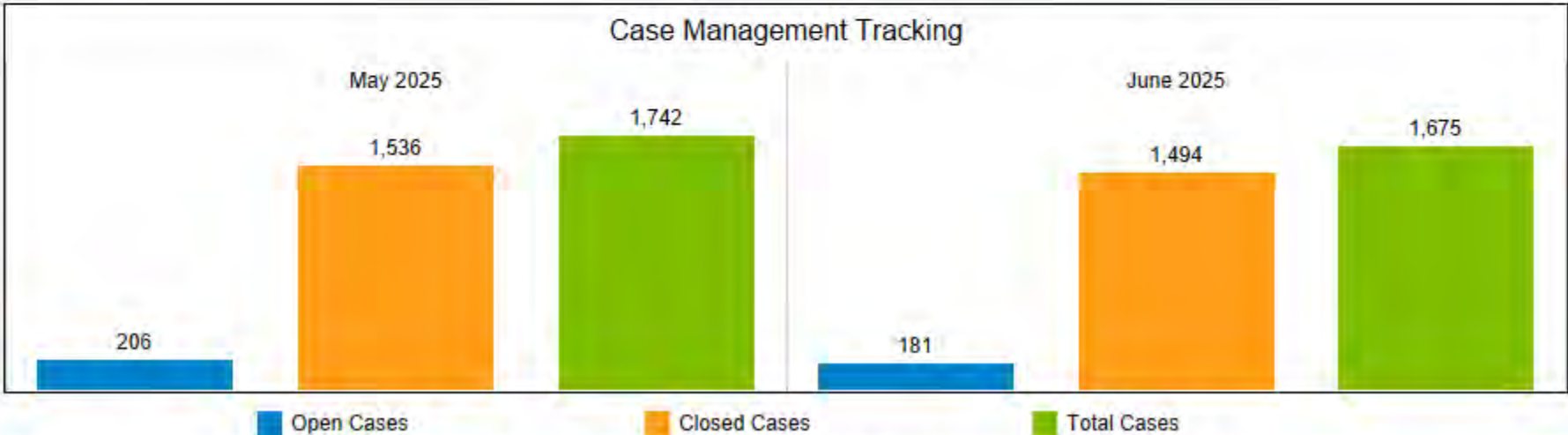


# Generator Suspension/Retirement - Overall



Source - MISO Transmission Planning Department

# Settlements/Client Services and Readiness





# MISO has set an even higher standard for its System Availability metrics in 2025, and while January and February had no downtime, a critical incident occurred in March that impacted STI

January - April 2025

| Short-Term Incentive Metrics                                   | JAN 25 | FEB 25 | MAR 25 | APR 25 | Trend *                                                                               | YTD            | Threshold   Target   Excellent |
|----------------------------------------------------------------|--------|--------|--------|--------|---------------------------------------------------------------------------------------|----------------|--------------------------------|
| Critical Systems Availability<br>(Downtime in Hours)           | 0.0    | 0.0    | 1.5    | 0.0    |    | 1.5            | 4 Hours   3 Hours   2 Hours    |
| Number of Critical System Incidents Exceeding 30 Minutes       | 0      | 0      | 1      | 0.0    |    | 1              | 2   1   0                      |
| Other Availability Metrics                                     | JAN 25 | FEB 25 | MAR 25 | APR 25 | Trend *                                                                               | Monthly Target |                                |
| ICCP**<br>(Availability %)                                     | 100    | 100    | 100    | 100    |    | 99.5           |                                |
| Customer Facing Applications – Portals<br>(Availability Index) | 10     | 10     | 10     | 10     |  | 10 of 10       |                                |
| Markets<br>(Availability Index)                                | 4      | 4      | 4      | 4      |  | 4 of 4         |                                |
| Reliability Targets<br>(Availability Index)                    | 3      | 3      | 3      | 3      |  | 3 of 3         |                                |

\*Trend lines represent quarter-over-quarter performance

\*\*ICCP = Inter-Control Center Communications Protocol



# 2025 Dashboard Metric Criteria (1 of 2)

\*New or revised 2025 Metric;

| Operational Excellence                       |       |                                                                                            |                                                                                                                                    |                                                                                                                                                                                               |                                                                     |       |                                                                   |                                                                                            |                                                                                                                                                      |
|----------------------------------------------|-------|--------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|-------|-------------------------------------------------------------------|--------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| Metric                                       | Chart | Expected                                                                                   | Monitor                                                                                                                            | Review                                                                                                                                                                                        | Metric                                                              | Chart | Expected                                                          | Monitor                                                                                    | Review                                                                                                                                               |
| Percentage Price Deviation*                  | A     | Absolute DA-RT price difference divided by DA LMP <=28.6%                                  | Absolute DA-RT price difference divided by DA LMP is >28.6% but <=34.3%                                                            | Absolute DA-RT price difference divided by DA LMP >34.3%                                                                                                                                      | Unit Commitment Efficiency*                                         | H     | >=93%                                                             |                                                                                            | <93%                                                                                                                                                 |
| Monthly Average Gross Virtual Profitability* | B     | Within the standard deviation bands (threshold \$0.44/MWh)                                 | Outside the standard deviation bands                                                                                               |                                                                                                                                                                                               | Real-Time Obligation fulfilled by Day-Ahead Supply at the Peak Hour | I     | >=95%                                                             | >=93% but <95%                                                                             | <93%                                                                                                                                                 |
| FTR Funding                                  | C     | Monthly FTR Allocation % is >=92% and YTD FTR Allocation % is >=96%                        | Not in good status AND Monthly FTR Allocation % is >=87% AND Rolling 12-month FTR Allocation % is >=93%                            | Not in Good AND not in Monitor status                                                                                                                                                         | Day Ahead Wind Generation Forecast Error                            | K     | # of days that the hourly average forecast error exceeds 10% <= 6 | # of days that the forecast error exceeds 10% >6 or Forecast error exceeds 15% in = 3 days | # of days that the forecast error exceeds 10% >8 or Forecast error exceeds 15% in > 3 days or Forecast error resulted in declaring 1 Real Time Event |
| Market Efficiency Metric                     | D     | >= 95%                                                                                     |                                                                                                                                    | <95%                                                                                                                                                                                          | Day Ahead Solar Generation Forecast Error                           | T     | # of days that the hourly average forecast error exceeds 10% <= 6 | # of days that the forecast error exceeds 10% >6 or Forecast error exceeds 15% in = 3 days | # of days that the forecast error exceeds 10% >8 or Forecast error exceeds 15% in > 3 days or Forecast error resulted in declaring 1 Real Time Event |
| RSG per MWh to Energy Price*                 | E     | <=0.38%                                                                                    | >0.38% and <=0.46%                                                                                                                 | >0.46%                                                                                                                                                                                        | Tie Line Error                                                      | L     | <=1                                                               | >1 but <=3                                                                                 | >3                                                                                                                                                   |
| Day Ahead Mid-Term Load Forecast**           | F     | # of days that forecast error exceeds 3% <=6 AND # days that forecast error exceeds 4% <=4 | # of days that forecast error exceeds 3% > 6 OR # days that forecast error exceeds 4% > 4 OR forecast error exceeds 6% on >= 1 day | # of days that forecast error exceeds 3% > 10 OR # days that forecast error exceeds 4% > 8 OR forecast error exceeds 7% on >= 1 day OR Forecast error resulted in declaring 1 Real Time Event | Control Performance - BAAL                                          | M     | Monthly performance score >=2                                     | Monthly performance score <2 but >=1                                                       | Monthly performance score < 1                                                                                                                        |

# 2025 Dashboard Metric Criteria (2 of 2)

\*New or revised 2025 Metric;

| Operational Excellence          |       |                                                                                           |                                                                                                     |                                                                                          |                                                      |       |                                             |                                        |                                                      |
|---------------------------------|-------|-------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|------------------------------------------------------|-------|---------------------------------------------|----------------------------------------|------------------------------------------------------|
| Metric                          | Chart | ● Expected                                                                                | ■ Monitor                                                                                           | ▼ Review                                                                                 | Metric                                               | Chart | ● Expected                                  | ■ Monitor                              | ▼ Review                                             |
| Short-Term Load Forecast*       | G     | Forecast error exceeding the 95% percentile of forecast error for the past year <= 2 days | 3 days <= Forecast error exceeding the 95% percentile of forecast error for the past year <= 5 days | Forecast error exceeding the 95% percentile of forecast error for the past year > 5 days | Control Performance – CPS1 and CPS1 12-month rolling | N     | >=100%                                      |                                        | <100%                                                |
|                                 |       |                                                                                           |                                                                                                     |                                                                                          | ARS Deployment                                       | P     | DCS monthly average % recovery (APR) = 100% | Analysis of event not yet complete     | DCS monthly average % recovery (APR) confirmed <100% |
| Customer Service                |       |                                                                                           |                                                                                                     |                                                                                          |                                                      |       |                                             |                                        |                                                      |
| System Impact Study Performance | Q     | Studies completed in less than 60 days >=85%                                              | Studies completed in less than 60 days <85% but >=75%                                               | Studies completed in less than 60 days <75%                                              | Settlement Disputes                                  | S     | Increase of up to 20 disputes               | Increase of between 20 and 50 disputes | Increase of more than 50 disputes                    |

BEFORE THE UNITED STATES DEPARTMENT OF ENERGY

Federal Power Act Section 202(c)     )  
Emergency Order: Midcontinent     )  
Independent System Operator     )  
(MISO)     )  
\_\_\_\_\_

Order No. 202-25-7

Exhibit to  
Motion to Intervene and Request for Rehearing and Stay of  
Public Interest Organizations

Filed September 5, 2025

Exhibit 112  
  
Witmeier 2024  
Queue Cap  
Testimony

TAB A



**UNITED STATES OF AMERICA  
BEFORE THE  
FEDERAL ENERGY REGULATORY COMMISSION**

**Midcontinent Independent System                    )  
Operator, Inc.                                            )**                   **Docket No. ER25-\_\_\_\_-000**

**PREPARED DIRECT TESTIMONY OF ANDREW WITMEIER  
ON BEHALF OF THE MIDCONTINENT INDEPENDENT  
SYSTEM OPERATOR, INC.**

**November 21, 2024**

UNITED STATES OF AMERICA  
BEFORE THE  
FEDERAL ENERGY REGULATORY COMMISSION

Midcontinent Independent System                    )  
Operator, Inc.                                            )                   Docket No. ER25-\_\_\_\_-000

PREPARED DIRECT TESTIMONY OF  
ANDREW WITMEIER

I.       PROFESSIONAL BACKGROUND AND QUALIFICATIONS

Q.       PLEASE STATE YOUR NAME, CURRENT POSITION AND YOUR BUSINESS  
ADDRESS.

A.       My name is Andrew Witmeier. I am the Director of Resource Utilization for the  
Midcontinent Independent System Operator, Inc. (“MISO”). My business address is: 720  
City Center Drive, Carmel, IN 46032-7574.

Q.       PLEASE BRIEFLY DESCRIBE YOUR EDUCATIONAL BACKGROUND AND  
PROFESSIONAL EXPERIENCE.

A.       I joined MISO in 2003 after graduating from Purdue University with a bachelor's degree  
in electrical engineering. I spent the first 17 years of my career in various positions in  
MISO Operations. During that time, I worked as a North American Electric Reliability  
Corporation (“NERC”) certified system operator in scheduling, engineering, and as a  
reliability coordinator. I also led several groups within MISO Operations as a manager in  
engineering, reliability coordination, and seams administration. In January 2020, I was  
appointed to my current position.

1 **Q. PLEASE DESCRIBE YOUR JOB RESPONSIBILITIES WITH MISO AS THEY**  
2 **RELATE TO THIS FILING.**

3 **A.** As the Director of Resource Utilization, I am responsible for the administration of MISO's  
4 Generator Interconnection Procedures ("GIP"), which are set forth in Attachment X of  
5 MISO's Open Access Transmission, Energy and Operating Reserve Markets Tariff  
6 ("Tariff" or "MISO Tariff").<sup>1</sup> I oversee MISO's generation interconnection queue,  
7 including the negotiation and execution of Generator Interconnection Agreements  
8 ("GIAs"), which are based on MISO's *pro forma* GIA set forth in Appendix 6 of the GIP. I  
9 also oversee the group that manages and processes generation retirement, generator  
10 replacement, and Surplus Interconnection Service requests for generators connected to  
11 MISO's Transmission System. I have been directly involved in the preparation and  
12 development of the current proposals.

13 **Q. HAVE YOU PREVIOUSLY SUBMITTED TESTIMONY IN REGULATORY**  
14 **PROCEEDINGS?**

15 **A.** Yes. I submitted testimony at the Federal Energy Regulatory Commission ("FERC" or  
16 "Commission") in Docket No. ER22-661-000 on issues related to MISO's generator queue  
17 reform and resource utilization and Docket Nos. ER24-340-000 and ER24-341-000 on  
18 additional issues related to MISO's generator queue reform and management.

19 **II. OVERVIEW AND PURPOSE OF TESTIMONY**

20 **Q. ARE YOU SUBMITTING YOUR TESTIMONY ON BEHALF OF MISO?**

21 **A.** Yes.

---

<sup>1</sup> Unless otherwise indicated in my Testimony, all capitalized terms used herein have the meaning as set forth in the Tariff or the proposed Tariff revisions, as applicable.

**Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?**

A. My testimony supports the updated Tariff revisions that MISO is submitting in this docket to refile certain urgent quantity improvements to the GIP. As further discussed below, MISO's filing in this docket contains two severable proposals. While these proposals are separate from each other, both should be implemented as soon as possible to ensure that MISO's generator interconnection queue can continue to operate in a just and reasonable manner in the face of severe challenges precipitated by an ongoing and unprecedented increase in the number and volume of Interconnection Requests in MISO. The proposed changes will make MISO's administration of the queue more efficient and will improve MISO's compliance with the GIP timing requirements.

**Q. HOW WAS THIS NEW PROPOSAL DEVELOPED?**

A. MISO developed this updated proposal through a broad and inclusive stakeholder process. This filing incorporates the extensive stakeholder input we received in the past several months and reflects the lessons we learned from our previous queue reform efforts, including the Commission's guidance in Docket No. ER24-341-000. As discussed in more detail below, we have addressed the specific suggestions and concerns identified in the guidance order and have provided extensive opportunities for all interested parties to comment during the stakeholder review process. The final proposal that MISO is submitting today incorporates many of the comments and recommendations we have received in the process.

1   **Q.    HOW IS THIS FILING DIFFERENT FROM THE NOVEMBER 2023 CAP**  
2       **PROPOSAL?**

3   **A.**    MISO adjusted the formula for determining the cap, how exemptions will fit within the cap  
4       structure, and the types of exemptions presented in the current filing. With respect to the  
5       cap formula, the current proposal responds to the Commission’s directives and opts for a  
6       more balanced, much simpler approach that relies on the MTEP power flow model to run  
7       the interconnection studies as the basis for the cap formula. The proposed cap formula will  
8       be 50% of the non-coincident summer peak values for each study region from the power  
9       flow model that will be used to perform the queue studies.<sup>2</sup> This percentage was chosen  
10      based on analysis performed by MISO that showed when queue volumes continue to rise  
11      above 50%, more Network Upgrades are required to mitigate congestion caused by new  
12      Interconnection Requests, offsetting substantially more existing generation. The purpose  
13      of a cap is to establish a more realistic dispatch that includes existing generation with new  
14      Interconnection Requests. This improved dispatch should result in less Network Upgrades,  
15      which reduces costs and reduces the need for additional facility studies and should  
16      therefore lead to faster processing and less dropouts. In light of the Commission’s Order  
17      in Docket Nos. ER24-340-000 and ER24-341-000, MISO significantly modified the  
18      exemptions from its prior proposal. First, MISO removed the RERRA exemption. After  
19      special consideration of the comments and concerns brought forth by stakeholders and the  
20      Commission and the unique needs of RERRAs, MISO has committed to address RERRAs

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<sup>2</sup>    *Queue Improvements Cap Proposal* (October 16, 2024),  
      [https://cdn.misoenergy.org/20241016%20PAC%20Item%20006b%20Cap%20Proposal%20\(PAC-2023-1\)653144.pdf](https://cdn.misoenergy.org/20241016%20PAC%20Item%20006b%20Cap%20Proposal%20(PAC-2023-1)653144.pdf).



1 in a separate, newly proposed Expedited Resource Adequacy Study (“ERAS”) process.<sup>3</sup>

2 This new process will expedite the approval process of new generation needed to address

3 state resource adequacy goals.<sup>4</sup> Second, addressing the Commission’s earlier concerns

4 regarding uncapped exemptions, MISO updated its queue cap formula to note that

5 approved exemptions will be included in the number of Interconnection Requests needed

6 to reach the 50% cap number. Put another way, approved exemptions will count towards

7 the total MW queue cap of a given region. Third, any exemption must be elected at the

8 time the interconnection application is submitted. This ensures the efficient

9 implementation of the processing of the exemptions, less volatility in establishing the

10 queue cap, and increases the levels of communication between MISO and stakeholders

11 regarding when the queue cap is met. Finally, MISO is modifying the Provisional

12 Generator Interconnection Agreement (“PGIA”) exemption to stipulate that the PGIA

13 exemption must be requested at the time of application. MISO determined that mandating

14 an executed PGIA made it extremely difficult for Interconnection Customers to utilize this

15 exemption for the reasons outlined above. Additionally, Interconnection Customers with

16 a requested PGIA have assumed additional risks when their request for PGIA is made.

17 While they are similarly situated to Replacement Generating Facilities or ERIS to NRIS

18 conversions, MISO addressed PGIA specific concerns, such as when an Interconnection

19 Customer can revert to non-provisional status.

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<sup>3</sup> See *Expedited Resource Adequacy Study (ERAS) Introduction* (November 13, 2024), [https://cdn.misoenergy.org/20241113%20PAC%20Item%2009%20Expedited%20Resource%20Adequacy%20Study%20\(ERAS\)%20Introduction660245.pdf](https://cdn.misoenergy.org/20241113%20PAC%20Item%2009%20Expedited%20Resource%20Adequacy%20Study%20(ERAS)%20Introduction660245.pdf);

<sup>4</sup> See *Expedited Resource Adequacy Study (ERAS) Workshop* (November 18, 2024), [https://cdn.misoenergy.org/20241118%20Expedited%20Resource%20Adequacy%20Study%20\(ERAS\)%20Workshop661622.pdf](https://cdn.misoenergy.org/20241118%20Expedited%20Resource%20Adequacy%20Study%20(ERAS)%20Workshop661622.pdf).

1 **Q. PLEASE DESCRIBE WHY THE EXEMPTIONS, SITE CONTROL AND**  
2 **PAYMENTS ARE NOW REQUESTED WITH THE APPLICATION SUBMITTAL.**

3 **A.** Following the Commission's Order on its first proposal, MISO reanalyzed its internal  
4 processes on how it would validate Interconnection Requests. MISO determined it was  
5 administratively inefficient to allow Interconnection Customers to retroactively request  
6 priority project status. Retroactive requests undermine the assertion that a project is truly  
7 a priority project. Retroactive requests can also unfairly game the limitation on a queue  
8 cycle. For example, under MISO's previous proposal, if a project learns that it will not be  
9 under the queue cap, then it could retroactively propose to enter into a PGIA in order to  
10 gain access to the next queue cycle. Under the previous proposal, that same project could  
11 later revert to non-provisional status with no penalty. Stakeholders expressed similar  
12 concerns. By adjusting the requirements for when an exemption must be declared and the  
13 requirements to maintain that exemption, MISO levels the playing field for all projects.  
14 These changes will necessitate that Interconnection Customers who want to make use of  
15 the PGIA exemption evaluate its project's feasibility and viability earlier in the process to  
16 determine whether they are willing to be bound by the PGIA commitments that make these  
17 projects more certain and justify their priority inclusion. This approach will allow MISO  
18 to efficiently process and prepare for a given Definitive Planning Phase ("DPP") Cycle.  
19 Additionally, MISO modified its proposal to notify its Interconnection Customers of the  
20 queue cap earlier in the process.

21 **Q. PLEASE SUMMARIZE THE ADDITIONAL STAKHOLDER MEETINGS**  
22 **FOLLOWING THE ISSUES OF THE COMMISION'S REJECTION.**

1    **A.**     MISO re-engaged with the stakeholders and revised its initial cap proposal. The revised  
2           proposal was posted for stakeholder review and discussed in the Interconnection Process  
3           Working Group (“IPWG”) and Planning Advisory Committee (“PAC”) on multiple  
4           occasions. During these discussions, an alternative proposal (“Savion VPE proposal”) was  
5           presented and subsequently voted on by stakeholders at the IPWG. Ultimately, the  
6           alternative proposal didn’t receive enough votes to pass.

7    **Q.     PLEASE DESCRIBE THE BREAKDOWN OF THIS FILING.**

8    **A.**     MISO views the Queue Cap Proposal and the Exemptions to the Queue Cap Proposal as  
9           being two separate, but related, proposals included together in one filing for administrative  
10          convenience and Tariff version control. The Queue Cap Proposal is necessary and  
11          appropriate to address the unsupportable number of Interconnection Requests that MISO  
12          must process. It is a complete proposal in and of itself and does not depend on the approval  
13          of any of the exemptions to be complete or reasonable rate. While the Exemptions to the  
14          Queue Cap Proposal will necessarily depend on the acceptance of the Queue Cap Proposal,  
15          it is severable and a complete proposal. The Exemptions to the Queue Cap Proposal is  
16          intended as a standalone set of enhancements to the Queue Cap Proposal. While it is not  
17          necessary to make the cap function, the exemptions add independent value. Specifically,  
18          they allow the historically limited number of projects that have used PGIAs, sought ERIS  
19          to NRIS conversions, or sought to add additional interconnection service to a replacement  
20          facility to proceed directly into the next queue cycle in acknowledgement of the facts that  
21          these types of projects have proven highly certain given the level of commitment  
22          undertaken or the existing facilities. Even if the Commission determines the Exemptions  
23          to the Queue Cap Proposal does not adequately address the open access concerns identified

1 in its previous order, the state of the queue still necessitates a backstop queue cap to  
2 properly function, and the cap can function without the exemptions. I note that neither I  
3 nor my staff made any promises regarding whether the exemptions should be included in  
4 the cap filing or made any compromises to secure stakeholder support for the Queue Cap  
5 Proposal based on these exemptions. MISO commits to making a subsequent filing with  
6 the Commission to update the Tariff sheets to reflect the most up-to-date versions of the  
7 then-current Tariff provisions and within sixty (60) days of an order on each proposal is

8 **Q. DID MISO ENGAGE THIRD PARTIES TO SUPPORT THE DEVELOPMENT OF**  
9 **THE PROPOSED REFORMS?**

10 **A.** Yes. MISO hired Charles River Associates (“CRA”) in early 2023 to perform an analysis  
11 of the MISO generator interconnection queue and to recommend changes to the process  
12 that would improve the quality of projects entering the queue, as well as MISO’s ability to  
13 provide timely and consistent study results. CRA provided its findings in the stakeholder  
14 process and their final report is included as Exhibit 1 to my testimony (“CRA Report”).

15 **Q. DID MISO ADOPT ALL OF CRA’S RECOMMENDATIONS IN THIS**  
16 **PROPOSAL?**

17 **A.** MISO adopted a significant number of CRA recommendations, with some adjustments.  
18 MISO adjusted the Proposals based on guidance of the Commission’s Order in Docket No.  
19 ER24-341-000. These final proposals reflect the collaborative input from MISO, its  
20 stakeholders, and the additional CRA analysis on the need for a cap. An example of the  
21 CRA recommendation that was not included was to consider an individual developer cap  
22 on proposed projects, in addition to the overall MW value cap. The intent of this CRA  
23 recommendation was to provide a protection mechanism such that smaller developers are

not crowded out of the process by larger developers. This concept potentially could be necessary at some point in the future, but at this time MISO believes there is insufficient evidence to support a per-developer cap in the Queue Cap Proposal as needed.

**Q. HOW DO THESE FILINGS RELATE TO MISO'S COMPLIANCE OBLIGATIONS UNDER ORDER NO. 2023/2023-A?**

**A.** At the time of this submission, MISO submitted its Order No. 2023-2023-A compliance filings pursuant to the independent entity variation requirements set forth in Order No. 2003.<sup>5</sup> If the Commission accepts the proposed revisions, they will become part of the MISO Tariff. The proposal is submitted as a necessary independent entity variation to MISO's compliance with Order No. 2023-2023-A.

**III. THE CURRENT STATE OF THE MISO QUEUE AND**  
**THE CONTINUED NEED FOR A CAP**

**Q. PLEASE DESCRIBE MISO'S INTERCONNECTION QUEUE PROCESS.**

**A.** MISO's generator interconnection queue process generally follows the Commission's *pro forma* Large Generator Interconnection Procedures ("LGIP"), with changes and improvements adopted over the years pursuant to the Commission's independent entity variation. The current framework was put in effect in January 2017 as a result of extensive stakeholder driven reforms, which implemented a novel three-phase DPP structure to study Interconnection Requests, which since has been successfully adopted in some other regional transmission organizations ("RTOs"). MISO uses clusters to study

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<sup>5</sup> See *Standardization of Generator Interconnection Agreements and Procedures*, Order No. 2003, FERC Stats. & Regs. ¶ 31,146 (2003), *order on reh'g*, Order No. 2003-A, FERC Stats. & Regs. ¶ 31,160, *order on reh'g*, Order No. 2003-B, FERC Stats. & Regs. ¶ 31,171 (2004), *order on reh'g*, Order No. 2003-C, FERC Stats. & Regs. ¶ 31,190 (2005), *aff'd sub nom. Nat'l Ass'n of Regulatory Util. Comm'rs v. FERC*, 475 F.3d 1277 (D.C. Cir. 2007), *cert. denied*, 552 U.S. 1230 (2008).



1 Interconnection Requests, with each calendar year producing one or two study clusters,  
2 known as “cycles.” The clusters are studied on a subregional basis and, as I previously  
3 noted, MISO currently has five interconnection queue study regions.

4 **Q. PLEASE EXPLAIN HOW THE THREE-PHASE DPP PROCESS WORKS.**

5 **A.** The DPP structure provides for a sequential process to study Interconnection Requests in  
6 the queue. MISO conducts one System Impact Study (“SIS”) in each of the three DPP  
7 Phases (*i.e.*, Preliminary SIS in DPP Phase I, Revised SIS in DPP Phase II, and Final SIS  
8 in DPP Phase III) to account for project withdrawals and to refine and update the analysis.  
9 Facilities Studies are conducted in DPP Phases II and III. The DPP process also includes  
10 three milestone payments—M2, M3, and M4, and provides for two designated off-ramps—  
11 Interconnection Customer Decision Points I and II (“Decision Points”). The first milestone  
12 payment, M2, is fixed at \$8,000 per MW of Interconnection Service requested and is  
13 payable at entry into the queue. The second milestone, M3, is equal to the greater of twenty  
14 (20) percent of the amount of Network Upgrades identified in the Preliminary SIS less the  
15 amount previously posted as M2 or \$1,000/MW. M3 is due at the end of Decision Point I.  
16 The third milestone, M4, is equal to 30 percent of the amount of Network Upgrades  
17 identified in the Revised SIS less than the amount previously posted as M2 and M3  
18 payments. M4 is due at the end of Decision Point II. These milestones may be partially  
19 refundable upon withdrawal depending on the time of withdrawal and on whether they  
20 increase the Network Upgrade cost to other Interconnection Customers in the same cycle  
21 pursuant to a calculation of financial harm to other Interconnection Customers, as set forth  
22 in Section 7.8 of the GIP (*i.e.*, the “harm test”). The GIP also provides for penalty-free  
23 withdrawals in specified circumstances, as set forth in Section 7.6.2.4 of the GIP, less any

Automatic Withdrawal Penalty that was established in reforms approved by FERC in January 2024.<sup>6</sup> The two off-ramps, Decision Points I and II, each last fifteen (15) Business Days and allow Interconnection Customers to review the study results from the most recent phase, pay the applicable milestone, and decide whether to proceed to the next DPP phase or withdraw from the queue.

**Q. PLEASE DESCRIBE THE CURRENT STATUS OF MISO'S GENERATOR INTERCONNECTION QUEUE.**

**A.** As of October 30, 2024, MISO's generator interconnection queue contained 1,706 active Interconnection Requests comprising of nearly 312 GW of proposed new generator interconnection capacity, which is a considerable backlog. This backlog is spread over all five queue study regions and includes queue cycles going back to 2019. It should be noted that when MISO previously made this cap filing in November of 2023, MISO's generator interconnection queue contained 1,371 active Interconnection Requests comprising nearly 236 GW of proposed new generator interconnection capacity. In contrast, MISO's peak load is only 127.1 GW and, as of December 2023, 191 GW of functioning total installed generation capacity already exists in the MISO Region.

**Q. HOW DOES THE CURRENT QUEUE SIZE COMPARE TO PRIOR YEARS?**

**A.** The current queue size is extraordinary and unprecedented. The most recent queue cycle, DPP-2023, alone is 124 GW. The two immediately preceding cycles, DPP-2022 and DPP-2021, were 170.8 GW and 76.8 GW, respectively. In contrast, the two cycles that started in 2017 following the implementation of the three-phase DPP process, DPP-2017-FEB and

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<sup>6</sup> *Midcontinent Indep. Sys. Operator*, 186 FERC ¶ 61,054 (January 19, 2024).

1 DPP-2017-AUG, were only 30.7 GW, which generally is in line with the average queue  
2 cycle size in 2014-2016. It is important to note that the queue reforms approved by FERC  
3 in January 2024 did result in lower number of submitted projects. DPP-2023 had 30% less  
4 Interconnection Requests submitted than the amount of DPP-2022. However, the 124 GW  
5 in DPP-2023 is still as large as MISO's typical summer peak load. This shows that the  
6 previous reforms were not enough to facilitate a more efficient queue, and a MW cap is  
7 still necessary.

8 **Q. WHAT IS THE CURRENT FUEL PROFILE OF THIS PROPOSED**  
9 **GENERATION?**

10 **A.** Virtually all the proposed generating capacity in the latest queue cycles involves  
11 intermittent and weather-dependent resources, with solar facilities accounting for the lion's  
12 share of those.

13 **Q. WHAT IS THE PERCENTAGE OF PROPOSED GENERATION IN THE MISO**  
14 **QUEUE THAT USUALLY GETS BUILT?**

15 **A.** The CRA Report analyzed queue withdrawals in the latest queue cycles. *See* Exhibit 1 at  
16 7-10. In the most recent completed cycles at the time of the report, DPP-2017-FEB, DPP-  
17 2017-AUG, and DPP-2018-APR, nearly 70% of the total generation capacity that entered  
18 these cycles was eventually withdrawn. *Id.* at 8-9. The remaining approximately 30% got  
19 their GIAs, but the actual MWs of generating capacity that will be constructed and  
20 energized will be less than 30% due to financial and construction stage challenges. Some  
21 of these GIAs have already been terminated, and various delays impacting some of the  
22 remaining GIAs will reduce the number of projects that achieve commercial operation still  
23 further.

1    **Q.    DO YOU EXPECT THE CURRENT QUEUE TRENDS TO CONTINUE?**

2    **A.**    Yes. I expect the queue to continue to grow in the next several years, with the bulk of the  
3           new proposed generating resources continuing to be intermittent and weather dependent.

4    **Q.    WHAT IS THE BASIS FOR YOUR EXPECTATION?**

5    **A.**    I attribute this trend to growing customer demand for renewable generation, the  
6           considerable financial incentives for renewable generation implemented in the  
7           *Infrastructure Investment and Jobs Act of 2021* and the *Inflation Reduction Act of 2022*,<sup>7</sup>  
8           and the backbone transmission MISO has approved, and plans to approve, through our  
9           Long Range Transmission Planning (“LRTP”) effort. In July 2022, the MISO Board of  
10          Directors approved the first tranche of LRTP projects worth an estimated \$10.3 billion of  
11          regional transmission facilities, which will provide access to the MISO grid for many new  
12          renewable resources. MISO anticipates a second tranche of projects to be approved in  
13          December 2024, currently estimated at \$21.8 billion and known as LRTP Tranche 2.1.  
14          These contributing factors make a growth in Interconnection Requests very likely, and it  
15          is critical to implement the proposed reforms to ensure that MISO can manage the  
16          continuing growth.

17   **Q.    IF THE MAJORITY OF INTERCONNECTION REQUESTS IN THE QUEUE**  
18          **WITHDRAW, WHY IS THE CURRENT QUEUE GROWTH PROBLEMATIC?**

19   **A.**    The increasing number and volume of speculative Interconnection Requests in the queue  
20          strains MISO’s resources and ability to process Interconnection Requests in accordance  
21          with the Commission’s timing requirements and causes delays in the completion of  
22          required Interconnection Studies. This leads to increasing withdrawals, less certain DPP

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1 Phase I and II study results, and ultimately, uncertainty and delays for all Interconnection  
2 Customers in the queue. Currently, queue delays are one of the largest contributing factors  
3 that negatively impact Interconnection Customers' ability to timely execute a GIA and,  
4 potentially, receive timely capacity accreditation under MISO's Resource Adequacy  
5 construct. Although cluster studies allow for multiple Interconnection Requests to be  
6 studied together, many administrative tasks required to process the queue are performed  
7 on an individual Interconnection Request basis. Such tasks include application processing  
8 to review modeling data, Site Control, and financial security and certain other tasks. Also,  
9 each Interconnection Request usually has one POI that requires its own individual studies,  
10 and each GIA is negotiated and executed individually.

11 Furthermore, independent from these timing challenges, the growth of the interconnection  
12 queue jeopardizes the ability of Interconnection Customers to receive study results that  
13 reflect actual system impacts, and the costs needed to mitigate them, especially in earlier  
14 phases of the DPP. To capture the actual impact of an Interconnection Request on the  
15 Transmission System, MISO must study that Interconnection Request at its full output,  
16 according to fuel-based dispatch assumptions, to establish the Network Upgrades needed  
17 to accommodate that request. Because a project is allowed to operate up to the service  
18 levels specified in its GIA, failure to capture the impacts of operating at such a level would  
19 artificially understate the impact of that project. This, in turn, can lead to overloads and  
20 other reliability cost problems if not mitigated, and cause cost shifts if the mitigations are  
21 identified in later studies for other projects. Thus, it is important to capture the full impact  
22 of a proposed project in an Interconnection Study. However, this becomes increasingly  
23 challenging when the amount of generation proposed in a queue cycle begins to exceed



1 projected peak load. Proposed generating facilities do not exist in a vacuum on MISO's  
2 system. In addition to what is proposed in a given queue cycle, there is existing generation  
3 already in commercial operation on the Transmission System and higher queued projects  
4 whose output must be accounted for in studies for new Interconnection Requests. When  
5 the total of this generation far exceeds load, MISO must use assumptions in order to  
6 develop a valid mathematical solution that will allow for a model that studies new  
7 generation at its authorized output while still sinking that power in the MISO region. MISO  
8 has some limited flexibility in model building to address these problems. However, the  
9 larger the queue size, the more aggressively MISO must adjust its assumptions to allow the  
10 model to solve (*i.e.*, to balance generation and load). Past a certain point, these assumptions  
11 begin to diverge sufficiently from reality and the model is no longer modelling how  
12 MISO's Transmission System and generation resources are expected to behave. The  
13 results of a study built on such models have diminished value because some existing  
14 generation will continue to dispatch well above the artificially lowered assumptions  
15 resulting in reliability issues on the Transmission System that were not studied. This, in  
16 turn, will require new studies in the interconnection process or in annual transmission  
17 planning studies resulting in potential cost shifts to future Interconnection Requests or to  
18 load, which creates risks and cost uncertainty for both existing and future projects, can lead  
19 to reliability issues on the Transmission System, and ultimately delays in deploying new  
20 generation. In short, assumptions diverging from expected conditions is a necessary result  
21 of study clusters that are too large to study under realistic system conditions, particularly  
22 when populated with increasing numbers of speculative Interconnection Requests. And,  
23 while Interconnection Customers will receive some "results" from these studies, those

1 results have a diminished value and, will ultimately cause more risk to the Transmission  
2 System and Interconnection Customers than study results based on cluster sizes that allow  
3 for realistic assumptions to be used.

4 **Q. HAS MISO ATTEMPTED TO ADDRESS THESE CHALLENGES WITHOUT**  
5 **LIMITING ITS QUEUE SIZE ?**

6 **A.** MISO is continuously striving to improve its GIP. Following the introduction of the three-  
7 phase DPP in 2017, MISO made several targeted efforts to improve various aspects of the  
8 DPP process, such as milestone and penalty provisions, Site Control requirements,  
9 expedited processing options and other improvements, as summarized in the transmittal  
10 letters accompanying the MISO filings in the dockets. Nonetheless, no material changes  
11 have been made to the milestone amounts and penalty-free withdrawal provisions since  
12 2017. Accordingly, the new challenges that have recently arisen require an urgent response  
13 and change to those GIP requirements. Additionally, MISO submitted and received  
14 approval for a set of queue reforms in early 2024 regarding increased financial payments  
15 and penalties along with increased site control requirements.

16 **D. TRANSITION PROVISIONS**

17 **Q. IS MISO PROPOSING ANY TRANSITION PROVISIONS FOR THE REFORMS**  
18 **INCLUDED IN THE GIP IMPROVEMENTS FILING?**

19 **A.** Yes, the transition provisions are included in proposed section 5.11 of the GIP. Generally,  
20 the proposed reforms will apply only to Interconnection Requests submitted in study cycles  
21 with application deadlines after the effective date of the reforms, starting with the DPP  
22 2025 cycle. All preceding cycles will be exempt from the proposed changes.

23

IV. THE NEW CAP FILING

**Q. PLEASE DESCRIBE THE UPDATED PERCENTAGE-BASED CAP MECHANISM.**

**A.** The percentage-based load nature of the cap ensures that the studies are appropriately scaled to consider existing generation, new Interconnection Requests, and the load MISO serves while still enabling competition. The new queue cap formula is noted below:

$$MISO \text{ study region cap} = 50\% * \text{study region non-coincident summer peak}$$

The proposed cap formula will be 50% of the non-coincident summer peak values for each study region from the power flow model that will be used to perform the queue studies. MISO will use the most recent available MTEP model series. Open access is maintained as Interconnection Requests that are included in the cap are based on the timing of their request. This formula will ensure more reasonable study volumes and subsequently result in more certain study outcomes. The new proposed cap formula differs in three ways from the rejected cap formula. First, the new proposed cap formula uses non-coincident summer peak values while the original cap formula used non-coincident shoulder peak values. Second, the old cap formula utilized the Pmin value as floor to which existing generation can be turned down to accommodate to generation. The new cap formula does not. Finally, the old cap formula adjusted for estimated withdrawals and exemptions. MISO will review the need for a queue cap after three (3) years.

**Q. WHY IS IT REASONABLE TO REQUIRE A 50% QUEUE CAP?**

**A.** The 50% queue cap is reasonable because it allows MISO to balance the appropriate level of the interconnection queue size to ensure that Interconnection Requests are processed efficiently, increasing certainty for active projects and reduces the risk of future cost shifts,

while also addressing the base load needs of each study region. After numerous rounds of internal analysis, MISO determined that 50% of the non-coincident peak best strikes that balance. The analysis entailed performing iterative model builds at a reduced non-coincident peak value until the model could be built and solved without the need for Backbone Network Upgrades or needing exports to neighboring systems. This threshold was met at 50%. Backbone Network Upgrades are an indication that the model, before taking any contingencies, is in such a state that the power flow can't be solved without the addition of Network Upgrade(s). Typically, this is an indication of voltage collapse. Similar, exports to neighbors are indication of further Affected System costs. The internal analysis recommended that the appropriate level of the queue cap as well would be 50%. This would balance out the backbone upgrades to a reasonable level where it is appropriate to obtain a usable model and run the DPP studies from. MISO provides the results below based on that internal analysis:

| <b>Power flow model</b> | <b>Total GW of Queue Projects</b> | <b>% of Non-Coincident Peak Load</b> | <b>Backbone Network Upgrades</b> | <b>Export to Neighbors (GW)</b> |
|-------------------------|-----------------------------------|--------------------------------------|----------------------------------|---------------------------------|
| 2022 Cycle test cases   | 67.6                              | 50%                                  | 0                                | 0                               |
| 2022 Cycle test cases   | 80.9                              | 60%                                  | 0                                | 0                               |
| 2022 Cycle test cases   | 84.3                              | 63%                                  | 0                                | 10.2                            |
| 2022 Cycle test cases   | 90.9                              | 68%                                  | 1 Transmission line              | 12.2                            |
| 2022 Cycle test cases   | 95.9                              | 72%                                  | 1 Transmission line              | 15.0                            |

|                      |       |      |                                                      |      |
|----------------------|-------|------|------------------------------------------------------|------|
| 2022 Cycle Kickoff   | 142.0 | 106% | 21.5 GVAR of voltage support                         | 6.4  |
| 2022 Cycle Prescreen | 177.0 | 132% | 3 Transmission lines<br>42.5 GVAR of voltage support | 10.3 |

As noted in the chart, while the 60% test case did eliminate the need to make Backbone Network Upgrades under the previous formula, MISO also accounted for shoulder peak load and Pmin evaluation, which are no longer accounted for in the newly proposed queue cap formula. Based upon this evidence, MISO elected to move forward with the 50% cap value. This new formula represents a balance between MISO's need to efficiently manage the queue while also addressing regional load needs and open access concerns.

**Q. WHY ARE THE PROPOSED CAP CHANGES STILL NECESSARY AND URGENT GIVEN THE EARLIER APPROVED QUEUE REFORMS?**

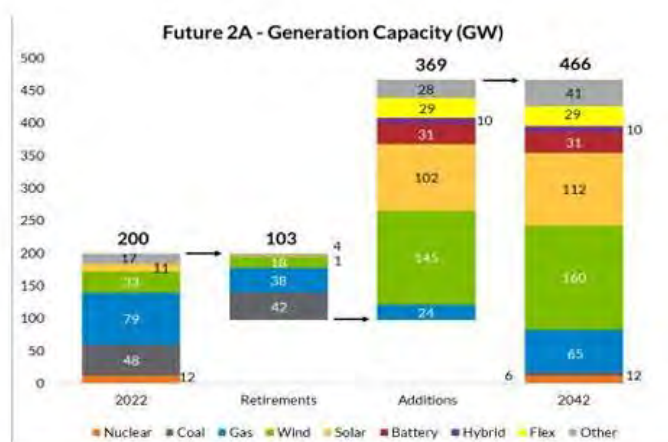
**A.** While MISO noted that the increased GIP financial commitments and penalties along with updated site control evidence requirements that were approved in early 2024 resulted in a 30% reduction of "uncertain" interconnection applications from the previous cycle, it still represents a large number of projects for the team to study. Adding in the 2023 study cycle, MISO's current interconnection queue is sitting at roughly 312 GW. To put this into more context, MISO's all-time system peak load is 127 GW. Even with notable reductions of interconnection applications, the current interconnection service proposed in the queue is more than twice the all-time system peak load. This only further demonstrates purely qualitative improvements do not sufficiently increase in the queue size and ability to efficiently manage that queue. A MW limitation on individual interconnection queue



cycles will ensure that MISO can continue to produce more realistic resource dispatch, models, reduce queue timelines and produce lower Interconnection costs and therefore improving the success rate of the Queue, thereby increasing overall certainty in the interconnection queue. Additionally, MISO notes that the application portal is currently open and available for projects to be submitted into the next available study cycle; the cap is needed urgently to ensure that the appropriate balance of interconnection requests is processed in that study cycle.

**Q. PLEASE DESCRIBE HOW THIS NEW PROPOSED CAP ADDRESSES THE COMMISSIONS EARLIER CONCERNS REGARDING FUTURE RESOURCE ADEQUACY NEEDS?**

**A.** MISO re-engaged with its stakeholder to develop a proposal that would adequately address future adequacy needs. Per FERC’s guidance, MISO reviewed the Future Planning Scenarios developed in conjunction with the Transmission Planning process(“Futures”). MISO calls these scenarios “Futures,” and they help MISO envision a set of possible resource adequacy outcomes up to twenty (20) years in the future. The scenarios establish a bookended range of economic, policy, and technological possibilities—such as load growth, electrification, decarbonization, renewable energy levels, generator retirements, fuel prices, and generation capital costs. The Futures hedge uncertainty by utilizing stakeholder information, policy direction, industry trends, and capacity expansion modeling to create the forecasts. Futures are updated with new or changing information. In reviewing the Futures 2A Planning Scenario, it was noted that 248 GW of Net Additions would be needed in the years 2025-2042 (17 years):



Taking this into account, MISO compared how the cap would impact this forecasted need.

|                                               |         |
|-----------------------------------------------|---------|
| Active Interconnection Requests in the Queue8 | 321 GW  |
| Assumed completion rate of 21%                | 67.4 GW |
| Proposed Queue Cap                            | 68 GW   |
| Per Year additions (21% completion rate)      | 14.3 GW |

Per the CRA report, using a historical completion rate of 21%, MISO estimates per year additions of 14.3 GW. From 2025 to 2042 and adding to the existing active Interconnection Requests already in the queue, this equates to 310 GW. Based on this analysis MISO believes there will be adequate throughput even with the cap to meet our future Resource Adequacy needs even with a queue cap of 50% of the non-coincidental peak load.

1   **Q.   PLEASE DESCRIBE HOW THIS NEW PROPOSED CAP FORMULA**  
2       **ADDRESSES THE COMMISSIONS EARLIER CONCERNS REGARDING**  
3       **EXEMPTIONS?**

4   **A.**   While limited in use given their inherent nature that minimize their submittals, MISO has  
5       found that projects related to increases in replacements, ERIS to NRIS conversions and  
6       PGIAs tend to reflect a greater commitment of the Interconnection Customer to the project  
7       and a lower withdrawal rate, leading to a greater level of certainty, given they are  
8       comprised of instances where an Interconnection Customer seeks to add incremental new  
9       service to an existing generating facility or have committed to a higher level of financial  
10      commitment. Given this criterion of existing generation facilities, MISO anticipates the  
11      continued limited use of these exemptions based on the inherent practical nature of these  
12      products that have historically limited their submittals. Additionally, in rejecting MISO's  
13      initial cap filing, citing the RERRA exemption, FERC noted an "uncapped exemption"  
14      potential that might undermine the benefits of having a cap in place. MISO ultimately  
15      found that the RERRA exemption engendered strong criticism from the stakeholders and  
16      the Commission, and the filing was ultimately rejected. Under the current proposal, MISO  
17      is amending Section 4.1.2 of Attachment X to remove the RERRA exemption. MISO has  
18      recognized that this as a more distinct queue issue that should be addressed in a separate  
19      filing. MISO has committed to working on addressing the needs of RERRA entities  
20      through a newly proposed ERAS process that will expedite the approval process of new  
21      generation needed to address resource adequacy. Furthermore, MISO has updated the cap  
22      formula to note that approved exemptions will be included with all projects that are used  
23      to meet the cap limit.

1    **Q.    DID CRA RECOMMEND A QUEUE CAP?**

2    **A.**    Yes. In fact, the CRA Report recommends two separate caps: (1) a queue cap per cycle;  
3            and (2) a per developer cap. *See* Exhibit 1 at 17-18. The CRA Report views a queue cap  
4            as a critical remedy to address the challenges outlined in my testimony. CRA  
5            recommended that MISO determine the level of the queue cap as well as its application  
6            across study regions, queue cycles and potentially individual entities. *Id.* at 17. The CRA  
7            Report further suggested that the following criteria could be considered in designing an  
8            appropriate queue cap: (1) peak load and forecasted peak load, (2) installed capacity,  
9            guaranteed additions, and expected retirements, and (3) reliability and resource adequacy.  
10          *Id.* at 18.

11   **Q.    WHAT ARE THE BENEFITS OF A STUDY CYCLE CAP?**

12   **A.**    The proposed cap will ensure that Interconnection Study results are based on a more  
13            realistic dispatch, thereby removing the need for prohibitively expensive and unrealistic  
14            Network Upgrades. Currently, Interconnection Customers receive realistic and  
15            informative study results only after enough projects exit the queue to achieve a realistic  
16            dispatch. The proposed cap will ensure more realistic and informative study results at an  
17            earlier point in the study process, without the delays and uncertainty caused by withdrawals  
18            after studies are performed with unrealistic Network Upgrade assumptions. The cap  
19            benefits Interconnection Customers by providing better cost estimates and a timelier study  
20            process. As discussed above, the cap also will provide benefits to the engineers performing  
21            these studies by improving their ability to solve these complex models and will reduce the  
22            amount of unnecessary engineering analyses, which are performed on a study model using  
23            unrealistic assumptions.

1   **Q.    WHERE WILL THIS CAP FORMULA BE STATED?**

2   **A.**    MISO will put the queue cap formula in the Tariff. In addition, MISO will post a report to  
3       its website prior to each study cycle describing the cap calculation and results.

4   **Q.    WILL MISO USE THE SAME FORMULA FOR POST-2025 QUEUE CYCLES?**

5   **A.**    MISO will continue to work with stakeholders to determine if the calculation should be  
6       modified for future cycles. MISO purposely used a simple calculation that more than  
7       adequately meets regional load needs. MISO also has committed to revisiting its cap-  
8       related Tariff provisions in three (3) years. MISO is willing to either provide an  
9       informational report discussing the effectiveness of these provisions after the third cluster  
10      study cycle or propose changes in a subsequent FERC filing based on the accumulated  
11      experience.

12 **Q.    HOW WILL MISO PROCESS APPLICATIONS ONCE THE CAP IS**  
13 **ESTABLISHED?**

14 **A.**    Once the cap amount has been calculated and posted, MISO will process the applications  
15       using a serial “first-come, first-served” approach based on when the applications were  
16       queued during the open application window. MISO will subsequently review the  
17       interconnection applications until the cap amount is reached. This process will provide an  
18       incentive to submit an Interconnection Request earlier in the open application window as  
19       opposed to right up until the application deadline as is often the case today. In addition,  
20       this process will have the added effect of “flattening the curve” for application submittals,  
21       *i.e.*, the projects would enter the queue when they are ready rather than wait until the last  
22       moment, thereby allowing MISO to manage the study cycle more efficiently. Meaning we  
23       expect projects to enter the queue when they are ready and will meet all necessary



1 requirements to secure their spot. MISO recognizes that this flattening of the curve will  
2 not hold true for the 2023 cycle, as it is expected that most applications will be submitted  
3 on the first day that MISO opens the web-based application tool to accept new applications.

4 **Q. CAN YOU PLEASE EXPAND ON WHAT HAPPENS TO THOSE**  
5 **INTERCONNECTION REQUESTS THAT FOUND TO BE “OVER THE CAP”?**

6 **A.** Interconnection Requests that are processed after the cap has been met will continue  
7 to be evaluated by MISO to ensure they are valid requests, including necessary items such  
8 as milestones, Site Control, and modeling data. Once approved as valid, these  
9 Interconnection Requests will remain in the queue and will be studied in the next available  
10 queue cycle. Therefore, all Interconnection Customers, even those that are "above the cap",  
11 have comparable access to the interconnection process. A subset of the Interconnection  
12 Requests, i.e., those submitted closest to the time when the cap was met, can potentially  
13 replace projects that withdraw up to 30 days before the start of the DPP process. If a project  
14 that was under the cap withdraws, then MISO will pull the first project in the next cycle  
15 forward. This will be done up until the model needs to be built for the pre-screening  
16 analysis, which is 30 days before the start of the DPP process. This will allow 15 days to  
17 develop the model and post the pre-screening results, and then another 15 days for  
18 Interconnection Customers to review the analysis and determine if they should withdraw  
19 or remain in the queue and be included in the DPP process. Any dropouts that occur  
20 between the window when the pre-screening model is being developed and the start of the  
21 DPP process will not be replaced.

22

23

1   **Q.     CAN INTERCONNECTION REQUESTS IN THE QUEUE THAT ARE WAITING**  
2       **FOR THE NEXT CYCLE BE MODIFIED?**

3   **A.**    Yes, these Interconnection Requests will be able to make all the modifications allowable  
4       per section 4.4 of the GIP, which could include, but are not limited to: POI changes, MW  
5       reduction, removal of one fuel source for hybrids. Once these Interconnection Requests  
6       are included in a DPP study cycle, any changes will be evaluated as a potential material  
7       modification per Section 4.4.

8   **Q.     WILL DEVELOPERS KNOW THE MAXIMUM AMOUNT OF MEGAWATTS**  
9       **THAT CAN BE SUBMITTED IN A GIVEN QUEUE CYCLE?**

10  **A.**    Yes, the MW value for each DPP study cycle will be posted on the MISO public website  
11       at least ten (10) Business Days prior to the application deadline of that Definitive Planning  
12       study cycle. Additionally, MISO will post an associated whitepaper to the MISO public  
13       website to inform stakeholders how the cap was developed and set. It should be noted that  
14       as part of this process, MISO will be re-evaluating the formula prior to each study cycle,  
15       including the cap amount and the associated margins. There will be no cap on the number  
16       of individual requests any Interconnection Customer can submit. All applications will be  
17       evaluated against the cap on a “first come, first served” basis. This could result in an  
18       Interconnection Customer having a higher percentage of projects within any given queue  
19       cycle than another. If MISO determines this could create an unfair advantage over other  
20       Interconnection Customers, then MISO will develop an individual cap per Interconnection  
21       Customer and will file that tariff change with FERC for future queue cycles.

22

23

**Q. IS MISO PROPOSING ANY EXEMPTIONS FROM THE QUEUE CAP?**

**A.** Yes. MISO recognized in the early stages of development of its queue reform proposals the importance for a narrow set of Interconnection Requests to be included in a cycle if they already have an existing Generating Facility or Interconnection Service in place or otherwise exhibit a high level of certainty. These proposed exemptions are set forth in Section 4.1.2 of the GIP and include: 1) Interconnection Requests involving an increase in the capacity of an approved Replacement Generating Facility; (2) Interconnection Requests involving a conversion of ERIS into NRIS; (3) Interconnection Requests involving a Generating Facility with a requirement to request a PGIA. MISO initially proposed that these projects be exempt from the queue size limitations and other aspects of the initial proposal. In consideration of the concerns highlighted by the Commission, these projects will no longer be exempt from the queue cap limitations. However, as described herein, these projects will be exempt from certain requirements that will allow these exemptions to receive first access to the cycle for which it applies. Exemption requests must be submitted with their application submittal.

**Q. PLEASE EXPLAIN THE REPLACEMENT FACILITY EXEMPTION.**

**A.** Under the Tariff, Replacement Generating Facility requests generally are processed outside the interconnection queue. One exception to this process is when a Replacement Generating Facility requires Interconnection Service (in MW) in excess of that of the Existing Generating Facility that is being replaced. In such instances, the Replacement Generating Facility is allowed to generate up to the existing Interconnection Service of the Existing Generating Facility. However, an Interconnection Request associated with the excess MW value must proceed through the regular DPP cycle procedures. The proposed

1 exemption is for such excess capacity requests. Such requests are highly valuable to the  
2 MISO Transmission System because they are certain: the Replacement Generating Facility  
3 was already approved through the replacement process and exists under an executed  
4 replacement GIA.

5 **Q. PLEASE EXPLAIN THE ERIS TO NRIS CONVERSION EXEMPTION.**

6 **A.** The Tariff allows Interconnection Customers to convert their ERIS to NRIS, which is a  
7 higher level of Interconnection Service. The conversion requires submission of an  
8 Interconnection Request and proceeding through the queue. MISO proposes to exempt  
9 such “NRIS conversion” Interconnection Requests from the cap. The rationale is similar  
10 to that for the Replacement Generating Facility exemption discussed above. The  
11 Interconnection Request seeking conversion already has an executed GIA and as such, are  
12 highly valuable to the MISO Transmission System.

13 **Q. PLEASE EXPLAIN THE PGIA EXEMPTION.**

14 **A.** MISO’s Tariff currently includes a process that allows its Interconnection Customers to  
15 enter into a PGIA before the end of the DPP cycle. The PGIA allows limited operation,  
16 based upon the results of available studies. This option allows an Interconnection  
17 Customer with a ready project to connect to the MISO Transmission System and inject  
18 power into the grid before the completion of all studies. The potential downside of the  
19 PGIA is that Interconnection Customers assume the risk of interconnecting prior to the  
20 completion of Network Upgrades being identified through the DPP process. Because  
21 Interconnection Customers with a requested PGIA have assumed additional risks and  
22 commit to proceeding through the DPP cycle regardless of the potential costs of Network  
23 Upgrades, MISO views these types of Interconnection Requests are as certain as existing

1 generation—so long as the ability to revert is limited. Unlike MISO’s current PGIA  
2 process, which allows reversion from provisional to non-provisional status,  
3 Interconnection Customers that claim this exemption will forfeit its ability to revert with  
4 no consequences. Any Interconnection Customer that elects to proceed under the PGIA  
5 exemption and reverts back to non-provisional status will lose all monies and will forfeit  
6 its queue position. This exemption is available to any Interconnection Customer willing to  
7 assume PGIA risks, thus allowing an exception for Interconnection Customers who are  
8 willing to make commitments that a reasonable developer would not undertake for an  
9 uncertain project.

10 **Q. PLEASE EXPLAIN WHY THE RERRA EXEMPTION WAS REMOVED FROM**  
11 **THIS UPDATED CAP FILING.**

12 **A.** In early 2024, MISO and its stakeholders embarked on a joint effort to address the  
13 challenges introduced with the RERRA exemption. MISO engaged in discussions with  
14 stakeholders to identify the challenges associated with the implementation of the RERRA  
15 exemption for the cap. MISO identified several concerns with the original RERRA  
16 exemption process. First, MISO was concerned with how to limit the size of RERRA  
17 exemptions. The RERRA exemptions, unlike the included exemptions, posed a particular  
18 risk to diminishing the value of the cap. Second, multiple stakeholders brought forth  
19 comments regarding the standardization of format and processing of the RERRA  
20 exemptions. Third, MISO further recognized this as a more distinct queue issue that should  
21 be addressed in a separate process. There is a fundamental necessity for a short-term  
22 generator interconnector product to handle direct urgent resource adequacy needs for the  
23 states within the MISO system. Due to these challenges, MISO removed the RERRA



1 exemption from the current filing. However, the importance of RERRAs to the MISO  
2 Transmission System is not lost on MISO. To better respond to the unique needs of  
3 RERRAs, MISO will work with stakeholders on a separate, concentrated effort to address  
4 the unique resource adequacy needs of a RERRA. MISO has committed to working on  
5 addressing the needs of RERRA entities through a new ERAS process that is being  
6 developed with stakeholders now and will more comprehensively address the approval  
7 process of new generation needed to address resource adequacy.

**VI. STAKEHOLDER PROCESS**

9 **Q. PLEASE DESCRIBE THE STAKEHOLDER PROCESS USED TO DEVELOP**  
10 **THIS PROPOSAL.**

11 **A.** MISO engaged in an extensive stakeholder process throughout the development of its  
12 updated queue cap proposal. MISO obtained feedback through the PAC and the IPWG,  
13 conducted dozens of calls with stakeholders across the MISO sectors, and receiving  
14 multiple rounds of formal and informal written feedback. During the stakeholder process,  
15 MISO considered the advantages and disadvantages of multiple approaches for addressing  
16 the identified challenges and risks, collaborating with stakeholders on identifying areas  
17 where flexibility could be increased. MISO revised its initial proposal considerably,  
18 incorporating the input received.

19 The key milestones of the stakeholder process were as follows:

- 20 • January 30, 2024: MISO provided an update to the IPWG regarding FERC's  
21 response on MISO's GIP Improvements and Cap filings, along with next steps.
- 22 • July 23, 2024: MISO presented several updates to the cap proposal to address  
23 FERC concerns with the original filing at the IPWG

- September 3, 2024: MISO provided refined proposal and responded to feedback at the IPWG.
- September 30, 2024: MISO held a special IPWG workshop to review the current proposal and answer stakeholder questions
- October 16, 2024: MISO presented a final package of reforms at the PAC. MISO also introduced its Expedited Resource Adequacy Study proposal.<sup>9</sup>

**Q. WHAT WAS MISO’S RESPONSE TO CONCERNS AND RECOMMENDATIONS FROM STAKEHOLDERS?**

**A.** Stakeholders asked MISO to justify a rationale for the 50% limitation, with some expressing concern that this cap would “arbitrarily” reduce the number of projects that can compete. MISO understands these concerns but notes that the rationale for selecting 50% is to ensure a balance of supply to demand while also addressing the queue administration difficulties MISO faces due to the volume of Interconnection Requests. Without limiting the amount of Interconnection Requests, the interconnection queue will continue to grow at an unsustainable rate, slowing study processes and making results less accurate. MISO supports many of the objectives of the alternative Savion VPE Proposal and is committed to working with stakeholders to incorporate elements of that proposal to meet those objectives.

**Q. IS MISO STILL CONINUING TO IMPROVE QUEUE COORDINATION WITH INTERCONNECTION CUSTOMERS AND TRANSMISSION OWNERS?**

**A.** Yes. In addition to the proposed Tariff changes, MISO has multiple efforts underway to enhance the queue experience. These transparent initiatives will facilitate enhanced

---

<sup>9</sup> ERAS Workshop Citation

1 Interconnection Customer workflow throughout Interconnection Request lifecycle. MISO  
2 is coordinating the development of these enhancements through the stakeholder process.

**VII. CONCLUSION**

4 **Q. IN YOUR OPINION, ARE MISO'S FILINGS JUST AND REASONABLE?**

5 **A.** Yes. This updated cap Filing address certain specific needs that MISO, the Commission  
6 and the stakeholder process identified. To ensure that MISO is on the right track to  
7 resolving its interconnection backlog, MISO requests that the Commission approve this  
8 updated proposal. The proposed new Tariff revisions address the Commissions earlier  
9 concerns and will significantly enhance the GIP by reducing queue delays and by  
10 improving the precision and timeliness of Interconnection Studies and will enable MISO  
11 to take the necessary steps to manage the size of individual cluster studies performed during  
12 the interconnection queue process.

13 **Q. DOES THIS CONCLUDE YOUR TESTIMONY?**

14 **A.** Yes, it does.

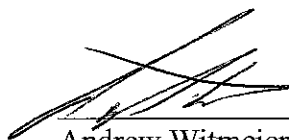
**Affidavit of Andrew Witmeier**

COUNTY OF HAMILTON )

)

STATE OF INDIANA )

Andrew Witmeier, being duly sworn, deposes and states that he prepared the Prepared Direct Testimony of Andrew Witmeier, and the statements contained therein are true and correct to the best of his knowledge and belief.



Andrew Witmeier

SUBSCRIBED AND SWORN BEFORE ME, this 7<sup>th</sup> day of November, 2024.

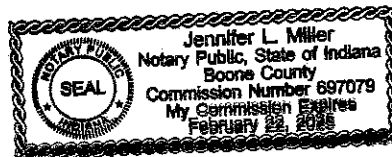
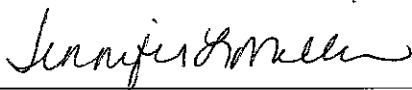


EXHIBIT 1  
TO  
PREPARED DIRECT TESTIMONY OF  
ANDREW WITMEIER



**Prepared for:**

Midcontinent Independent System Operator  
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Carmel, IN 46032

# MISO Generator Interconnection Queue: M2, M3, and M4 Security Deposits and Return Procedures Evaluation and Suggested Adjustments

**Prepared by:**

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Date: September 27, 2023



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## 1. BACKGROUND

The Midcontinent Independent System Operator (MISO) generator interconnection queue has experienced significant growth, leading to a substantial backlog of projects that is negatively impacting MISO stakeholders and interconnection customers. Recognizing this challenge, MISO has undertaken efforts to improve the efficiency of the interconnection queue process and reduce the backlog.

In pursuit of these objectives, MISO has enlisted the expertise of Charles River Associates (CRA) to provide an independent review of current rules for entry to and exit from the interconnection queue. Within the review, we evaluate the security deposits required within the MISO Definitive Planning study process, with a specific focus on the M2, M3, and M4 deposit amounts. The analysis conducted by CRA has relied upon data from the 2017-2022 study cycles, which forms the basis for the charts and recommendations presented in this report.

CRA's historical analysis has concentrated on the volume of interconnection requests, the magnitude of network upgrade costs assessed at different stages of the queue process, and withdrawal rates. These analyses have provided insights into how deposit amounts, policies, and the overall study process can be restructured to enhance the efficiency of the interconnection queue.

## 2. STATE OF THE QUEUE

A prevailing trend observed with respect to the interconnection queue studies published in recent years<sup>1</sup> is the consistent rise in queue sizes, accompanied by prolonged wait times and elevated withdrawal rates.

### 2.1. QUEUE SIZE

Figure 1 illustrates a concerning trend in the MISO queue. For years, the queue remained relatively stable but has inflated significantly in recent years to increasingly unmanageable levels. Comparing the 2022 queue size to the 2017 cycle, the queue has grown by 4.5 times. Moreover, the 2022 queue size, which stands at 170.8 GW, surpasses the all-time MISO summer peak demand of 127.1 GW and approaches the total MISO installed capacity of 192 GW.

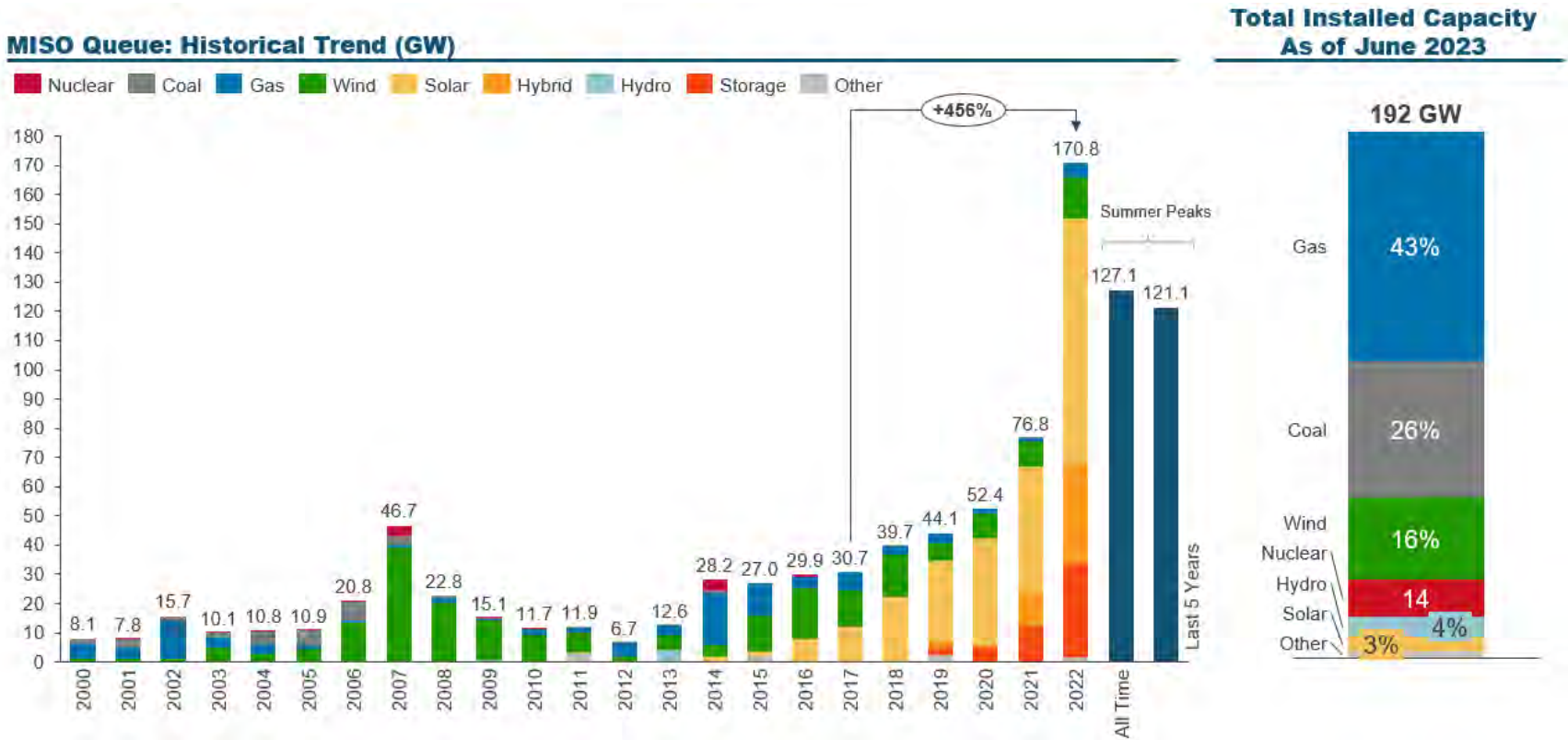
The analysis of the 2022 interconnection queue, as presented in Figure 1, examines the costs associated with bringing all submitted capacity online as installed capacity. Results will likely show that significant costs are required, in the form of network upgrade and affected system costs, to bring all submitted capacity online. This data has been examined to give context to the proposed reforms outlined in this report and to help quantify the suggested magnitudes of deposits required and deposits at risk of forfeiture.

---

<sup>1</sup> For example, "Queued Up: Characteristics of Power Plants Seeking Transmission Interconnection" published by Berkeley Lab <https://emp.lbl.gov/queues>

As a practical matter, a significant portion of the queued generation will not ultimately be placed in service and much of the study effort will, arguably, be wasted.

Figure 1. MISO Queue: Historical Trend (GW)



Source: MISO

## 2.2. QUEUE PHASES, MILESTONES, AND TIMING <sup>2</sup>

The MISO interconnection queue study process is structured into distinct phases and incorporates milestone payments. In the pre-queue phase, interconnection customers (ICs) submit interconnection requests and MISO carries out essential preliminary tasks before commencing a formal study. These tasks include a set of initial screenings and a scoping meeting. A completed application includes an M2 milestone payment of \$4,000 per MW studied.

The MISO Definitive Planning Phase (DPP) follows the pre-queue phase. During this phase, detailed studies and planning activities are conducted to assess the feasibility and impact of the proposed project on the MISO transmission system. The DPP consists of three phases: DPP Phase 1 (DPP 1), DPP Phase 2 (DPP 2), and DPP Phase 3 (DPP 3).

In the initial phase of the Definitive Planning Phase (DPP 1), the interconnection customer receives a comprehensive preliminary analysis of their request's impact on the reliability of the transmission system. During this phase, MISO conducts the initial Model Building and Review, followed by the preliminary System Impact Study (SIS). After completing the analysis, interconnection customers reach Decision Point 1, where they have two options: (1) withdraw their request and potentially be subject to harm calculations (i.e., calculations to determine whether withdrawal shifted cost from the withdrawn project to other projects), with a potential to lose up to 50% of the M2 deposit, or (2) choose to proceed further in the queue process by paying an additional security deposit (M3). The M3 security deposit equals 10 percent of the network upgrade cost, as assessed in DPP 1, minus the M2 deposit.

DPP 2 is designed to provide the interconnection customer with a revised and more detailed analysis of the interconnection project's impact on the reliability of the transmission system after incorporating updated generation assumptions resulting from the withdrawal of interconnection requests during DPP 1. Once the revised SIS and affected system analysis are completed, inclusive of estimated upgrade costs, the interconnection customer enters Decision Point 2. Here, if the interconnection customer decides to withdraw, 100% of the M2 deposit becomes at risk (subject to harm calculations), and 100% of M3 is returned. If the project meets penalty-free withdrawal criteria,<sup>3</sup> 100% of the M2 deposit is returned. If the interconnection customer decides to continue in the queue, they are required to submit an M4 deposit. The M4 deposit equals 20% of the network upgrade cost calculated in DPP 2, minus the M3 and M2 deposits.

DPP Phase 3 is designed to provide ICs with a final, detailed analysis of their interconnection project's impact on the reliability of the transmission system after incorporating updated generation assumptions due to the withdrawals of interconnection requests during Decision Point 2. All milestone deposits (M2, M3, and M4) become at risk and subject to harm calculations upon entry into Phase 3. However, all three deposits may be returned in full upon withdrawal in DPP 3 if the project meets penalty-free withdrawal criteria.

---

<sup>2</sup> Information in this section is based on MISO's Generation Interconnection Business Practices Manual PM-015-r25

<sup>3</sup> Section 7.6.2.4 Withdrawal and refund due to increase in network upgrade costs of Generator Interconnection Procedures



The Generation Interconnection Agreement (GIA) Execution Phase follows DPP 3. For more detail, see MISO's Generator Interconnection Procedures, and Generation Interconnection Business Practices Manual.

We find that in our sample, the average length of the pre-kick off phase is 305 days and the average length of the DPP1 is 298 days, see Figure 2 below.

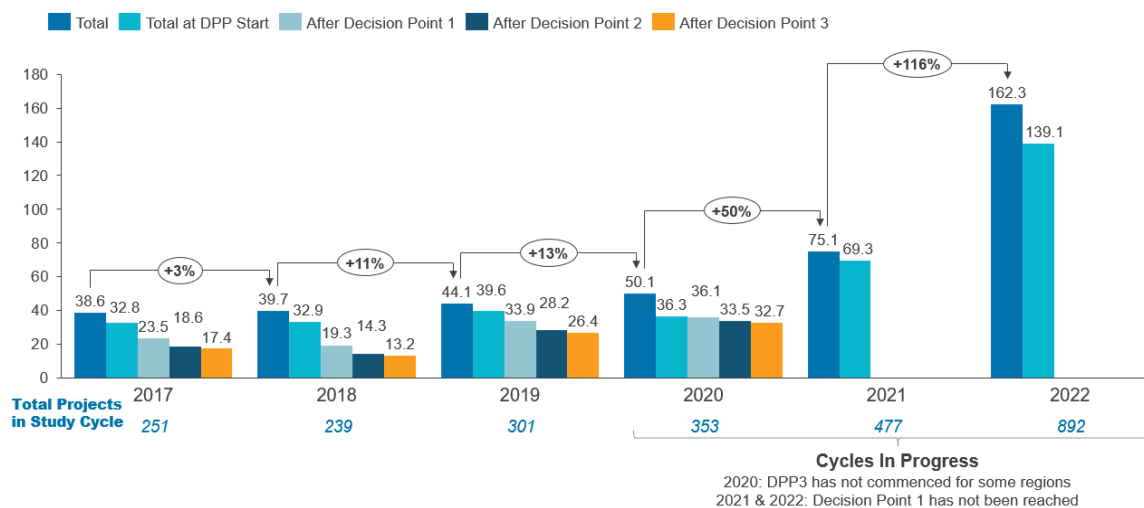
**Figure 2. Days spent in each queue cycle (2017-2022)**

| Queue Phase   | Average # days in phase |
|---------------|-------------------------|
| Pre-Kick-Off  | 305                     |
| DPP 1         | 298                     |
| DPP 2         | 200                     |
| DPP 3         | 187                     |
| GIA Execution | 142                     |

Source: MISO

### 2.3. WITHDRAWALS

Figure 3 further illustrates the year-over-year percentage increase in the size of the interconnection queue along with the dynamics of withdrawals. The queue size has experienced significant growth, with the steepest increase occurring between the 2021 and 2022 cycles, where the queue expanded by 116%. The withdrawals are significant and occur at every stage.

**Figure 3. MISO Queue Withdrawals by Cycle (GW)**

Source: MISO. Note: This figure does not include withdrawals without a specified date.

**Table 1. MISO Queue Withdrawals by Cycle, percentages based on MW withdrawn**

| Status          | Withdrawal Phase           | DPP-2017-<br>AUG | DPP-2017-<br>FEB | DPP-2018-<br>APR | DPP-2019-<br>Cycle | DPP-2020-<br>Cycle | DPP-2021-<br>Cycle | DPP-2022-<br>Cycle |
|-----------------|----------------------------|------------------|------------------|------------------|--------------------|--------------------|--------------------|--------------------|
| Active          |                            | 2%               | 0%               | 0%               | 13%                | 53%                | 88%                | 86%                |
| Done            |                            | 35%              | 26%              | 32%              | 44%                | 6%                 | 0%                 | 0%                 |
| Withdrawn       |                            |                  |                  |                  |                    |                    |                    |                    |
|                 | Pre Kick-off               | 19%              | 1%               | 17%              | 10%                | 28%                | 8%                 | 14%                |
|                 | Decision Point 1 (DPP 1)   | 22%              | 34%              | 34%              | 13%                | 0%                 | 2%                 | 0%                 |
|                 | Decision Point 2 (DPP 2)   | 11%              | 17%              | 13%              | 13%                | 5%                 | 0%                 | 0%                 |
|                 | During DPP Phase 3         | 1%               | 11%              | 3%               | 4%                 | 2%                 | 0%                 | 0%                 |
|                 | During GIA Execution Phase | 8%               | 0%               | 0%               | 0%                 | 1%                 | 0%                 | 0%                 |
|                 | Post GIA                   | 2%               | 11%              | 1%               | 0%                 | 0%                 | 0%                 | 0%                 |
|                 | Withdrawn (Other)          | 0%               | 0%               | 0%               | 2%                 | 6%                 | 2%                 | 0%                 |
| Withdrawn Total |                            | 63%              | 74%              | 68%              | 43%                | 41%                | 12%                | 14%                |

Source: MISO.

Table 1 provides an overview of the percentage of total MW in the queue that has been withdrawn at various stages, including Active and Done<sup>4</sup>. Note that as of now, the 2019-2022 queue cycles remain active. Looking at the fully completed cycles in our sample (2017-2018

<sup>4</sup> Done means the project has completed the interconnection queue process.

cycles), nearly 70% of the total generation capacity that entered these cycles was eventually withdrawn. We observe that a considerable percentage of capacity is withdrawn during the Pre-Kick-off phase. The 2022 Cycle for example, which has not yet reached the DPP Phase, has already had 14% of the initially entered capacity withdrawn. This raises concerns about whether some projects are being entered into the queue speculatively without undergoing proper due diligence. Most of the withdrawn projects exit either before the DPP Start or at Decision Point 1, which highlights the need to incentivize more careful project assessment before entry into the queue.

Next, we examine the withdrawal dynamics based on the relative portion of the queue that each participant holds. The company size is determined by considering the total MW of projects within our sample. Table 2 illustrates the overall share of projects and the withdrawal pattern for the top developers in MISO territory.

According to the data in Table 2, the top 3 companies (as defined by requests to enter into the queue) collectively accounted for 30% of the capacity entered into the 2017 - 2022 interconnection queues. Of all applications submitted by these top 3 companies, 72% were eventually withdrawn. As we expand our analysis to include more companies, the overall percentage of withdrawn applications decreases. In comparison, when considering all companies in the sample, the withdrawal rate was 53%. This observation may imply a greater likelihood of speculative entry among the most active companies.

**Table 2. MISO Queue Withdrawals by Top Interconnection Customers**

|                      | Withdrawn MW<br>2017 – 2020 Cycles                 |                                     | Point of Withdrawal                |                        |                        |                                     |
|----------------------|----------------------------------------------------|-------------------------------------|------------------------------------|------------------------|------------------------|-------------------------------------|
|                      | MW submitted<br>into queue as %<br>of all projects | Out of<br>submitted, %<br>withdrawn | % Withdrawn<br>before DPP<br>Start | % Withdrawn at<br>DPP1 | % Withdrawn at<br>DPP2 | % Withdrawn<br>Phase 3 and<br>after |
| Top 3 Companies      | 30%                                                | 72%                                 | 32.5%                              | 37.8%                  | 22.6%                  | 5.5%                                |
| Top 5 Companies      | 34%                                                | 69%                                 | 36.3%                              | 34.8%                  | 21.6%                  | 5.9%                                |
| Top 10 Companies     | 40%                                                | 68%                                 | 38.4%                              | 32.1%                  | 20.9%                  | 7.4%                                |
| Top 15 Companies     | 43%                                                | 67%                                 | 37.0%                              | 33.4%                  | 20.2%                  | 6.9%                                |
| Top 20 Companies     | 46%                                                | 66%                                 | 38.0%                              | 33.2%                  | 19.3%                  | 7.1%                                |
| Top 25 Companies     | 49%                                                | 67%                                 | 36.4%                              | 32.8%                  | 19.3%                  | 8.6%                                |
| <b>All Companies</b> | <b>100%</b>                                        | <b>53%</b>                          | <b>33.6%</b>                       | <b>31.4%</b>           | <b>19.7%</b>           | <b>11.0%</b>                        |

Source: MISO. Note: figures by row may not sum to 100% due to missing withdrawal dates for some projects.

When we consider the timing of withdrawals, the top companies' withdrawal patterns differ from the broader pool of companies in the sample. The top developers are more likely to withdraw in the initial stages of the process and less likely to withdraw in Phase 3 or beyond. This finding suggests that top companies might have greater resources enabling follow-through and

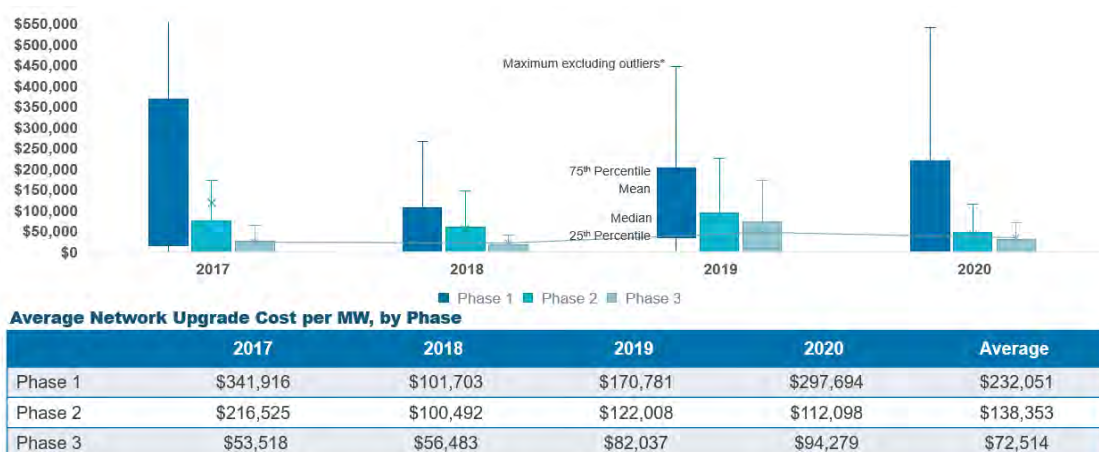
commitment, which explains the lower withdrawal rates at later phases as compared to other companies in the sample.

## 2.4. NETWORK UPGRADE COSTS

In this section, we analyze the network upgrade costs per MW. As previously discussed in Section 2.2, the network upgrade costs are initially calculated in DPP 1, followed by DPP 2, and ultimately finalized in DPP 3. For a comprehensive overview, Figure 4 illustrates the network upgrade costs for the cycles spanning from 2017 to 2020, allowing for a comparison of average costs across the three DPP phases.

The average network upgrade costs in DPP 1 are notably higher compared to those in DPP 2 and DPP 3. This outcome is not surprising, considering the larger size of the initial queue. As projects progress through the phases, many drop out, leading to a more manageable number of projects being analyzed and, consequently, more realistic network upgrade costs. Additionally, the projects with the highest network upgrade costs are expected to drop out first.

**Figure 4. Network Upgrade Cost per MW, by DPP Phase<sup>5</sup>**

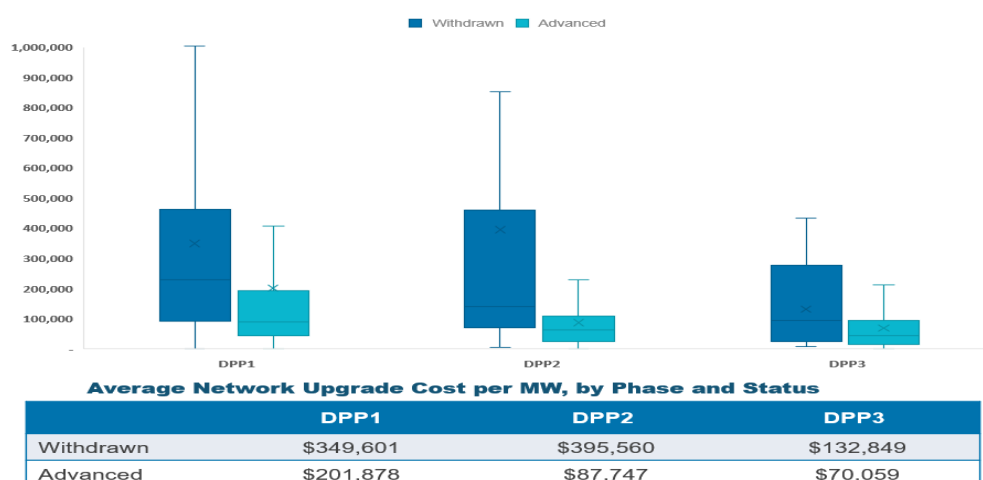


Source: MISO.

<sup>5</sup> A box plot consists of a rectangular "box" that represents the interquartile range (IQR) of the data, (25<sup>th</sup> to 75<sup>th</sup> percentile), and the "whiskers" show the range of the data. Any data points beyond the whiskers are considered outliers and are not shown on this chart.

We observe that the sample mean (marked as 'x') consistently exceeds the median (denoted by a line). This suggests that most of the projects within each plotted distribution have network upgrade costs lower than the average.

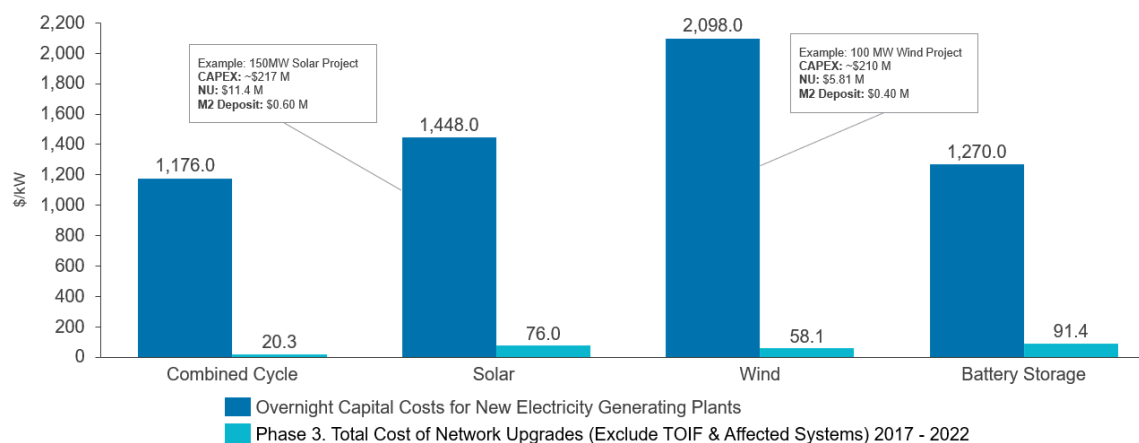
**Figure 5. Network Upgrade Cost per MW, by Phase and Status**



Source: MISO.

Figure 5 presents the aggregate data for the 2017 – 2020 cycles. It illustrates the distinct cost distributions of network upgrades for projects that either proceeded to the subsequent DPP stage or were withdrawn at each respective DPP stage. At Decision Point 1, the average network upgrade cost per MW for a withdrawn project was \$349,601, and projects that advanced to the next stage had an average network upgrade cost of \$201,878. As anticipated, the projects that were advanced tend to, on average, have lower costs compared to those that were withdrawn.

The average network upgrade cost for projects that advanced beyond DPP 1 is notably higher than those advanced beyond DPP 2. This suggests that developers have an understanding that the network upgrade costs are likely to decrease in subsequent phases.

**Figure 6. Network Upgrade Cost per MW vs. CapEx**

Source: MISO (2017-2022 Cycles), EIA AEO (March 2023) [Overnight Capital Costs for New Electricity Generating Plants](#)

Figure 6 illustrates the comparison between the capital costs needed to construct a new generation facility and the average network upgrade costs that the same facility is anticipated to incur for securing interconnection in MISO. The network upgrade costs constitute only a fraction of the overall budget that developers are required to allocate.

This consideration plays a role when discussing incentives to deter speculative entry into the interconnection queue. The accepted economic deterrents for unwanted behavior are penalties. To be effective, penalties should be assessed within the context of overall costs and budgets.

### 3. RECOMMENDATIONS

This section presents our recommendations for MISO queue policies, aiming to achieve the dual goals of reducing the size of the interconnection queue and decreasing the withdrawal rate. Once these challenges are successfully addressed, study times will decrease, leading to enhanced efficiency within the MISO interconnection queue. This improvement will enable MISO to process more projects more quickly than the current situation allows and should result in customers receiving more dependable information with which to make business decisions regarding their projects.

#### 3.1. DEFINITION OF HARM

The interconnection queue within MISO has reached a point where it has become unmanageable at entry, and modeling upgrade costs in the early phases has become unrealistic. Additionally, the frequent dropouts within the interconnection queue create significant uncertainty, making the results of studies unreliable and subject to significant change over the course of the study process. This constant fluctuation requires continual reevaluation, adding complexity to the process. We observed that interconnection requests are withdrawn at every stage, leading to changes in results and even more withdrawals.



Two behavioral aspects behind the problems identified above are (1) speculative entry and (2) frequent withdrawals. The two aspects are intertwined as projects that enter the queue without due diligence regarding readiness and feasibility are more likely to be withdrawn.

Effective preventive measures should be implemented to discourage these harmful behaviors. Creating and enforcing these measures establishes a more responsible environment, minimizing harm. To achieve this, harmful behavior must be clearly defined. Once appropriately defined, it becomes the basis for levying penalties where harmful behavior is proven to exist.

Withdrawals are unlikely to be penalized under the present definition of harm, which is narrowly focused on cost increases to remaining projects due to required Network Upgrades following a project's withdrawal. This definition accounts for situations where shares of required transmission upgrades are allocated to remaining projects after a re-study analysis. However, it may also result in less expensive required transmission upgrades and lower allocated shares, reflecting the stepped nature of upgrade costs as incremental generation capacity is accommodated. Such outcomes do not mean that the remaining projects are unharmed by the withdrawal. On the contrary, they suffer from the additional time required for necessary re-studies and the uncertainty engendered by the constantly changing queue.

Interdependencies among projects and shared information mean that withdrawals inevitably impact other projects through delays and increased uncertainty; these two impacts should be recognized as harmful:

**Delays:** The study process is delayed when projects withdraw, and previously identified upgrades may no longer be applicable. This leads to more time required for analysis.

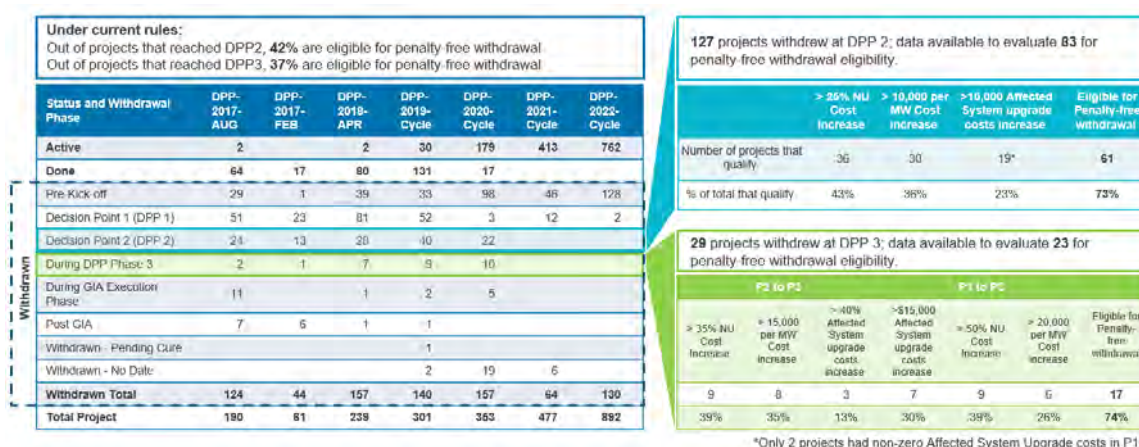
**Uncertainty:** Projects in the queue rely on network upgrade estimates for crucial business decisions, and these decisions are undermined when projects are withdrawn.

Regardless of why a project is withdrawn from the interconnection queue, such withdrawal invariably inflicts some harm on remaining projects. This harm might be quantifiable in monetary terms but is often intangible and can only be described qualitatively.

Besides the measurable harm of increased upgrade costs, the delays and uncertainty inherent in the process argue for a harm penalty. This penalty, even when the harm isn't directly measurable, should escalate with each stage of the process to encourage early decision-making regarding non-viable projects. The presence of such a penalty recognizes that harm extends beyond mere dollars and cents, encompassing broader impacts on the queue's efficiency and reliability.

### **3.2. PENALTY FREE WITHDRAWAL ADJUSTMENT**

Penalty-free withdrawal should be eligible only for projects facing a significant increase in total costs. Current MISO rules that allow for penalty-free withdrawal are outlined in Section 7.6.2 Refunds of Definitive Planning Phase Milestones (M2, M3, M4) of the Generator Interconnection Procedures (GIP). Figure 7 below summarizes our analysis of the penalty-free withdrawal rules.

**Figure 7. Penalty-free withdrawal rules application**

Source: MISO

The penalty-free withdrawal procedure is based on a comparison between the previously estimated network upgrade cost within the same cycle and the new estimates. As such, this procedure is only applicable at Decision Point 2 and when the DPP3 cost estimates become available.

Current rules allow for a broad set of circumstances to qualify. For example, projects that experience a significant decrease in network upgrade costs may still qualify if affected systems costs increase. This is one of the key reasons why penalty-free withdrawals apply to a large number of projects in the queue. For example, 42% of all projects that reached DPP2 are eligible for penalty-free withdrawal, and 37% of all projects that received network upgrade costs in phase 3 are eligible for penalty-free withdrawal in that phase.

Simple and efficient rules ensure that only projects facing significant increases in overall costs qualify for penalty-free withdrawal. We suggest streamlining the rules and applying only a percentage increase in combined network upgrade and affected systems costs from DPP1 to DPP2 or DPP2 to DPP3. That is, streamline rules to allow penalty-free withdrawal if:

Combined NU + AS cost increased by 50% from P1 and P2 (1)

Combined NU + AS cost increased by 35% from P2 and P3 (2)

The suggested thresholds of 50% and 35% are selected using data in Table 3 below. First column in Table 3 is the threshold, second shows the % of projects that reached DPP2 that would be eligible for penalty free withdrawal under (1) above, and the third column shows the % of projects that reached DPP3 eligible for withdrawal penalty-free withdrawal under (2) above.

At the suggested threshold of 50% cost increase from P1 to P2, 30% of all projects that reached DPP2 would be eligible for penalty-free withdrawal. At the suggested threshold of 35% cost increase from P2 to P3, 20% of all projects that reached DPP3 would be eligible for penalty-free withdrawal.

**Table 3. Sensitivity of Withdrawal Eligibility to NU + AS Threshold**

| Combined NU + AS<br>% Increase Threshold | P2 to P1:<br>% of Projects that Reached<br>DPP2 Eligible for Withdrawal | P3 to P2:<br>% of Projects that Reached<br>DPP3 Eligible for Withdrawal |
|------------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------------------------------|
| 10%                                      | 43%                                                                     | 27%                                                                     |
| 20%                                      | 37%                                                                     | 22%                                                                     |
| 25%                                      | 36%                                                                     | 21%                                                                     |
| 30%                                      | 34%                                                                     | 20%                                                                     |
| 35%                                      | 33%                                                                     | 20%                                                                     |
| 40%                                      | 31%                                                                     | 18%                                                                     |
| 45%                                      | 31%                                                                     | 16%                                                                     |
| 50%                                      | 30%                                                                     | 15%                                                                     |
| 55%                                      | 29%                                                                     | 14%                                                                     |
| 60%                                      | 29%                                                                     | 13%                                                                     |
| 65%                                      | 27%                                                                     | 13%                                                                     |

Source: MISO

### 3.3. M2, M3 AND M4 ADJUSTMENTS

We recommend that MISO adjusts M2, M3, and M4 deposits to better reflect potential harm caused by a withdrawal at each study phase.

In The M2 deposit should be more representative of the final NU payment and significant enough to discourage speculative behavior. To aid our analysis of the appropriate deposit we consider average per MW costs in each phase of DPP cycle. We consider a range of 15% to 25% of the average NU cost in Phase 3 to determine a reasonable value range for the M2 deposit amount.

**Table 4. Network Upgrade Costs<sup>6</sup>**

| Study Cycle                    | Average of NU Cost per MW, Phase 1 | Average of NU Cost per MW, Phase 2 | Average of NU Cost per MW, Phase 3 | 15% of NU Cost in Phase 3 | 20% of the NU Cost in Phase 3 | 25% of NU Cost in Phase 3 |
|--------------------------------|------------------------------------|------------------------------------|------------------------------------|---------------------------|-------------------------------|---------------------------|
| DPP-2017-AUG                   | \$177,999                          | \$118,107                          | \$53,583                           | \$8,038                   | \$10,717                      | \$13,396                  |
| DPP-2017-FEB                   | \$840,358                          | \$521,006                          | \$53,247                           | \$7,987                   | \$10,649                      | \$13,312                  |
| DPP-2018-APR                   | \$101,703                          | \$100,492                          | \$56,483                           | \$8,472                   | \$11,297                      | \$14,121                  |
| DPP-2019-Cycle                 | \$170,781                          | \$122,008                          | \$82,037                           | \$12,306                  | \$16,407                      | \$20,509                  |
| DPP-2020-Cycle                 | \$297,694                          | \$112,098                          | \$94,279                           | \$14,142                  | \$18,856                      | \$23,570                  |
| <b>Total In-Sample Average</b> | <b>\$232,051</b>                   | <b>\$138,353</b>                   | <b>\$72,514</b>                    | <b>\$10,877</b>           | <b>\$14,503</b>               | <b>\$18,129</b>           |
| <b>Total in-Sample Median</b>  | <b>\$80,624</b>                    | <b>\$70,690</b>                    | <b>\$48,420</b>                    | <b>\$7,263</b>            | <b>\$9,684</b>                | <b>\$12,105</b>           |

Source: MISO

We recommend an increase of the M2 amount from \$4,000 / MW to a value in the range of \$10,000 to \$14,000 / MW.

Deposits should increase at each stage, reflecting harm that occurs with withdrawal at later stages in the study process. Additionally, we suggest that M3 and M4 deposits should never be negative. Negative or zero deposits are not representative of harm that occurs should a project withdraw. We suggest adjusting M3 and M4 formulas to:

$$M3 = \text{Max of } \$1,000 \text{ and } ((10\% * \text{NU}) - M2)$$

$$M4 = \text{Max of } \$1,000 \text{ and } ((20\% * \text{NU}) - M3 - M2)$$

We believe that this deposit structure more accurately aligns with the network upgrade costs that developers are likely to incur.

### 3.4. FIXED PENALTY SCHEDULE

To mitigate the issues of an unwieldy queue size and frequent withdrawals, it is essential to implement penalties for detrimental practices. As previously discussed, both entering the queue without adequate due diligence and exiting the queue by interconnection customers contribute to an unmanageable queue size and create significant uncertainty.

Penalties are a proven economic lever for curbing undesirable behavior. For such penalties to be effective, they must be both substantial and consistently applied when unwanted actions occur.

Requiring a deposit alone is not a sufficient deterrent unless it is integrated with a comprehensive penalty structure. We propose implementing a fixed penalty schedule in conjunction with the current penalties to address this. Specifically, the current total amounts at risk from the DPP1 and beyond will remain unchanged. However, a predetermined percentage of the M2 deposit will be forfeited at withdrawal, regardless of the specific harm calculations. This percentage should

<sup>6</sup> Similar table based on median values is included in the Appendix

escalate with each successive phase of the DPP. We recommend that this penalty be applied to every withdrawal, extending even to those that occur before the commencement of the DPP.

Table 5 illustrates the suggested penalty schedule with an example.

**Table 5. Current and Potential Penalties by DPP Cycle**

| Withdrawal Time/ Stage of the Cycle | Current Penalties: at risk subject to harm calculations | Suggested Penalty Schedule: Example |                  |                         |
|-------------------------------------|---------------------------------------------------------|-------------------------------------|------------------|-------------------------|
|                                     |                                                         | Fixed Penalty Schedule              | Harm Calculation | Penalty-Free withdrawal |
| Before DPP Start                    | No penalty                                              | 10% of M2 Deposit                   | Doesn't apply    | Doesn't apply           |
| Decision Point 1                    | 50% of M2 at risk                                       | 25% of M2 Deposit                   | Applies          | Doesn't apply           |
| Decision Point 2                    | 100% of M2 at risk                                      | 50% of M2 Deposit                   | Applies          | Applies                 |
| During Phase 3                      | M2, M3, and M4 at risk                                  | 75% of M2 Deposit                   | Applies          | Applies                 |
| GIA Execution Phase and beyond      | M2, M3, and M4 at risk                                  | 100% of M2 Deposit                  | Applies          | Doesn't apply           |

Source: MISO

We suggest distributing the collected penalties pro-rata to completed projects of the same cycle. This provides additional support for projects that go through the process and additional incentive for interconnection customers to complete projects.

### 3.5. QUEUE CAP PER CYCLE

Robust demand for generation interconnection has caused the MISO queue to grow to an unmanageable size, with interconnection requests exceeding what MISO can process in a single cycle, contributing to a substantial backlog.

To mitigate the negative impact of excessive requests on participants and the overall study process, establishing a queue cap might be a solution. The implementation of a queue cap not only limits these detrimental effects but also strengthens the case for withdrawal penalties at every stage, including pre-kick-off.

The excessive interconnection requests compromise other study cycle participants and the overall integrity of the study process. As previously shown, these excessive requests can artificially inflate the magnitude of network upgrade costs in the early stages of the study cycle, leading to escalating financial and manpower burdens on MISO and other stakeholders as the queue size surpasses reasonable limits. Moreover, dissatisfaction with the process could fuel more speculative requests, and projects forced to drop out may swell the number of requests seen in subsequent study cycles.

MISO should determine the level of the queue cap along with its application across study regions, cycles, and possibly entities. The cap should be designed considering certain criteria for MISO overall and by region. For example, the following could be considered:

- Peak load and forecasted peak load.
- Installed capacity, guaranteed additions, and expected retirements.
- Reliability and resource adequacy.

All applications in excess of the cycle queue cap should be entered into the next cycle.

To give a tangible example, the queue cap per cycle could be set as a percentage of the forecasted peak load and/or installed capacity.

### 3.6. PER DEVELOPER CAP

Implementing a per-developer cap can be an approach to ensuring fairness within the interconnection queue, though it may present challenges in execution. To prevent a single developer from having disproportionate control or excessively entering multiple projects, it is advisable to consider specific safeguards when putting an overall queue cap in place.

These safeguards should be designed to maintain a balanced playing field among developers. It's important to recognize that no specific threshold is universally accepted to spark antitrust concerns; rather, this depends on a variety of factors, including market concentration, the potential for market manipulation, barriers to entry, and the possibility of harm to competition.

If an overall queue cap is put in place, we recommend considering a per-developer cap as well, set at a level between 5% and 15% of the overall queue cap per cycle. The implementation of a per-developer cap would necessitate a robust administrative process, with certain key elements to be included. These could encompass:

- **Authentication:** Define the entity or organization that is subject to the cap. Clear procedures should be established to ensure that all branches or subsidiaries of the same organization are included under the same cap.
- **Monitoring and Reporting:** Establish a system to track the project entries of each developer.
- **Verification:** Develop processes to validate the reported information provided by developers.
- **Transfers:** Ensure that transfers do not result in cap violations.
- **Penalties:** Define penalties for developers who exceed the prescribed limits.
- **Appeals and Dispute Resolution:** Establish a process for developers to appeal decisions related to cap enforcement.
- **Regular Review and Adjustment:** Conduct regular reviews of the cap's effectiveness and consider adjustments if necessary.

## 4. SUMMARY

CRA's analysis supports the argument that reform to generator interconnection queue rules for queue entry and exit could alleviate interconnection constraints. A key step to reform is an



adjustment to the definition of harm. The new definition should acknowledge that withdrawn projects harm those remaining in the queue beyond cost shifting via queue delay and uncertainty. One suggestion to reducing queue sizes is that MISO establish queue cap rules. These caps, either in the form of regional caps or developer caps per cycle, could limit excessive requests detrimental to other participants and the overall study process. Updating the monetary value placed on entering, remaining in, and withdrawing from the queue will prevent speculative projects from entering the interconnection process. CRA recommends increasing the M2 deposit to a value in the range of \$10,000-\$14,000/MW and adjusting the M3 and M4 deposit formulas to a minimum of \$1,000 to reflect final costs better. CRA also recommends that MISO implement an escalating fixed penalty schedule, including a minimum pre-kick-off stage withdrawal penalty to support the queue cap implementation. The penalty-free withdrawal rules should be updated to consider the overall percentage increase in combined network upgrades and affected system costs. Penalty-free rules should not apply after phase 3.

## 5. APPENDIX

The table presented below is a revised version of Table 4 from the report, adjusted to reflect median values. We've incorporated this table in response to feedback from stakeholders.

The values in this table support our recommendation for the M2 deposit, particularly when greater emphasis is placed on values from the latest cycles. Giving more weight to values from recent studies offers a more accurate representation of the queue's current status.

**Table 6. Network Upgrade Costs, Median Values**

| Study Cycle            | Median of NU Cost per MW, Phase 1 | Median of NU Cost per MW, Phase 2 | Median of NU Cost per MW, Phase 3 | 15% of Median NU Cost in Phase 3 | 20% of Median NU Cost in Phase 3 | 25% of Median NU Cost in Phase 3 |
|------------------------|-----------------------------------|-----------------------------------|-----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| DPP-2017-AUG           | \$ 89,051                         | \$ 52,000                         | \$ 42,948                         | \$ 6,442                         | \$ 8,590                         | \$ 10,737                        |
| DPP-2017-FEB           | \$ 655,871                        | \$ 111,467                        | \$ 35,815                         | \$ 5,372                         | \$ 7,163                         | \$ 8,954                         |
| DPP-2018-APR           | \$ 67,918                         | \$ 55,860                         | \$ 36,524                         | \$ 5,479                         | \$ 7,305                         | \$ 9,131                         |
| <b>DPP-2019-Cycle</b>  | <b>\$ 100,511</b>                 | <b>\$ 75,228</b>                  | <b>\$ 56,814</b>                  | <b>\$ 8,522</b>                  | <b>\$ 11,363</b>                 | <b>\$ 14,203</b>                 |
| <b>DPP-2020-Cycle</b>  | <b>\$ 135,621</b>                 | <b>\$ 80,175</b>                  | <b>\$ 65,872</b>                  | <b>\$ 9,881</b>                  | <b>\$ 13,174</b>                 | <b>\$ 16,468</b>                 |
| Total in-Sample Median | \$ 80,624                         | \$ 70,690                         | \$ 48,420                         | \$ 7,263                         | \$ 9,684                         | \$ 12,105                        |

Source: MISO

BEFORE THE UNITED STATES DEPARTMENT OF ENERGY

Federal Power Act Section 202(c)     )  
Emergency Order: Midcontinent     )  
Independent System Operator     )  
(MISO)     )  
\_\_\_\_\_

Order No. 202-25-7

Exhibit to  
Motion to Intervene and Request for Rehearing and Stay of  
Public Interest Organizations

Filed September 5, 2025

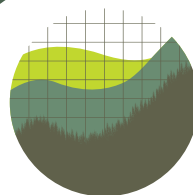
Exhibit 113  
  
Inst. Pol'y Integrity  
Report



# Enough Energy

A Review of DOE's Resource Adequacy Methodology

Jennifer Danis  
Christoph Graf, Ph.D.  
Matthew Lifson  
**July 2025**



Institute for  
**Policy Integrity**

NEW YORK UNIVERSITY SCHOOL OF LAW

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The authors thank Dr. Adria Brooks and Rob Gramlich for their valuable feedback.

This report does not purport to present the views, if any, of NYU School of Law.

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# Executive Summary

On April 8, 2025, President Trump issued an Executive Order on Strengthening the Reliability and Security of the United States Electric Grid (the EO) requiring the Department of Energy (DOE) to (1) “identify current and anticipated regions with reserve margins below acceptable thresholds” and (2) “establish . . . a protocol to identify which generation resources within a region are critical to system reliability.”<sup>1</sup> DOE responded on July 7, 2025 with its *Resource Adequacy Report: Evaluating the Reliability and Security of the United States Electric Grid* (DOE Study).<sup>2</sup>

This report reviews best practices for analyzing whether a region is resource adequate and for identifying whether a particular resource is critical for resource adequacy. It next analyzes the DOE Study as compared to those best practices. Finally, it examines next steps for U.S. resource adequacy policy following the DOE Study, in light of different entities’ respective authorities over the issue.

In Part 1, this report outlines a four-step process for evaluating whether a region is resource adequate and then identifying which resources are critical. Each step involves choices between traditional methods and best practices adapted to the evolving risks posed by the energy transition and the new conditions brought about by climate change.

- *Step 1: Set a Resource Adequacy Target:* Planners should define resource adequacy targets using a multi-metric approach that captures not just outage frequency but also magnitude and duration, possibly supplemented by metrics focused on tail risks instead of expected values. Targets should be region-specific and reflect a local cost-benefit analysis that weighs the incremental benefits and costs of achieving reduced outages.
- *Step 2: Conduct Resource Adequacy Modeling:* Rather than focusing narrowly on annual peak load, planners should assess whether a region achieves the target from Step 1 by modeling all 8,760 hours of the year in chronological order using probabilistic techniques that account for uncertainty like the Monte Carlo method. Best practices include incorporating weather-linked dependencies; climate-adjusted inputs; and realistic assumptions about retirements and additions, interregional imports, and storage and demand response dynamics. This modeling more accurately reflects the risks posed by variable generation and energy-limited resources.
- *Step 3: Establish Accreditation Values:* Resource accreditations—the specific contribution of a resource or resource type to resource adequacy—should be derived from Step 2’s probabilistic modeling of a resource’s ability to contribute during hours of highest risk.

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<sup>1</sup> Exec. Order No. 14,262, Strengthening the Reliability and Security of the United States Electric Grid, 90 Fed. Reg. 15521, 15521–22 (Apr. 14, 2025).

<sup>2</sup> U.S. DEP’T OF ENERGY, RESOURCE ADEQUACY REPORT: EVALUATING THE RELIABILITY AND SECURITY OF THE UNITED STATES ELECTRIC GRID (2025), <https://perma.cc/A587-S88S>.

Effective Load Carrying Capability or related probabilistic methods should be applied to all resource types, including thermal plants, to accurately describe their contributions under a wide range of possible futures and hard-to-predict risk periods. Accreditation methods should be applied equally to thermal and variable resources to allow for technology-neutral comparisons.

- *Step 4: Calculate the Reference Margin Level and the Reserve Margin:* Using the resource adequacy modeling and accreditation values from Steps 2 and 3, planners should calculate a reference margin level—the amount of accredited capacity that corresponds to achieving the resource adequacy target. Comparing a region’s actual resource fleet to this benchmark allows planners to determine whether the exit or entry of specific resources would affect achievement of the reference margin level and thus the resource adequacy target, given the resources’ accreditations.

Part 2 compares the best practices from Part 1 to DOE’s methodology in the DOE Study—in which DOE concluded that all transmission planning regions except ERCOT are currently resource adequate but that all regions except ISO-NE and NYISO will be resource inadequate in 2030. Across multiple dimensions, DOE’s approach departs from best practices in ways that call these results into question.

- *Resource Adequacy Targets:* DOE’s use of a multi-metric standard—2.4 hours of lost load per year and 0.002% normalized unserved energy—is consistent with best practices, but the choice of values is not. Neither value is appropriately justified based on a cost-benefit framework, and the use of a one-size-fits-all target for the entire country ignores regional differences. Additionally, DOE inappropriately attempts to label PJM as currently resource inadequate even though the region achieves DOE’s own target according to DOE’s modeling.
- *Resource Adequacy Modeling:* DOE models all 8,760 hours of the year chronologically but relies on a deterministic rather than probabilistic framework, limiting its ability to assess uncertainty or tail risks. This less accurate approach evaluates adequacy only under a fixed set of historical weather and load years. Further, DOE’s truncated description of how its model decides whether an outage has been triggered makes this assumption impossible to fully evaluate, but DOE’s limited explanation does suggest that it may have adopted an overly conservative approach that exaggerates resource adequacy risk. Finally, DOE’s 2030 results are significantly shaped by unrealistic assumptions about additions, retirements, load, and possibly interregional imports.
- *Accreditation and Reference Margin Levels:* The DOE Study does not attempt to identify resources that are critical for any region’s resource adequacy, and thus does not calculate accreditation values or reference margin levels. But DOE does estimate the amount of perfect capacity required to bring certain regions to the 0.002% NUSE target. DOE could build upon this approach in the future to calculate reference margin levels, but any future efforts should attend to all prongs of its multi-metric resource adequacy target. Additionally, DOE’s perfect capacity additions inexplicably bring regions far beyond 0.002% NUSE, meaning that DOE overstates how difficult it would be to cure the purported resource adequacy shortfalls.

Part 3 answers what should happen next for U.S. resource adequacy policy now that DOE has published its study.

- Given how DOE’s statutory authority under Section 202(c) of the Federal Power Act is limited to emergencies, DOE’s own conclusion that most regions are not currently experiencing resource adequacy shortfalls suggests that DOE has limited legal authority to address potential problems in 2030. Moreover, the limitations of the DOE Study call into question the accuracy of DOE’s forecasts.
- Instead of DOE, the Federal Energy Regulatory Commission and the North American Electric Reliability Corporation could more appropriately—and less intrusively from the perspective of states, grid operators, and markets—support resource adequacy by issuing reliability standards that require best practices for regions’ resource adequacy efforts. Rather than establishing a national resource adequacy target, these standards would govern how regions select resource adequacy targets, evaluate if they are achieving them, and measure the contributions of specific resources. This step would be in line with the Federal Energy Regulatory Commission’s Order No. 747, which approved analytical guardrails for resource adequacy analysis for a portion of the U.S.

# Introduction

How does a regional electric grid operator know when its region has enough electricity to meet demand and whether any specific generation resource, like a particular coal plant, is essential for doing so? President Trump’s Executive Order on Strengthening the Reliability and Security of the United States Electric Grid (the EO) implicates these questions: The EO directs the Department of Energy (DOE) to assess if each region of the United States has sufficient energy resources to meet current and future demand, and to identify and retain critical resources.<sup>3</sup> On July 7, 2025, DOE responded to the EO by publishing its *Resource Adequacy Report: Evaluating the Reliability and Security of the United States Electric Grid* (DOE Study).<sup>4</sup>

This report addresses the EO and the DOE Study’s fundamental concern: resource adequacy. Resource adequacy is one key aspect of a power system’s reliability. It refers to a system’s “ability . . . to generate and transmit adequate quantities of electricity to meet demand, taking into account scheduled and reasonably expected unscheduled system outages.”<sup>5</sup> Resource adequacy thus concerns whether a system’s supply of energy exceeds demand. Determining whether an area is resource adequate is, however, ultimately a policy question, rather than an engineering one, because it would be prohibitively expensive to build a system that serves 100% of demand under all conditions.<sup>6</sup> Deciding whether a region is resource adequate always explicitly or implicitly balances society’s desire for reliable electricity with the cost of providing that reliability.

Starting from first principles, Part 1 examines how to determine whether a region meets its selected resource adequacy target and how a planner can know whether any one particular resource is critical for resource adequacy. Part 2 discusses whether the DOE Study reflects, rejects, or obscures these first principles. Part 3 explores next steps for U.S. resource adequacy policy following the publication of the DOE Study, considering the respective roles of the Federal Energy Regulatory Commission (FERC), the North American Electric Reliability Corporation (NERC), DOE, grid operators, and states.

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<sup>3</sup> Exec. Order No. 14,262, Strengthening the Reliability and Security of the United States Electric Grid, 90 Fed. Reg. 15521, 15521 (Apr. 14, 2025).

<sup>4</sup> U.S. DEP’T OF ENERGY, RESOURCE ADEQUACY REPORT, *supra* note 2.

<sup>5</sup> BURÇIN ÜNEL & AVI ZEVIN, INST. FOR POL’Y INTEGRITY, TOWARD RESILIENCE: DEFINING, MEASURING, AND MONETIZING RESILIENCE IN THE ELECTRICITY SYSTEM 11 (2018), <https://perma.cc/UDB5-DEEM> (citing a NERC “Frequently Asked Questions” page that is no longer available).

<sup>6</sup> ENERGY SYS. INTEGRATION GRP., NEW RESOURCE ADEQUACY CRITERIA FOR THE ENERGY TRANSITION: MODERNIZING RELIABILITY REQUIREMENTS 38 (2024), <https://perma.cc/NXU4-N4UG>.

# Part 1: Best Practices for Resource Adequacy

The EO requires DOE to evaluate the sufficiency of regions’ “reserve margins” and establish a resulting protocol to identify “critical” resources that should be retained.<sup>7</sup> To figure out what kind of buffer will ensure that a region achieves a given level of resource adequacy, and to label specific generators as essential for that resource adequacy, a planner would need to undertake a four-step process. At each step, the planner must pick between antiquated approaches and newer best practices.

First, the planner must make the policy choice of selecting a resource adequacy target for the region that, if achieved, would indicate resource adequacy. Second, it should use resource adequacy modeling to determine whether a region has achieved and will continue to achieve the selected target under foreseeable future conditions. Third, the planner should use its resource adequacy modeling with accurate data curation to derive how each generation and storage resource contributes to meeting the target (their “accreditation” values). Fourth, it should use the resource adequacy modeling plus resources’ accreditation values to derive an acceptable reserve margin for the region (the “reference margin level”). At this fourth step, the planner can use the accreditation values to check whether the exit of a particular resource would cause a region to dip below the reference margin level.

These best practices have largely emerged to address the resource adequacy challenges caused by the energy transition and extreme weather events caused by climate change. Whereas traditional methods have focused on whether demand would exceed supply during peak load hours, system risk has shifted to *net* peak hours, i.e., when load minus variable generation is highest.<sup>8</sup> Measuring whether supply will meet demand has itself become more complicated. Increasingly, it has become important to perform modeling resource adequacy chronologically—each hour reflecting the conditions that came before it—to account for the dynamics of battery storage resources and demand response.<sup>9</sup> And policymakers now are also confronting the outdated idea that thermal resources are “perfect” capacity, given their weather-related vulnerabilities.<sup>10</sup>

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<sup>7</sup> Exec. Order No. 14,262, Strengthening the Reliability and Security of the United States Electric Grid, 90 Fed. Reg. 15521, 15521–22 (Apr. 14, 2025).

<sup>8</sup> JUAN PABLO CARVALLO ET AL., LAWRENCE BERKELEY NAT’L LAB’Y, A GUIDE FOR IMPROVED RESOURCE ADEQUACY ASSESSMENTS IN EVOLVING POWER SYSTEMS: INSTITUTIONAL AND TECHNICAL DIMENSIONS 13 (2023), <https://perma.cc/5VLY-B7HF>.

<sup>9</sup> N. AM. ELEC. RELIABILITY CORP. & NAT’L ACAD. OF ENG’G, EVOLVING PLANNING CRITERIA FOR A SUSTAINABLE POWER GRID: A WORKSHOP REPORT 9 (2024), <https://perma.cc/KE8D-W6VX>.

<sup>10</sup> NAT’L ASS’N OF REGUL. UTIL. COMM’RS, RESOURCE ADEQUACY FOR STATE UTILITY REGULATORS: CURRENT PRACTICES AND EMERGING REFORMS 32–34 (Nov. 2023), <https://perma.cc/K88X-2JCR>.

## Step 1: Pick a Resource Adequacy Target

Before any analysis can determine if a system is resource adequate, policymakers must set a clear resource adequacy target.<sup>11</sup> This first step involves two distinct choices: (1) selecting one or more metrics to represent the variables by which resource adequacy will be judged, and (2) setting the numerical values for those chosen metrics to achieve the resource adequacy target.

Consider what it would take to set a target, not for resource adequacy, but for human health. First, you would pick the metrics that you think would best define whether a person is healthy, e.g., blood pressure, resting heart rate, or cholesterol levels. Using only one metric would not give you enough information. And paying attention to only each metric's average levels without also examining whether the metric ever reaches dangerous levels could obscure risk of a catastrophic health event. Second, you would pick a value for each metric, like a blood pressure of less than less than 120/80 mmHg. To pick that value, you would consider the best available evidence on what level is optimal.

Similarly, when it comes to resource adequacy, the best practice is to move beyond the standard approach of attending primarily to the *frequency* of outages and to also consider their *magnitude* and *duration*. Additionally, regions should consider metrics focused on the extremes of the probability distribution, rather than expected value metrics that could label a system as resource adequate when a low probability (but plausible) event would be catastrophic.

When selecting numerical values for the chosen resource adequacy metrics, the best practice is to consider the best available evidence on the tradeoff between the benefits and costs of additional resource adequacy. The optimal level of resource adequacy may be different in each region, depending on the local costs of the investments that would be needed to reduce shortfall events and the local consequences of a shortfall.<sup>12</sup> A resource adequacy target should ideally represent the level of resource adequacy that the system planner has identified as socially optimal because it balances costs and benefits.

## Metrics

Historically, U.S. policymakers have framed their resource adequacy targets in terms of loss of load expectation (LOLE),<sup>13</sup> and this metric remains widespread.<sup>14</sup> LOLE typically refers to the number of days per year in which an outage occurs and is largely a measure of frequency.<sup>15</sup>

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<sup>11</sup> See ENERGY SYS. INTEGRATION GRP., NEW RESOURCE ADEQUACY CRITERIA, *supra* note 6, at 2 tbl.1.

<sup>12</sup> *Id.* at 39, 41.

<sup>13</sup> ELEC. POWER RSCH. INST., METRICS AND CRITERIA: INSIGHTS FROM CASE STUDIES AND RECOMMENDATIONS AND CONSIDERATIONS FOR FUTURE PRACTICE 31 (2024), <https://perma.cc/W4VF-VQPD>.

<sup>14</sup> ENERGY SYS. INTEGRATION GRP., NEW RESOURCE ADEQUACY CRITERIA, *supra* note 6, at 8 tbl.2.

<sup>15</sup> ELEC. POWER RSCH. INST., RESOURCE ADEQUACY FOR A DECARBONIZED FUTURE 3, 8 (Apr. 2022), <https://perma.cc/7G9V-CNWB>. Technically, the number of days per year in which an outage occurs is “loss of load days” (LOLD), which is a special case of the broader concept of LOLE, which can be used with different event-periods. *Id.* at 7–8. In North America, however, LOLE typically means LOLD. *Id.* at 7; accord Gord Stephen et al., *Clarifying the Interpretation and Use of the LOLE Resource Adequacy Metric* at 2, <https://perma.cc/A9DJ-C3B5>.



Frequency is an important characteristic to track because consumers prefer fewer outages.<sup>16</sup> LOLE coarsely accounts for duration, too, in that an outage that stretches multiple days will count as an additional event for each additional day.

LOLE does, however, obscure important aspects of resource adequacy. It will not differentiate between (1) a 10-hour event with 1 GWh of load shed that is followed by a second identical event within the same day and (2) a 30-minute event with 5 MWh of load shed. Customers are not indifferent, however, between these two situations.<sup>17</sup> Because damages depend on outages' frequency, magnitude, and duration, LOLE neglects key dimensions of resource adequacy affecting customers' wellbeing.<sup>18</sup> Attending to these characteristics when setting resource adequacy targets is more important than ever, because changes in the resource mix and extreme weather due to climate change mean that loss-of-load events have become less uniform and thus less interchangeable.<sup>19</sup>

### ***The Multi-Metric Approach***

The best practice is to supplement the traditional LOLE metric (or a different frequency-focused metric like "loss of load events," which separately counts all events within a year and thus differentiates between events that occur during the same day<sup>20</sup>) with additional metrics that capture other dimensions of resource adequacy.<sup>21</sup> Both the Electric Reliability Council of Texas (ERCOT) and the Northwest Power and Conservation Council (NWPCC) have done exactly this, augmenting their LOLE-based targets to include magnitude and duration metrics.<sup>22</sup> Under a multi-metric approach, a system could be declared resource adequate if it achieves selected value targets for each and every metric,<sup>23</sup> or if it achieves some minimum number or combination of the metrics (e.g., any two of a system's three metrics).<sup>24</sup>

A leading magnitude metric that could be incorporated into a multi-metric approach is expected unserved energy (EUE): the amount of demand that the system will fail to serve during a period, typically a year.<sup>25</sup> A region's EUE can be contextualized by dividing it by the region's total annual load—this is called normalized unserved energy (NEUE).<sup>26</sup> Australia uses an annual unserved

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<sup>16</sup> ENERGY SYS. INTEGRATION GRP., NEW RESOURCE ADEQUACY CRITERIA, *supra* note 6, at 17.

<sup>17</sup> *Id.* at 3.

<sup>18</sup> *Id.* at 10.

<sup>19</sup> *Id.* at 11, 15, 22.

<sup>20</sup> ELEC. POWER RSCH. INST., RESOURCE ADEQUACY FOR A DECARBONIZED FUTURE, *supra* note 15, at 8.

<sup>21</sup> ENERGY SYS. INTEGRATION GRP., NEW RESOURCE ADEQUACY CRITERIA, *supra* note 6, at 33–37; ELEC. POWER RSCH. INST., RESOURCE ADEQUACY PHILOSOPHY: A GUIDE TO RESOURCE ADEQUACY CONCEPTS AND APPROACHES 23 (2022), <https://perma.cc/ZH4Y-ZD7J>; JUAN PABLO CARVALLO ET AL., *supra* note 8, at 28–29; N. AM. ELEC. RELIABILITY CORP. & NAT'L ACAD. OF ENG'G, *supra* note 9, at vii.

<sup>22</sup> Reliability Standard for the ERCOT Region, No. 54584, 2024 WL 4263493, at \*24 (Tex. Pub. Utils. Comm'n Sept. 9, 2024); Resource Adequacy, NW. POWER & CONSERVATION COUNCIL, <https://perma.cc/39P6-VBNN>.

<sup>23</sup> ENERGY SYS. INTEGRATION GRP., NEW RESOURCE ADEQUACY CRITERIA, *supra* note 6, at 35.

<sup>24</sup> ELEC. POWER RSCH. INST., METRICS AND CRITERIA, *supra* note 13, at 31–32.

<sup>25</sup> ENERGY SYS. INTEGRATION GRP., NEW RESOURCE ADEQUACY CRITERIA, *supra* note 6, at 17.

<sup>26</sup> *Id.* at 18.

energy metric,<sup>27</sup> as does NWPCC.<sup>28</sup> Planning around these magnitude metrics can help a region avoid catastrophic events associated with significant unserved energy.<sup>29</sup>

But, like LOLE, magnitude-focused metrics like EUE and NEUE are incomplete alone; they do not account for how the unserved energy is distributed throughout the year.<sup>30</sup> An alternative or complementary magnitude metric is “peak shortfall,” defined as the largest expected outage of the period.<sup>31</sup> Peak shortfall is potentially useful because damages from a single outage increase nonlinearly with its scale.<sup>32</sup> Both ERCOT and NWPCC have versions of a peak shortfall metric (NWPCC’s complements its EUE metric).<sup>33</sup>

For duration, a popular metric that could supplement frequency and magnitude metrics is loss of load hours (LOLH), which measures the number of hours per year in which an outage occurs.<sup>34</sup> LOLH fundamentally resembles LOLE, but is more granular because it analyzes each hour, rather than each day. As such, LOLH does a better job at expressing the aggregate duration of all shortfalls in a region.<sup>35</sup>

Many countries use LOLH as their sole resource adequacy metric,<sup>36</sup> but, in aggregating hours, it neglects the duration of individual events—even though damages increase nonlinearly with an outage’s duration.<sup>37</sup> Supplemental metrics such as average shortfall duration<sup>38</sup> and the maximum shortfall length (used in Texas and NWPCC)<sup>39</sup> can capture this aspect of duration.

### **Accounting for Tail Risks**

Beyond questions of frequency, magnitude, and duration, a separate question when using any chosen metric is whether to look at the mean of the distribution, extremes, or both. Traditionally, regions have framed their LOLE, EUE, and LOLH goals in terms of their *mean* values.<sup>40</sup> But the energy transition and climate change have increased the risk of extremely damaging tail risks,<sup>41</sup>

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<sup>27</sup> *Id.* at 9.

<sup>28</sup> NW. POWER & CONSERVATION COUNCIL, *supra* note 22.

<sup>29</sup> ENERGY SYS. INTEGRATION GRP., NEW RESOURCE ADEQUACY CRITERIA, *supra* note 6, at 19 tbl.4.

<sup>30</sup> *Id.*

<sup>31</sup> ELEC. POWER RSCH. INST., RESOURCE ADEQUACY ASSESSMENT TOOL GUIDE 18 (2024), <https://perma.cc/CB7Q-MXZM> (using the equivalent phrase “MW Short”).

<sup>32</sup> ENERGY SYS. INTEGRATION GRP., NEW RESOURCE ADEQUACY CRITERIA, *supra* note 6, at 3.

<sup>33</sup> Reliability Standard for the ERCOT Region, No. 54584, 2024 WL 4263493, at \*24 (Tex. Pub. Utils. Comm’n Sept. 9, 2024); *Resource Adequacy*, NW. POWER & CONSERVATION COUNCIL, <https://perma.cc/39P6-VBNN>.

<sup>34</sup> ELEC. POWER RSCH. INST., RESOURCE ADEQUACY FOR A DECARBONIZED FUTURE, *supra* note 15, at 8.

<sup>35</sup> *Id.* at 8.

<sup>36</sup> ENERGY SYS. INTEGRATION GRP., NEW RESOURCE ADEQUACY CRITERIA, *supra* note 6, at 8.

<sup>37</sup> *Id.* at 3.

<sup>38</sup> ELEC. POWER RSCH. INST., RESOURCE ADEQUACY FOR A DECARBONIZED FUTURE, *supra* note 15, at 10.

<sup>39</sup> Reliability Standard for the ERCOT Region, No. 54584, 2024 WL 4263493, at \*24 (Tex. Pub. Utils. Comm’n Sept. 9, 2024); *Resource Adequacy*, NW. POWER & CONSERVATION COUNCIL, <https://perma.cc/39P6-VBNN>.

<sup>40</sup> ELEC. POWER RSCH. INST., RESOURCE ADEQUACY GAP ASSESSMENT 4 (2023), <https://perma.cc/M3A5-2WAL>; JUAN PABLO CARVALLO ET AL., *supra* note 8, at 12.

<sup>41</sup> ENERGY SYS. INTEGRATION GRP., NEW RESOURCE ADEQUACY CRITERIA, *supra* note 6, at 22.

making it increasingly appropriate to factor these risks into regions' metrics.<sup>42</sup> When it comes to resource adequacy, customers care not just about how the how severe and common outages will be on average, but also about how bad the worst outages they will experience could be.

One option for assessing these potentially severe consequences is the "value at risk" method. This method defines the selected metric (whether it is focused on frequency, magnitude, or duration), not in terms of its expected value, but in terms of how bad some relatively unlikely but still plausible scenario would be.<sup>43</sup> For example, one of NWPCC's metrics is the maximum shortfall length, framed in terms of what the maximum shortfall length will be at the 97.5<sup>th</sup> percentile of the distribution, i.e., how long the shortfall would be if there were only a 2.5% chance that the shortfall could be longer.<sup>44</sup> Planners can also frame a metric both in terms of expected value *and* value at risk for the same system: Belgium previously had an LOLE metric that simultaneously required an expected value of less than 3 LOLH and required the 95<sup>th</sup> percentile of the distribution to be less than 20 LOLH.<sup>45</sup>

An alternative to the value at risk method is the "conditional value at risk" method, in which the metric is framed not in terms of the value at some percentile of the distribution, but in terms of the average value of the distribution beyond the percentile.<sup>46</sup> Policymakers' preference between these two options will depend on their risk tolerance, as the value at risk method will equally weight all tail events while the conditional value at risk method effectively places more weight on extreme events even within the tail.<sup>47</sup>

## Values

After picking resource adequacy metrics—whether singular or multi-valued, and based on expected values, tail risks, or a combination of the two—the second step for setting a resource adequacy target is picking the numerical value for the metric(s). In the U.S., the most common value for the LOLE metric is 0.1, i.e., outages should occur no more than 0.1 days per year.<sup>48</sup> Selecting a value inherently involves balancing customers' desire for resource adequacy with the cost of achieving it.<sup>49</sup>

Notwithstanding that tradeoff, U.S. resource adequacy planners have largely set these values without any economic analysis. The origin of the widespread 0.1 LOLE target is somewhat enigmatic, especially relative to its contemporary significance, but it appears to describe the

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<sup>42</sup> See JUAN PABLO CARVALLO ET AL., *supra* note 8, at 29; ELEC. POWER RSCH. INST., RESOURCE ADEQUACY GAP ASSESSMENT, *supra* note 40, at 8; ELEC. POWER RSCH. INST., RESOURCE ADEQUACY FOR A DECARBONIZED FUTURE, *supra* note 15, at 10; ENERGY SYS. INTEGRATION GRP., NEW RESOURCE ADEQUACY CRITERIA, *supra* note 6, at 26–27.

<sup>43</sup> ENERGY SYS. INTEGRATION GRP., NEW RESOURCE ADEQUACY CRITERIA, *supra* note 6, at 26–27.

<sup>44</sup> NW. POWER & CONSERVATION COUNCIL, PACIFIC NORTHWEST POWER SUPPLY ADEQUACY ASSESSMENT FOR 2029 12 (2024), <https://perma.cc/GZY2-PKY7>.

<sup>45</sup> ELEC. POWER RSCH. INST., METRICS AND CRITERIA, *supra* note 13, at 17.

<sup>46</sup> ENERGY SYS. INTEGRATION GRP., NEW RESOURCE ADEQUACY CRITERIA, *supra* note 6, at 26–27; ELEC. POWER RSCH. INST., RESOURCE ADEQUACY FOR A DECARBONIZED FUTURE, *supra* note 15, at 10.

<sup>47</sup> ENERGY SYS. INTEGRATION GRP., NEW RESOURCE ADEQUACY CRITERIA, *supra* note 6, at 27 fig.8.

<sup>48</sup> *Id.* at 8.

<sup>49</sup> *Id.* at 38.

level of resource adequacy that happened to exist in the 1940s.<sup>50</sup>

The values used in NERC's reports on regions' long-term resource adequacy similarly seem arbitrary. NERC uses a LOLH metric, labeling regions with greater than 2.4 LOLH as high risk, 0.1-2.4 as elevated risk, and less than 0.1 as normal risk. NERC does not explain the basis for these categories, but they appear to stem this from a common (but widely criticized) hourly conversion of the 0.1 LOLE standard.<sup>51</sup> And NERC's values for the NEUE metric—above 0.002% is high risk, less than 0.002% but above zero is elevated risk, negligible or zero is normal risk—is adapted from Australia's 0.002% NEUE target without considering the different national contexts.<sup>52</sup> Context matters because the U.S. and Australia may vary in terms of how damaging outages would be (e.g., how bad it would be to lose electric heating and cooling in light of the region's temperatures) and how expensive it would be to avert them (e.g., the country-specific cost of building a natural gas peaker plant).

A better practice would be to use economic principles to select a socially efficient resource adequacy target, i.e., to select the value at which the incremental costs of additional resource adequacy equal the incremental benefits of achieving it.<sup>53</sup> Where policymakers do estimate the costs of improving resource adequacy, they often turn to the concept of "cost of new entry" (CONE).<sup>54</sup> CONE, expressed in \$/MWh, represents the marginal investment and fixed costs of adding additional capacity to the system to achieve a more stringent resource adequacy standard.<sup>55</sup> Historically, planners assumed the marginal resource was a combustion turbine, but today it is more accurate to assume a portfolio of diverse resources.<sup>56</sup> Considering CONE by itself, however, does not accurately capture the social marginal cost of achieving higher levels of resource adequacy, because adding capacity can have follow-on effects like reducing the cost of energy.<sup>57</sup> Accordingly, it is better to estimate total net CONE, which nets out potential system benefits such as reduced energy costs for loads and lower operating costs.<sup>58</sup>

To estimate the *benefits* of additional resource adequacy, planners typically rely on the value of lost load (VOLL).<sup>59</sup> The VOLL represents the societal cost of failing to serve a unit of energy

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<sup>50</sup> KEVIN CARDEN ET AL., NAT'L REGUL. RSCH. INST., THE ECONOMICS OF RESOURCE ADEQUACY: WHY RESERVE MARGINS ARE NOT JUST ABOUT KEEPING THE LIGHTS ON 2 (2011), <https://perma.cc/LS2F-2EZR>; ENERGY SYS. INTEGRATION GRP., NEW RESOURCE ADEQUACY CRITERIA, *supra* note 6, at 6.

<sup>51</sup> See N. AM. ELEC. RELIABILITY CORP., 2024 LONG-TERM RELIABILITY ASSESSMENT 11–12 (2024), <https://perma.cc/GJB2-VCZQ>; JUAN PABLO CARVALLO ET AL., *supra* note 8, at 11 ("The LOLE is typically used as a target setting metric and has historically taken a value of 1 event-day in 10 years, commonly (and incorrectly) interpreted as 2.4 hours per year.").

<sup>52</sup> N. AM. ELEC. RELIABILITY CORP., 2024 LONG-TERM RELIABILITY ASSESSMENT, *supra* note 51, at 141.

<sup>53</sup> KEVIN CARDEN ET AL., *supra* note 50, at 1; ENERGY SYS. INTEGRATION GRP., NEW RESOURCE ADEQUACY CRITERIA, *supra* note 6, at 38–42; ELEC. POWER RSCH. INST., METRICS AND CRITERIA, *supra* note 13, at 35.

<sup>54</sup> ENERGY SYS. INTEGRATION GRP., NEW RESOURCE ADEQUACY CRITERIA, *supra* note 6, at 13, 41–42.

<sup>55</sup> *Id.* at 42.

<sup>56</sup> *Id.*

<sup>57</sup> Christoph Graf et al., *Cost-Effective Capacity Markets* 29, [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=4864513](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4864513) (posted June 21, 2024); KEVIN CARDEN ET AL., *supra* note 50, at 8–9.

<sup>58</sup> ENERGY SYS. INTEGRATION GRP., NEW RESOURCE ADEQUACY CRITERIA, *supra* note 6, at 42.

<sup>59</sup> ELEC. POWER RSCH. INST., METRICS AND CRITERIA, *supra* note 13, at 35.

demanded by consumers and is denominated in \$/MWh.<sup>60</sup> Estimates vary significantly across customer classes,<sup>61</sup> but modelers can capture this through averaging.<sup>62</sup> More challenging is capturing how the VOLL varies with an outage's particular characteristics. For relatively short outages, the first hour tends to be the most expensive,<sup>63</sup> indicating that many frequent outages could be more socially disruptive than a consolidated one of equal length. Long-duration outages result in damages that increase nonlinearly (food spoilage, jeopardized medical care, and loss of access to safe drinking water).<sup>64</sup> Similarly, the VOLL can increase nonlinearly with magnitude: When the grid operator can no longer manage the situation through rotating outages, the resulting uncontrolled outage is much more damaging.<sup>65</sup> Accordingly, undertaking a cost-benefit analysis that allows VOLL to vary with duration and magnitude would produce a more accurate, cost-benefit-justified resource adequacy target.

Many jurisdictions use some version of a cost-benefit analysis when setting their resource adequacy targets. In the European Union, countries solve for their specific LOLH targets by dividing a local CONE value by the local VOLL, which, in 2023, resulted in a range from 1 LOLH (Sweden) to 15 LOLH (Czechia).<sup>66</sup> The United Kingdom uses this same approach.<sup>67</sup> Australia periodically reviews its 0.002% NEUE target to ensure that the implied "value of customer reliability," which is akin to the VOLL, is close to its estimated value.<sup>68</sup> Somewhat analogous to these examples, the administratively set, downward-sloping demand curves for capacity markets in U.S. regions like PJM embody the tradeoff between the benefits and costs of additional resource adequacy, because the curves dictate how much regions are willing to pay for each increment of additional capacity given the capacity's incremental benefits.<sup>69</sup> Technically, though, this cost-benefit thinking happens not when *setting* the resource adequacy target, but in deciding whether to under-, over-, or exactly *achieve* an already-determined target.

<sup>60</sup> JENNIFER DANIS ET AL., INST. FOR POL'Y INTEGRITY, TRANSMISSION PLANNING FOR THE ENERGY TRANSITION: RETHINKING MODELING APPROACHES 6 (2023), <https://perma.cc/5A6L-DJHL>.

<sup>61</sup> MICHAEL J. SULLIVAN ET AL., ERNEST ORLANDO LAWRENCE BERKELEY NAT'L LAB'Y, UPDATED VALUE OF SERVICE RELIABILITY ESTIMATES FOR ELECTRIC UTILITY CUSTOMERS IN THE UNITED STATES xii, tbl.ES-1 (2015), <https://perma.cc/CT53-8WEA>.

<sup>62</sup> See ELEC. POWER RSCH. INST., METRICS AND CRITERIA, *supra* note 13, at 35.

<sup>63</sup> MICHAEL J. SULLIVAN ET AL., *supra* note 61, at xii, tbl.ES-1.

<sup>64</sup> ENERGY SYS. INTEGRATION GRP., NEW RESOURCE ADEQUACY CRITERIA, *supra* note 6, at 23 fig.5.

<sup>65</sup> See, e.g., Joshua W. Busby et al., *Cascading Risks: Understanding the 2021 Winter Blackout in Texas*, 77 ENERGY RSCH. & SOC. SCI. (2021); Sergio Castellanos et al., *A Synthesis and Review of Exacerbated Inequities from the February 2021 Winter Storm (Uri) in Texas and the Risks Moving Forward*, 5 PROGRESS IN ENERGY (2023); Hassan Haes Alhelou et al., *A Survey on Power System Blackout and Cascading Events: Research Motivations and Challenges*, 12 ENERGIES 1, 16–17 (2019).

<sup>66</sup> ENERGY SYS. INTEGRATION GRP., NEW RESOURCE ADEQUACY CRITERIA, *supra* note 6, at 39 fig.12, 40.

<sup>67</sup> *Id.* at 40.

<sup>68</sup> RELIABILITY PANEL AEMC, FINAL REPORT: RELIABILITY STANDARD AND SETTINGS REVIEW 2018 I, 14 (2018), <https://perma.cc/TAN8-TPXZ>.

<sup>69</sup> *PJM Interconnection, L.L.C.*, 117 FERC ¶ 61,331, at P 76 (2006) ("In addition, we agree with PJM that a downward-sloping demand curve provides a better indication of the incremental value of capacity at different capacity levels than the current vertical demand curve. Under a vertical demand curve, capacity above the Installed Reserve Margin is deemed to have no value. Incremental capacity above the Installed Reserve Margin is likely to provide additional reliability benefits, albeit at a declining level. This value is reflected in the positive (but declining) prices in the sloped demand curve to the right of the Installed Reserve Margin, but is not reflected in the current capacity market.").



## Step 2: Conduct Resource Adequacy Modeling

Once the policymaker sets a resource adequacy target, a resource adequacy model can predict whether a region is achieving it (and will continue to do so). Traditionally, modeling was limited to examining whether demand would exceed supply during one or a few peak load hours. But the energy transition, combined with extreme weather from climate change, requires planners to rethink prevailing resource adequacy modeling techniques. For most systems, it is now important to model all 8,760 hours of the year, in chronological order, to accurately capture the risk of load shed.

Along with improving models' temporal resolution, it has become important to make more sophisticated assumptions about modeling inputs. In particular, it has become critical to capture how supply and demand have become more dependent on the weather, which, in turn, has become more extreme. In general, a best practice is to use the Monte Carlo method, and run many (on the order of hundreds or thousands) simulations of grid operations, allowing the model to randomly pull from a distribution of possible values for every input.<sup>70</sup> Additionally, best practices exist for curating the data for each input and their interdependencies, such as representing the relationship between the weather and thermal outages.<sup>71</sup>

### Temporal Scope

Historically, resource adequacy modeling focused on the likelihood that supply would exceed demand during one (or a few) top demand hours, ignoring the risk of inadequate supply during the rest of the year.<sup>72</sup> This simplification was more plausible when the grid was dominated by dispatchable resources with relatively predictable outputs.<sup>73</sup>

Now, with the increased penetration of wind and solar, periods of resource adequacy risk have shifted from peak demand to “net peak” demand, defined as load minus energy from non-dispatchable resources.<sup>74</sup> In this new reality, the system is most likely to lack sufficient supply when there is high demand unserved by wind or solar. And, just as weather dictates the performance of these variable resources, it also affects outages at thermal generators (e.g., interruptions of natural gas supply) and load (not just by influencing customers' demand, but also by altering

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<sup>70</sup> See Inputs, below, for a more detailed description of the Monte Carlo method.

<sup>71</sup> For example, cold winter snaps have historically yielded correlated outages of thermal generators. Nick Wintermantel & Nick Simmons, ASTRAPÉ CONSULTING 8 (2022), <https://perma.cc/6D7Y-QCZ2>. Similarly, extreme hot weather can require both thermal and nuclear units to cease operations, if the unit can no longer use intake water bodies for cooling. E.g., *High French River Temperatures to Hit Nuclear Production Next Week*, REUTERS (June 20, 2025), <https://www.reuters.com/business/energy/high-french-river-temperatures-hit-nuclear-production-next-week-2025-06-20>.

<sup>72</sup> JUAN PABLO CARVALLO ET AL., *supra* note 8, at 9; N. AM. ELEC. RELIABILITY CORP. & NAT'L ACAD. OF ENG'G, *supra* note 9, at 2.

<sup>73</sup> N. AM. ELEC. RELIABILITY CORP. & NAT'L ACAD. OF ENG'G, *supra* note 9, at 2; JUAN PABLO CARVALLO ET AL., *supra* note 8, at 1, 27.

<sup>74</sup> JILL MORASKI ET AL., CLEAN AIR TASK FORCE, BEYOND LCOE: A SYSTEMS-ORIENTED PERSPECTIVE FOR EVALUATING ELECTRICITY DECARBONIZATION PATHWAYS 21 (2025), <https://perma.cc/3A39-FQLW>.



behind-the-meter generation that typically provides “negative” load).<sup>75</sup> Given this confluence of variables, the best practice is now to examine all 8,760 hours of the year when evaluating the likelihood and expected characteristics of shortfalls.<sup>76</sup>

The increased prevalence of energy-limited resources like battery storage and demand response have similarly complicated more traditional resource adequacy modeling assumptions. Battery storage’s ability to avoid a resource adequacy shortfall will depend on its state of charge.<sup>77</sup> For example, a battery could have sufficient energy to prevent a shortfall in the morning and then, if it has no opportunity to recharge, be empty for a second event that same afternoon. Similarly, demand response participants have only a limited willingness to curtail or shift their demand; activating the program degrades its later effectiveness.<sup>78</sup> Accordingly, the best practice for resource adequacy modeling is to not just to consider all 8,760 hours, but to do so sequentially, capturing how storage and demand response used in one hour can affect their subsequent availability.<sup>79</sup>

## Inputs

To keep pace with the many uncertainties of contemporary resource adequacy analysis, planners have shifted to probabilistic modeling approaches like the Monte Carlo method.<sup>80</sup> Under this best practice, rather than assessing resource adequacy using specific expected values for each input, the user provides the model with a probability distribution for different inputs, and the model randomly samples from those distributions across hundreds or thousands of simulated scenarios.<sup>81</sup> The model will draw the load for each hour, along with potentially correlated variable generation, thermal resource availability, and transmission outages.<sup>82</sup>

While the Monte Carlo method can yield more accurate resource adequacy estimates than simpler methods, its accuracy depends on the user-provided probability distributions, as well as accurate specification of key interdependencies.<sup>83</sup> For weather data, the current best practice is to use as many years as are available, with hourly resolution and geographic granularity.<sup>84</sup> And, especially when forecasting longer-term resource adequacy, it has become important to account

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<sup>75</sup> JUAN PABLO CARVALLO ET AL., *supra* note 8, at 27; Standard Authorization Request (SAR) Form, N. AM. ELEC. RELIABILITY CORP. at 2, <https://perma.cc/Q8AU-9YWW>.

<sup>76</sup> JUAN PABLO CARVALLO ET AL., *supra* note 8, at 27; Standard Authorization Request (SAR) Form, N. AM. ELEC. RELIABILITY CORP. at 2, <https://perma.cc/Q8AU-9YWW>.

<sup>77</sup> ENERGY SYS. INTEGRATION GRP., ENSURING EFFICIENT RELIABILITY: NEW DESIGN PRINCIPLES FOR CAPACITY ACCREDITATION 11 (2023), <https://perma.cc/4ETD-JQK2>.

<sup>78</sup> ELEC. POWER RSCH. INST., RESOURCE ADEQUACY ASSESSMENT TOOL Guide, *supra* note 31, at 55–56.

<sup>79</sup> N. AM. ELEC. RELIABILITY CORP. & NAT’L ACAD. OF ENG’G, *supra* note 9, at 9; JUAN PABLO CARVALLO ET AL., *supra* note 8, at 9; NAT’L ASS’N OF REGUL. UTIL. COMM’RS, *supra* note 12, at 44.

<sup>80</sup> ELEC. POWER RSCH. INST., RESOURCE ADEQUACY ASSESSMENT TOOL Guide, *supra* note 31, at 9.

<sup>81</sup> *Id.* at 10.

<sup>82</sup> JUAN PABLO CARVALLO ET AL., *supra* note 8, at 13.

<sup>83</sup> ELEC. POWER RSCH. INST., RESOURCE ADEQUACY ASSESSMENT TOOL Guide, *supra* note 31, at 12.

<sup>84</sup> JUAN PABLO CARVALLO ET AL., *supra* note 8, at 30.

for climate change projections,<sup>85</sup> including the increasing severity of extreme events.<sup>86</sup>

For load, the best practice is to capture its relationship to the weather, and to add a probabilistically determined amount of distributed generation as negative load.<sup>87</sup> Similarly, for generation, the best practice is to derive the relationship between weather and its output, while also accounting for how technological improvements will improve production profiles,<sup>88</sup> along with the possibility of other types of common mode failures.<sup>89</sup>

Other important considerations include realistic assumptions about electricity imports from neighboring regions (e.g., probabilistically modeling neighbors' operations during tight periods),<sup>90</sup> intraregional transmission constraints,<sup>91</sup> the impact of probabilistic intraregional transmission failures,<sup>92</sup> and for when the model decides that an outage has been triggered.<sup>93</sup>

Additionally, for forecasting longer-term resource adequacy, modelers need to make assumptions about which resources retire and come online. These assumptions will have a large bearing on model outputs. For retirements, modelers should include announced retirements while also forecasting unannounced retirements by accounting for likely retirements due to federal and state policy, age-based retirements, and retirements driven by economics.<sup>94</sup> For near-term new generation and storage, modelers should consider projects that have cleared or will soon clear the interconnection queue, along with expected build times.<sup>95</sup> To anticipate later-term resource additions, modelers should consider resource costs and trajectories, regulatory incentives and barriers, and other relevant drivers. As with other inputs, modelers can implement retirements and additions through a distribution of probabilities, rather than strict assumptions about what will occur.<sup>96</sup>

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<sup>85</sup> *Id.*

<sup>86</sup> ELEC. POWER RSCH. INST., RESOURCE ADEQUACY GAP ASSESSMENT, *supra* note 40, at 22.

<sup>87</sup> JUAN PABLO CARVALLO ET AL., *supra* note 8, at 31.

<sup>88</sup> *Id.* at 32.

<sup>89</sup> ELEC. POWER RSCH. INST., MODELING NEW AND EXISTING TECHNOLOGIES AND SYSTEM COMPONENTS IN RESOURCE ADEQUACY 17–18 (2023), <https://perma.cc/3CWR-G5LM>; ENERGY SYS. INTEGRATION GRP., ENSURING EFFICIENT RELIABILITY, *supra* note 77, at 37–38; *How MISO Utilizes PLEXOS for Enhanced Resource Adequacy*, ENERGY EXEMPLAR (Oct. 9, 2024), <https://perma.cc/VQY8-WAVX>.

<sup>90</sup> ELEC. POWER RSCH. INST., RESOURCE ADEQUACY GAP ASSESSMENT, *supra* note 40, at 31; ADRIA E. BROOKS ET AL., GRID STRATEGIES LLC, RESOURCE ADEQUACY VALUE OF INTERREGIONAL TRANSMISSION 31 (2025), <https://perma.cc/77FQ-L94V>; SAM HOSTETTER & DEREK STENCLIK, ANALYSIS OF RESOURCE ADEQUACY ACROSS THE EASTERN INTERCONNECTION 7, 16 (2025), <https://perma.cc/LCU4-LBZF>.

<sup>91</sup> ELEC. POWER RSCH. INST., RESOURCE ADEQUACY SCENARIO SELECTION GUIDE 6, (2024), <https://perma.cc/FZ5A-5G2M>.

<sup>92</sup> JUAN PABLO CARVALLO ET AL., *supra* note 8, at 13–14; ELEC. POWER RSCH. INST., RESOURCE ADEQUACY GAP ASSESSMENT, *supra* note 40, at 12.

<sup>93</sup> KEVIN CARDEN ET AL., *supra* note 50, at 7.

<sup>94</sup> Inst. for Pol'y Integrity, Comments on Policy-Driven Retirements in the Context of Order No. 1920 at 4–6 (Oct. 18, 2024), <https://perma.cc/GB4R-X55D>.

<sup>95</sup> E.g., N. AM. ELEC. RELIABILITY CORP., 2024 LONG-TERM RELIABILITY ASSESSMENT, *supra* note 51, at 137.

<sup>96</sup> See Inst. for Pol'y Integrity, Comments, *supra* note 94, at 7–8.

### Step 3: Accreditation

After resource adequacy modeling, the next step is to derive how much credit each resource deserves for its contribution towards the system's resource adequacy—a process called "accreditation." A resource's accreditation, typically expressed as a fraction of its nameplate capacity, captures the resource's estimated availability during the periods when resource adequacy is most strained.<sup>97</sup>

If a planner is interested in determining only whether a system is achieving its resource adequacy target, this step is unnecessary because Step 2 will accomplish that.<sup>98</sup> Nor is this step strictly necessary to determine how the retirement of any particular resource would affect reaching the resource adequacy target; a planner can accomplish that by re-running Step 2 without the resource included.

But, as explained further in Step 4, accreditation is important to calculate a region's *reference reserve margin*, i.e., the resource adequacy cushion that, when obtained, suggests that the system will achieve its resource adequacy target. Accreditation is also valuable because, once a planner calculates the reference margin level, having these accreditation values can allow a policymaker to quickly estimate how the retirement or addition of particular resources would affect maintaining that margin, without needing to re-run the resource adequacy modeling. This kind of analysis could satisfy the EO's call for a protocol to "identify which generation resources within a region are critical to system reliability."<sup>99</sup>

Historically, planners accredited thermal resources at their full nameplate capacity—reflecting an assumption that they could always generate at maximum capacity during the moments of greatest resource adequacy risk—or accredited them based on their nameplate capacity discounted by their average forced outage rate.<sup>100</sup> Variable resources have often been accredited based on their historical performance during peak load hours.<sup>101</sup>

With the energy transition and climate change, however, the best practice is to derive a resource's accreditation from the resource adequacy modeling described in Step 2 using a probabilistic

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<sup>97</sup> AN PHAM ET AL., NAT'L RENEWABLE ENERGY LAB'Y, AVERAGE AND MARGINAL CAPACITY CREDIT VALUES OF RENEWABLE ENERGY AND BATTERY STORAGE IN THE UNITED STATES POWER SYSTEM 5 (2024) (using the equivalent phrase "capacity credit"). These times have become increasingly decoupled with peak load events. ENERGY SYS. INTEGRATION GRP., ENSURING EFFICIENT RELIABILITY, *supra* note 77, at 4.

<sup>98</sup> JUAN PABLO CARVALLO ET AL., *supra* note 8, at 36 ("Capacity accreditation is not inherent to resource adequacy assessments . . . ."); ENERGY SYS. INTEGRATION GRP., ENSURING EFFICIENT RELIABILITY, *supra* note 77, at vii ("While resource adequacy analysis assesses whether there are enough resources to serve load across the system, capacity accreditation measures the contribution of individual resources toward meeting that goal, both in terms of capacity and energy.").

<sup>99</sup> Exec. Order No. 14,262, Strengthening the Reliability and Security of the United States Electric Grid, 90 Fed. Reg. 15521, 15522 (Apr. 14, 2025).

<sup>100</sup> ENERGY SYS. INTEGRATION GRP., ENSURING EFFICIENT RELIABILITY, *supra* note 77, at 9, 37; NAT'L ASS'N OF REGUL. UTIL. COMM'RS, *supra* note 12, at 5.

<sup>101</sup> JUAN PABLO CARVALLO ET AL., *supra* note 8, at 36.

method.<sup>102</sup> Probabilistic methods like Effective Load Carrying Capability (ELCC) analyze how slight changes in the modeled resource inputs would affect resource adequacy outcomes.<sup>103</sup> They typically work by adding more of the studied resource to the model, beyond what exists in the base case, and then adding load until the model's base case resource adequacy outcome is restored.<sup>104</sup>

The benefit of probabilistic approaches like ELCC is that, when the modeling inputs from Step 2 are well-curated, the resulting accreditations will more accurately reflect a resource's contribution to resource adequacy during the true risk periods.<sup>105</sup> Additionally, these methods consider a wide range of possible futures, including the possibility of tail events, rather than assuming the future will resemble the past.<sup>106</sup>

The best practice is to apply these ELCC-style methodologies to both variable and thermal resources, storage, and transmission.<sup>107</sup> It is important to treat all resource types equally because capacity accreditation provides a technology-agnostic way of comparing resources' resource adequacy contributions.<sup>108</sup> That purpose is compromised when the resource adequacy value of variable resources is reduced to account for myriad factors affecting their output, without parallel reductions capturing thermal resources' weather dependency and common mode outages.<sup>109</sup> With increased saturation of natural gas resources—which are susceptible to fuel disruptions and extreme weather—it is more important than ever to accurately account for thermal generations' winter risks, especially the risk that a significant amount of thermal capacity will become unavailable at once.<sup>110</sup> Probabilistic methods are ideal for understanding the effect of these risks, including tail risks, in light of the complicated interdependencies of all the factors that dictate the timing of resource adequacy shortfalls.<sup>111</sup>

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<sup>102</sup> *Id.* at 36–37; N. AM. ELEC. RELIABILITY CORP., METHODS TO MODEL AND CALCULATE CAPACITY CONTRIBUTIONS OF VARIABLE GENERATION FOR RESOURCE ADEQUACY PLANNING 24–27 (2011), <https://perma.cc/294F-25KU>.

<sup>103</sup> ELEC. POWER RSCH. INST., RESOURCE ADEQUACY FOR A DECARBONIZED FUTURE, *supra* note 15, at 13.

<sup>104</sup> *Id.*

<sup>105</sup> ENERGY SYS. INTEGRATION GRP., ENSURING EFFICIENT RELIABILITY, *supra* note 77, at 12–14; ELEC. POWER RSCH. INST., RESOURCE ADEQUACY FOR A DECARBONIZED FUTURE, *supra* note 15, at 15; Christoph Graf et al., *supra* note 57, at 30. As explained in Step 2 above, these risk periods are becoming harder to predict due to weather's increased influence on supply and demand, and because of increased energy-limited resources in the generation mix.

<sup>106</sup> ENERGY SYS. INTEGRATION GRP., ENSURING EFFICIENT RELIABILITY, *supra* note 77, at 14.

<sup>107</sup> JUAN PABLO CARVALLO ET AL., *supra* note 8, at 37; N. AM. ELEC. RELIABILITY CORP., METHODS TO MODEL AND CALCULATE CAPACITY CONTRIBUTIONS, *supra* note 102, at 28; ADRIA E. BROOKS ET AL., *supra* note 90, at 31.

<sup>108</sup> ENERGY SYS. INTEGRATION GRP., ENSURING EFFICIENT RELIABILITY, *supra* note 77, at 32, 37.

<sup>109</sup> *Id.* at 37–38.

<sup>110</sup> ELEC. POWER RSCH. INST., RESOURCE ADEQUACY GAP ASSESSMENT, *supra* note 40, at 24; NAT'L ASS'N OF REGUL. UTIL. COMM'RS, *supra* note 12, at 40–41; ELEC. POWER RSCH. INST., RESOURCE ADEQUACY ASSESSMENT TOOL GUIDE, *supra* note 31, at 30; ELEC. POWER RSCH. INST., RESOURCE ADEQUACY PHILOSOPHY, *supra* note 21, at 27.

<sup>111</sup> See ENERGY SYS. INTEGRATION GRP., ENSURING EFFICIENT RELIABILITY, *supra* note 77, at 11 ("Increasingly, periods of risk are driven by correlation among many components that are often weather-related, including high load, low renewable resource availability, drought, and correlated outages and fuel supply disruptions from the fossil fuel generators."); N. AM. ELEC. RELIABILITY CORP., 2024 LONG-TERM RELIABILITY ASSESSMENT, *supra* note 51, at 91 ("If resource performance were to occur at the levels expected during average winter days, the system should be able to serve these high loads. However, resource performance from thermal resources on very cold days, especially natural gas resources, is more likely to be poor. This, coupled with poor performance from solar

## Step 4: Calculating the Reference Margin Level and the Reserve Margin

Using Step 2's resource adequacy modeling and Step 3's accreditations, a planner can assess whether a region's fleet would achieve its appropriate reference margin level.<sup>112</sup> The reference margin level typically expresses the amount of accredited capacity that a region would need to achieve its resource adequacy target. The planner will conduct resource adequacy modeling, adding or subtracting additional capacity or load until the system reaches the resource adequacy target. The reference margin level is the sum of the accredited capacity needed to achieve the target.

Once the planner derives the reference margin level (how much total accredited capacity the system requires), it is also possible to answer whether any particular resource is critical to achieving the margin. To check this, the planner would subtract the accredited capacity of the resource in question from the total accredited capacity of the region, and check whether the difference exceeds the reference margin level.

### Reference Margin Levels

Historically, reference margin levels were—and, in some places, continue to be—resource adequacy targets in themselves (e.g., a target of accredited capacity that is 15% above peak load).<sup>113</sup> But setting a target framed entirely around the summed accredited capacity, even when informed by years of operating experience at different margin levels, yields a target that does not explicitly aim to achieve any particular outcome.<sup>114</sup> As explained in Step 1, targets are more typically expressed in terms of outcomes: the frequency, duration, and/or magnitude of shortfalls.

Yet the idea of a reference margin level has persisted, as planners often convert their outcome-focused targets into the equivalent reference margin levels.<sup>115</sup> For example, a region might have a 0.1 LOLE target and then determine that the 0.1 LOLE target is achieved when the region's installed capacity has an accreditation of at least 15% above peak load.<sup>116</sup> The same type of translation is possible for targets set using other metrics, like EUE or LOLH.<sup>117</sup>

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resources, results in very low total electricity supply and causes loss-of-load events in the ProbA analysis. The winter load-loss events tend to occur during morning and evening demand peaks and coincide with poor thermal performance and poor solar performance.”).

<sup>112</sup> This is also commonly referred to as a planning reserve margin, connoting that it includes resources that are in reserve and only be dispatched in highly constrained scenarios.

<sup>113</sup> ELEC. POWER RSCH. INST., *RESOURCE ADEQUACY PHILOSOPHY*, *supra* note 21, at 24; ENERGY SYS. INTEGRATION GRP., *NEW RESOURCE ADEQUACY CRITERIA*, *supra* note 6, at 8–9.

<sup>114</sup> ELEC. POWER RSCH. INST., *RESOURCE ADEQUACY FOR A DECARBONIZED FUTURE*, *supra* note 15, at 5–6; N. AM. ELEC. RELIABILITY CORP., *METHODS TO MODEL AND CALCULATE CAPACITY CONTRIBUTIONS*, *supra* note 102, at 29–30.

<sup>115</sup> ENERGY SYS. INTEGRATION GRP., *NEW RESOURCE ADEQUACY CRITERIA*, *supra* note 6, at 7; JUAN PABLO CARVALLO ET AL., *supra* note 8, at 37; N. AM. ELEC. RELIABILITY CORP. & NAT'L ACAD. OF ENG'G, *supra* note 9, at 1.

<sup>116</sup> JUAN PABLO CARVALLO ET AL., *supra* note 8, at 28.

<sup>117</sup> N. AM. ELEC. RELIABILITY CORP. & NAT'L ACAD. OF ENG'G, *supra* note 9, at 15; JUAN PABLO CARVALLO ET AL., *supra* note 8, at 29.

Given how resource adequacy risk has evolved, however, the best practice is to derive the reference margin level using the probabilistic resource adequacy modeling from Step 2 (itself conducted in accordance with best practices).<sup>118</sup> Doing this helps to ensure that the margin is calculated to comprehensively reflect year-round risks. Indeed, when resource adequacy risk shifts beyond peak load hours, the amount of accredited capacity necessary to achieve the resource adequacy target can become *lower* than peak load—because resources’ accreditations will be based on their outputs during moments of greatest risk, which may be lower than their outputs at peak load.<sup>119</sup> Accordingly, calculating a reference margin level that matches accredited capacity to peak load would overestimate the necessary margin.

While there are multiple plausible ways to use probabilistic resource adequacy modeling to convert the resource adequacy target to a reference margin level, the general approach depends on whether the modeling reveals that the system is exactly achieving the target, underachieving it, or overachieving it. For the rare case in which the system happens to be exactly achieving the resource adequacy target, then the sum of the total accredited capacity installed on the system equals the reference margin level. It can be expressed as MW of accredited capacity, or in reference to some other amount, like a percentage of peak load.<sup>120</sup>

It is more likely, however, that the system is either above or below the resource adequacy target. In these instances, it is common to add or subtract accredited capacity in the model until the system achieves the target.<sup>121</sup> Then, the reference margin level will be the amount of accredited capacity on the modeled system when the target is achieved, again expressed as a quantity of MWs or as a percentage of peak load.

## Effect of Particular Resources

Once the reference margin level and accreditation values have been calculated, it becomes possible to test how the exit (or entry) of a particular resource would affect the region’s resource adequacy.

An example is useful in understanding how. Imagine that the reference margin level for a region is 25 GW, and its resource mix has 26 GW of accredited capacity. As is, the region would be exceeding its reference margin level by 1 GW. If any resource with an accreditation greater than 1 GW were to exit the grid, that would cause the actual reserve margin to dip below the reference margin level. Because the reference margin level was calculated following Steps 1–3,

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<sup>118</sup> ELEC. POWER RSCH. INST., RESOURCE ADEQUACY FOR A DECARBONIZED FUTURE, *supra* note 15, at 6, 11; NAT’L ASS’N OF REGUL. UTIL. COMM’RS, *supra* note 12, at 95. See also N. AM. ELEC. RELIABILITY CORP., 2024 LONG-TERM RELIABILITY ASSESSMENT, *supra* note 51, at 11.

<sup>119</sup> ENERGY SYS. INTEGRATION GRP., ENSURING EFFICIENT RELIABILITY, *supra* note 77, at 18.

<sup>120</sup> *Id.*; N. AM. ELEC. RELIABILITY CORP., METHODS TO MODEL AND CALCULATE CAPACITY CONTRIBUTIONS, *supra* note 102, at 6.

<sup>121</sup> NAT’L ASS’N OF REGUL. UTIL. COMM’RS, *supra* note 12, at 95. See also, e.g., MISO, PLANNING YEAR 2025–2026 LOSS OF LOAD EXPECTATION STUDY REPORT 34–35, <https://perma.cc/4VV5-4FHU>; WESTERN POWER POOL, WESTERN RESOURCE ADEQUACY PROGRAM, 102 FORWARD SHOWING RELIABILITY METRICS 14 (2024), <https://perma.cc/7A6Q-A96E>; NYISO, 2024 RELIABILITY NEEDS ASSESSMENT 44 (2024), <https://perma.cc/LD5E-RMV9>; IESO, ANNUAL PLANNING OUTLOOK: RESOURCE ADEQUACY AND ENERGY ASSESSMENTS METHODOLOGY 19 (2024), <https://perma.cc/26N7-QC5J>.



this dip would indicate that the region can no longer be expected to achieve the resource adequacy target (e.g., 0.1 LOLE) underlying the 25 GW reference margin level. In contrast, any resource with an accredited capacity of 1 GW or less could retire without causing the system to violate its resource adequacy target.

Importantly, this technique for evaluating individual resources' impact works only for relatively small changes to the system, such as the exit or entry of one or a few plants. When larger changes happen in the region's resource composition, the new mix will itself affect resources' accreditation values, because these values inherently depend on the entire fleet composition.<sup>122</sup> To calculate the resource adequacy effect of major changes to the fleet (e.g., the retirement of half of the coal capacity in a region), it would be necessary to re-run the modeling from Step 2 with different inputs.

Having reviewed resource adequacy terms, methodologies, and best practices, Part 2 next uses this understanding to discuss DOE's recent resource adequacy modeling endeavor.

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<sup>122</sup> ENERGY SYS. INTEGRATION GRP., ENSURING EFFICIENT RELIABILITY, *supra* note 77, at 30.

## Part 2: DOE's Resource Adequacy Report

On July 7, 2025, DOE published its *Resource Adequacy Report: Evaluating the Reliability and Security of the United States Electric Grid* (DOE Study), responding to the EO's request for a "uniform methodology to identify at-risk region(s) and guide reliability interventions."<sup>123</sup> The report does not fulfill the EO's separate request for a "a protocol to identify which generation resources within a region are critical to system reliability."<sup>124</sup>

The DOE Study generally examines the resource adequacy of two time periods: today and 2030. According to the study, today, only ERCOT currently fails to achieve DOE's selected resource adequacy targets.<sup>125</sup> Under DOE's assumptions about load growth (including load growth from data centers), resource additions, and retirements, its modeling shows that all transmission planning regions will be resource inadequate in 2030 except ISO-NE and NYISO.<sup>126</sup> When reporting that a region is or would be resource inadequate, DOE sometimes calculates the amount of perfect capacity that could restore the region to resource adequacy.<sup>127</sup>

The DOE Study borrows heavily from NERC's recent Interregional Transfer Capability Study, which analyzed interregional transmission capacity and evaluated how additional interregional capacity could improve resource adequacy.<sup>128</sup> In contrast to NERC's Interregional Transfer Capability Study, the DOE Study does not consider how shortfalls could be mitigated through additional interregional transmission, which can be an alternative to new generation.<sup>129</sup>

Building on Part 1's discussion of how a resource adequacy model's metrics, values, and input assumptions drive its results, this Part evaluates DOE's resource adequacy methodology, including its input choices for load growth, resource additions, and retirements. At each step, it discusses the assumptions embedded in DOE's modeling choices, and reviews why those assumptions provide a weak basis for commanding specific, aging resources to continue serving load at consumers' expense and outside of existing market structures.

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<sup>123</sup> U.S. DEP'T OF ENERGY, RESOURCE ADEQUACY REPORT, *supra* note 2, at vi.

<sup>124</sup> Exec. Order No. 14,262, Strengthening the Reliability and Security of the United States Electric Grid, 90 Fed. Reg. 15521, 15521 (Apr. 14, 2025).

<sup>125</sup> U.S. DEP'T OF ENERGY, RESOURCE ADEQUACY REPORT, *supra* note 2, at 7.

<sup>126</sup> *Id.* at 8.

<sup>127</sup> *Id.* at 5. The exact meaning of these perfect capacity quantities is unclear due to contradictions within the DOE Study. At times, DOE explains that these are the perfect capacity quantities that restore the system to 0.002% while assuming projected retirements. *Id.* At other points, though, DOE states that these quantities assume no retirements. *Id.* at 9.

<sup>128</sup> *Id.* at 2; N. AM. ELEC. RELIABILITY CORP., INTERREGIONAL TRANSFER CAPABILITY STUDY vi, ix (2024), <https://perma.cc/U7M3-L56J>.

<sup>129</sup> See generally ADRIA E. BROOKS ET AL., *supra* note 90.

## Resource Adequacy Targets

The DOE Study uses a multi-metric resource adequacy target of 2.4 LOLH and 0.002% normalized unserved energy (NUSE), which is the deterministic equivalent to NEUE.<sup>130</sup> DOE's decision to use a multi-metric target aligns with best practices, and its decision to use LOLH and NEUE together is reasonable. But DOE's value selections for these metrics are problematic.

For LOLH, DOE indicated that it picked 2.4 because that value "translates into one day of lost load in ten years," i.e., the traditional 0.1 LOLE standard.<sup>131</sup> This decision does not align with best practices for two reasons. First, it seeks to unquestioningly replicate the already arbitrary 0.1 LOLE standard (which merely captures the level of resource adequacy that happened to exist in the 1940s).<sup>132</sup> DOE's choice thus does not reflect any meaningful cost-benefit analysis.

Second, DOE's conversion of 0.1 LOLE to 2.4 LOLH is inaccurate.<sup>133</sup> A region with 0.1 LOLE will experience only one day with an outage—of any length—across ten years, which will be 24 hours in only the most extreme case. A region with 2.4 LOLH will have 24 hours of outages across the decade, across any combination of hours. DOE's selection of 2.4 LOLH metric would therefore, in the vast majority of cases, permit a greater duration and frequency of outages.<sup>134</sup> Although this 2.4 LOLH target might indicate that, all else being equal, DOE's methodology is too permissive, DOE's inputs and assumptions likely dominate its analysis and lead DOE to overestimate potential shortfalls.

Turning to NUSE, DOE reports that it selected 0.002% because NERC uses that same value in its long-term resource adequacy assessments.<sup>135</sup> But, as discussed in Part 2, NERC adopted that value from Australia without any consideration of how the costs and benefits of resource adequacy differ in the U.S. context.<sup>136</sup> In contrast, DOE previously used 0.001% in the National Transmission Planning Study.<sup>137</sup>

Moreover, contrary to best practices, for both LOLH and NUSE, DOE imposes the same resource adequacy target across the entire continental United States, without considering regional differences. As noted in Part 1, when it comes to averting outages, regions face different costs and benefits with regard to resource adequacy and thus different socially optimal levels of resource adequacy.

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<sup>130</sup> U.S. DEP'T OF ENERGY, RESOURCE ADEQUACY REPORT, *supra* note 2, at 4, 14 ("This study does not employ common probabilistic industry metrics such as EUE or LOLE due to their reliance on probabilistic modeling. Instead, deterministic equivalents are used.").

<sup>131</sup> *Id.* at 4.

<sup>132</sup> KEVIN CARDEN ET AL., *supra* note 50, at 2; ENERGY SYS. INTEGRATION GRP., NEW RESOURCE ADEQUACY CRITERIA, *supra* note 6, at 6.

<sup>133</sup> JUAN PABLO CARVALLO ET AL., *supra* note 8, at 11 ("The LOLE is typically used as a target setting metric and has historically taken a value of 1 event-day in 10 years, commonly (and incorrectly) interpreted as 2.4 hours per year.").

<sup>134</sup> Gord Stephen et al., *supra* note 15, at 3, <https://perma.cc/A9DJ-C3B5>.

<sup>135</sup> U.S. DEP'T OF ENERGY, RESOURCE ADEQUACY REPORT, *supra* note 2, at 4 n.10.

<sup>136</sup> N. AM. ELEC. RELIABILITY CORP., 2024 LONG-TERM RELIABILITY ASSESSMENT, *supra* note 51, at 141.

<sup>137</sup> U.S. DEP'T OF ENERGY, NATIONAL TRANSMISSION PLANNING STUDY: CHAPTER 2: LONG-TERM U.S. TRANSMISSION PLANNING SCENARIOS 4, 82 (2024), <https://perma.cc/R8RA-23E2>.

Finally, at times, the DOE Study appears to struggle with the very meaning of a resource adequacy standard: It questions both PJM's and SPP's resource adequacy, even though each satisfies the metrics DOE's itself picked for its analysis. For PJM in particular, DOE notes that the region currently satisfies both prongs of the resource adequacy metric, but not for the particular weather year that includes Winter Storm Elliot.<sup>138</sup> Seemingly for this reason, DOE concludes that PJM needs 2.4 GW of additional perfect capacity to be resource adequate now.<sup>139</sup> But DOE's resource adequacy targets are, in DOE's own words, "average indicators" to be achieved across all modeled scenarios, not a requirement that must be achieved in each and every scenario.<sup>140</sup> PJM is resource adequate today according to DOE's targets.

Of course, as discussed in Part 1, it may be reasonable for a system planner to set a resource adequacy target that depends, in part, on each region's performance during tail risks. But DOE has not done so here.

## Resource Adequacy Modeling

DOE's resource adequacy modeling is inconsistent with best practices. DOE's high-level decisions about the study's overall modeling approach and data input decisions both diverge from the best practices described in Part 1.

### Deterministic Model

While the DOE Study appropriately examines all 8,760 hours of the year in chronological order,<sup>141</sup> DOE departs from best practices by using deterministic modeling rather than a probabilistic approach (like the Monte Carlo method), perhaps because of the EO's relatively short timeline.<sup>142</sup> Rather than randomly sampling probability distributions for each input to construct hundreds or thousands of plausible scenarios, DOE "evaluates whether a power system has sufficient resources . . . under a pre-defined set of conditions which correspond to the past few years of real-world events."<sup>143</sup> DOE uses twelve years of data (2007–2013 and 2019–2023) for weather, load, and generation.<sup>144</sup>

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<sup>138</sup> U.S. DEP'T OF ENERGY, RESOURCE ADEQUACY REPORT, *supra* note 2, at 7, 9, 27.

<sup>139</sup> *Id.* at 9.

<sup>140</sup> *Id.* at 7.

<sup>141</sup> See U.S. DEP'T OF ENERGY, RESOURCE ADEQUACY REPORT, *supra* note 2, at 10, 12–13.

<sup>142</sup> *Id.* at 2. The EO provided an extremely accelerated deadline of 90-days for DOE to produce results. See Exec. Order No. 14,262, Strengthening the Reliability and Security of the United States Electric Grid, 90 Fed. Reg. 15521, 15521 (Apr. 14, 2025). The DOE Study itself provides additional evidence for this conclusion, with its acknowledgement that "[p]robabilistic approaches incorporate data and advanced modeling techniques to represent uncertainty" but "require more computing power." U.S. DEP'T OF ENERGY, RESOURCE ADEQUACY REPORT, *supra* note 2, at 2 n.2.

<sup>143</sup> U.S. DEP'T OF ENERGY, RESOURCE ADEQUACY REPORT, *supra* note 2, at 10.

<sup>144</sup> *Id.* at 11. While DOE uses historical data for the years 2019–2023, it uses "synthetic" data for 2007–2013. *Id.* "The synthetic approach used historical weather data to estimate load and resource availability if those same weather conditions were to occur again in the future. The historic approach used historical measured data for load, as well as wind and solar resource output, from recent years and scaled it appropriately to represent future conditions." N. AM. ELEC. RELIABILITY CORP., INTERREGIONAL TRANSFER CAPABILITY STUDY, *supra* note 128, at 74.

By examining whether regions would be resource adequate only under conditions that resemble the recent past, DOE's study does not sufficiently account for uncertainty. Indeed, in the Interregional Transfer Capability Study, from which DOE borrowed, NERC itself explains the limitations of this same deterministic approach and same data: Some regions may look resource adequate because they happened to do well during the twelve years of data, while others look resource inadequate but be unlikely to perform as poorly in the future.<sup>145</sup> Addressing the deterministic vs. probabilistic distinction, NERC cautions that, because a "[p]robabilistic resource adequacy analysis was not conducted[,] . . . the [Interregional Transfer Capability Study] should not be considered a North American resource adequacy assessment."<sup>146</sup>

DOE grounds its use of a deterministic model in "transparency" and an interest in "modell[ing] detailed historic system conditions."<sup>147</sup> Neither is a reason to step away from best practices: DOE could document a probabilistic approach in a transparent way, and relying on a small sample of historic years is less accurate than a probabilistic approach. Given the high stakes associated with resource adequacy planning, any future DOE resource adequacy assessment should prioritize accuracy over expediency.

## Outage Threshold

Another modeling choice is the threshold for determining when a shortfall event has occurred. DOE projects a shortfall if "the remaining capacity after transmission and demand response falls below the 6 percent or 3 percent needed for error forecasting and ancillary services, depending on the scenario."<sup>148</sup> This choice means that DOE identifies shortfall events in the hours when, after exhausting imports and demand response, a region's excess energy falls below 6% or 3% of hourly load—but it is not clear when DOE uses 6% versus 3%. DOE states that more details are available in a section of the study's appendix entitled "Outputs," but, as of publication of this report, no such section appears to be available.<sup>149</sup>

NERC uses a 3% threshold in its Interregional Transfer Capability Study, using 6% only in a sensitivity analysis.<sup>150</sup> According to NERC, the 3% value "was established based on an evaluation of average reserve requirements where load shed may occur" and reflects how "a Balancing Authority will continue to hold reserves even if involuntary load shed is underway to safeguard the system from cascading or widespread outages."<sup>151</sup> It is impossible to tell from the DOE Study when DOE used 6% versus 3%, but the fact that DOE listed 6% first may suggest that 6% was not limited to a sensitivity analysis.

If DOE's model instead identifies shortage events even when a region still has 6% of load available as spare capacity, then DOE's results depart from NERC's practice and may overstate

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<sup>145</sup> *Id.* at 138.

<sup>146</sup> *Id.* at 4.

<sup>147</sup> U.S. DEP'T OF ENERGY, RESOURCE ADEQUACY REPORT, *supra* note 2, at 2 n.2.

<sup>148</sup> *Id.* at 12.

<sup>149</sup> *Id.*

<sup>150</sup> N. AM. ELEC. RELIABILITY CORP., INTERREGIONAL TRANSFER CAPABILITY STUDY, *supra* note 128, at 84.

<sup>151</sup> *Id.* at 91 n.90, 85.

the extent of expected outages. In NERC's Interregional Transfer Capability Study, this change alone *significantly* altered the existence and extent of predicted outages in many regions, such as producing a 690% increase in the size of the maximum outage event in SERC-Florida.<sup>152</sup> Under the 6% sensitivity, NERC also recommended 58 GW of transmission additions to address resource adequacy instead of 35 GW, illustrating the sizable influence of shifting this assumption from 3% to 6%.<sup>153</sup>

## Inputs

DOE's prediction that most regions will experience resource inadequacy by 2030 depends heavily on its assumptions about resource additions, retirements, load growth, and interregional imports. In each instance, DOE makes choices that raise significant questions about the validity of its modeling results.

## Additions

DOE assumes that the only resource additions by 2030 will be those NERC currently categorizes as "Tier 1."<sup>154</sup> To be a Tier 1 resource, the resource must have achieved at least one milestone from a NERC list that signifies the unit is "very mature in the development pipeline."<sup>155</sup> This assumption is very conservative: The study itself admits that "[t]his results in minimal capacity additions beyond 2026."<sup>156</sup> In other words, DOE's finding of widespread resource inadequacy in 2030 rests on the assumption that very little will be built from 2027–2030. For example, NERC identifies 17,047 MW of Tier 1 resources slated to come online in PJM throughout 2025 and 2026, but only 1,108 MW from 2027–2030.<sup>157</sup>

The drop-off in Tier 1 resources after 2026 is not due to a shortage of projects in development, but rather because NERC currently classifies much of the capacity that will come online between 2027 and 2030 as "Tier 2."<sup>158</sup> Tier 2 resources occupy a wide range of positions in the interconnection queue, from the earliest stages (e.g., those having completed a feasibility study) to the very end

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<sup>152</sup> *Id.* at 105 tbl.8.4

<sup>153</sup> *Id.*

<sup>154</sup> U.S. DEP'T OF ENERGY, RESOURCE ADEQUACY REPORT, *supra* note 2, at 4.

<sup>155</sup> *Id.* at A-5. More specifically, the resource must have finished construction, be under construction, have a signed/approved interconnection service agreement, have a signed/approved power purchase agreement, have a signed/approved construction service agreement, have a signed/approved wholesale market participant agreement, or (if it is in the footprint of a vertically integrated utility) be included in an integrated resource plan or under a regulatory environment that mandates a resource adequacy requirement. N. AM. ELEC. RELIABILITY CORP., 2024 LONG-TERM RELIABILITY ASSESSMENT, *supra* note 51, at 137.

<sup>156</sup> U.S. DEP'T OF ENERGY, RESOURCE ADEQUACY REPORT, *supra* note 2, at A-5. See also Ric O'Connell, *GridLab Analysis: Department of Energy Resource Adequacy Report*, GRIDLAB (July 11, 2025), <https://perma.cc/B3GC-T7GA> ("The report assumes just 22 GW of new 'firm' capacity (narrowly defined as gas) is added which is based on NERC LTRA 'Tier 1' – projects with a very high likelihood of success. The report assumes no projects are built post 2026, which is not realistic for a report forecasting to 2030. A more reasonable assumption for capacity additions is the EIA 860 released in June, which has 35 GW of gas additions, and another 53 GW of batteries – **88 GW of firm additions by 2030.**") (bolded text in original).

<sup>157</sup> N. AM. ELEC. RELIABILITY CORP., 2024 LONG-TERM RELIABILITY ASSESSMENT, *supra* note 51, at 89.

<sup>158</sup> See *id.* at 137.



of the process (e.g., those that have requested an interconnection service agreement).<sup>159</sup>

In recent years, the median project has taken approximately 55 months (4.58 years) to go from entering the queue to commercial operation.<sup>160</sup> Extrapolating from this historical trend reveals that a large number of Tier 2 resources will likely be operating by 2030. DOE should have anticipated some of them in the 2030 resource mix, and it departed from best practices by excluding all Tier 2 resources.<sup>161</sup> To do this forecasting accurately, DOE should have examined historical statistics of interconnection queue time by region, resource type, and resource size, along with differentiated queue withdrawal rates, estimating Tier 2 resource additions for each region.<sup>162</sup>

And applying historical statistics for time spent in a region's interconnection queue would itself be a conservative methodology for DOE to use, as FERC Order 2023 and related regional interconnection queue updates are set to speed up waiting times.<sup>163</sup> For example, the DOE Study found a 10.5 GW resource adequacy deficit for PJM in 2030 but failed to consider the almost 12 GW of nameplate capacity—mostly gas—that PJM is fast-tracking through its Reliability Resource Initiative.<sup>164</sup> PJM expects that 90% of this capacity will be online by 2030.<sup>165</sup> PJM is simultaneously pursuing other resource adequacy interventions, including a FERC-approved change to surplus interconnection service (to allow new generators to come online faster by taking advantage of underutilized transmission capacity),<sup>166</sup> and a FERC-pending proposal to expedite the process to transfer capacity interconnection rights from retiring generators to new resources.<sup>167</sup>

Finally, recently “retired” resources represent another potential source of fast additions.<sup>168</sup>

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<sup>159</sup> *Id.*

<sup>160</sup> JOSEPH RAND ET AL., LAWRENCE BERKELEY NAT'L LAB'Y, QUEUED UP: 2024 EDITION: CHARACTERISTICS OF POWER PLANTS SEEKING TRANSMISSION INTERCONNECTION AS OF THE END OF 2023 41 (2024), <https://perma.cc/5DE4-XNK6>.

<sup>161</sup> See N. AM. ELEC. RELIABILITY CORP., 2024 LONG-TERM RELIABILITY ASSESSMENT, *supra* note 51, at 23 fig.2.

<sup>162</sup> See *generally* JOSEPH RAND ET AL., LAWRENCE BERKELEY NAT'L LAB'Y, QUEUED UP: 2024 EDITION: CHARACTERISTICS OF POWER PLANTS SEEKING TRANSMISSION INTERCONNECTION AS OF THE END OF 2023 (2024), <https://perma.cc/5DE4-XNK6>.

<sup>163</sup> *Improvements to Generator Interconnection Procedures and Agreements*, 184 FERC ¶ 61,054 (2023).

<sup>164</sup> DONNIE BIELAK, PJM, RELIABILITY RESOURCE INITIATIVE: ADDITIONAL SUMMARIES 2 (2025), <https://perma.cc/Y2AB-3CEM>; DONNIE BIELAK, PJM, RELIABILITY RESOURCE INITIATIVE: RESULTS SUMMARY 6 (2025), <https://perma.cc/MYQ8-Y53G>. See also Ric O'Connell, *supra* note 156 (“The study ignores both utility plans for meeting increased load growth and how markets will respond. In fact, markets and utilities have already responded with plans to add new capacity and fast track new resources. These include PJM's Reliability Resource Initiative, which plans on adding 11 GW of new firm resources by 2030. SPP and MISO both have proposals at FERC (called ERAS) that will likely add another 30 GW of firm resources. Those three regional efforts alone would add roughly twice what the DOE assumed for the entire nation.”).

<sup>165</sup> *PJM Chooses 51 Generation Resource Projects To Address Near-Term Electricity Demand Growth*, PJM INSIDE LINES (May 2, 2025), <https://perma.cc/8EW2-G2XZ>.

<sup>166</sup> *PJM Interconnection*, L.L.C., 190 FERC ¶ 61,083 (2025).

<sup>167</sup> Proposed Revisions to PJM's Open Access Transmission Tariff, PJM, Docket No. ER25-\_\_\_\_-000 (Jan. 31, 2025), <https://perma.cc/J9T3-MCGL>.

<sup>168</sup> E.g., Francisco “A.J.” Camacho & Daviel Schulman, *Mothballed Nuclear Plant on Brink of Revival*, ENERGYWIRE (July 15, 2025), <https://subscriber.politicopro.com/article/eenews/2025/07/15/mothballed-nuclear-plant-on-brink-of-revival-00445239>.

## Retirements

DOE's assumption that 104 GW of nameplate capacity will retire by 2030 likely overestimates retirements.<sup>169</sup> This number includes both "confirmed" retirements—resources that have notified their system operators of their impending retirements and begun the retirement process—and "announced" retirements—which are publicly stated but not officially noticed.<sup>170</sup> These data come from NERC's Long-Term Reliability Assessment 2024 model.<sup>171</sup> In turn, NERC receives reports of confirmed retirements directly from each region, while announced retirements come from multiple sources, including Energy Information Agency Form 860 data, trade press, and utility integrated resource plans.<sup>172</sup>

These data likely overestimate retirements.<sup>173</sup> First, the economics of energy production have changed since 2024. The combined effect of new demand from data centers and the elimination of federal tax credits for new wind and solar resources improves the financial outlook for thermal resources.<sup>174</sup> Second, federal environmental regulations that would have required thermal resources to make investments reducing their pollution or else retire were projected to result in significant retirements before 2030.<sup>175</sup> But the Trump Administration has begun to rescind or reexamine these rules, which could cause resources to delay their retirements.<sup>176</sup>

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<sup>169</sup> See U.S. DEP'T OF ENERGY, RESOURCE ADEQUACY REPORT, *supra* note 2, at 5.

<sup>170</sup> *Id.* at 12.

<sup>171</sup> *Id.*

<sup>172</sup> N. AM. ELEC. RELIABILITY CORP., 2024 LONG-TERM RELIABILITY ASSESSMENT, *supra* note 51, at 28 n.19.

<sup>173</sup> Ric O'Connell, *supra* note 156 ("The report assumed 104 GW of retirements by 2030, with 3/4 of this coal and 1/4 gas. But the most recent data from the U.S. Energy Information Administration released in June (the EIA 860) has just **half** of this capacity retiring. In the report, the DOE assumed these 50 GW of likely retirements, but included another 50 GW of *announced* retirements, inconsistent with their assumption around capacity additions. Most likely many plants will choose not to retire due to the changing regulatory and economic landscape, driven by the administration's policies.") (bolded text in original).

<sup>174</sup> AURORA ENERGY RESEARCH, IMPACT OF REFORM TO CLEAN ENERGY TAX CREDITS ON INVESTMENT, JOBS AND CONSUMER BILLS 10 (2025), <https://perma.cc/VHR5-UEGP>; ("Most demand is made up through more production from existing plants (35%), meaning these plants are running for longer hours and/or at higher output levels. Some projects that retired in the base case scenario see longer lifetimes in Tax Credit Removal scenario because of more favorable economics due to clean energy decline (making up 17% of lost generation), and the rest is made up for by new build thermal plants (29%)."); ENERGY INNOVATION POL'Y & TECH. LLC, FEDERAL CLEAN ENERGY TAX CREDITS MAKE ENERGY MORE AFFORDABLE—A META-ANALYSIS (2025) <https://perma.cc/QH2E-7PLL> ("The research is clear—repealing technology-neutral energy tax credits would raise annual energy bills up to \$140–\$220 per year nationally, and over \$500 per year in some states."). See also Ethan Howland, *PJM Capacity Prices Hit Record Highs, Sending Build Signal to Generators*, UTILITY DIVE (July 31, 2024), <https://perma.cc/UC6U-QHYT> ("Prices in the PJM Interconnection's latest capacity auction hit record highs, which should provide incentives for power plant companies to build new generating resources and keep existing ones operating, according to the grid operator."); Ethan Howland, *MISO Summer Capacity Prices Jump to \$666.50/MW-day as Power Supplies Shrink*, UTILITY DIVE (Apr. 29, 2025), <https://perma.cc/A6S5-4A4U> ("Capacity prices for the upcoming summer season jumped to \$666.50/MW-day from \$30/MW-day last year across the Midcontinent Independent System Operator's footprint—driven in part by declining surplus capacity, according to the results of its latest planning resource auction released Monday.").

<sup>175</sup> PJM, ENERGY TRANSITION IN PJM: RESOURCE RETIREMENTS, REPLACEMENTS & RISKS 8 (2023), <https://perma.cc/7J3A-FL8U>.

<sup>176</sup> EPA Launches Biggest Deregulatory Action in U.S. History, EPA (Mar. 12, 2025), <https://perma.cc/55MN-2SUB>.

## Load

The DOE Study assumes 50 GW of growth in data center load and 51 GW of additional non-data center load.<sup>177</sup> DOE does not account for the possibility that this data center load could be flexible, even as one study suggests that 76 GW of additional data center load could be accommodated today if it could be curtailed only 0.25% of the time, and relevant corporations have confirmed flexibility potential.<sup>178</sup>

In June 2025, Texas enacted a law that allows ERCOT to curtail certain new loads over 75 MW during emergencies.<sup>179</sup> DOE assumes an additional 8 GW of data center load in ERCOT by 2030 and finds a reliability shortfall of 10.5 GW (which is likely an overestimate for the reasons discussed elsewhere in this Part, including how this 10.5 GW brings ERCOT to 0.0008% NUSE instead of 0.002% NUSE).<sup>180</sup> Accordingly, Texas's new law could go a long way towards avoiding the DOE-identified resource adequacy problem. Other regions like PJM are considering strategies to soften the resource adequacy impact of data centers, including ways to better encourage their participation in demand response programs.<sup>181</sup> DOE should have considered the possibility that some of the projected data center load would be flexible, especially in ERCOT.

Additionally, how DOE chose to distribute the projected 50 GW of data center load across regions is questionable. The DOE Study explains it used state-level growth ratios to perform this allocation.<sup>182</sup> But it is unlikely that all the computing demand needs to be processed close to load centers (i.e., proportional to a region's current electric load). In fact, some computing demand

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<sup>177</sup> U.S. DEP'T OF ENERGY, RESOURCE ADEQUACY REPORT, *supra* note 2, at 2–3.

<sup>178</sup> TYLER H. NORRIS ET AL., NICHOLAS INST. FOR ENERGY, ENV'T & SUSTAINABILITY, RETHINKING LOAD GROWTH: ASSESSING THE POTENTIAL FOR INTEGRATION OF LARGE FLEXIBLE LOADS IN US POWER SYSTEMS 2 (2025), <https://perma.cc/6693-3HZU>; EPRI Launches Initiative to Enhance Data Center Flexibility and Grid Reliability, ELEC. POWER RSCH. INST. (Oct. 29, 2024), <https://perma.cc/75LY-PSP5> ("Led by EPRI, DCFlex will coordinate real-world demonstrations of flexibility in a variety of existing and planned data centers and electricity markets, creating reference architectures and providing shared learnings to enable broader adoption of flexible operations that benefit all electricity consumers. Specifically, DCFlex will establish five to ten flexibility hubs, demonstrating innovative data center and power supplier strategies that enable operational and deployment flexibility, streamline grid integration, and transition backup power solutions to grid assets. Demonstration deployment will begin in the first half of 2025, and testing could run through 2027."); Anuja Ratnayake, *Unlocking AI Potential with Data Center Flexibility*, ENERGYCENTRAL (June 12, 2025), <https://www.energycentral.com/intelligent-utility/post/unlocking-ai-potential-with-data-center-flexibility-PtPoXIAuRMzs5Ff> ("In a preliminary test of the depth of computational flexibility possible in an AI data center, the Arizona demonstration site experienced some early success. It showcased the potential for an AI data center to provide grid relief during a peak system event—such as a hot summer day with high power demand—by temporarily and precisely ramping down its electricity consumption without compromising data center performance."). See also Ric O'Connell, *supra* note 156 ("It does not address flexibility of this load, however, which was recently demonstrated in a report from Duke University to allow for 100 GW of large load additions today with minimal grid impact.").

<sup>179</sup> S.B. No. 6 § 4, 89th Legislature (Tex. 2025) (to be enacted at Tex. Util. Code § 39.170), <https://perma.cc/4Z7H-9XKQ>; Brian Martucci, *Texas Law Gives Grid Operator Power to Disconnect Data Centers During Crisis*, UTILITY DIVE (JUNE 25, 2025), <https://perma.cc/SYK3-V4XX>; WALEED ASLAM & ROBIN HYTOWITZ, ELEC. POWER RSCH. INST., TEXAS SB6 EXPLAINED: ADDRESSING LARGE LOAD IMPACTS (2025), <https://perma.cc/QD8S-3M5C>.

<sup>180</sup> U.S. DEP'T OF ENERGY, RESOURCE ADEQUACY REPORT, *supra* note 2, at 40.

<sup>181</sup> TIM HORGER, PJM, LARGE LOAD ADDITIONS WORKSHOP 28 (2025), <https://perma.cc/4HSN-CW4W>.

<sup>182</sup> U.S. DEP'T OF ENERGY, RESOURCE ADEQUACY REPORT, *supra* note 2, at 17.

may be served from other regions if it will be cheaper to integrate the data center elsewhere. Given the scale of DOE's projected data center load compared to the relatively small resource adequacy shortfalls that the study identifies, these assumptions may have made the difference between whether a region achieves DOE's resource adequacy targets.<sup>183</sup>

### ***Interregional Imports***

The DOE Study states that it has adopted the interregional transfer capacities from NERC's Interregional Transfer Capability Study but also notes that transfers are "available up to the *minimum* total transfer capacity."<sup>184</sup> NERC's values describe the available transmission capacity between regions, including sub-regions of larger transmission-constrained regions like PJM, SPP, and MISO.<sup>185</sup> NERC provides a summer value and a winter value for each interregional interface and for each direction of flow.<sup>186</sup>

It is unclear what DOE means when it says that transfers are allowed up to their "minimum." If DOE picked the lesser of the summer and winter transfer capacities and applied that annually, doing so would inaccurately underestimate the amount of interregional transfer capacity.

### **Accreditation & Reference Margin Levels**

While DOE issued its study in response to the EO's request for a "methodology to identify current and anticipated regions with reserve margins below acceptable thresholds,"<sup>187</sup> it does so through resource adequacy modeling, rather than by calculating accreditation values and using them to derive reference margin levels. As explained in Part 2, properly performed resource adequacy modeling is sufficient to determine whether a region is resource adequate.

In contrast, accreditations and reference margin levels are useful in combination to quickly evaluate how the loss or addition of a particular resource would affect whether a region achieves its resource adequacy target without re-running regional resource adequacy modeling. They are thus more applicable to EO Section 3(c)'s separate command to establish a "protocol to identify which generation resources within a region are critical to system reliability."<sup>188</sup> Thus far, DOE has not released a study implementing this provision. DOE may eventually supplement the DOE Study with additional accreditation and reference margin level analyses.

Nonetheless, while the DOE Study does not calculate accreditation values or reference margin levels, it does undertake the related exercise of evaluating how much additional perfect capacity would bring certain regions to resource adequacy.<sup>189</sup> (DOE calculated these perfect capacity

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<sup>183</sup> See *id.* at 9, 17.

<sup>184</sup> *Id.* at 18, 12, A-1 (emphasis added).

<sup>185</sup> N. AM. ELEC. RELIABILITY CORP., INTERREGIONAL TRANSFER CAPABILITY STUDY, *supra* note 128, at 7, 9–10.

<sup>186</sup> *Id.* at 17–24.

<sup>187</sup> Exec. Order No. 14,262, Strengthening the Reliability and Security of the United States Electric Grid, 90 Fed. Reg. 15521, 15521 (Apr. 14, 2025).

<sup>188</sup> *Id.* at 15522.

<sup>189</sup> U.S. DEP'T OF ENERGY, RESOURCE ADEQUACY REPORT, *supra* note 2, at 5.

additions for only four of the seven regions that failed to achieve 0.002% NUSE in 2030: PJM, SPP, SERC, and ERCOT—not MISO, CAISO, or West Non-CAISO.<sup>190</sup> More specifically, DOE asked how much perfect capacity it would take for regions to achieve the 0.002% NUSE resource adequacy standard in 2030.<sup>191</sup>

If, in the future, DOE were to also calculate the accredited capacity of a region's fleet and then add the solved-for perfect capacity, it could calculate the region's reference margin level. Similarly, although DOE did not perform any perfect capacity analysis for regions that achieve 0.002% NUSE, DOE could subtract perfect capacity from the accredited capacity of the regional fleets to solve for reference margin levels. Once DOE calculates a region's reference margin, it could look at the accredited capacity of any resource to evaluate how its exit or entry would affect achievement of the reference margin level.

In calculating any reference margin levels, DOE should attend to all prongs of its multi-metric resource adequacy target. Here, DOE Study's perfect capacity exercise focuses exclusively on 0.002% NUSE. But if a region achieves 0.002% NUSE and not 2.4 LOLH, it would be resource inadequate according to the terms of this DOE Study. Separate reference margin levels may apply to each prong, and a region would be resource adequate only when the highest reference margin level is achieved.

Additionally, going forward, DOE should better prioritize accuracy in any new studies with respect to calculating a region's need for perfect capacity additions/subtractions. Critically, while DOE asserted that it added the amount of perfect capacity needed to bring each region to 0.002% NUSE, the 10.5 GW that it added to PJM actually brought it to 0.0003% NUSE; the 500 MW added to SERC brought it to 0.0002% NUSE; the 1.5 GW added to SPP brought it to 0.0002% NUSE; and the 10.5 GW added to ERCOT brought it to 0.0008% NUSE.<sup>192</sup> All of these values indicate significantly greater resource adequacy than 0.002% NUSE, sometimes by an order of magnitude.

While DOE explains that its perfect capacity additions were done "by hand with a limited number of iterations (15)" such that the capacity additions "should not be considered the minimum possible capacity to accomplish these targets," that approach does not appear to explain why DOE brought these regions far beyond the 0.002% NUSE target.<sup>193</sup> Rather, this explanation suggests that, for each of the regions, DOE could have achieved these high levels of resource adequacy using less perfect capacity than it added. Accordingly, to achieve 0.002% NUSE, DOE likely could have added much less perfect capacity than it did. Identifying resources that meet these overestimated capacity levels could result in overpaying to achieve a different resource adequacy target than selected.

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<sup>190</sup> *Id.* at 20–42.

<sup>191</sup> *Id.* at 5.

<sup>192</sup> *Id.* at 27, 30, 32, 40.

<sup>193</sup> *Id.* at 19.



## Part 3: Next Steps

Having reviewed best practices for resource adequacy modeling and the DOE Study, this final section discusses next steps for U.S. resource adequacy policy considering the diverse actors in this space and their respective authorities.

The Federal Power Act (FPA) gives FERC, and FERC’s designated “Electric Reliability Organization” (ERO), NERC, jurisdiction over and responsibility for ensuring “[e]lectric reliability” for the “bulk power system,” i.e., the high-voltage transmission network and the energy that flows through it.<sup>194</sup> More specifically, the FPA requires NERC to “establish and enforce reliability standards,” which take effect after FERC approves them.<sup>195</sup> Importantly, FERC can also order NERC to submit reliability standards on particular topics and can independently enforce reliability standards.<sup>196</sup> NERC’s six regional entities (comprising the continental U.S. plus Canada) also have authority to propose reliability standards to NERC.<sup>197</sup>

Achieving reliability arguably requires that bulk power system be resource adequate because, as FERC explains, “[i]f resources cannot meet load, or are insufficient to provide a reserve margin above expected load, then instability, uncontrolled separation or cascading failures can result from the unanticipated loss of a system element.”<sup>198</sup> But, although reliable grid operations depend in part on resource adequacy, the FPA does not put FERC and NERC in the driver’s seat for this aspect of reliability. FERC lacks authority to *directly achieve* resource adequacy because it cannot order construction of electric generation facilities.<sup>199</sup> Rather, states retain their traditional authority “over facilities used for the generation of electric energy,”<sup>200</sup> which some exercise by requiring utilities to submit integrated resource plans describing their plans to meet future demand.<sup>201</sup> Other states fully or partially delegate this authority to the Regional Transmission Organizations (RTOs) that operate their regional grids, e.g., by relying on the RTOs to achieve resource adequacy through capacity markets.<sup>202</sup>

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<sup>194</sup> 16 U.S.C. § 824o(a).

<sup>195</sup> 16 U.S.C. § 824o(a)(2), (d). FERC does not have authority to create reliability standards directly. See *id.* at § 824o(d).

<sup>196</sup> 16 U.S.C. § 824o(d)(5), (e)(3).

<sup>197</sup> 16 U.S.C. § 824o(e)(4); *ERO Enterprise; Regional Entities*, N. AM. ELEC. RELIABILITY CORP., <https://perma.cc/EQ9E-BXJW>.

<sup>198</sup> *Planning Resource Adequacy Assessment Reliability Standard*, 134 FERC ¶ 61,212, at P 25 (2011). Reliable operation also encompasses a second aspect of reliability not implicated by the EO—operational reliability—which refers to “ability of the electric system to withstand sudden disturbances while avoiding cascading blackouts.” BURÇIN ÜNEL & AVI ZEVIN, *supra* note 5, at 11.

<sup>199</sup> 16 U.S.C. § 824o(a)(3). The FPA also prohibits FERC from directing utilities to build transmission, and states retain primary siting authority for transmission. See *id.*; *Building for the Future Through Electric Regional Transmission Planning and Cost Allocation*, 187 FERC ¶ 61,068 at P258 (2024).

<sup>200</sup> 16 U.S.C. § 824(b)(1).

<sup>201</sup> Coley Girouard, *Understanding IRPs: How Utilities Plan for the Future*, ADVANCED ENERGY UNITED (Aug. 11, 2015), <https://perma.cc/5MDN-26QY>.

<sup>202</sup> DENA ADLER & JENNIFER DANIS, INST. FOR POL’Y INTEGRITY, REDUCING POLLUTION WITHOUT SACRIFICING RELIABILITY 14–16



But FERC and NERC can still play an important role for resource adequacy: FERC and NERC, through reliability standards, can ensure grid operators are proactively conducting appropriate resource adequacy assessments and analyses. In Order No. 747, FERC approved a regional reliability standard for conducting resource adequacy assessments.<sup>203</sup> This enforceable reliability standard requires, at a minimum, that entities within the applicable footprint conduct an annual analysis of what reserve margin would be necessary to ensure no more than 0.1 LOLE, using specific inputs like the median load forecast and accounting for important factors like fuel availability.<sup>204</sup> This reliability standard does not require regions to actually achieve 0.1 LOLE, only to conduct the mandated analysis.<sup>205</sup> A future reliability standard could require regions to instead adopt best practices comparable to those described in Part 1.

Turning to DOE, the DOE Reorganization Act put emergency grid reliability powers in DOE's hands for addressing certain emergency situations. Section 202(c) of the FPA empowers DOE, upon the finding of an emergency, to require, among any things, "such generation . . . as in its judgment will best meet the emergency and serve the public interest."<sup>206</sup> Section 202(c) and its implementing regulations, along with the common understanding of the word "emergency," indicate that this authority is limited to unexpected events.<sup>207</sup> Additionally, DOE's implementing regulations indicate that a shortage caused by a resource's poor economics would not qualify as an emergency, unless the shortage is "imminent."<sup>208</sup> When promulgating these regulations, DOE noted that:

DOE does not intend these regulations to replace prudent utility planning and system expansion. This intent has been reinforced in the final rule by expanding the "Definition of Emergency" to indicate that, while a utility may rely upon these regulations for assistance during a period of unexpected inadequate supply of electricity, it must solve long-term problems itself.<sup>209</sup>

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(2024), <https://perma.cc/G6J3-9ZL4>. These capacity markets are FERC-jurisdictional, and operate according to rules contained in tariffs filed with FERC, specifying particulars like demand curve type, resource accreditation, and formulas for calculating reserve margins. See, e.g., *PJM Interconnection, L.L.C.*, 191 FERC ¶ 61,066, at P 8 (2025).

<sup>203</sup> *Planning Resource Adequacy Assessment Reliability Standard*, 134 FERC ¶ 61,212, at P 1 (2011).

<sup>204</sup> Standard BAL-502-RF-03, N. AM. ELEC. RELIABILITY CORP., <https://perma.cc/9MB5-5H67>.

<sup>205</sup> *Planning Resource Adequacy Assessment Reliability Standard*, 134 FERC ¶ 61,212, at P 33 (2011) ("The only obligations under BAL-502-RFC-02 are analysis and documentation requirements. This regional Reliability Standard does not specify how the results of the analysis required in this standard are to be used. For example, BAL-502-RFC-02 does not require state commissions to use the resource assessment analysis resulting from BAL-502-RFC-02 for economic decisions regarding resource adequacy requirements.").

<sup>206</sup> 16 U.S.C. § 824a(c)(1).

<sup>207</sup> 16 U.S.C. § 824a(c)(1); 10 C.F.R. § 205.371; BURÇIN ÜNEL & AVI ZEVIN, *supra* note 5, at 37–38.

<sup>208</sup> 10 C.F.R. § 205.371 ("Situations where a shortage of electric energy is projected due solely to the failure of parties to agree to terms, conditions or other economic factors relating to service, generally will not be considered as emergencies unless the inability to supply electric service is imminent.").

<sup>209</sup> Emergency Interconnection of Electric Facilities and the Transfer of Electricity to Alleviate an Emergency Shortage of Electric Power, 46 Fed. Reg. 39984, 39985 (Aug. 6, 1981) (codified at 10 C.F.R. pt. 205).

In a departure from prior practice,<sup>210</sup> DOE has now used this authority to prevent thermal plants from retiring.<sup>211</sup> These orders have already drawn challenges from multiple parties, including from a politically diverse coalition of utility regulators.<sup>212</sup> Parties argue, among other points, that the plants' retirements were not unexpected; that the regions would be resource adequate even without the plants; and that DOE's newly asserted authority over resource adequacy triggers the major questions doctrine.<sup>213</sup>

Having nationally set best practices and principles for determining resource adequacy in the face of rapidly escalating demand and the clean energy transition could be useful if they are well vetted and use appropriate legal constructs. The FPA in conjunction with the DOE Reorganization Act suggest that the appropriate course of action for the federal government to support resource adequacy would be for NERC and FERC to set national resource adequacy *planning* standards (not a national resource adequacy target) to help regions guard against potential resource adequacy risks that might materialize in the future, instead of allowing DOE to stretch its 202(c) emergency authorities.

The DOE study itself cautions, "the resource adequacy analysis that was performed in support of this study could benefit greatly from the in-depth engineering assessments which occur at the regional and utility level."<sup>214</sup> Despite DOE's press statement asserting that the study's methodology can help guide "guide Federal reliability interventions,"<sup>215</sup> presumably to address the EO's mandate that DOE find a way to routinize further 202(c) emergency orders,<sup>216</sup> the study reports a fundamental limitation for doing so: It does not find any near-term reliability risk from current levels of resource adequacy.

The study itself states that, "one of the key takeaways from this study process is the underscored 'call to action' for strengthened regional engagement, collaboration, and robust data exchange which are critical to addressing the urgency of reliability and security concerns that underpin our

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<sup>210</sup> CONG. RSCH. SERV., FEDERAL POWER ACT: THE DEPARTMENT OF ENERGY'S EMERGENCY AUTHORITY 4 (updated 2025), <https://perma.cc/AU8L-VR55>.

<sup>211</sup> DOE's Use of Federal Power Act Emergency Authority, U.S. DEP'T OF ENERGY, <https://perma.cc/DPB9-6B74>.

<sup>212</sup> Ethan Howland, *Groups Appeal DOE "Emergency" Order Keeping Michigan Plan Online*, UTILITY DIVE (updated June 20, 2025), <https://perma.cc/P9YZ-FNLK>; Ethan Howland, *Eight Utility Regulators Challenge DOE Order Keeping Michigan Coal Plant Open*, UTILITY DIVE (June 26, 2025), <https://perma.cc/55FE-2RYR>; Motion to Intervene and Request for Rehearing of the Joint Consumer Advocates, Dep't of Energy Order No. 202-25-4 (June 27, 2025), <https://perma.cc/PD74-6CNC>.

<sup>213</sup> Request for Rehearing by Michigan Attorney General Dana Nessel, Dep't of Energy Order No. 202-25-3, at 27–31, 35–36 (June 18, 2025); Motion to Intervene and Request for Rehearing and Stay of Sierra Club et al., Dep't of Energy Order No. 202-25-3, at 29–36 (June 18, 2025), <https://perma.cc/4MYN-MHZC>; Petition to Intervene and Request for Rehearing of the Organization of MISO States, Inc., Dep't of Energy Order No. 202-25-3, at 2–6 (June 23, 2025), <https://perma.cc/D3PG-56H2>. See also Brief of the Institute for Policy Integrity at 4–13, *V.O.S. Selections, Inc. v. Trump*, No. 25-00066-GSK-TMR-JAR (Ct. Int'l Trade May 8, 2025), <https://perma.cc/5Z4T-8CHG> (describing the major questions doctrine).

<sup>214</sup> U.S. DEP'T OF ENERGY, RESOURCE ADEQUACY REPORT, *supra* note 2, at i.

<sup>215</sup> Department of Energy Releases Report on Evaluating U.S. Grid Reliability and Security, U.S. DEP'T OF ENERGY (July 7, 2025), <https://perma.cc/942V-L7VB>.

<sup>216</sup> See Exec. Order No. 14,262, Strengthening the Reliability and Security of the United States Electric Grid, 90 Fed. Reg. 15521, 15521–22 (Apr. 14, 2025).

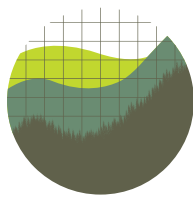
collective economic and national security.” And it presents a pathway to fulfill DOE’s discussion of what will happen next: “The report will inform joint planning processes and help integrate modern metrics into national reliability assessment methodology.”<sup>217</sup> FERC directing NERC to develop national resource adequacy planning metrics, protocols, and input parameters would fit neatly within this call to action.

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<sup>217</sup> Reliability, U.S. DEP’T OF ENERGY, <https://perma.cc/RSW3-FNN2>.

# Conclusion

**G**iven ever-increasing demand for electricity—proliferation of data centers for artificial intelligence; electrification of heating, cooling, and transportation; and pushes to onshore manufacturing—maintaining resource adequacy is essential. But there is no single answer to the question of when a system is resource adequate, or even what constitutes resource adequacy. Still, as this report explains, there are better and worse ways to pick resource adequacy targets, to evaluate whether the system has achieved and will maintain them, and to understand the resource adequacy impacts of a particular resource entering or exiting the system. The DOE Study uses some of these best practices but not other important ones, undermining the accuracy of its predictions. The DOE Study will hopefully focus additional attention on resource adequacy and speed up federal and state endeavors already underway to bolster resource adequacy. It does not, however, provide a rational basis for DOE to take action now to thwart ongoing plans for uneconomic, aging resources to retire. DOE's next best step would be to request that FERC open a proceeding eliciting proposals for nationwide, enforceable reliability standards mandating not a national resource adequacy target, but best practices for grid planners to conduct resource adequacy assessments. Additionally, states and grid operators should continue working together to expedite resource permitting, better forecast what hyperscaler demand will materialize, engage in holistic transmission planning, and speed interconnection queues—all of which will support future resource adequacy.



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BEFORE THE UNITED STATES DEPARTMENT OF ENERGY

Federal Power Act Section 202(c)     )  
Emergency Order: Midcontinent     )  
Independent System Operator     )  
(MISO)     )  
\_\_\_\_\_     )

Order No. 202-25-7

Exhibit to  
Motion to Intervene and Request for Rehearing and Stay of  
Public Interest Organizations

Filed September 5, 2025

Exhibit 114  
  
2025 EPA MI Haze  
SIP Approval



PRA. This proposed action does not establish any new information collection requirements.

*D. Regulatory Flexibility Act (RFA)*

This rule is not subject to notice and comment requirements because the Agency has invoked the APA “good cause” exemption under 5 U.S.C. 553(b)(B).

*E. Unfunded Mandates Reform Act (UMRA)*

This action does not contain an unfunded mandate as described in UMRA, 2 U.S.C. 1531–1538, and does not significantly or uniquely affect small governments. The action imposes no enforceable duty on any state, local or Tribal governments or the private sector.

*F. Executive Order 13132: Federalism*

This action does not have federalism implications. It will not have substantial direct effects on the states, on the relationship between the national government and the states, or on the distribution of power and responsibilities among the various levels of government.

*G. Executive Order 13175: Consultation and Coordination With Indian Tribal Governments*

This action does not have Tribal implications as specified in Executive Order 13175. This action withdraws two rules impacting the State of Texas. No Tribe is subject to the requirement to submit an implementation plan under the findings of inadequacy relevant to this action. Thus, Executive Order 13175 does not apply to this action.

*H. Executive Order: 13045 Protection of Children From Environmental Health & Safety Risks*

The EPA interprets Executive Order 13045 as applying only to those regulatory actions that concern health or safety risks that the EPA has reason to believe may disproportionately affect children, per the definition of “covered regulatory action” in section 2–202 of the Executive Order. This action is not subject to Executive Order 13045 because it withdraws two rules that are no longer applicable to the State of Texas and does not directly or disproportionately affect children

*I. Executive Order 13211: Actions That Significantly Affect Energy Supply, Distribution or Use*

This action is not subject to Executive Order 13211, because it is not a significant regulatory action under Executive Order 12866.

*J. National Technology Transfer and Advancement Act*

This proposed action does not involve technical standards.

This action is subject to the Congressional Review Act (CRA), and the EPA will submit a rule report to each House of the Congress and to the Comptroller General of the United States. This action is not a “major rule” as defined by 5 U.S.C. 804(2).

Under section 307(b)(1) of the CAA, petitions for judicial review of this action must be filed in the United States Court of Appeals for the appropriate circuit by November 4, 2025. Filing a petition for reconsideration by the Administrator of this final rule does not affect the finality of this action for the purposes of judicial review nor does it extend the time within which a petition for judicial review may be filed, and shall not postpone the effectiveness of such rule or action. This action may not be challenged later in proceedings to enforce its requirements (see section 307(b)(2)).

**List of Subjects in 40 CFR Part 52**

Environmental protection, Air pollution control, Incorporation by reference, Intergovernmental relations, Reporting and recordkeeping requirements, Sulfur oxides.

Dated: August 26, 2025.

**Walter Mason,**

*Regional Administrator, Region 6.*

For the reasons stated in the preamble, the Environmental Protection Agency amends 40 CFR part 52 as follows:

**PART 52—APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS**

■ 1. The authority citation for part 52 continues to read as follows:

**Authority:** 42 U.S.C. 7401 *et seq.*

**Subpart SS—Texas**

**§ 52.2277 [Amended]**

■ 2. Amend § 52.2277 by removing and reserving paragraph (c).

[FR Doc. 2025–17029 Filed 9–4–25; 8:45 am]

**BILLING CODE 6560–50–P**

**ENVIRONMENTAL PROTECTION AGENCY**

**40 CFR Part 52**

**[EPA–R05–OAR–2021–0577; FRL–12588–02–R5]**

**Air Plan Approval; Michigan; Second Period Regional Haze Plan**

**AGENCY:** Environmental Protection Agency (EPA).

**ACTION:** Final rule.

**SUMMARY:** The Environmental Protection Agency (EPA) is approving the Regional Haze State Implementation Plan (SIP) revision submitted by the Michigan Department of Environment, Great Lakes, and Energy (EGLE) on August 23, 2021, and supplemented on July 24, 2025, as satisfying applicable requirements under the Clean Air Act (CAA) and EPA’s Regional Haze Rule (RHR) for the program’s second implementation period. EGLE’s SIP submission addresses the requirement that States must periodically revise their long-term strategies for making reasonable progress towards the national goal of preventing any future, and remedying any existing, anthropogenic impairment of visibility, including regional haze, in mandatory Class I Federal areas. The SIP submission also addresses other applicable requirements for the second implementation period of the regional haze program. EPA is taking this action pursuant to sections 110 and 169A of the CAA.

**DATES:** This final rule is effective on October 6, 2025.

**ADDRESSES:** EPA has established a docket for this action under Docket ID No. EPA–R05–OAR–2021–0577. All documents in the docket are listed on the <https://www.regulations.gov> website. Although listed in the index, some information is not publicly available, *i.e.*, Confidential Business Information (CBI), Proprietary Business Information (PBI), or other information whose disclosure is restricted by statute. Certain other material, such as copyrighted material, is not placed on the internet and will be publicly available only in hard copy form. Publicly available docket materials are available either through <https://www.regulations.gov> or at the Environmental Protection Agency, Region 5, Air and Radiation Division, 77 West Jackson Boulevard, Chicago, Illinois 60604. This facility is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding Federal holidays. We recommend that you telephone Matt

Rau, at (312) 886–6524 before visiting the Region 5 office.

**FOR FURTHER INFORMATION CONTACT:** Matt Rau, Air and Radiation Division (AR–18J), Environmental Protection Agency, Region 5, 77 West Jackson Boulevard, Chicago, Illinois 60604, (312) 886–6524, [rau.matthew@epa.gov](mailto:rau.matthew@epa.gov).

**SUPPLEMENTARY INFORMATION:**

Throughout this document whenever “we,” “us,” or “our” is used, we mean EPA.

This supplementary information section is arranged as follows:

- I. Background
- II. Public Comment Process
- III. Summary of Public Comments and EPA’s Responses
- IV. What action is EPA taking?
- V. Statutory and Executive Order Reviews

**I. Background**

On August 23, 2021, EGLE submitted a revision to its SIP to address regional haze requirements for the second implementation period. On July 24, 2025, EGLE submitted a supplement (Supplement) to its original submission providing expanded source-specific analyses and emissions updates. EGLE made this SIP submission to satisfy the requirements of the CAA’s regional haze program pursuant to CAA sections 169A and 169B and 40 CFR 51.308.

EPA proposed to approve EGLE’s submission into the SIP on June 18, 2025. A full background, the specifics of the Michigan regional haze plan, and EPA’s evaluation of the plan are given in the proposed rule and will not be restated in this rule. See 90 FR 25975 (June 18, 2025). EGLE submitted the Supplement in draft for parallel processing on April 3, 2025. Detail on parallel processing is provided in the proposed rule.

In this final action, EPA is affirming that it is now the Agency’s policy that, where visibility conditions for a Class I Federal area impacted by a State are below the uniform rate of progress (URP) and the State has considered the four statutory factors, the State will have presumptively demonstrated reasonable progress for the second planning period for that area. EPA acknowledges that this final action reflects a change in policy as to how the URP should be used in the evaluation of regional haze second planning period SIPs but believes that this policy better aligns with the purpose of the statute and RHR: achieving “reasonable” progress towards natural visibility.

As described in the approval of West Virginia’s regional haze plan (90 FR 29737, July 7, 2025), EPA has discretion and authority to change its policy. In *FCC v. Fox Television Stations, Inc.*, the

U.S. Supreme Court plainly stated that an agency is free to change a prior policy and “need not demonstrate . . . that the reasons for the new policy are better than the reasons for the old one; it suffices that the new policy is permissible under the statute, that there are good reasons for it, and that the agency believes it to be better.” 566 U.S. 502, 515 (2009) (referencing *Motor Vehicle Mfrs. Ass’n of United States, Inc. v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29 (1983)). See also *Perez v. Mortgage Bankers Assn.*, 135 S. Ct. 1199 (2015).

The Class I areas impacted by emissions from Michigan sources are all below the 2028 URP, and EGLE’s SIP submission demonstrated that the State took into consideration the four reasonable progress factors listed in CAA 169A(g)(1)<sup>1</sup> with respect to an adequate number of emissions sources. Thus, EPA determines that EGLE’s SIP revision is fully approvable.

In developing the regulations required by CAA section 169A(b), EPA established the concept of the URP for each Class I area. The URP is determined by drawing a straight line from the measured 2000 to 2004 baseline conditions (in deciviews) for the 20 percent most impaired days at each Class I area to the estimated natural conditions (in deciviews) for the 20 percent most impaired days in 2064. From this calculation, a URP value can be calculated for each year between 2004 and 2064. EPA developed the URP to address the diverse concerns of Eastern and Western States and account for the varying levels of visibility impairment in Class I areas around the country while ensuring an equitable approach nationwide. For each Class I area, States must calculate the URP for the end of each planning period (e.g., in 2028 for the second planning period).<sup>2</sup> 40 CFR 51.308(f)(1)(vi)(A). States may also adjust the URP to account for

<sup>1</sup> The four statutory factors required to be taken into consideration in determining reasonable progress are: the costs of compliance, the time necessary for compliance, and the energy and non-air quality environmental impacts of compliance, and the remaining useful life of any existing source subject to such requirements. CAA section 169(g)(1).

<sup>2</sup> We note that RPGs are a regulatory construct that we developed to address the statutory mandate in CAA section 169B(e)(1), which required our regulations to include “criteria for measuring ‘reasonable progress’ toward the national goal.” Under 40 CFR 51.308(f)(3)(ii), RPGs measure the progress that is projected to be achieved by the control measures a State has determined are necessary to make reasonable progress. Consistent with the 1999 RHR, the RPGs are unenforceable, though they create a benchmark that allows for analytical comparisons to the URP and mid-implementation-period course corrections if necessary. 82 FR 3091–92 (January 10, 2017).

impacts from anthropogenic sources outside the United States and/or impacts from certain wildland prescribed fires. 40 CFR 51.308(f)(1)(vi)(B). Then, for each Class I area, States must compare the reasonable progress goal (RPG) for the 20 percent most impaired days to the URP for the end of the planning period. If the RPG is above the URP, then an additional “robust demonstration” requirement is triggered for each State that contributes to that Class I area. 40 CFR 51.308(f)(3)(ii)(B).

In the 2017 RHR Revisions, EPA addressed the role of the URP as it relates to a State’s development of its second planning period SIP. 82 FR 3078 (January 10, 2017). Specifically, in response to comments suggesting that the URP should be considered a “safe harbor” that relieve States of any obligation to consider the four statutory factors, EPA explained that the URP was not intended to be such a safe harbor. *Id.* at 3099. “Some commenters stated a desire for corresponding rule text dealing with situations where RPGs are equal to (“on”) or better than (“below”) the URP or glidepath. Several commenters stated that the URP or glidepath should be a ‘safe harbor,’ opining that States should be permitted to analyze whether projected visibility conditions for the end of the implementation period will be on or below the glidepath based on on-the-books or on-the-way control measures, and that in such cases a four-factor analysis should not be required.” *Id.*

Other comments indicated a similar approach, such as “a somewhat narrower entrance to a ‘safe harbor,’ by suggesting that if current visibility conditions are already below the end-of-planning-period point on the URP line, a four-factor analysis should not be required.” *Id.* EPA stated in its response that we did not agree with either of these recommendations. “The CAA requires that each SIP revision contain long-term strategies for making reasonable progress, and that in determining reasonable progress States must consider the four statutory factors. Treating the URP as a safe harbor would be inconsistent with the statutory requirement that States assess the potential to make further reasonable progress towards natural visibility goal in every implementation period.” *Id.*

Importantly, EPA’s recently adopted policy does not make the URP a safe harbor. The policy merely creates a presumption that the State’s second planning period SIP is making reasonable progress for a Class I Federal Area if the State has taken into consideration the four statutory factors

of 169A(g)(1) and that area is below the URP. This is consistent with the CAA and RHR.

## II. Public Comment Process

The public comment period on EPA's proposed approval ended on July 18, 2025. During this period, EPA received three sets of comments. The Power Generators Air Coalition (PGen) and the Mid-Atlantic/Northeast Visibility Union (MANEVU) each submitted a set of comments. Four conservation groups, including the National Parks Conservation Association, the Sierra Club, the Environmental Law and Policy Center, and the Coalition to Protect America's National Parks, submitted a third set of comments and are collectively referred to as "the Conservation Groups" throughout this document.

## III. Summary of Public Comments and EPA's Responses

EPA has included all comments in the rulemaking docket for this action. The August 25, 2025, Response to Comments (RTC) document is included in the docket for this rulemaking under Docket ID No. EPA-R05-OAR-2021-0577 and provides full and detailed responses to all significant comments that further explain the basis for our final action.

EPA received comments on the proposed rule that covered several topics including, but not limited to, EPA's URP policy,<sup>3</sup> an "Ask" from a regional planning organization, source selection, analysis of effectively controlled sources, incorporation of measures into the SIP, four-factor analyses,<sup>4</sup> and the impact on local communities.

PGen's comments, summarized as Comment 1 in the RTC document, are supportive of the proposed approval and EPA's URP policy. EPA concurs with the supportive comments and acknowledges the comment on the URP policy.

MANEVU commented on EPA's URP policy and its "Asks" about the DTE- St. Clair Power Plant. MANEVU's comments and EPA's responses can be found in the RTC document at Comment

2a and 2b and Response 2a and 2b. EPA disagrees with MANEVU's comment as the URP policy is consistent with the statute for the reasons as detailed in Response 2a in the RTC document. EPA also disagrees with MANEVU's comment regarding DTE-St. Clair Power Plant since EGLE fully responded to MANEVU's "Asks"<sup>5</sup> in the Supplement, section 2.2. See Response 2b in the RTC document for more detail on how EGLE addressed the MANEVU "Asks."

The Conservation Groups commented on the economic, public health, and environmental benefits of reducing air pollution through Michigan's regional haze SIP. EPA notes, as explained in Response 3 of the RTC, that EGLE has made progress in reducing visibility-impairing pollution during the second implementation period as demonstrated in the monitoring data collected at the impacted Class I areas. EPA also notes that regional haze program is designed to address visibility concerns and that the National Ambient Air Quality Standards, required by the CAA, protect human health.

The Conservation Groups argue that EGLE's source selection process is arbitrary and capricious since EGLE did not select sources that the Conservation Groups previously recommended for selection. As explained in Response 4 of the RTC, EPA disagrees with the comment. EGLE addressed the requirements of 40 CFR 51.308(f)(2)(i) in its source selection process. EGLE provided information on its source selection process and the results in section 3.2.2 of its Supplement.

The Conservation Groups commented that EPA's proposal to approve EGLE's determination that no additional measures were necessary to make reasonable progress in the second implementation period is arbitrary and capricious. The Conservation Groups claim that EPA has no system to determine how current control technologies or past and potential ongoing emission reductions should be considered when evaluating whether additional measures are necessary. The Conservation Groups also assert that EPA failed to provide adequate public notice because the proposed approval did not provide a metric or an analysis to determine that no additional measures are necessary. See Comment and Response 5 in the RTC document for further details. EPA disagrees with the comment. EPA fully evaluated the information EGLE provided for the sources with current effective control technologies, as well as emission

reductions achieved in the second implementation period. In the proposed rule, EPA articulated its rationale in determining how to weigh current effective control measures and emission reductions to approve EGLE's determination that no additional measures are necessary for reasonable progress, citing references to effective control demonstrations in section 3(f) of the 2019 Regional Haze Guidance. See 90 FR 25975 (June 18, 2025). The record in the docket for this rulemaking contains evidence of enforceable emission reductions, as well as EPA's evaluation of emissions reductions in the Technical Support Document (TSD) accompanying the proposed rule. Therefore, EPA disagrees with the Conservation Groups that consideration of these emission reductions was improper in EGLE's determination that no additional measures are necessary to make reasonable progress in the second implementation period. EPA's proposed approval was not arbitrary or capricious because of a lack of a metric and analysis and, as such, does not constitute a failure of public notice.

The Conservation Groups claim that EGLE inappropriately failed to perform four-factor analyses for seven facilities that were improperly determined to be effectively controlled. The Conservation Groups state that the plain language of the CAA and the RHR does not allow EGLE or EPA to eliminate sources from analysis based on assertions that the sources are effectively controlled, but rather requires that States consider the four statutory factors. The Conservation Groups comment that the seven facilities are not effectively controlled and that there are likely cost-effective controls available for each of the sources that would further reduce emissions. The Conservation Groups also commented on two sources that EGLE did not select for analysis, saying EPA did not address or analyze EGLE's decision. As explained in Response 6 of the RTC document, EPA disagrees with this comment. Neither CAA section 169A(b)(2), CAA section 169A(g)(1), nor the RHR prohibit States from forgoing a four-factor analysis based on a source being effectively controlled. As outlined in the 2017 RHR, "the EPA has consistently interpreted the CAA to provide States with the flexibility to conduct four-factor analyses for specific sources, groups of sources or even entire source categories, depending on State policy preferences and the specific circumstances of each State." 82 FR 3088, January 10, 2017. EPA acknowledges that a State may reasonably decide not to select sources

<sup>3</sup> A change in Agency policy was introduced in the approval of West Virginia's regional haze plan. See the April 18, 2025, (90 FR 16478) proposed rule) and the July 7, 2025, (90 FR 29737) final rule.

<sup>4</sup> Under CAA 169A(g)(1), the four statutory factors are the costs of compliance, the time necessary for compliance, the energy and non-air quality environmental impacts of compliance, and the remaining useful life of any potentially affected sources. See also 40 CFR 51.308(f)(2)(i). An evaluation of potential control options for sources of visibility impairing pollutants based on applying the four statutory factors in CAA section 169A(g)(1) is referred to as a "four-factor" analysis.

<sup>5</sup> The August 25, 2017, and July 27, 2018, MANEVU "Asks".

that have recently installed effective controls. EPA notes that if a source's emissions are already well-controlled, it is unlikely that further cost-effective reductions are available. In this case, EGLE evaluated the seven units, including permit limitations, control efficiencies, regulations, actual emissions, past emission trends, and projected 2028 emissions to demonstrate that the existing level of control makes it reasonable to conclude that the controls are effective and that a full four-factor analysis would likely result in the conclusion that no further controls are necessary. EPA also disagrees with the comment regarding two sources EGLE did not select for evaluation of potential additional control measures. EGLE properly addressed the requirements of 40 CFR 51.308(f)(2)(i) in the source selection process it used.

The Conservation Groups commented that EGLE's analyses of existing effective controls are flawed and that EPA's TSD for the proposed rule does not support EPA's proposed approval of EGLE's Regional Haze SIP revision. The Conservation Groups also commented that EGLE did not perform four-factor analyses for specific sources. Detail on the general existing effective controls is given in Comment and Response 6 in the RTC document. Comment and Response 6a in the RTC document provide details on the TSD comment. More detail on the comments regarding the specific sources EGLE did not perform a four-factor analysis on and the responses are found in the RTC document under Comment and Response 6b: J. H. Campbell, Units 1, 2, and 3; Comment and Response 6c: Consumers Energy—Dan E. Karn Units 3 and 4; Comment and Response 6d: Tilden Mining Company Kiln 1; Comment and Response 6e: Belle River Power Plant Units 1 and 2; Comment and Response 6f: St. Mary's Cement—Charlevoix Plant; Comment and Response 6g: Holcim US Lafarge Alpena Plant; and Comment and Response 6h: Neenah Paper Michigan-Munising. EPA disagrees with the assertion that CAA sections 169A(b)(2), (g)(1), or the RHR require every source exceeding the source selection threshold to require a four-factor analysis. EPA disagrees with the commentors on what those portions of the CAA and the RHR require of selected sources. Specifically, States have the flexibility to determine that a source is effectively controlled. As detailed in Response 6 in the RTC document, CAA section 169A(b)(2) does not discuss which sources, types of sources, or groups of sources must be

considered to determine reasonable progress. Reasonable progress is addressed in CAA section 169A(g)(1) in that States must "take into consideration" the four statutory factors. Similarly, the RHR does not give minimum source selection criteria. EPA disagrees that the TSD does not provide support for the proposed approval. As explained in the TSD and RTC, EPA's approval of the Michigan regional haze plan is based on the consideration of all evidence provided in EGLE's submission and additional information provided in the docket. EPA also disagrees with the notion that a four-factor analysis is required for each of the specific units that were identified by the Conservation Groups. In summary, EPA finds that EGLE reasonably concluded that the units are effectively controlled and that conducting a four-factor analysis would not likely result in additional measures being needed for reasonable progress.

The Conservation Groups also commented with concerns that two specific sources, Midland Cogeneration Venture and EES Coke Battery, were not selected for evaluation of possible additional control measures. Further information regarding these two sources is found in the RTC at Response 6i: Midland Cogeneration Venture and Response 6j: EES Coke Battery. EPA disagrees that Midland Cogeneration Venture and EES Coke Battery should have been selected for analysis and EPA finds that EGLE's source selection process was appropriate and well supported. EGLE sufficiently captured the State's sources with the greatest impact on visibility impairment.

The Conservation Groups expressed concerns about EPA's review of EGLE's four-factor analyses, arguing that EPA did not provide an evaluation of EGLE's analyses or a conclusion as to whether the State's determinations complied with the CAA and RHR. The Conservation Groups also made specific comments on the four-factor analyses for three facilities. A summary of this comment and EPA's full response can be found as Comment and Response 7 in the RTC document. The comments and responses on specific four-factor analyses for Tilden Mining Company LLC Kiln 2, Billerud—Escanaba LLC Power Boiler 11, and Graymont Western Lime Kiln 1 are detailed in the RTC document as Comments and Responses 7a, 7b, and 7c, respectively. EPA disagrees with this comment. As explained in the proposed rule, EPA carefully evaluated EGLE's entire SIP submission, including the Supplement, the comments from the FLM consultation and the State's responses to

comments received during the State comment period. EGLE worked directly with the sources in evaluating potential measures and concluded that additional control measures are not necessary for reasonable progress during the second implementation period based on the four factors. EPA disagrees with the comments on these specific facilities. EGLE considered the four statutory factors, current effective control technologies, emission reductions that have already occurred during the second implementation period, and the projected 2028 visibility conditions for Class I areas influenced by emissions from Michigan sources. EPA therefore finds that EGLE reasonably concluded that no additional measures are necessary to make reasonable progress in the second implementation period for any of the three identified sources.

The Conservation Groups commented that EPA did not analyze the impact of haze-forming pollution from Michigan sources on the communities that surround these facilities. See Comment and Response 8 in the RTC document. The RHR does not require an analysis of health impacts. Instead, the National Ambient Air Quality Standards are established to separately protect human health.

The Conservation Groups argue that EPA's URP Policy violates the CAA's visibility provisions. The Conservation Groups comment on specific portions of the CAA and cite several cases. Those comments and EPA's responses are detailed in Comments and Responses 9, 9a, 9b, 9c, and 9d in the RTC document. EPA disagrees with the comments. EPA's URP policy is consistent with the CAA. Pursuant to CAA 169A(a)(4), Congress explicitly delegated the authority to EPA to promulgate regulations regarding reasonable progress towards meeting the national goal. In determining the measures necessary to make reasonable progress, Congress mandated "tak[ing] into consideration the cost of compliance, the time necessary for compliance, and the energy and non-air quality environmental impacts of compliance, and the remaining useful life of any existing source subject to such requirement." CAA 169A(g)(1). However, nothing in the statute defines what it means "to take into consideration" the four factors under CAA 169A(g)(1). Under this statutory framework, Congress has empowered EPA to give meaning to this statutory phrase. *Loper Bright Enters. v. Raimondo*, 603 U.S. 369, 395 (2024). The phrase "to take into consideration" implies a broader process not limited to the four statutory factors, allowing

States to weigh other factors, like visibility, to support their determination of whether additional measures are necessary to make reasonable progress at Class I areas. This follows from the fact that reasonable progress requires the improvement of visibility. CAA 169A(b)(2). As such, visibility improvement must be a fundamental part of determining the extent of progress that is considered reasonable. Being below the URP does not relieve a State of its obligations under the CAA and the RHR to make reasonable progress.

The Conservation Groups state that the URP policy is inconsistent with the RHR. The Conservation Groups comment that, “EPA cannot square its new policy with the RHR.” See Comment 10 and Response 10 in the RTC document for further detail. EPA disagrees with this comment. EPA’s URP policy is consistent with the RHR. To meet the reasonable progress goal requirements under 40 CFR 51.308(f)(3), the reasonable progress goals established by a State must reflect the measures it deemed to be necessary to make reasonable progress within the applicable implementation period and must be projected to be achieved by the end of the applicable implementation period. Therefore, it is sufficient under 40 CFR 51.308(f)(3) that this SIP establishes reasonable progress goals that reflect visibility conditions that are projected to be achieved by the end of the second planning period.

The Conservation Groups commented that the URP policy violates the procedural requirements of the CAA. The Conservation Groups comment that the URP policy unlawfully departs from national policy, that the URP policy is inconsistent with actions across EPA Regions, that the URP policy effectively revises the RHR, and that EPA must determine if its URP policy has a nationwide scope. The comments and responses on each point are presented in detail as Comments and Responses 11a, 11b, 11c, and 11d in the RTC document. EPA disagrees with each comment. As for the comment noting that the URP policy was announced in a regional action and that this change violates the CAA requirements that SIP actions be consistent with national policy, EPA disagrees that our Regional Consistency regulations at 40 CFR part 56, and 40 CFR 56.5(b) in particular, are relevant to this action. The Conservation Groups mention other regional haze actions in commenting that the URP policy is inconsistent with actions across EPA Regions. EPA disagrees that its change in policy means that all of its actions on second planning period

regional haze SIPs that pre-date its proposed approval of the West Virginia second planning period submittal are inconsistent with the URP policy. See 90 FR 29737 (July 7, 2025). The policy is consistent with EPA’s long-standing position that the URP is not a “safe harbor.” EPA’s policy establishes a presumption that the reasonable progress requirements of the CAA and the RHR are met if the State has taken into consideration the four statutory factors and the visibility impairment for each Class I Area is projected to be below the URP (*i.e.*, the “glidepath”) at the end of the applicable planning period. Unlike treating the URP as a “safe harbor,” the policy does not exempt or allow a State to evade the requirements of the CAA or the RHR. Treating the URP as a “safe harbor” would exempt States from considering the four statutory factors and would allow States to exclude measures necessary for reasonable progress from the SIP. EPA disagrees with the comment that it must determine if the URP policy has a nationwide scope. EPA notes that this action applies to a SIP submission from one State—Michigan. EPA also states that the comment that EPA “must” publish a finding that this action is “based on a determination of nationwide scope [or] effect” is also unsupported and incorrect. Under CAA section 307(b)(1), 42 U.S.C. 7607(b)(1), a petition for review of an action that is “locally or regionally applicable may be filed only in the United States Court of Appeals for the appropriate circuit,” with one exception: if (i) the action “is based on a determination of nationwide scope or effect” and (ii) “if in taking such action the Administrator finds and publishes that such action is based on such a determination,” then any petition for review must be filed in the D.C. Circuit. The Administrator has not made and published a finding that this action is based on a determination of nationwide scope or effect. Accordingly, any petition for review of this action must be filed in the United States Court of Appeals for the appropriate regional circuit.

The Conservation Groups commented that EGLE’s SIP Revision and Supplement do not meet EPA’s URP policy for presumptive approval. The Conservation Groups commented on EGLE relying on the IMPROVE Network to satisfy the monitoring requirement of the RHR and EGLE’s URP adjustments, as well as on EGLE not addressing additional Class I areas. As explained in Responses 12a, 12b, and 12c of the RTC document, EPA disagrees with these

comments. The IMPROVE network was in operation up to the time EGLE submitted its SIP revision. EGLE continues to support and participate in the IMPROVE network. Concerns regarding the future funding of the IMPROVE network are speculative, out of the control of EGLE, and beyond the scope of the basis for our action on EGLE’s second planning period SIP. As for the URP adjustments, the RHR at 40 CFR 51.308(f)(1) also provides the option for States to propose adjustments to the URP line for a Class I area to account for visibility impacts from anthropogenic sources outside the United States and the impacts from wildland prescribed fires that were conducted for certain, specified objectives. EGLE provided this analysis for its Class I areas. Under 40 CFR 51.308(f)(2)(ii)(B), States must consider and address the emissions reduction measures identified by other States for their sources as being necessary to make reasonable progress in the mandatory out-of-state Class I area. EGLE analyzed the Class I areas impacted by Michigan emissions using Lake Michigan Air Directors Consortium (LADCO) modeling, as the comment noted. EGLE identified 13 out-of-state Class I areas in addition to its own two Class I areas where Michigan sources contribute to total visibility impairment above 1 percent. EGLE also identified two additional Class I areas within the LADCO States, Voyageurs National Park and Boundary Waters Canoe Area Wilderness in Minnesota, even though Michigan sources contribute below 1 percent to total visibility impairment in each of those areas. The comment included several additional Class I areas. EGLE found no additional measures to be necessary to make reasonable progress in the out-of-state Class I areas. The contribution from Michigan sources would be even smaller at more distant Class I areas so there is no reason to expect that EGLE would find additional measures necessary to make reasonable progress for those distant Class I areas. EPA concludes that EGLE properly considered Michigan sources that are reasonably anticipated to contribute to visibility impairment Class I areas.

#### IV. What action is EPA taking?

EPA is approving the Regional Haze SIP revision submitted by EGLE on August 23, 2021, and supplemented on July 24, 2025, as satisfying applicable requirements under the CAA and RHR for the program’s second implementation period.

V. Statutory and Executive Order Reviews

Under the CAA, the Administrator is required to approve a SIP submission that complies with the provisions of the CAA and applicable Federal regulations. 42 U.S.C. 7410(k); 40 CFR 52.02(a). Thus, in reviewing SIP submissions, EPA's role is to approve State choices, provided that they meet the criteria of the CAA. Accordingly, this action merely approves State law as meeting Federal requirements and does not impose additional requirements beyond those imposed by State law. For that reason, this action:

- Is not a significant regulatory action subject to review by the Office of Management and Budget under Executive Order 12866 (58 FR 51735, October 4, 1993);
- Is not subject to Executive Order 14192 (90 FR 9065, February 6, 2025) because SIP actions are exempt from review under Executive Order 12866;
- Does not impose an information collection burden under the provisions of the Paperwork Reduction Act (44 U.S.C. 3501 *et seq.*);
- Is certified as not having a significant economic impact on a substantial number of small entities under the Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*);
- Does not contain any unfunded mandate or significantly or uniquely affect small governments, as described in the Unfunded Mandates Reform Act of 1995 (Pub. L. 104-4);
- Does not have federalism implications as specified in Executive

Order 13132 (64 FR 43255, August 10, 1999);

- Is not subject to Executive Order 13045 (62 FR 19885, April 23, 1997) because it approves a State program;
- Is not a significant regulatory action subject to Executive Order 13211 (66 FR 28355, May 22, 2001); and
- Is not subject to requirements of section 12(d) of the National Technology Transfer and Advancement Act of 1995 (15 U.S.C. 272 note) because application of those requirements would be inconsistent with the CAA.

In addition, the SIP is not approved to apply on any Indian reservation land or in any other area where EPA or an Indian Tribe has demonstrated that a Tribe has jurisdiction. In those areas of Indian country, the rule does not have Tribal implications and will not impose substantial direct costs on Tribal governments or preempt Tribal law as specified by Executive Order 13175 (65 FR 67249, November 9, 2000).

This action is subject to the Congressional Review Act, and EPA will submit a rule report to each House of the Congress and to the Comptroller General of the United States. This action is not a "major rule" as defined by 5 U.S.C. 804(2).

Under section 307(b)(1) of the CAA, petitions for judicial review of this action must be filed in the United States Court of Appeals for the appropriate circuit by November 4, 2025. Filing a petition for reconsideration by the Administrator of this final rule does not affect the finality of this action for the purposes of judicial review nor does it

extend the time within which a petition for judicial review may be filed, and shall not postpone the effectiveness of such rule or action. This action may not be challenged later in proceedings to enforce its requirements. (See section 307(b)(2).)

List of Subjects in 40 CFR Part 52

Environmental protection, Air pollution control, Incorporation by reference, Intergovernmental relations, Nitrogen oxides, Reporting and recordkeeping requirements, Sulfur oxides.

Dated: August 26, 2025.  
**Anne Vogel,**  
*Regional Administrator, Region 5.*

For the reasons stated in the preamble, title 40 CFR part 52 is amended as follows:

PART 52—APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS

- 1. The authority citation for part 52 continues to read as follows:  
**Authority:** 42 U.S.C. 7401 *et seq.*
- 2. In § 52.1170, the table in paragraph (e) is amended by adding an entry for "Regional Haze Plan for the Second Implementation Plan" after the entry for "Regional Haze Progress Report" to read as follows:  
**§ 52.1170 Identification of plan.**  
\* \* \* \* \*  
(e) \* \* \*

EPA—APPROVED MICHIGAN NONREGULATORY AND QUASI-REGULATORY PROVISIONS

| Name of nonregulatory SIP provision                    | Applicable geographic or nonattainment area | State submittal date  | EPA approval date                                                                | Comments       |
|--------------------------------------------------------|---------------------------------------------|-----------------------|----------------------------------------------------------------------------------|----------------|
| * * * * *                                              |                                             |                       |                                                                                  |                |
| Regional Haze Plan for the Second Implementation Plan. | Statewide .....                             | 8/23/2021, 7/24/2025. | 9/5/2025, 90 FR [Insert <b>Federal Register</b> page where the document begins]. | Full Approval. |
| * * * * *                                              |                                             |                       |                                                                                  |                |



BEFORE THE UNITED STATES DEPARTMENT OF ENERGY

Federal Power Act Section 202(c)     )  
Emergency Order: Midcontinent     )  
Independent System Operator     )  
(MISO)     )  
\_\_\_\_\_

Order No. 202-25-7

Exhibit to  
Motion to Intervene and Request for Rehearing and Stay of  
Public Interest Organizations

Filed September 5, 2025

Exhibit 115  
Mar. 2025 MI SIP  
Supplement



GRETCHEN WHITMER  
GOVERNOR

STATE OF MICHIGAN  
DEPARTMENT OF  
ENVIRONMENT, GREAT LAKES, AND ENERGY  
EXECUTIVE OFFICE



PHILLIP D. ROOS  
DIRECTOR

April 3, 2025

VIA ELECTRONIC SUBMISSION

Cheryl Newton, Acting Regional Administrator  
United States Environmental Protection Agency, Region 5  
77 West Jackson Boulevard, R-19J  
Chicago, Illinois 60604-3507

Dear Acting Regional Administrator Newton:

SUBJECT: Formal Request for Parallel Processing of Michigan's Supplement to the  
August 2021 Regional Haze State Implementation Plan

**Request for Parallel Processing**

The Michigan Department of Environment, Great Lakes, and Energy (EGLE) submits to the United States Environmental Protection Agency (USEPA) this formal request to initiate parallel processing, as authorized under Appendix V to Part 51 of Title 40 of the Code of Federal Regulations, for Michigan's Public Notice Draft Supplement to the August 2021 Regional Haze State Implementation Plan ("Supplement").

**Schedule for Final Submission to the USEPA**

The 30-day public comment period for the Supplement began on March 10, 2025, and was initially scheduled to end on April 8, 2025; however, upon receiving a request for extension from the National Parks Conservation Association, Coalition to Protect America's National Parks, and Sierra Club, EGLE decided to extend the public comment period by 14 days. Due to the approved extension, the new deadline for the public comment period regarding the Supplement is set to end on April 22, 2025. Upon completion of the public comment period, Air Quality Division (AQD) staff will address all public comments received, initiate further review by AQD management, and provide it for my consideration for submittal to the USEPA. EGLE anticipates that it has the ability to submit the Supplement to the USEPA in May, which would provide the USEPA with three or four months to issue a proposed approval, disapproval, or partial approval/disapproval for Michigan's Supplement, initiate a federal public comment period on the proposal, and issue a final rulemaking.

Please find Michigan's Public Notice Draft Regional Haze Supplement enclosed with this letter (Attachment A), along with all associated appendices (Attachments B-D).

Cheryl Newton, Acting Regional Administrator

Page 2

April 3, 2025

If you have any questions, please contact John Olson, SIP Development Unit, AQD, at 517-648-3551 or OlsonJ12@Michigan.gov; or you may contact me.

Sincerely,



Phillip D. Roos  
Director  
517-284-6700

Enclosures

cc/enc: John Mooney, USEPA, Region 5  
Michael Langman, USEPA, Region 5  
Aaron B. Keatley, Chief Deputy Director, EGLE  
Annette Switzer, EGLE  
Dr. Eduardo Olaguer, EGLE  
Tom Shanley, EGLE  
Robert Irvine, EGLE  
John Olson, EGLE

**SUPPLEMENT TO  
MICHIGAN'S AUGUST 23, 2021,  
REGIONAL HAZE STATE IMPLEMENTATION PLAN REVISION  
FOR THE SECOND PLANNING PERIOD**



MICHIGAN DEPARTMENT OF  
ENVIRONMENT, GREAT LAKES, AND ENERGY

Michigan Department of Environment, Great Lakes, and Energy  
Air Quality Division  
P.O. Box 30260  
Lansing, Michigan 48909-7760  
<https://www.michigan.gov/air>

[Public Notice Draft for 30-day Public Comment Period]

March 2025

| Facility Name                                   | Sector | Facility Unit ID | Retirement Date | 2016 Emissions (tpy) |                 |                   |                 |
|-------------------------------------------------|--------|------------------|-----------------|----------------------|-----------------|-------------------|-----------------|
|                                                 |        |                  |                 | NH3                  | NO <sub>x</sub> | PM <sub>2.5</sub> | SO <sub>2</sub> |
|                                                 |        | Unit 3           | 6/1/2021        |                      | 1859.4          | 3.6               | 2805.7          |
| LBWL, Erickson Station                          | EGU    | Unit 1           | 11/28/2022      | 0.1                  | 1058.5          | 1.4               | 2588.5          |
| LBWL, Eckert Station                            | EGU    | Unit 1           | 12/31/2020      | 0.1                  | 785.5           | 12.4              | 1858            |
|                                                 |        | Unit 3           | 12/31/2020      |                      |                 |                   |                 |
|                                                 |        | Unit 4           | 5/31/2021       |                      |                 |                   |                 |
|                                                 |        | Unit 5           | 12/31/2020      |                      |                 |                   |                 |
|                                                 |        | Unit 6           | 12/31/2020      |                      |                 |                   |                 |
| Consumers Energy – J.C. Weadock Facility        | EGU    | Weadock 7        | 4/15/2016       | 0                    | 510.5           | 30.9              | 1635.5          |
|                                                 |        | Weadock 8        | 4/15/2016       |                      |                 |                   |                 |
| Consumers Energy – D.E. Karn Facility           |        | Karn 1           | 6/1/2023        | 0                    | 213.8           | 12                | 283.9           |
|                                                 |        | Karn 2           | 6/1/2023        |                      |                 |                   |                 |
| MARQUETTE BOARD OF LIGHT & POWER - Shiras       | EGU    | Boiler 3         | 4/29/2019       | 0                    | 196.7           | 44.5              | 419             |
| Michigan Hub Plant                              | EGU    | Unit 1           | 9/30/2017       |                      | 132.9           | 0.8               | 139.5           |
| DTE – Pontiac North LLC                         |        | EUBHB9           | 1/10/2017       | 0                    | 0               | 0                 | 0               |
| Graphic Packing International, Inc. - Kalamazoo |        | Unit BLR08       | 10/07/2024      |                      | 82.1            | 4.5               | 0.4             |
| J B Sims                                        |        | Unit 3           | 6/1/2020        | 0                    | 459.4           | 9.5               | 364.9           |
| J R Whiting                                     |        | Unit 1           | 4/15/2016       | 0                    | 217.4           | 18.8              | 484.7           |
|                                                 |        | Unit 2           | 4/15/2016       | 0                    | 178.3           | 6.1               | 440.6           |
|                                                 |        | Unit 3           | 4/15/2016       | 14.4                 | 589             | 7.3               | 527.5           |
| James De Young                                  |        | Unit 5           | 6/1/2017        |                      | 0.1             | 0                 | 0               |
| Consumers Energy - Thetford                     |        | Unit 2           | 6/1/2019        |                      | 0               |                   | 0.6             |
|                                                 |        | Unit 3           | 4/1/2018        |                      | 0               |                   | 0.8             |
|                                                 |        | Unit 4           | 6/1/2019        |                      | 0               |                   | 1.5             |
|                                                 |        |                  |                 |                      |                 |                   |                 |
| Wyandotte                                       |        | Unit 8           | 6/30/2016       |                      | 0               | 0                 | 0.0             |

In addition to the retirements that have already occurred, the following units will be retired in the future, although not all were selected for a possible four-factor analysis under Section 3.2.2.

- **Consumers Energy – J.H. Campbell Plant: Units 1, 2, and 3**

Units 1, 2, and 3 are discussed in detail in Michigan's 2021 Regional Haze SIP submittal on pages 14, 20, and 21 (See Appendix 1). This SIP supplement provides further elaboration.

Consumers Energy – J.H. Campbell Power Plant is subject to a settlement agreement approved by the Michigan Public Service Commission on April 20, 2020, which requires closure/retirement of coal-fired Units 1, 2, and 3 on or before May 31, 2025. See April 20, 2022, Settlement Agreement – Michigan Public Service Commission, Case No. U-21090 – In the Matter of the Application of Consumers Energy Company for Approval of and Integrated Resource Plan under MCL 460.6t, certain accounting approvals, and for other relief. <https://mi-psc.my.site.com/sfc/servlet.shepherd/version/download/0688y000002gLkGAAU> (See Appendix 10).

The settlement agreement was executed by Consumers Energy Company, the Michigan Public Service Commission staff, Michigan Environmental Council, the Natural Resources Defense Council, the Sierra Club, Attorney General Dana Nessel, Environmental Law and Policy Center, Vote Solar, Ecology Center, Union of Concerned

Scientists, Urban Core Collective, Citizens Utility Board of Michigan, Hemlock Semiconductor Operations LLC, Michigan Energy Innovation Business Council, Institute for Energy Innovation, Clean Grid Alliance, Michigan Electric Transmission Company LLC, and Great Lakes Renewable Energy Association.

The settlement agreement was affirmed in the State of Michigan Court of Appeals. See No. 362294 Public Service Commission, LC No. 00-021090, March 23, 2023. <https://mi-psc.my.site.com/sfc/servlet.shepherd/version/download/0688y000007I2GEAA0> (See Appendix 11).

When retired sometime before May 31, 2025, the permanent shutdown of coal-fired Units 1, 2 and 3 at Consumers Energy – J.H. Campbell Power Plant will represent a reduction in emissions of 2,346 tpy NO<sub>x</sub> and 12,850 tpy SO<sub>2</sub> based on the 2016 inventory.

- **Consumers Energy – Dan E. Karn, Units 3 and 4**

Units 3 and 4 are discussed in detail in Michigan’s 2021 Regional Haze SIP submittal on pages 14,15, 21, and 22 (See Appendix 1). This SIP supplement provides further elaboration.

Consumers Energy – Dan E. Karn Power Plant is subject to the same settlement agreement mentioned above for the J.H. Campbell Plant that was approved by the Michigan Public Service Commission on April 20, 2022. The settlement agreement requires closure/retirement of coal-fired Units 3 and 4 at Consumers Energy – Dan E. Karn on or before May 31, 2031. See April 20, 2022, Settlement Agreement - Michigan Public Service Commission, Case No. U-21090 (See Appendix 10). In 2023, Consumers Energy voluntarily converted Units 3 and 4 from coal to natural gas and fuel oil – approximately 8 years ahead of its 2031 retirement deadline.

<https://www.consumersenergy.com/news-releases/news-release-details/2023/06/14/15/30/consumers-energy-takes-next-step-to-clean-energy-future-by-closing-karn-coal-plants>.

Although 2031 is beyond the end of the second implementation period in 2028, the 2019 Regional Haze Guidance states, “if a source is certain to close by December 31, 2028 (or soon thereafter), under an enforceable requirement, a state can reasonably consider that to be sufficient reason to remove the source from further analysis and reasonable progress consideration” (2019 Regional Haze Guidance, pg. 42).

Although Units 3 and 4 did not appear on LADCO’s list in Table 8 because the Q/d for both units was below 1.0, the emission reductions are still noteworthy. When retired sometime before May 31, 2031, the permanent shutdown of coal-fired Units 3 and 4 at Consumers Energy – Dan E. Karn will represent a reduction in emissions of 40 tpy NO<sub>x</sub> and 58 tpy SO<sub>2</sub> based on the 2016 inventory.



BEFORE THE UNITED STATES DEPARTMENT OF ENERGY

Federal Power Act Section 202(c)     )  
Emergency Order: Midcontinent     )  
Independent System Operator     )  
(MISO)     )  
\_\_\_\_\_

Order No. 202-25-7

Exhibit to  
Motion to Intervene and Request for Rehearing and Stay of  
Public Interest Organizations

Filed September 5, 2025

Exhibit 116  
  
July 2025 MI SIP  
Supplement

**SUPPLEMENT TO  
MICHIGAN'S AUGUST 23, 2021,  
REGIONAL HAZE STATE IMPLEMENTATION PLAN REVISION  
FOR THE SECOND PLANNING PERIOD**



MICHIGAN DEPARTMENT OF  
ENVIRONMENT, GREAT LAKES, AND ENERGY

Michigan Department of Environment, Great Lakes, and Energy  
Air Quality Division  
P.O. Box 30260  
Lansing, Michigan 48909-7760  
<https://www.michigan.gov/air>

July 2025

SRN: State Registration Number

Sources: See Table 8 Appendix 33 and 34

Michigan EGLE Air Permits System

[https://www.egle.state.mi.us/aps/downloads/rop/pub\\_ntce/pub\\_ntce.shtml](https://www.egle.state.mi.us/aps/downloads/rop/pub_ntce/pub_ntce.shtml)

List of Michigan EGLE Air Quality Division – Voided Renewable Operating Permits (ROPs)

[https://www.egle.state.mi.us/aps/downloads/rop/ROPlist/APS\\_ROP\\_Sources\\_Void.pdf](https://www.egle.state.mi.us/aps/downloads/rop/ROPlist/APS_ROP_Sources_Void.pdf)

Sources Subject to Michigan's Renewable Operating Permit Program

[https://www.egle.state.mi.us/aps/downloads/rop/ROPlist/APS\\_ROP\\_Sources\\_by\\_Name.pdf](https://www.egle.state.mi.us/aps/downloads/rop/ROPlist/APS_ROP_Sources_by_Name.pdf)

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The settlement agreement was executed by Consumers Energy Company, the Michigan Public Service Commission staff, Michigan Environmental Council, the Natural Resources Defense Council, the Sierra Club, Attorney General Dana Nessel, Environmental Law and Policy Center, Vote Solar, Ecology Center, Union of Concerned Scientists, Urban Core Collective, Citizens Utility Board of Michigan, Hemlock Semiconductor Operations LLC, Michigan Energy Innovation Business Council, Institute for Energy Innovation, Clean Grid Alliance, Michigan Electric Transmission Company LLC, and Great Lakes Renewable Energy Association.

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The permanent shutdown of coal-fired Units 1, 2 and 3 at Consumers Energy – J.H. Campbell Power Plant, which is now scheduled to occur in August 2025, will represent a reduction in emissions of 2,346 tpy NO<sub>x</sub> and 12,850 tpy SO<sub>2</sub> based on the 2016

inventory. On May 23, 2025, the DOE issued an emergency order<sup>3</sup>, pursuant to section 202(c) of the Federal Power Act, to Midcontinent Independent System Operator (MISO). The emergency order directs MISO, in coordination with Consumers Energy, to ensure that the J.H. Campbell Power Plant in West Olive, Michigan remains available for operation, minimizing any potential generation shortfall that could lead to unnecessary power outages. This Order has been written to expire on August 21, 2025, which EGLE anticipates will prompt the retirement of the three coal-fired units at the plant on, or shortly thereafter, that date.

- **Consumers Energy – Dan E. Karn, Units 3 and 4**

Units 3 and 4 are discussed in detail in Michigan’s 2021 Regional Haze SIP submittal on pages 14,15, 21, and 22 (see Appendix 1). This SIP supplement provides further elaboration.

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<https://www.consumersenergy.com/news-releases/news-release-details/2023/06/14/15/30/consumers-energy-takes-next-step-to-clean-energy-future-by-closing-karn-coal-plants>.

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### **3.3.2 Indefinitely Idled Source**

- **Cleveland-Cliffs, Inc. – Empire Iron Mining Partnership**

Empire Iron Mining Partnership was among the sources screened in using EGLE’s revised Q/d analysis based on emissions from a 2016 base year; however, since 2016, the facility has been idled indefinitely. A recent January 17, 2024, on-site inspection report by EGLE’s AQD documented the following conditions:

---

<sup>3</sup> [https://www.energy.gov/sites/default/files/2025-05/Midcontinent%20Independent%20System%20Operator%20%28MISO%29%20202%28c%29%20Order\\_1.pdf](https://www.energy.gov/sites/default/files/2025-05/Midcontinent%20Independent%20System%20Operator%20%28MISO%29%20202%28c%29%20Order_1.pdf)

BEFORE THE UNITED STATES DEPARTMENT OF ENERGY

Federal Power Act Section 202(c)     )  
Emergency Order: Midcontinent     )  
Independent System Operator     )  
(MISO)     )  
\_\_\_\_\_

Order No. 202-25-7

Exhibit to  
Motion to Intervene and Request for Rehearing and Stay of  
Public Interest Organizations

Filed September 5, 2025

Exhibit 117  
  
RTO Insider  
Article on August  
Order



Consumers Energy's J.H. Campbell coal plant | *Newkirk Electric Associates*

Aug 21, 2025 | John Cropley and Amanda Durish Cook

The U.S. Department of Energy has ordered the J.H. Campbell Generating Plant to remain available another 90 days, saying its capacity is needed to maintain MISO grid reliability.

Consumers Energy had planned to retire the 1,420-MW coal-fired facility in southwest Michigan on May 31, but DOE on May 23 issued an emergency order (202-25-3) under Section 202(c) of the Federal Power Act ordering it to remain ready to operate because of a shortage of electricity and capacity to generate electricity. (See DOE Orders Michigan Coal Plant to Reverse Retirement.)

That order expired at midnight Eastern time Aug. 21.

Energy Secretary Chris Wright issued the follow-up order (202-25-7) at 8:50 p.m. Eastern time Aug. 20; it expires Nov. 19.

### Why This Matters

#### Why This Matters

The order is another move by the Trump administration to use



In his Aug. 20 order, Wright indicated the generation shortfall in MISO is likely to continue.

President Donald Trump declared an energy emergency on his first day in office, and his Cabinet agencies have been scrambling to rejigger energy policy toward the fossil fuels he favors.

One of their stated priorities has been halting retirement of aging fossil-burning plants.

In a news release, Wright cited seasonal outlooks by NERC and NOAA warning of high temperatures in the Midwest as well as resource adequacy projections by MISO itself.

“The United States continues to face an energy emergency, with some regions experiencing more capacity constraints than others. With electricity demand increasing, we must put an end to the dangerous energy subtraction policies embraced by politicians for too long,” he said.

“This order will help ensure millions of Americans can continue to access affordable, reliable and secure baseload power regardless of whether the wind is blowing or the sun is shining.”

Section 202(c) has been a lightly used provision historically. Just 11 orders were issued during the Biden administration, all of them weather-related. This compares with nine by Wright since mid-May, only one of which was weather-related.

The cost of halting the J.H. Campbell retirement has been a point of contention. (See DOE Extension of Michigan Coal Plant Cost \$29M in 1st Month and FERC Rules Costs of Mich. Coal Plant Extension Can be Split Among 11 States.)

It also has been unpopular with environmental advocates.

Sierra Club Beyond Coal Campaign Director Laurie Williams said Aug. 21: “By illegally extending this sham emergency order, Donald Trump and Chris Wright are costing hardworking Americans more money every single day for a coal plant that is unnecessary, deadly and extremely expensive.”

Earthjustice Senior Attorney Michael Lenoff said: “Chris Wright is not a Soviet-era central planner, but his new order suggests he would fit right in. The order purports to override the considered judgment and careful work of many federal, state and regional bodies who actually have authority to keep the lights on. In their place, Secretary Wright blunders in.”

In a statement, MISO said it will “continue coordinating with Consumers Energy to comply with the order.”

aging fossil generation to shore up the grid.

The order is another move by the Trump administration to use aging fossil generation to shore up the grid.

But MISO again stressed that J.H. Campbell did not clear the planning resource auction and is unnecessary for resource adequacy in the 2025/26 planning year.

“MISO’s 2025-2026 Planning Resource Auction indicated adequate resources to meet anticipated demand. State regulators along with utilities have the responsibility of ensuring resource adequacy. MISO remains focused on reliably operating the grid using the resources our members provide, while working closely with stakeholders and regulatory partners, providing visibility into system needs and sending market signals to inform long-term resource planning,” MISO spokesperson Brandon Morris said in a statement to *RTO Insider*.

MISO leadership previously has said it might have to navigate similar future orders from the federal government to prop up retiring coal plants.

MISO Director Todd Raba said MISO might have to navigate similar edicts in the future, with about 30 coal plants in the footprint. At MISO’s June board meeting, he said it’s a “critical topic that will have huge implications in MISO.”

Lawmakers, health professionals and other officials *gathered* near the plant in West Olive, Mich., on Aug. 12 to protest its extension. On Aug. 18, a small crowd of community members marched to U.S. Rep. Bill Huizenga’s office in nearby Holland, Mich., to again protest continued operations.

Consumers Energy said it was evaluating the order extension and expects to “continue operating the plant as required by DOE.”

“We have worked closely with MISO and have been operating in compliance with the order and MISO’s dispatch requirements. All power generated by the Campbell plant and other Consumers generating plants is supplied to the MISO grid. Specific details on recent generation are not publicly available at this time,” spokesperson Brian Wheeler told *RTO Insider*.

Wheeler also said the utility was “pleased” with *FERC*’s approval of an allocation that’s set to disburse cost recovery of the plant among the 11 states or portions of states in MISO Midwest.

Consumers Energy declined to comment on the coal plant’s usefulness so far over the summer or how the plant will fit into the MISO market over the fall.

Data from power analytics company Yes Energy shows the 1.42-GW plant has been used consistently since the beginning of August, averaging an 84-88% hourly capacity factor.

COAL

RELIABILITY

RESOURCE ADEQUACY

BEFORE THE UNITED STATES DEPARTMENT OF ENERGY

Federal Power Act Section 202(c)     )  
Emergency Order: Midcontinent     )  
Independent System Operator     )  
(MISO)     )  
\_\_\_\_\_     )

Order No. 202-25-7

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Filed September 5, 2025

Exhibit 118

RMI Analysis of  
Coal Plants'  
Threats to  
Reliability

ELECTRICITY &gt;&gt; REALITY CHECK: WE HAVE WHAT'S NEEDED TO RELIABLY POWER THE DATA CENTER BOOM, AND IT'S NOT COAL PLANTS

## Reality Check: We Have What's Needed to Reliably Power the Data Center Boom, and It's Not Coal Plants

A range of clean, resilient solutions can help us meet the electrical needs of our growing digital economy while saving Americans money.

August 12, 2025

By Gabriella Tosado, Ashtin Massie, Joe Daniel

After decades of relatively flat electricity demand, the US power sector is expecting demand to grow due, in large part, to new data centers. These energy-intensive facilities are reshaping the grid, with some utilities now projecting over **20 percent load growth by 2035**. In places like Virginia, which constitutes **13 percent of all reported data center capacity globally and 25 percent of the data center capacity in the United States**, data centers already account for over a quarter of some utilities' total electric demand, and their footprint is only growing.

### The myth

Utilities are struggling to **maintain accurate forecasts** and identify resources that can meet this growth. There is a **high-profile effort** to keep coal plants that are set to retire online and run them at unprecedented levels, ostensibly for reasons of reliability. But the truth is, coal-fired power plants, far from being a reliable backbone for this new era of electricity demand, are a brittle, outmoded technology that threatens to undermine the very grid resilience they're being proposed to protect.

Coal-fired power plants, far from being a reliable backbone for this new era of electricity demand, are a brittle, outmoded technology that threatens to undermine the very grid resilience they're being proposed to protect.



Tweet

### Reality #1: Aging coal plants are failing to consistently deliver under stress

Coal plants face a fundamental constraint: they are aging and increasingly unreliable. Most of the coal fleet was built in the 1970s and 1980s, and years of wear and tear have led to a rise in unplanned outages. In many cases the sheer cost to maintain and modernize these plants did not make sense with the availability of more reliable and affordable alternatives – and that's still the case.

According to the Energy Systems Integration Group (ESIG) *Ensuring Efficient Reliability* report, a coal plant's capacity accreditation, or the amount of time it can contribute to peak demand, is only 83 percent when adjusted for real-world performance. **RJM** also has capacity accreditation of coal plants at 83 percent and some plants fare even worse. **Gridlab's reliability study** found Colstrip, a large regional coal plant in Montana, operating with a capacity accreditation of only 54 percent – meaning it's effectively unavailable nearly half the time it's needed.

Extreme weather exacerbates these vulnerabilities. Cold snaps, heat waves, and storms have all exposed coal's fragility during grid stress events. **Reliability is not just about being dispatchable**, it's about delivering performance under stress. Coal plants struggle to do that consistently. For coal plants to truly meet the constant demands of data centers, they would need to run at high-capacity factors and avoid major outages, all of which fly in the face of current performance trends. If a large coal plant trips offline while supporting a cluster of data centers,

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General

General Energy

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Hydrogen

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Islands

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Residential Buildings

RMI

South East Asia

Spark Chart

Strategic Insights

Supply Chain Emissions

Technology & Innovation

Third Derivative

Transportation

Trucking

US Policy

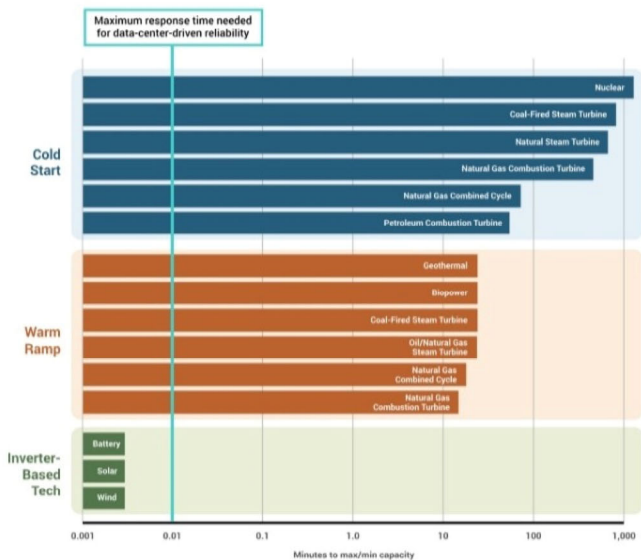
the sudden loss of supply could lead to cascading failures across the grid. This is because generation must equal load at all times, datacenter or no datacenter. As a result, relying on coal plants to support these high-density digital loads doesn't enhance reliability, it endangers it. And it's not a matter of *if* the coal plant will fail, but *when*.

Reality #2: The inflexibility of coal plants risks grid stability

Coal boosters often point to the “always-on” nature of coal plants as evidence of their reliability. But that characteristic is a liability, not a strength, when it comes to supporting large, fast-changing loads like data centers. Coal units are inherently inflexible: they ramp slowly, respond poorly to sudden load shifts, and are difficult to turn on or off quickly. This rigidity is a poor match for the dynamic and often unpredictable nature of data center demand. Further, inflexible coal plants can worsen grid congestion; by occupying limited transmission capacity with inflexible generation, they prevent cheaper or cleaner resources from being delivered. This issue has already been flagged by [independent market monitors](#) in regions like MISO – which covers 15 US states and a Canadian province – where congestion-related market distortions have cost [over \\$1 billion a year](#). Coal plants displace faster-responding resources that are better suited to follow load. And the stakes are high.

As noted by the North American Electric Reliability Corporation (NERC), large, voltage-sensitive loads like data centers require flexible, responsive grid solutions, not slow-ramping generators that can take 12 or more hours to come online. NERC’s recent [Incident Review and Guidance on Voltage-Sensitive Large Load Integration](#) describes an event in 2024 where a transmission fault triggered a sudden disconnection of 1,500 megawatts of voltage-sensitive data center load, leading to sharp frequency and voltage spikes that required operator intervention. The incident exposes the system’s vulnerability to instability when inflexible generation cannot respond to large load fluctuations.

Minutes needed for a power plant to reach max/min capacity



If a data center either loses access to load or goes offline rapidly, a grid’s generation needs to respond at sub-second speeds. The average coal plant ramp rate is [4 percent per minute](#) which translates to spending over 20 minutes to respond to a large load event. From a cold start, the average coal plant would take over [12 hours](#) to reach max capacity. Coal plants simply can’t respond fast enough to support the reliability needs of modern data centers. Whether it’s the hours-long startup time from a cold state or sluggish ramp rates to turn off, these plants are too slow to provide the real-time flexibility required during sudden load changes or outages.

Reality #3: Clean resources are available now that can better respond to and support data centers for less

The good news is that we don’t need to rely on brittle coal plants to meet the needs of a digital economy. A range of cleaner, more resilient solutions is already available – and scalable. For example, we recently found that [more than 95 percent](#) of future demand can be met with fast, scalable, and clean solutions:

Alternative near-term solutions to meet load growth

| Technology        | Opportunity                                                                                                                                                                                                                                                       |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Energy Efficiency | Over 50 GW of energy efficiency can be deployed – by both creating programs for new loads and expanding existing programs aligned with system needs. Energy efficiency can unlock benefits beyond system cost savings, improving comfort and resilience in homes. |

Shares





|                                    |                                                                                                                                                                                                                                                                                                                              |
|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Virtual Power Plants               | 60 GW of virtual power plants can be deployed by 2030, with programs stood up and enrolled in under 6 months. Policymakers in Virginia recently passed a <a href="#">bill that requires 450 MW of VPPs</a> deployed rapidly to meet growing demand.                                                                          |
| Advanced Transmission Technologies | Grid enhancing technologies and reconductoring can unlock over 80 GW of incremental peak capacity by reducing transmission and interconnection constraints. Lawmakers in New Mexico passed a <a href="#">bill requiring utilities to assess the use these technologies</a> in plans to get more out of the existing grid.    |
| Clean Repowering                   | There is <a href="#">14 GW of fossil-fuel generation expected to retire</a> , that could serve as sites for quick addition of new renewable energy and storage while reducing system costs. Market operators like PJM are enabling clean repowering by <a href="#">updating rules to allow for surplus interconnection</a> . |
| Power Couples                      | New load can be co-located with renewable energy at the site of existing, underutilized generators with approved interconnections—a strategy which we call <a href="#">“Power Couples.”</a> There is over 30 GW of opportunity to deploy Power Couples under \$100/MWh, and over 50 GW of opportunity under \$200/MWh.       |

Coal plants are a legacy technology, not a solution for the future. Coal plants’ operational characteristics make them less suited to meet the scale and speed of these new challenges. The path forward is not about discarding the past, but about building on it with cleaner, more adaptable resources that can reliably serve evolving grid needs.

Technologies like battery storage, demand flexibility, and clean energy portfolios offer practical, cost-effective options that align with modern load dynamics. As we noted in a recent [article](#), by running coal plants only when it is economical to do so and using the extra transmission headroom that creates to reinvest with clean energy upgrades, our grid can support the next wave of economic growth with the flexibility it demands. There are reasons to manage the shift to new, clean resources [thoughtfully and intentionally](#), but propping up coal plants that are not suited for the job is a step in the wrong direction.

## RECOMMENDED READING



### Gas Turbine Supply Constraints Threaten Grid Reliability; More Affordable Near-Term Solutions Can Help

June 18, 2025

[Read More](#)



### Reinvesting at Coal Plant Sites with Clean Energy Upgrades Supports both Reliability and Affordability

July 16, 2025

[Read More](#)

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Other

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# Donate

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\$50

\$100

\$500

\$1500

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\_\_\_\_\_

Order No. 202-25-7

Exhibit to  
Motion to Intervene and Request for Rehearing and Stay of  
Public Interest Organizations

Filed September 5, 2025

# Exhibit 119

## ZRC Replacement



# ZRC Replacement and instructions in the MECT

RASC

05/24/2023

Presentation updated as 7/11/2023  
Updates are at the end of the deck Slides 12-17

Presentation updated as of 9/29/2023  
Updates are on slides 14 & 17

# Purpose and Key Takeaways



## Purpose:

Provide Stakeholders with information and training on ZRC replacement in the MECT

## Key Takeaways:

- ZRC replacement uses, and process explained and clarified
- ZRC replacement does not impact settlements from the PRA
- ZRC replacement is used for suspension, retirement, Catastrophic Generator Outage or full or partial Generator Planned Outages that may exceed thirty-one (31) Days in the Season
- [MECT User Guide](#) has additional detail

# Reasons to use ZRC Replacement

- Generators that have cleared a season(s) in the PRA that go on suspension, retirement or Catastrophic Generator Outage
- Cleared ZRCs for resources with planned generator outages and/or derates in excess of 31 days in a season
- ZRC replacement must overlap the suspension, retirement, catastrophic outage or outages/derates of the cleared generation being replaced
- Resources ZRCs cannot be replaced other than for the reasons listed above

# ZRC Replacement FAQ

- ZRC replacement substitutes the Resource Adequacy Requirement (RAR) and Must Offer Obligation for the cleared resource
- Fully replaced resources (>95% cleared ZRC) will be granted Tier 1 & 2 exemptions during the replacement hours from Schedule 53 SAC calculation
  - Exemptions are for SAC calculations only, still subject to the capacity replacement rules and penalties
  - Exemptions for derates is still under discussion
- ZRC replacement does not impact settlements from the PRA, however resources that failed to meet the replacement requirement will incur non-compliance charges



# Process for ZRC Replacement

- Use the “Replacement Calculator” on the MECT
- Obtain the ZRCs used in the replacement
- Submit the replacement on the “Resource Substitution” screen in the MECT
  - ZRC replacement should be entered into the MECT at least 7 calendar days prior to the effective date of replacement
- Contact MISO with any issues through the [MISO help center](#)

# Use Replacement Calculator

- The Replacement Calculator is to verify that the prospective replacement ZRCs do not violate LCR, CIL or CEL for each zone when using ZRCs from another LRZ or ERZ

| Zonal Data | PRMR<br>(Obligation) | Offers<br>Cleared +<br>FRAP | LCR     | Import<br>Level (CIL) | Export<br>Level (CEL) | Auction<br>Import | Auction<br>Export | Replacement<br>Import | Replacement<br>Export | Import<br>Available | Export<br>Available |
|------------|----------------------|-----------------------------|---------|-----------------------|-----------------------|-------------------|-------------------|-----------------------|-----------------------|---------------------|---------------------|
| 1          | 18374.9              | 18661.2                     | 16588.7 | 3754.0                | 3373.2                | 0.0               | 286.3             | 0.0                   | 0.0                   | 4040.3              | 3086.9              |
| 2          | 13449.9              | 13536.9                     | 13017.5 | 1714.0                | 978.7                 | 0.0               | 87.0              | 48.1                  | 22.0                  | 1774.9              | 917.8               |
| 3          | 9882.0               | 10391.1                     | 7960.2  | 2896.0                | 4589.7                | 0.0               | 509.1             | 0.0                   | 0.4                   | 3405.5              | 4080.2              |

| Calculator | Total MW needing<br>replacement  | Replacement ZRCs from<br>the same zone | ZRCs from same zone<br>after replacement | LCR test | Total Import<br>Amount Needed | Amount<br>Exported              | Import Test | Export Test |
|------------|----------------------------------|----------------------------------------|------------------------------------------|----------|-------------------------------|---------------------------------|-------------|-------------|
| 1          | <input type="text" value="200"/> | <input type="text" value="100"/>       | 18561.2                                  | PASS     | 100                           | <input type="text" value="0"/>  | PASS        |             |
| 2          | <input type="text" value="0"/>   | <input type="text" value="0"/>         | 13470.8                                  | PASS     |                               | <input type="text" value="40"/> |             | PASS        |
| 3          | <input type="text" value="0"/>   | <input type="text" value="0"/>         | 10331.5                                  | PASS     |                               | <input type="text" value="60"/> |             | PASS        |
| 4          | <input type="text" value="0"/>   | <input type="text" value="0"/>         |                                          |          |                               | <input type="text" value="0"/>  |             |             |

# Obtain the ZRCs

- Market Participants will need the un-cleared ZRCs to use in the ZRC replacement
  - This can be from their own un-cleared ZRCs
  - This can be from a ZRC Transaction
    - [Non-MISO Bulletin](#) can be utilized to find ZRCs from other Market Participants

# ZRC Replacement in the MECT

- Navigate to the “Resource Substitution” screen in the MECT, fill in the form and submit

The screenshot displays the 'Resource Substitution' form in the MECT system. The form is organized into several sections with numbered callouts (4-12) indicating key fields:

- 4:** Resource Substitution Name (text input field)
- 5:** Original Resource (dropdown menu)
- 6:** Substitution Resource (dropdown menu)
- 7:** Substitution Amount (text input field, with 'ZRC' as a placeholder)
- 8:** Effective Date (text input field)
- 9:** Contact Person (text input field)
- 10:** Contact Email (text input field)
- 11:** Contact Phone (text input field)
- 12:** Resource Substitution Comments (text area)

# Next Steps

- MECT release at the end of May will include an “end date” for ZRC replacement”. When the replacement is completed the ZRCs will be repopulated to the resource
- Additional details and screenshots will be added to this presentation and the MECT user guide and both will be reposted

# References

- MISO Resource Adequacy BPM-011-r27
  - Section 6.4, “Replacement Resources”
- MISO Tariff Module E-1
  - Section 69A.3.1.h, “Retirement, Suspension and Replacement of Planning Resources”
- MECT User Guide
  - Sections 18, 30, 31 and 32





<https://help.misoenergy.org/support/>

Additional Content  
added as of 7/11/2023

# BPM-011-r28 updated and posted to MISO website

- BPM-011-r28 has been posted to MISO website with clarification to sections 6.4.3 – 6.4.7
- Updates are limited to ZRC Replacement and implementation and assessment of the 31-day rule

# Updates to the MECT allowing ZRC Replacement Termination

- Resource Substitution defaults to the end of the season
  - Before the effective date, a new dropdown will allow MPs to delete the substitution
  - After the effective date, a new dropdown will allow MPs to terminate the ZRC replacement between the effective date and current date

The screenshot displays a web application interface for managing Resource Substitutions. On the left, a table with columns 'Substitution Name' and 'Substitution Type' is partially visible. A row with 'XYZ' under 'Substitution Name' and 'Resource' under 'Substitution Type' is highlighted. A context menu is open over this row, showing 'View' and 'Terminate' options. On the right, a 'Terminate' modal is displayed. It features a red header bar with a warning icon and the text: 'Are you sure you want to terminate this Resource Substitution? This will end it, but not delete it.' Below this, there is a 'Termination Date' label and an empty input field. At the bottom right of the modal are 'CANCEL' and 'SUBMIT' buttons.

# Scheduling 31+ day Generator Outages and participation in the PRA

- For resources that have anticipated planned outages that last longer than 31 days in the next Planning Year, the following options are available
  - Straddle seasons, if the resource has a planned 50-day outage, having 25 at the end of one season, continuing for the other 25 days into the subsequent season
  - If the outage is long enough, the resource could plan the outage during one season and not offer into the PRA for that season (requires working with the IMM). During the time the resource is available in the season, they could provide ZRC replacement for other resources
  - Work with the IMM to factor in the 31-day penalty price into the offer for the PRA, which can exceed the FSRL limit ~\$25-30/MW-day

# 31-day Outage Rule (1 of 2)

- MISO's Control Room Operations Window (CROW) includes the following 4 categories of out of service (OOS) and derates: Planned, Urgent, Emergency and Forced. For purposes of calculating CRNCCs, MISO will use CROW outages prioritized as Planned. In addition, all outages not prioritized as Planned in CROW, but that were: (1) known or reasonably known at the time of the PRA, or (2) were determined by the IMM to be incorrectly prioritized in CROW shall be included in calculation of the CRNCC. See BPM-008 and the CROW users guide for outage prioritization codes and definitions. must replace ZRCs or incur a CRNCC penalty cost.
- Capacity non-compliance charge as stated in section 6.4.7 of BPM-011-r28 is equal to the # of days greater than 31 that did not properly replace \* # of ZRCs \* (seasonal ACP + daily Zonal CONE)
  - For example. A 100 MW resource in LRZ5 for Summer 2023 (\$10 ACP) that was on a planned outage for 35 days and did not replace any ZRCs would incur the following charges
    - $4 \text{ days} * 100\text{MW} * (10 + 300.2) = \$124,080$
- The ZRC replacement and penalties are assessed and applied to the Market Participant who converts SAC to ZRCs



# 31-day Outage Rule (2 of 2)

- The 31-day rule will be implemented on an hourly basis as laid out in section 6.4.7 of BPM-011-r28 (31 days \* 24 hours = 744hours)
- CROW has 4 outage types
  - Forced – already out at time of submission Not counted
  - Emergency – 0 to 2 days in the future Not counted
  - Urgent – 2 to 14 days in the future Not counted\*
  - Planned – 14 days + in the future Counted
- The hours of planned outages across the season per resource will be summed up from most ZRCs to least ZRCs, the 31 days will apply to the most severe planned outage days and the remaining hours will be counted towards the penalty
- The penalty is assessed on a daily basis so the hours will be converted back to days and rounded down to the nearest day

BEFORE THE UNITED STATES DEPARTMENT OF ENERGY

Federal Power Act Section 202(c)     )  
Emergency Order: Midcontinent     )  
Independent System Operator     )  
(MISO)     )  
\_\_\_\_\_

Order No. 202-25-7

Exhibit to  
Motion to Intervene and Request for Rehearing and Stay of  
Public Interest Organizations

Filed September 5, 2025

Exhibit 120  
  
2024 OMS-MISO  
Survey



# 2024 OMS-MISO Survey Results

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*Furthering our joint commitment to regional resource adequacy, OMS and MISO are pleased to announce the results of the 2024 OMS-MISO Survey*

**CORRECTIONS**  
**Reposted 6/20/2024**  
**Slide 11 PRM% Updated**

June 20, 2024

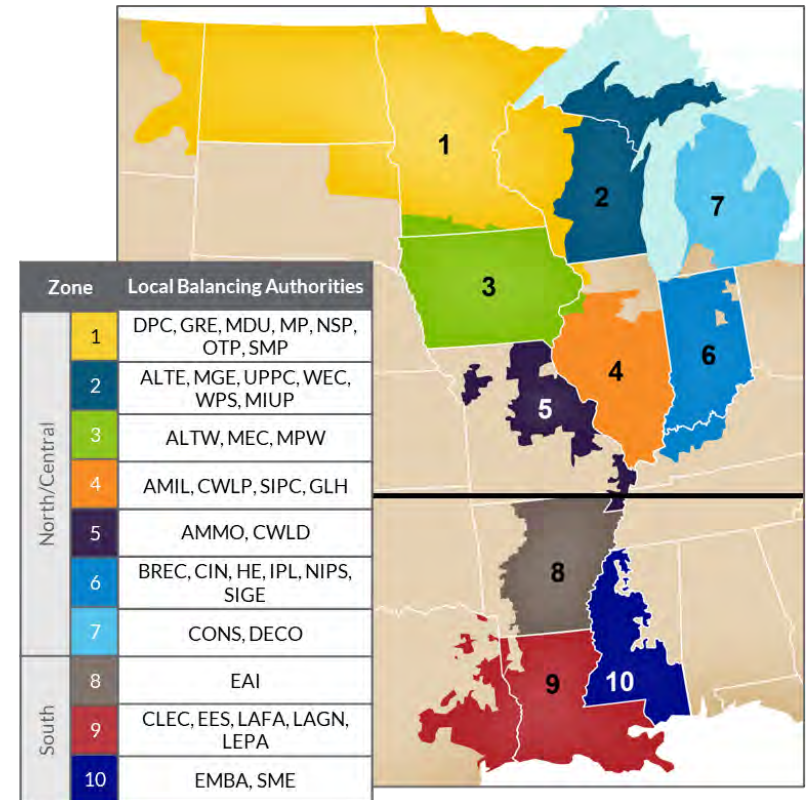
# The 2024 OMS-MISO Survey reinforces near-term risks and highlights key uncertainties impacting resource adequacy in the MISO region

- Results indicate a potential surplus of 1.1 GW to a deficit of 2.7 GW for the summer of PY2025/26, depending on critical, yet uncertain, drivers such as the pace and quantity of new resource additions and projected resource retirements.
- Resource Adequacy risks could grow over time across all seasons, absent increased new capacity additions and actions to delay capacity retirements.
- Significant economic development activities are spurring new, large spot-load additions (e.g., data centers, onshoring of manufacturing, new industrials) and increasing pressures on resource adequacy and requiring improved abilities for the timely addition of new resources.
- Recent reforms to MISO's resource adequacy construct will enhance MISO's ability to accurately assess the changing resource adequacy risks driven by extreme weather, the rapid growth of weather-dependent resources, and the retirement of dispatchable resources.
- Results highlight resource adequacy challenges in the MISO region and the need for continued collaboration between OMS, MISO, and its Members to maintain a reliable electricity system.

*All presentation references to capacity indicate Seasonal Accredited Capacity (SAC)*

# The OMS-MISO Survey provides a resource adequacy view over a five-year horizon based on currently available information

- The survey results indicate the degree to which expected capacity resources satisfy planning reserve margin requirements with either a surplus or a deficit.
- The survey considers that Load Serving Entities (LSEs) within each zone must have sufficient resources to meet load and required reserves.
- Surplus resources may be shared among LSEs with resource deficits to meet reserve requirements.



*This year's survey includes an updated baseline methodology to reflect the changing pace of new resource additions. Various scenarios for projected capacity and anticipated large spot-load additions across the MISO region are also included to highlight the increasing uncertainty and evolving risk.*

# Additional factors can impact projected deficits or surpluses that are observed in the survey



## Downside Risks

- Continuing rapid pace of resource retirements
- EPA regulations further accelerating resource retirements
- Ongoing delays to capacity additions due to supply chain bottlenecks, permitting delays, and commercial challenges
- Continued queue challenges due to exceptionally large accumulated backlog and expectations for high quantities of future applications
- Higher load growth due to economic development and new, large spot-load additions (e.g., data centers and onshoring of manufacturing/new industrials), absent an improved ability to concurrently add new resources

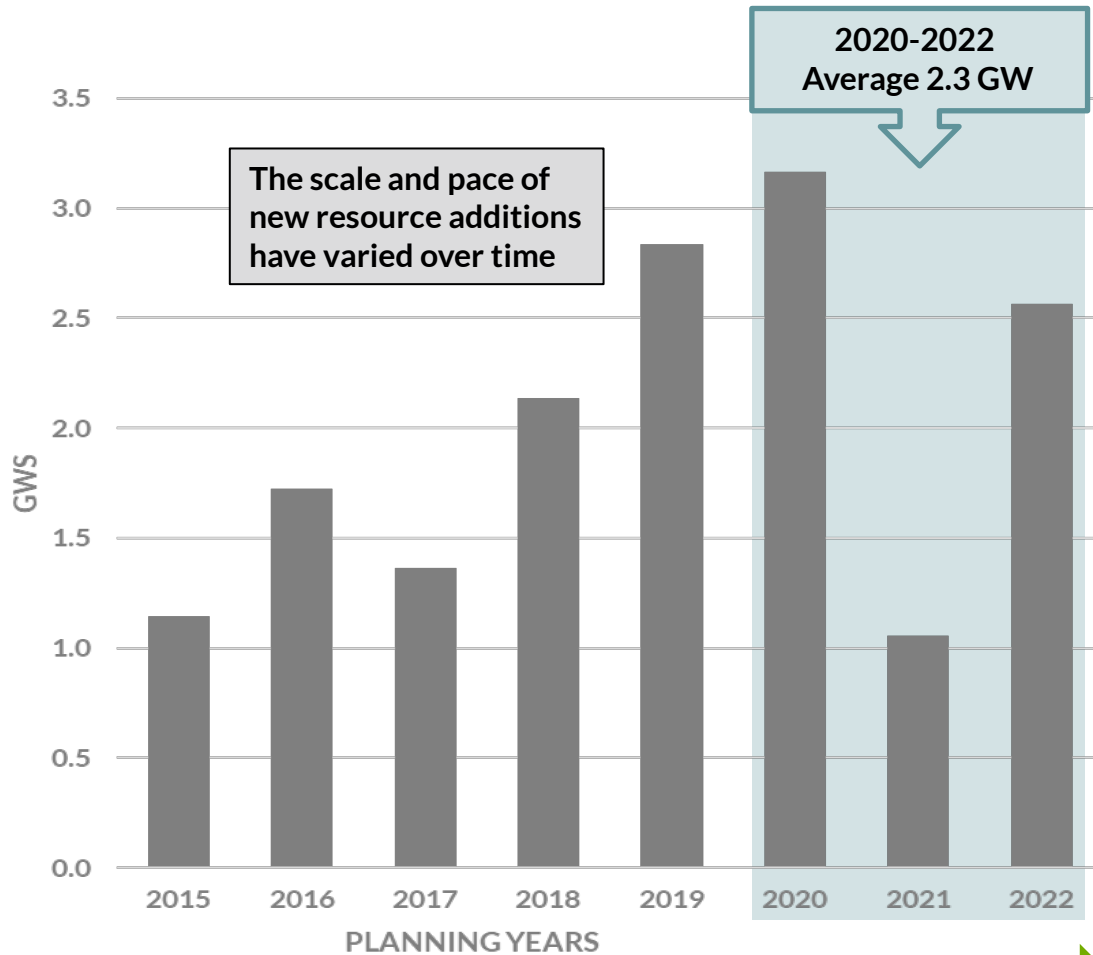


## Upside Possibilities

- Substantial new capacity enabled by the easing of supply chain bottlenecks, permitting constraints, and labor shortages
- Continued queue improvements to reduce speculative quantities and associated delays
- Market responses to local capacity deficits
- Improved price signals through market reforms, such as the Reliability Based Demand Curve, incentivizing additional capacity
- Improved ability to add new resources and support economic development and related new, large spot-load additions



# Trends and market pressures related to new capacity additions suggest refinements are needed to better reflect uncertainty



Queue applications have grown to >300 GW & >50 GW signed GIAs

In the past, it was reasonable to use probability-adjusted estimates applied to quantities of projects in various phases of queue development.

That's no longer applicable due to the larger queue and constraints faced by projects with signed generation interconnection agreements (GIAs). The 2024 survey uses a range of estimates for new resource additions:

- 1. Three-Year Historical Average:** based on the historical rate of additions per planning year\*
- 2. Alternative Projection:** based on MISO's updated timing estimates from interconnection customers with GIAs\*

Note: 2023 data unavailable during time of analysis. Including 2023 projects would change the 3-year average to 2.2 GW.

\*Based on Historical averages defined on slide 6

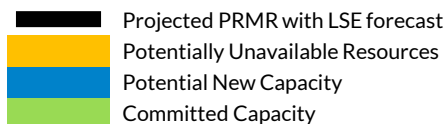
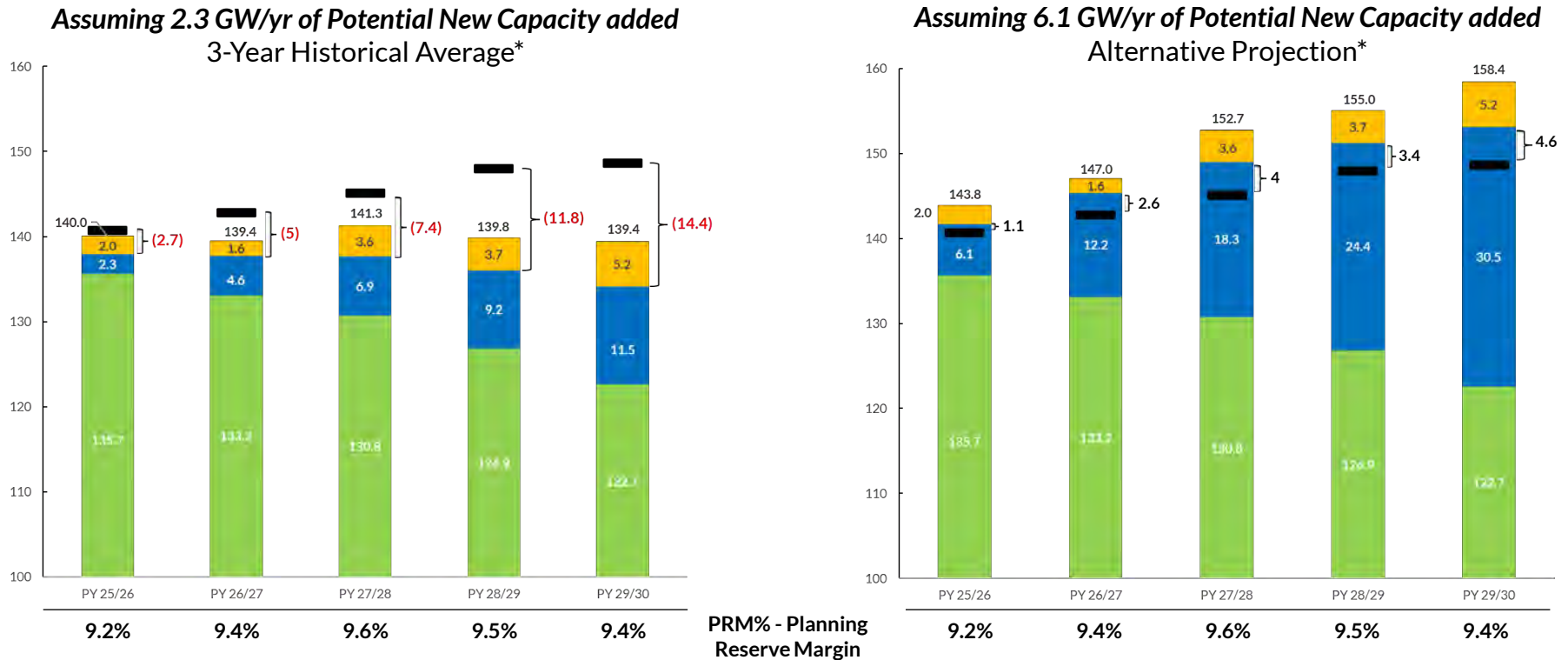
# Understanding Resource Categories

| Resource Category                                                                                                                                                                                            | Past Practice                                                                                                                                                                                                                                                         | 2024 Survey                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <b>Committed Capacity</b><br><i>Resources committed to serving MISO's load</i>                                               | <ul style="list-style-type: none"> <li>Existing generation resources</li> <li>Signed Generation Interconnection Agreement Projects</li> <li>External resources with firm contracts to MISO load</li> <li>Assumes resources will be used to meet PRMR</li> </ul>       | <ul style="list-style-type: none"> <li>Same, except does not include signed Generation Interconnection Agreement (GIA) projects (Signed GIA projects moved to 'Potential New')</li> </ul>                                                                                                                                                                                                                  |
|  <b>Potential New Capacity</b>                                                                                                | <ul style="list-style-type: none"> <li>Projects in the MISO Generator Interconnection Queue adjusted for queue phase and related probabilities for projects reaching commercial operations</li> <li>Assumes resources will <b>NOT</b> be used to meet PRMR</li> </ul> | <ul style="list-style-type: none"> <li>Using 3-Year Historical Average: Capacity addition based (2.3 GW/year) based on the average new capacity built in Planning Years 2020-2022</li> <li>Using Alternative Projection: Informed by timing estimates from interconnection customers with signed GIA projects* (6.1 GW/year)</li> <li>Assumes resources <u><b>WILL</b></u> be used to meet PRMR</li> </ul> |
|  <b>Potentially Unavailable Resources</b><br><i>May be available to serve MISO's load but may not have firm commitments</i> | <ul style="list-style-type: none"> <li>Indicated as Low Certainty in survey results by Market Participants</li> <li>Includes potential retirements or suspensions</li> <li>Assumes resources will <b>NOT</b> be used to meet PRMR</li> </ul>                          | <ul style="list-style-type: none"> <li>No Changes</li> </ul>                                                                                                                                                                                                                                                                                                                                               |

\*MISO Alternative Projection: Responses indicate 6.8GW can be built for PY 2025/26. MISO data shows 90% of GIAs get built.  
PRMR: Planning Reserve Margin Requirement

# The 2024 OMS-MISO Survey illustrates a strong sensitivity to the pace of new capacity additions, with PY 2025/26 showing a range from a 2.7 GW deficit to a 1.1 GW surplus and widening thereafter

## MISO Resource Adequacy Projection – Summer (GW)



- Bracketed values indicate difference between Committed + Projected New Capacity and Projected PRMR with LSE forecast
- Capacity accreditation values and PRM projections based on current practices
- Regional Directional Transfer (RDT) limit of 1900 MW is reflected in this chart

Note: Y-axis truncated in all capacity projection charts to accentuate capacity sufficiency/deficiency.

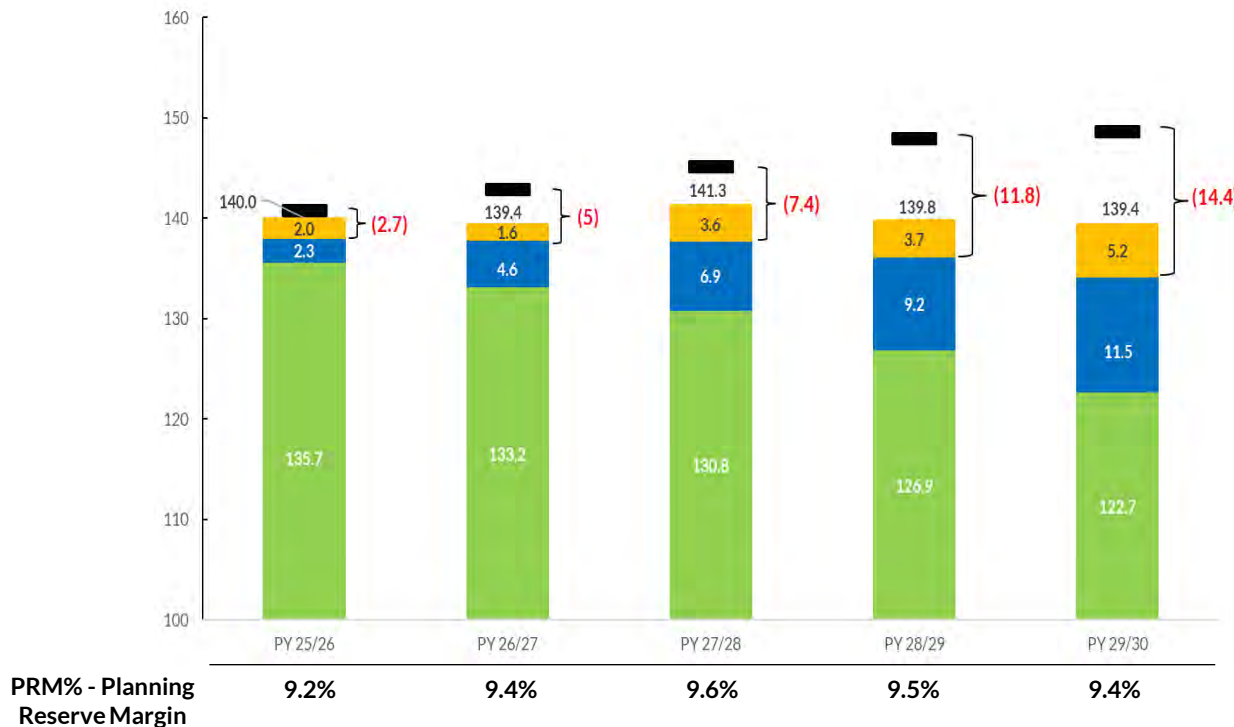
PRMR: Planning Reserve Margin Requirement

\*Using methods for potential New Capacity described on Slide 6

# Continued pace of retirements and pressures on generation development could potentially result in deficits as early as PY 2025/26

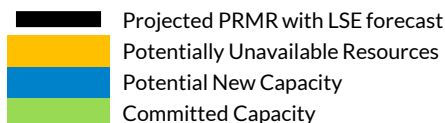
## MISO Resource Adequacy Projection – Summer (GW)

Assuming 2.3 GW/yr of Potential New Capacity added  
3-Year Historical Average\*



Projection of 2.3 GW of new capacity per year derived from:

- Actual buildout over PYs 2020-2022
- Projected capacity buildout in line with historical rate
- Reflects impacts from COVID slowdown, such as continuing supply-chain bottlenecks, commercial uncertainty and permitting/labor delays



- Bracketed values indicate difference between Committed+ Projected New Capacity and Projected PRMR with LSE forecast
- Capacity accreditation values and PRM projections based on current practices
- Regional Directional Transfer (RDT) limit of 1,900 MW is reflected in this chart

Note: Y-axis truncated in all capacity projection charts to accentuate capacity sufficiency/deficiency.

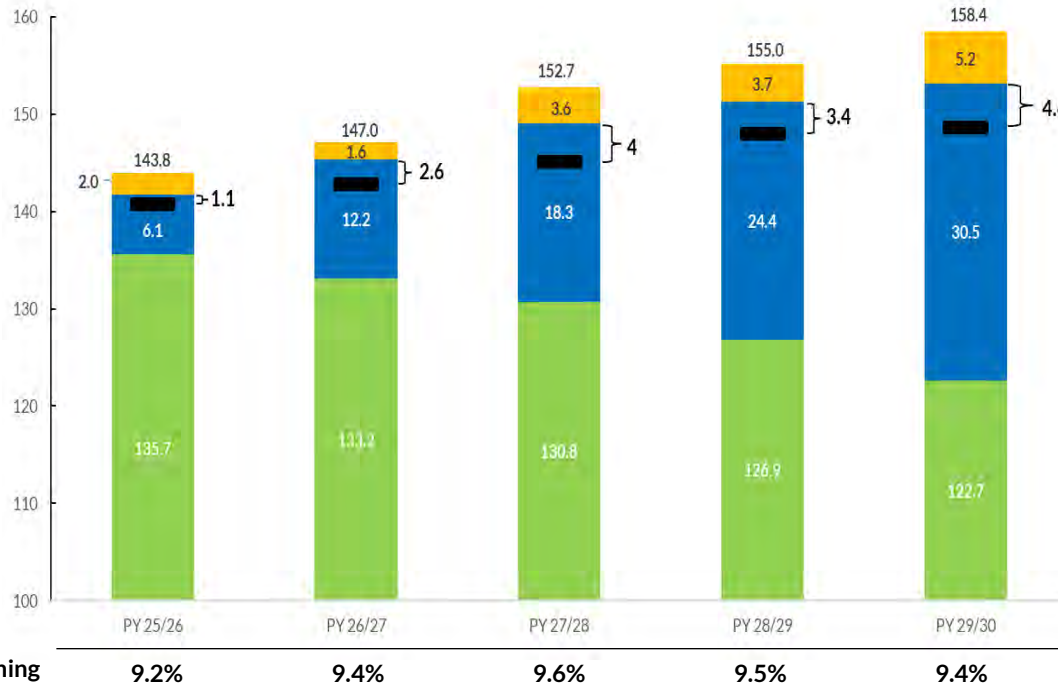
All references to capacity indicate Seasonal Accredited Capacity (SAC)

\*Using Potential New Capacity as described on slide 6

# Favorable changes in development drivers could accelerate capacity additions necessary to cover projected growth

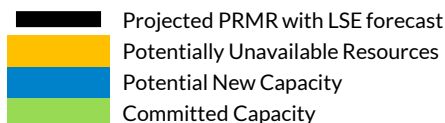
## MISO Resource Adequacy Projection – Summer (GW)

Assuming 6.1 GW/yr of Potential New Capacity added  
Alternative Projection\*



Projection of 6.1 GW of new capacity per year dependent upon:

- Easing of supply chain bottlenecks
- Reduced permitting-related delays
- Adequate supply of skilled labor
- Supportive commercial viability
- Continued queue improvements to reduce speculative quantities and associated delays



- Bracketed values indicate difference between Committed+ Projected New Capacity and Projected PRMR with LSE forecast
- Capacity accreditation values and PRM projections based on current practices
- Regional Directional Transfer (RDT) limit of 1,900 MW is reflected in this chart

Note: Y-axis truncated in all capacity projection charts to accentuate capacity sufficiency/deficiency.

All references to capacity indicate Seasonal Accredited Capacity (SAC)

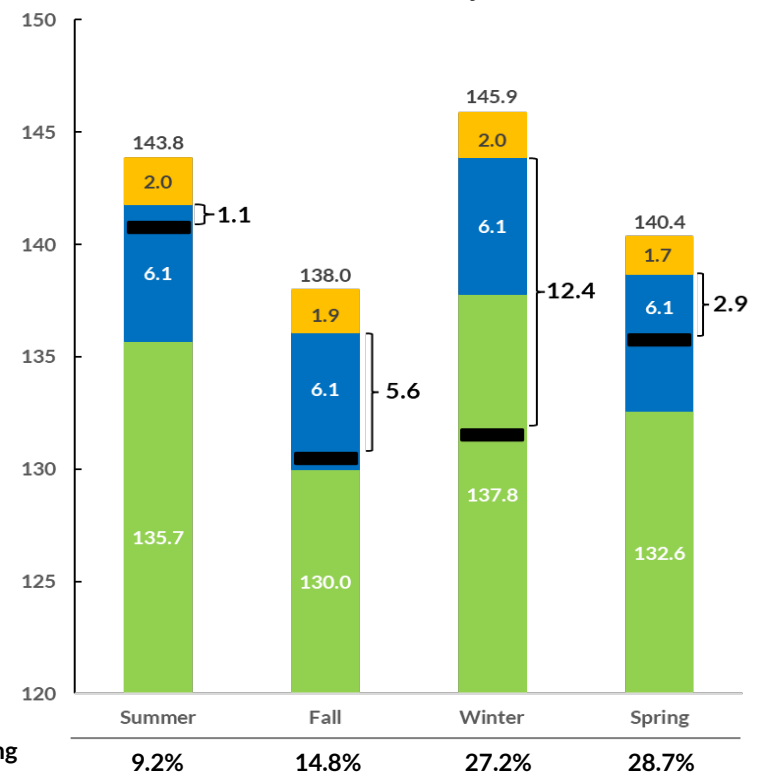
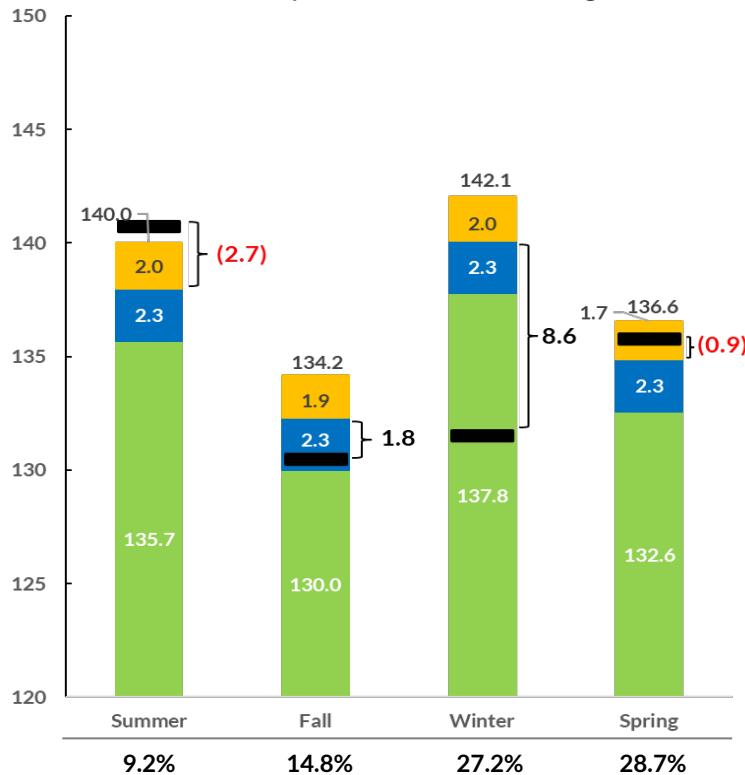
\*Using Potential New Capacity as described on slide 6

# Seasonal comparison for PY 2025-26 shows the greatest risk in summer and spring

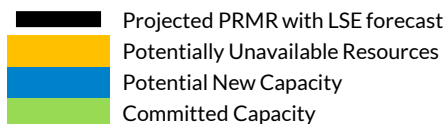
## MISO Resource Adequacy Projection 2025/26 (GW)

Assuming 2.3 GW/yr of Potential New Capacity added  
3-year Historical Average\*

Assuming 6.1 GW/yr of Potential New Capacity added  
Alternative Projection\*



PRM% - Planning Reserve Margin



- Bracketed values indicate difference between Committed+ Projected New Capacity and Projected PRMR with LSE forecast
- Capacity accreditation values and PRM projections based on current practices
- Regional Directional Transfer (RDT) limit of 1,900 MW is reflected in this chart

Note: Y-axis truncated in all capacity projection charts to accentuate capacity sufficiency/deficiency.

PRMR: Planning Reserve Margin Requirement

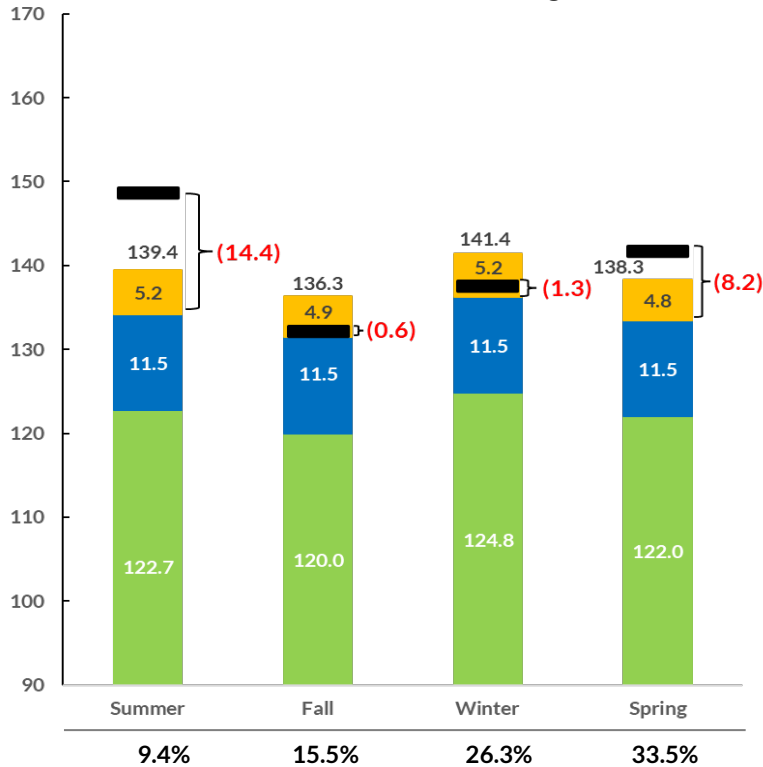
\*Using Potential New Capacity as described on slide 6



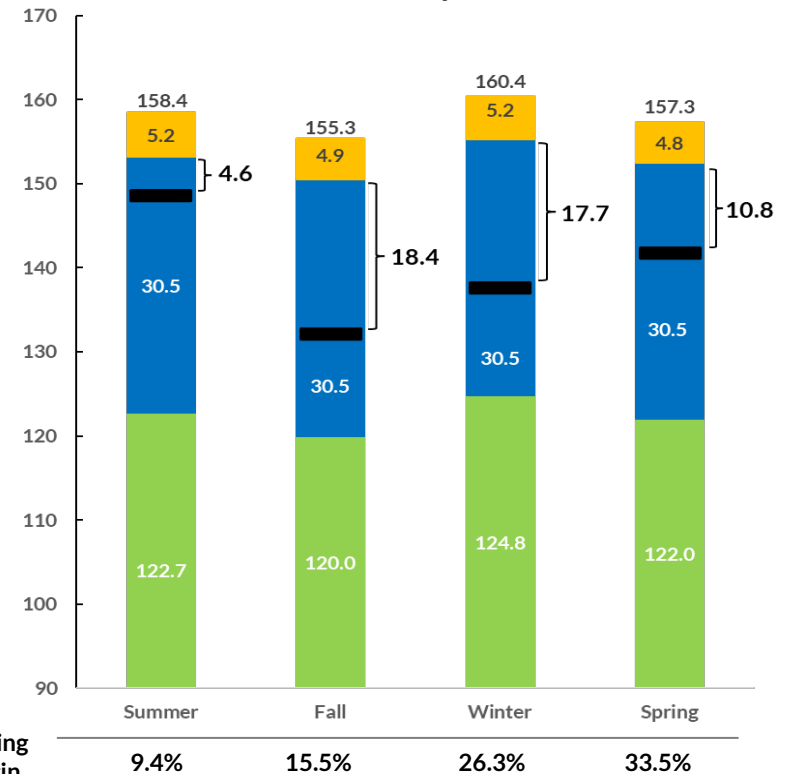
# Projections for PY 2029/30 show increased reliance on new resources to meet PRMR

## MISO Resource Adequacy Projection 2029/30 (GW)

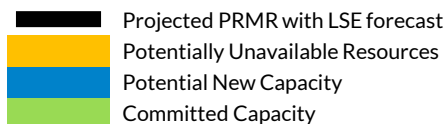
*Assuming 2.3 GW/yr of Potential New Capacity added  
3-Year Historical Average\**



*Assuming 6.1 GW/yr of Potential New Capacity added  
Alternative Projection\**



PRM% - Planning  
Reserve Margin



- Bracketed values indicate difference between Committed+ Projected New Capacity and Projected PRMR with LSE forecast
- Capacity accreditation values and PRM projections based on current practices
- Regional Directional Transfer (RDT) limit of 1,900 MW is reflected in this chart

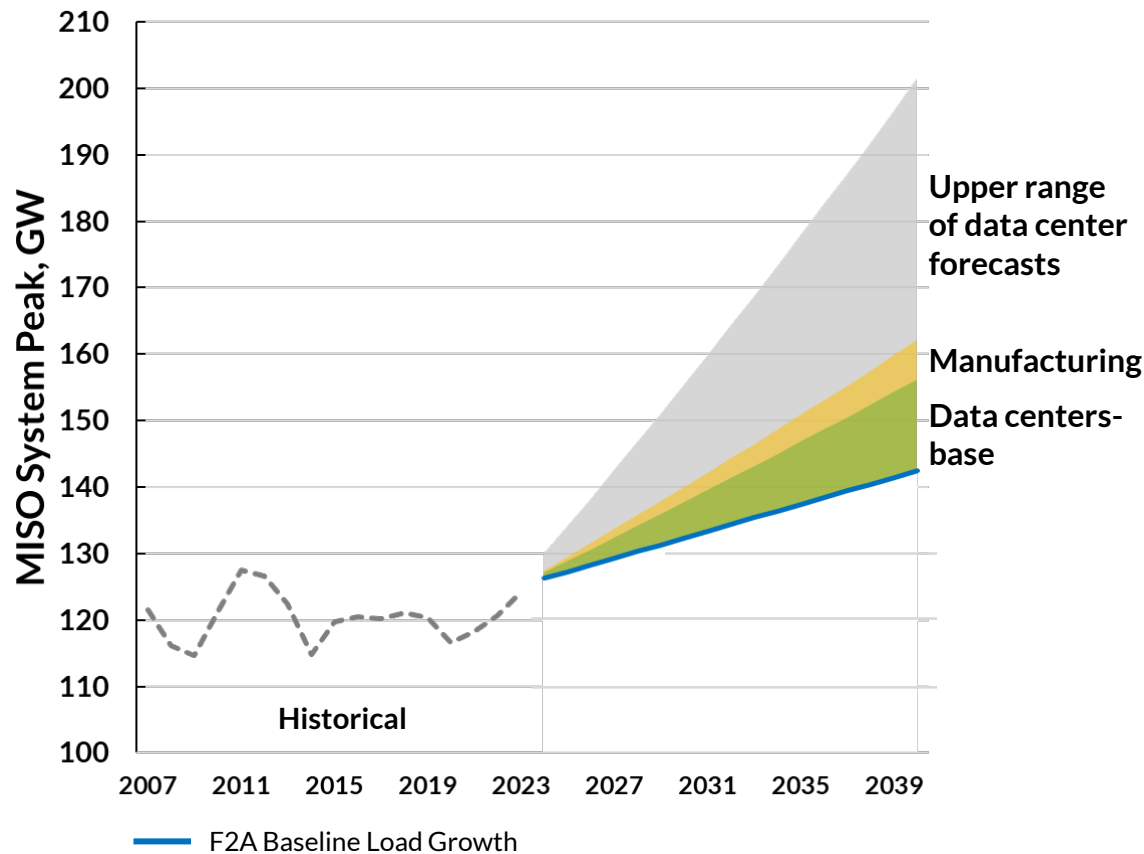
Note: Y-axis truncated in all capacity projection charts to accentuate capacity sufficiency/deficiency.

PRMR: Planning Reserve Margin Requirement

\*Using Potential New Capacity as described on slide 6

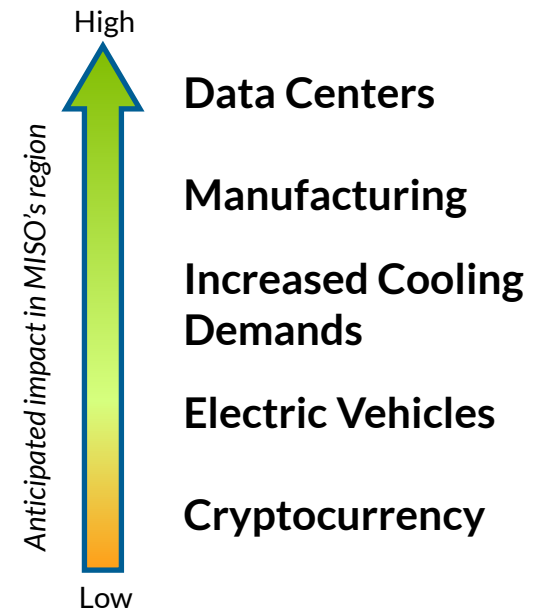
# MISO's future long-term load forecasts will account for emerging digital demands, industrial expansion and climate changes

EPRI and Grid Strategies<sup>1</sup> anticipate manufacturing growth to favor MISO's service area

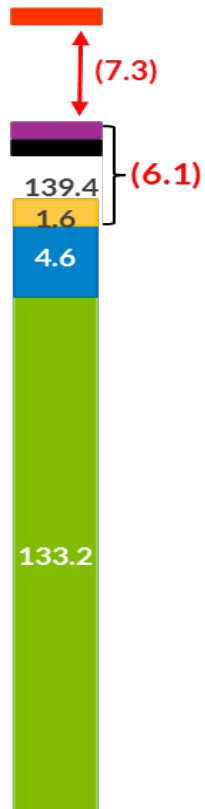


Note: All figures shown are PRELIMINARY

- Grid planners nearly *doubled* their 5-year peak load growth forecasts since last year
- MISO anticipates strong *long-term* load growth driven primarily by:



# NEW: The 2024 OMS-MISO Survey includes sensitivities considering a range of new, large spot-load additions



Illustrative Example:  
PY 2026/27 Using  
Three-Year  
Historical Average

## PRMR based on a higher range of large spot-load additions

- Uses MISO Future 2A as starting point<sup>1</sup>
- Models higher load-growth scenario using data from third-party consultants based on aggressive buildout of large load spot additions<sup>2</sup>

## PRMR considering large spot-load additions

- Uses MISO Future 2A as starting point<sup>1</sup>
- Models increased demand based on public announcements for proposed data centers and manufacturing facilities within the MISO region<sup>2</sup>

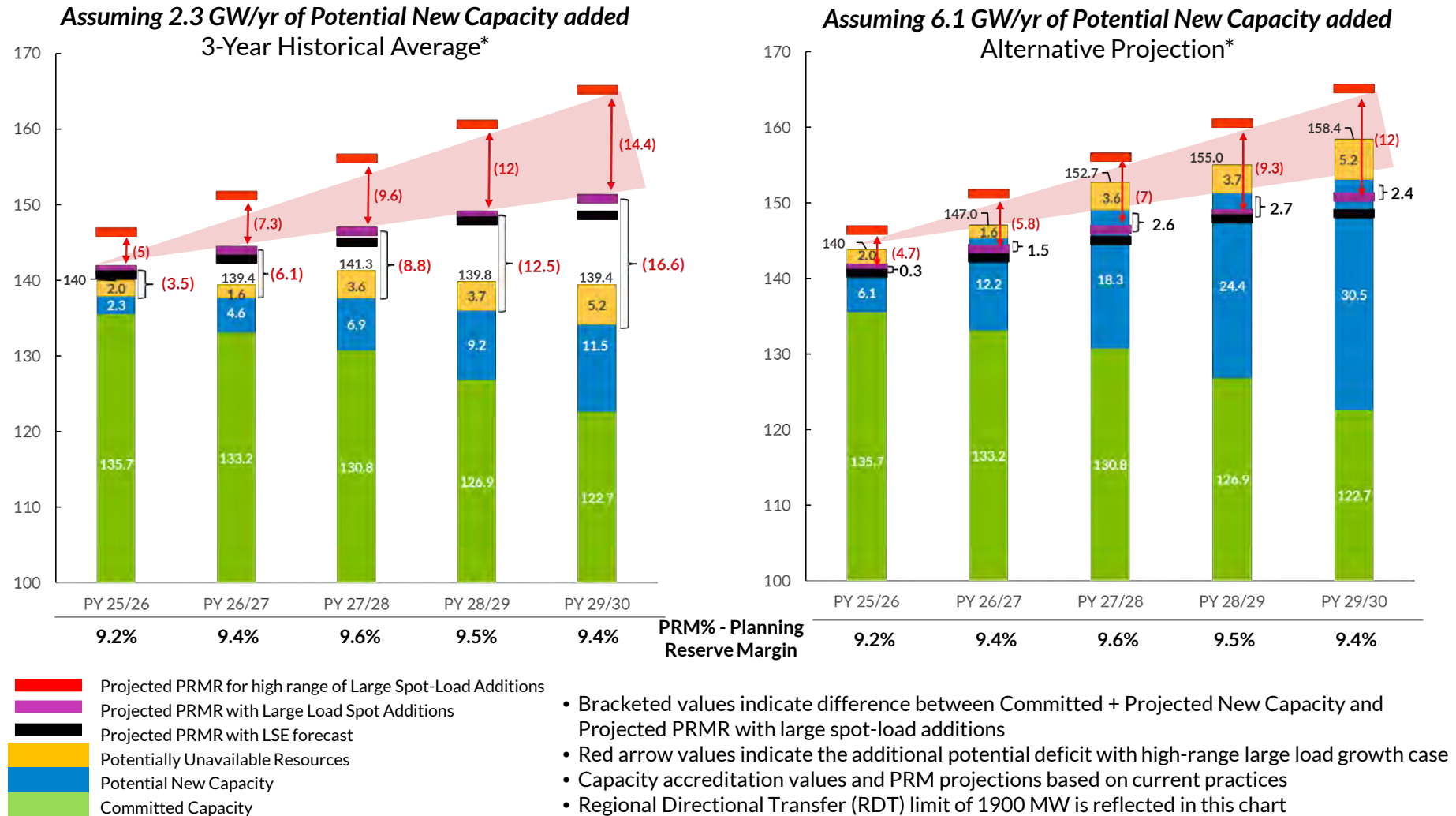
## PRMR based on LSE submitted load forecast

- LSE-submitted Non-Coincident Peak Forecast (NCPF) converted to Coincident Peak Forecast (CPF) using MISO posted Coincidence Factors
- Transmission losses added
- PRMR calculated using out year PRM% from PY 2024/25 LOLE Study

<sup>1</sup> [https://cdn.misoenergy.org/Series1A\\_Futures\\_Report630735.pdf](https://cdn.misoenergy.org/Series1A_Futures_Report630735.pdf), <sup>2</sup>See slides 12 & 31 for more information

# Capacity deficits continue to grow in the near and long term under a large spot-load additions scenario

## MISO Resource Adequacy Projection – Summer (GW)



Note: Y-axis truncated in all capacity projection charts to accentuate capacity sufficiency/deficiency.

PRMR: Planning Reserve Margin Requirement

\*Using Potential New Capacity as described on slide 6

# MISO's existing accreditation methods can overstate a resource's capacity value during the highest risk periods, especially as the region's risk profile changes, leading to understated risk

- Increased reliance on wind, solar and storage, projected large-load additions and electrification, and frequent large-scale weather events are decoupling periods of risk from periods of high demand.
- These drivers are upending traditional methods for establishing reliability requirements and resource accreditation.
- MISO's proposed resource accreditation methodology\* (Direct Loss of Load) will value a resource's marginal contribution to reliability during the highest risk periods.

*MISO's proposed accreditation reforms, on file at FERC and targeted for implementation in PY 2028/29, will better measure a resource's contribution to reliability.*

\*See Resource Accreditation White Paper, published March 2024:

<https://cdn.misoenergy.org/Resource%20Accreditation%20White%20Paper%20Version%202.1630728.pdf>

# **The 2024 Survey shows that the near-term resource decisions made by utilities, regulators, MISO and its Members will determine whether the region's resources remain adequate**

- Continued collaboration between OMS and MISO is necessary to maintain a reliable electricity system.
- The survey shows a range of potential resource adequacy outcomes, reinforcing near-term risks and illustrating key uncertainties impacting resource adequacy in the MISO region.
- Immediate actions are needed to expedite the addition of new capacity, coordinate resources for new load additions, and potentially moderate the pace of resource retirements.
- MISO's reforms under the Reliability Imperative are timely and responsive to the drivers contributing to resource adequacy challenges.
  - Implemented: Seasonal construct and thermal accreditation
  - Filed at FERC: 1) Reliability-Based Demand Curve, 2) resource accreditation
  - Ongoing reforms: 1) Load Modifying Resource accreditation, 2) Resource adequacy risk modeling improvements, 3) Attributes Roadmap, 4) LRTP, 5) JTIQ, 6) Queue Reforms



# Appendix

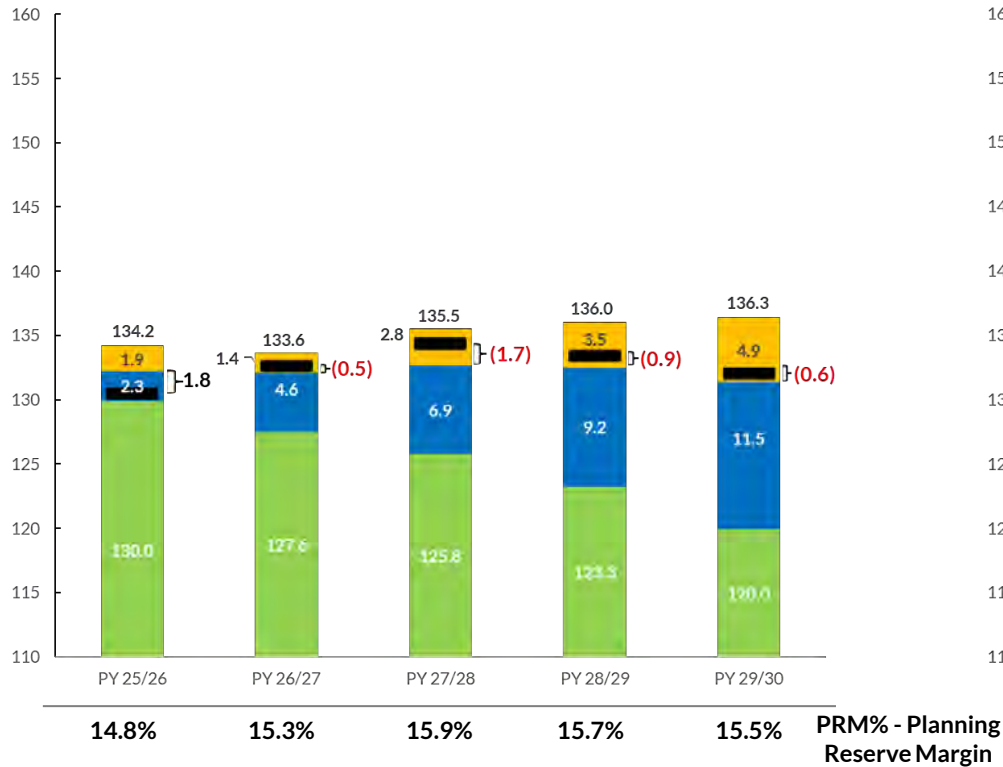
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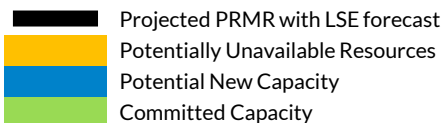
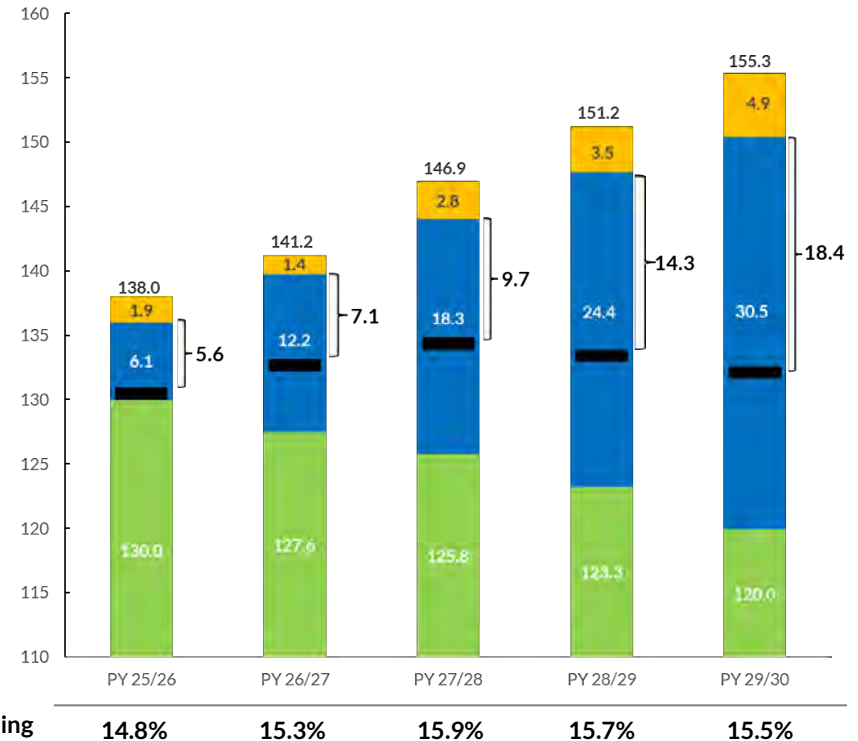
# Fall capacity ranges from 1.8 GWs to 5.6 GWs surplus in the prompt year

## MISO Resource Adequacy Projection – Fall (GW)

Assuming 2.3 GW/yr of Potential New Capacity added  
3-Year Historical Average\*



Assuming 6.1 GW/yr of Potential New Capacity added  
Alternative Projection\*



- Bracketed values indicate difference between Committed+ Projected New Capacity and Projected PRMR with LSE forecast
- Capacity accreditation values and PRM projections based on current practices
- Regional Directional Transfer (RDT) limit of 1900 MW is reflected in this chart
- Fall demand and PRMR calculated by using summer and winter demand forecast percent change seen year-over-year since out year Non- Coincident Peak Forecast (NCPF) is not submitted for out years for fall and spring

Note: Y-axis truncated in all capacity projection charts to accentuate capacity sufficiency/deficiency.

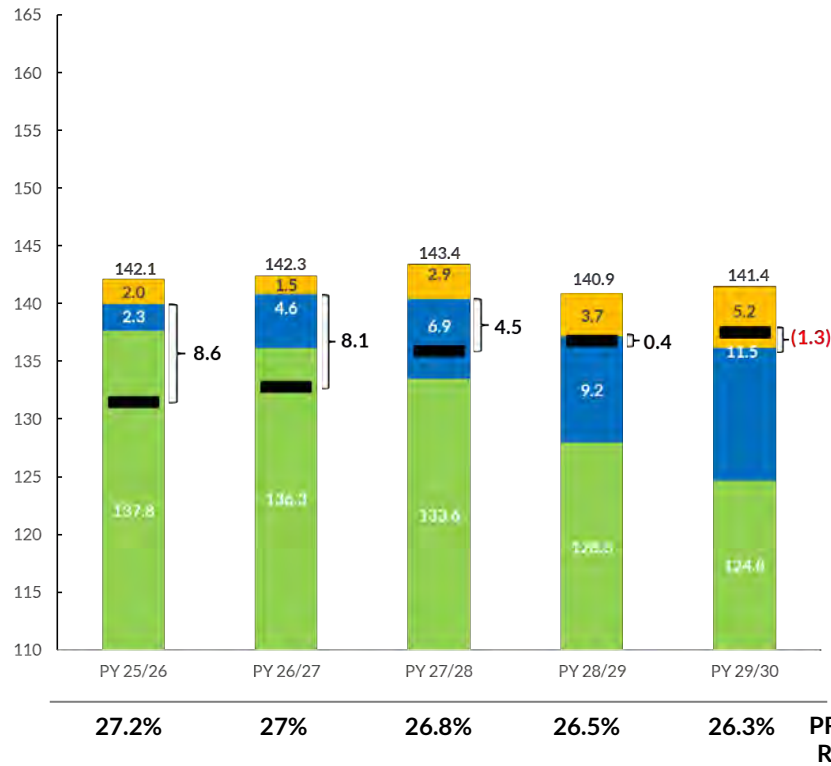
PRMR: Planning Reserve Margin Requirement

\*Using Potential New Capacity as described on slide 6

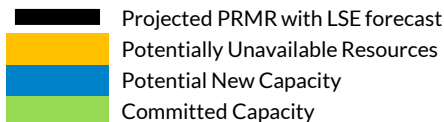
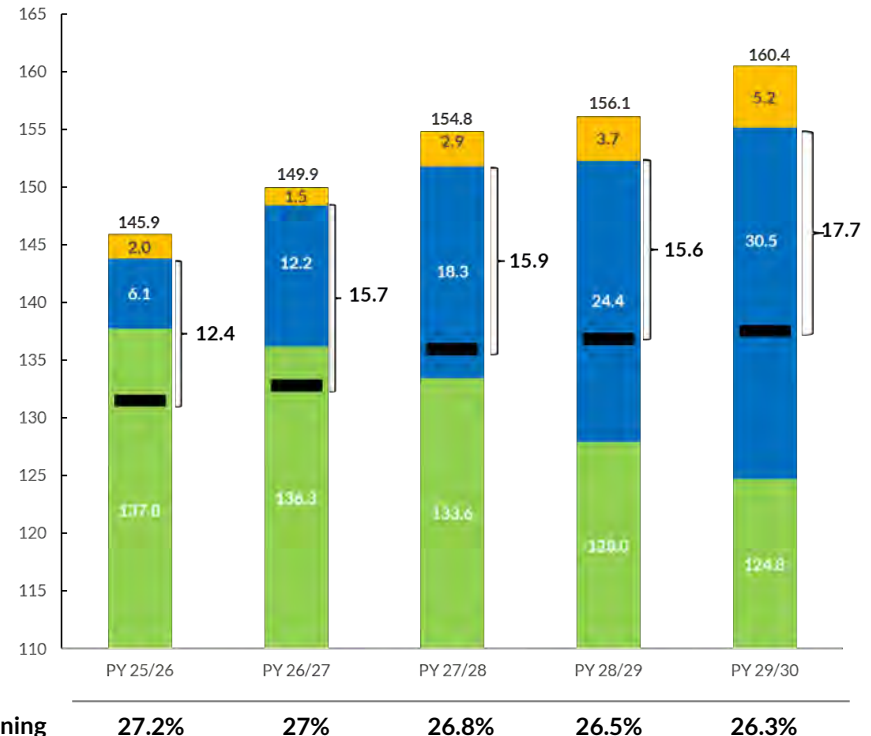
# Winter capacity ranges from 8.6 GWs to 12.4 GWs surplus in the prompt year

## MISO Resource Adequacy Projection – Winter (GW)

Assuming 2.3 GW/yr of Potential New Capacity added  
3-Year Historical Average \*



Assuming 6.1 GW/yr of Potential New Capacity added  
Alternative Projection\*



- Bracketed values indicate difference between Committed+ Projected New Capacity and Projected PRMR with LSE forecast
- Capacity accreditation values and PRM projections based on current practices
- Regional Directional Transfer (RDT) limit of 1900 MW is reflected in this chart

Note: Y-axis truncated in all capacity projection charts to accentuate capacity sufficiency/deficiency.

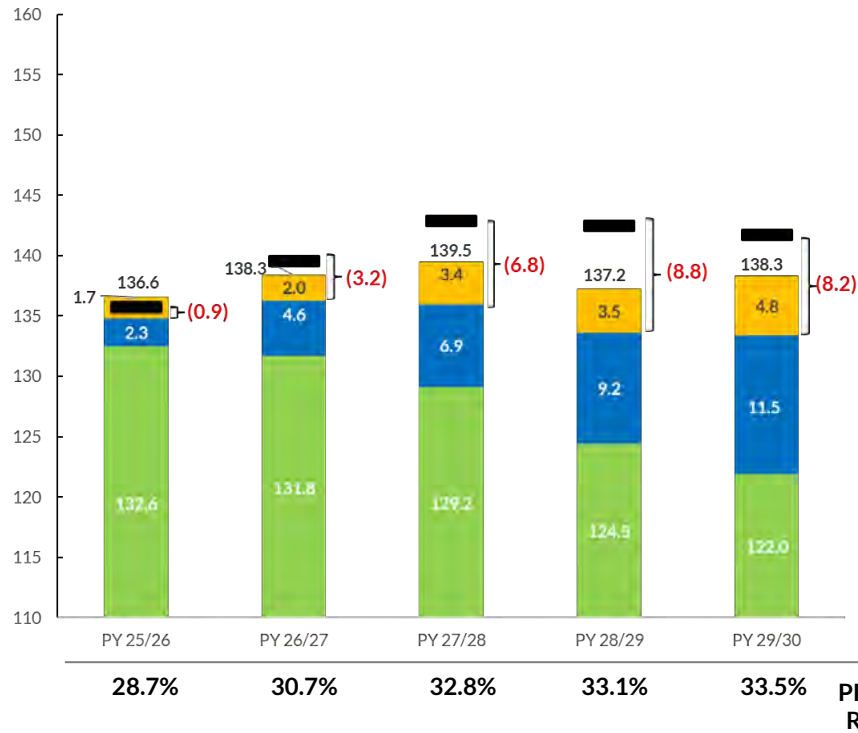
PRMR: Planning Reserve Margin Requirement

\*Using Potential New Capacity as described on slide 6

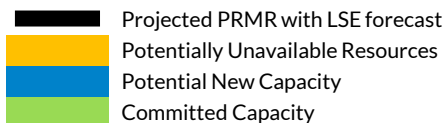
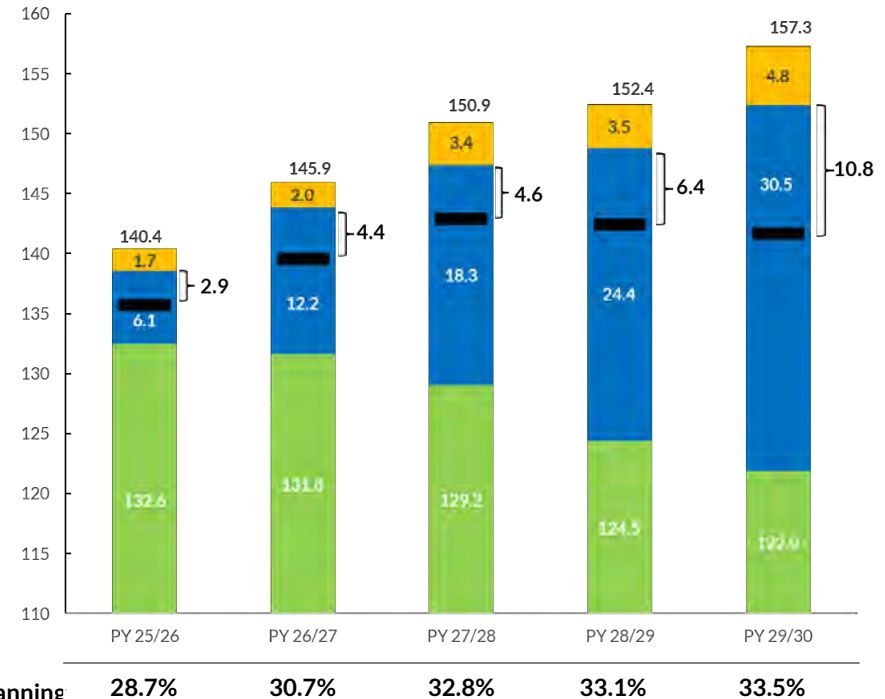
# Spring capacity ranges from 0.9 GWs deficit to 2.9 GWS surplus in the prompt year

## MISO Resource Adequacy Projection – Spring (GW)

Assuming 2.3 GW/yr of Potential New Capacity added  
3-Year Historical Average \*



Assuming 6.1 GW/yr of Potential New Capacity added  
Alternative Projection\*



- Bracketed values indicate difference between Committed+ Projected New Capacity and Projected PRMR with LSE forecast
- Capacity accreditation values and PRM projections based on current practices
- Regional Directional Transfer (RDT) limit of 1900 MW is reflected in this chart
- Spring demand and therefore PRMR is calculated by using Summer and Winter demand forecast percent change seen year over year since out year NCPF is not submitted for out years for Fall and Spring

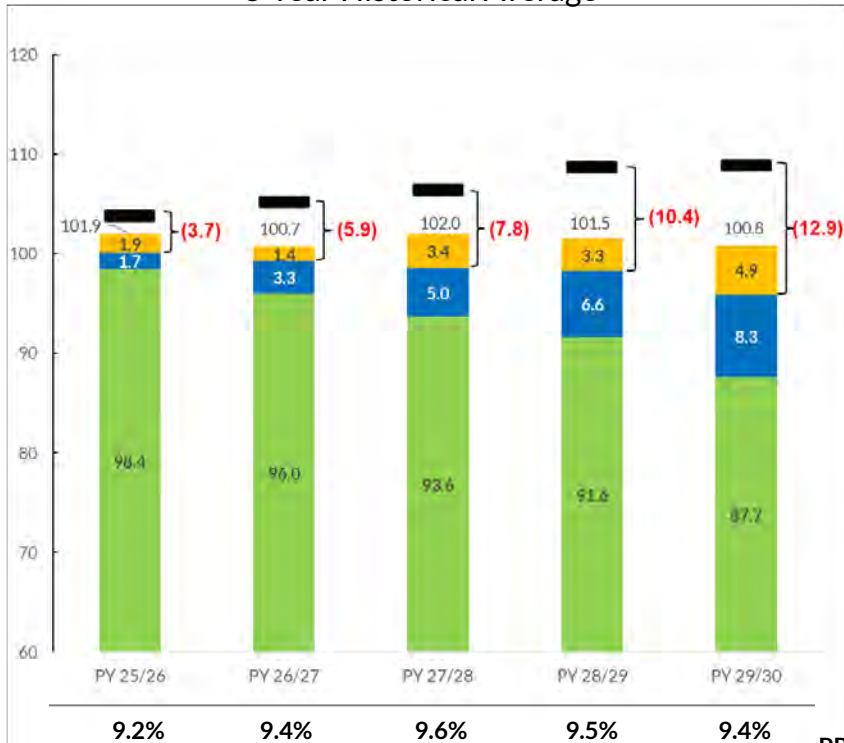
Note: Y-axis truncated in all capacity projection charts to accentuate capacity sufficiency/deficiency.

PRMR: Planning Reserve Margin Requirement

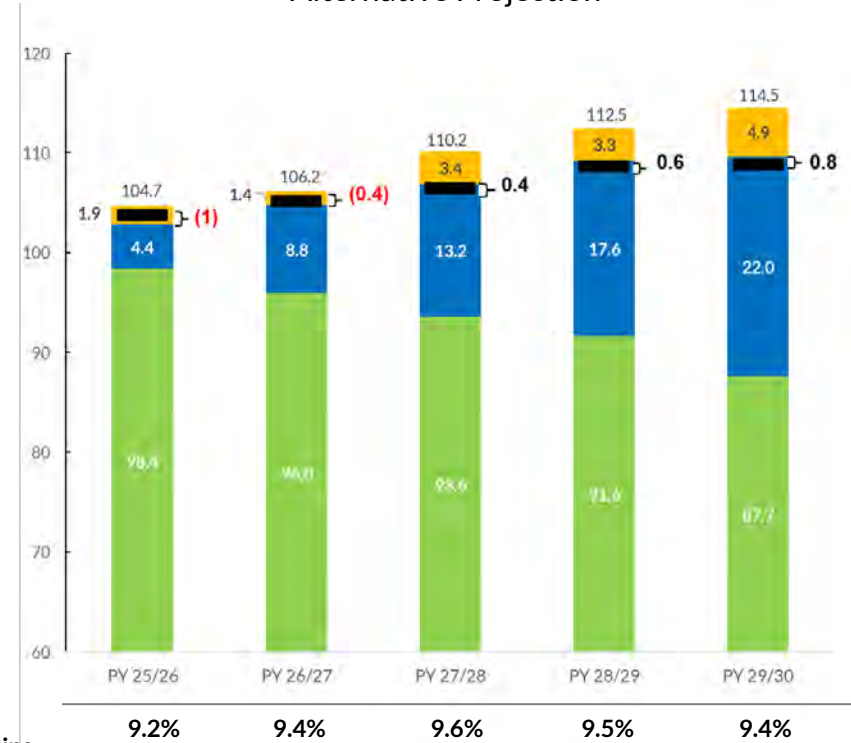
\*Using Potential New Capacity as described on slide 6

# The North/Central subregion capacity for Summer ranges from 3.7 GWs to 1 GW deficit in the prompt year

Assuming 2.3 GW/yr of Potential New Capacity added  
3-Year Historical Average \*



Assuming 6.1 GW/yr of Potential New Capacity added  
Alternative Projection\*



PRM% - Planning Reserve Margin

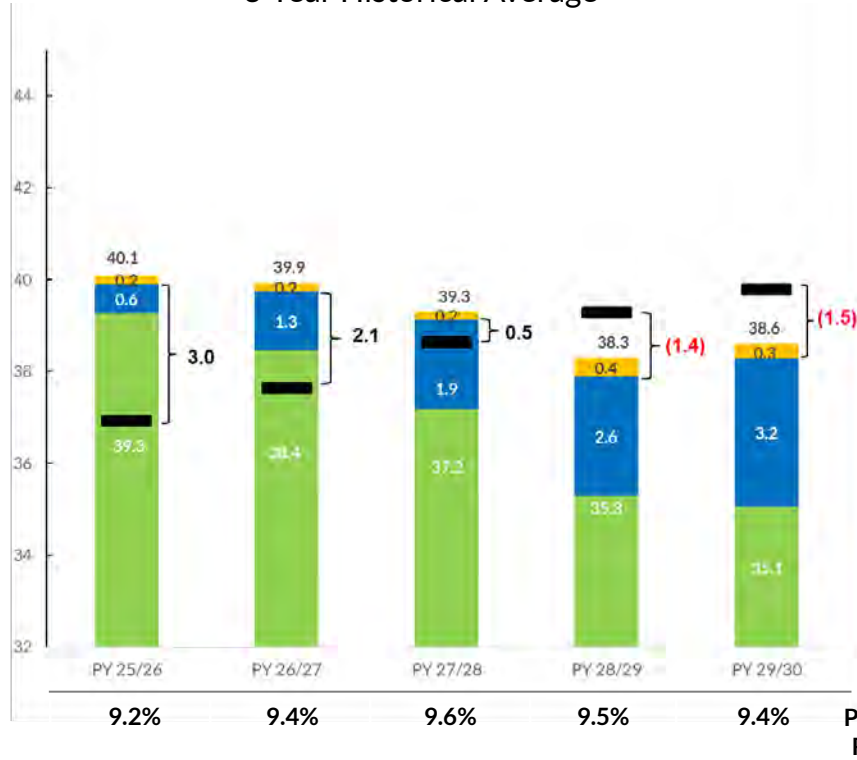
- Projected PRMR with LSE forecast
- Potentially Unavailable Resources
- Potential New Capacity
- Committed Capacity

\*Using Potential New Capacity as described on slide 6

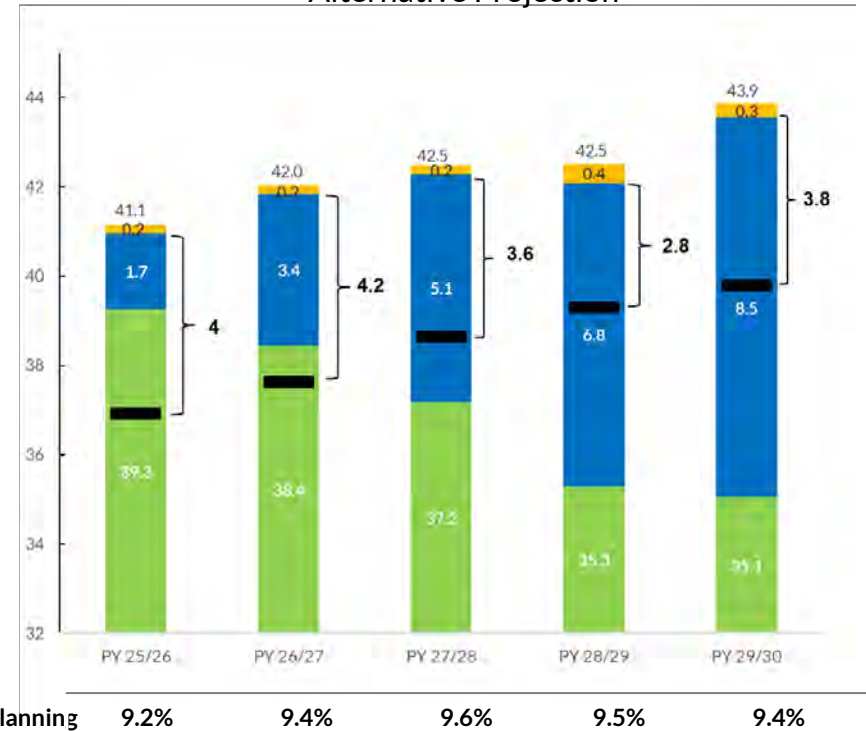
Note: Y-axis truncated in all capacity projection charts to accentuate capacity sufficiency/deficiency. While RDT is not reflected in these charts the limit is currently modeled at 1900 MW in Resource Adequacy. PRMR: Planning Reserve Margin Requirement.

# The South subregion capacity for Summer ranges from 3 GWs to 4 GWs of surplus in the prompt year

Assuming 2.3 GW/yr of Potential New Capacity added  
3-Year Historical Average \*



Assuming 6.1 GW/yr of Potential New Capacity added  
Alternative Projection\*



- Projected PRMR with LSE forecast
- Potentially Unavailable Resources
- Potential New Capacity
- Committed Capacity

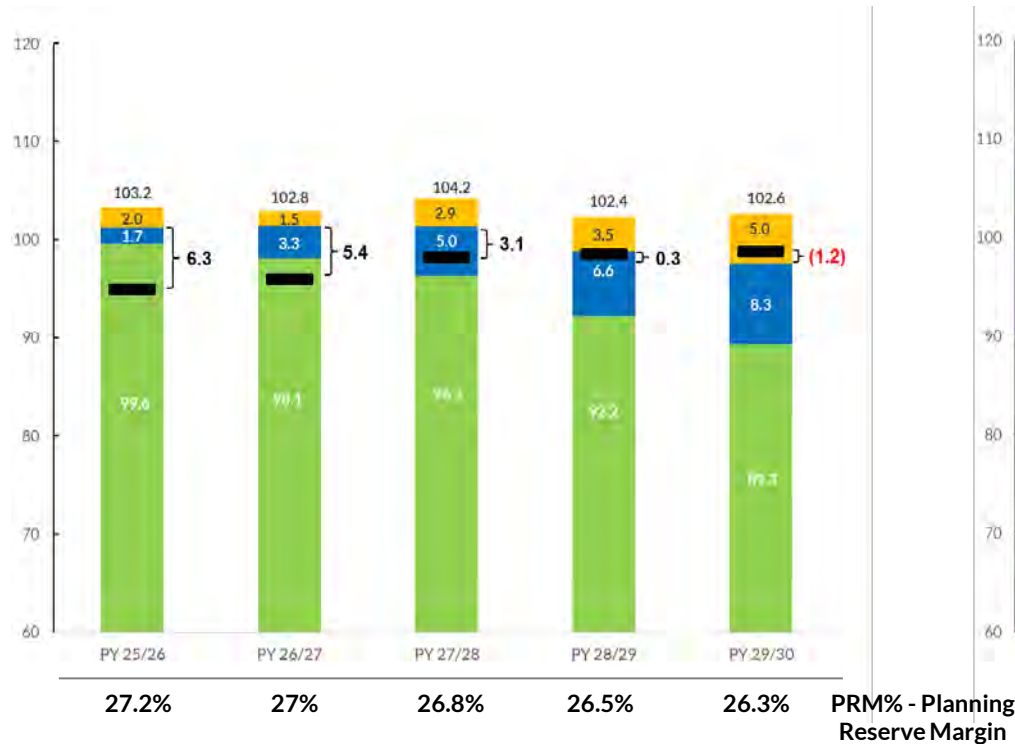
\*Using Potential New Capacity as described on slide 6

Note: Y-axis truncated in all capacity projection charts to accentuate capacity sufficiency/deficiency. While RDT is not reflected in these charts the limit is currently modeled at 1900 MW in Resource Adequacy. PRMR: Planning Reserve Margin Requirement.

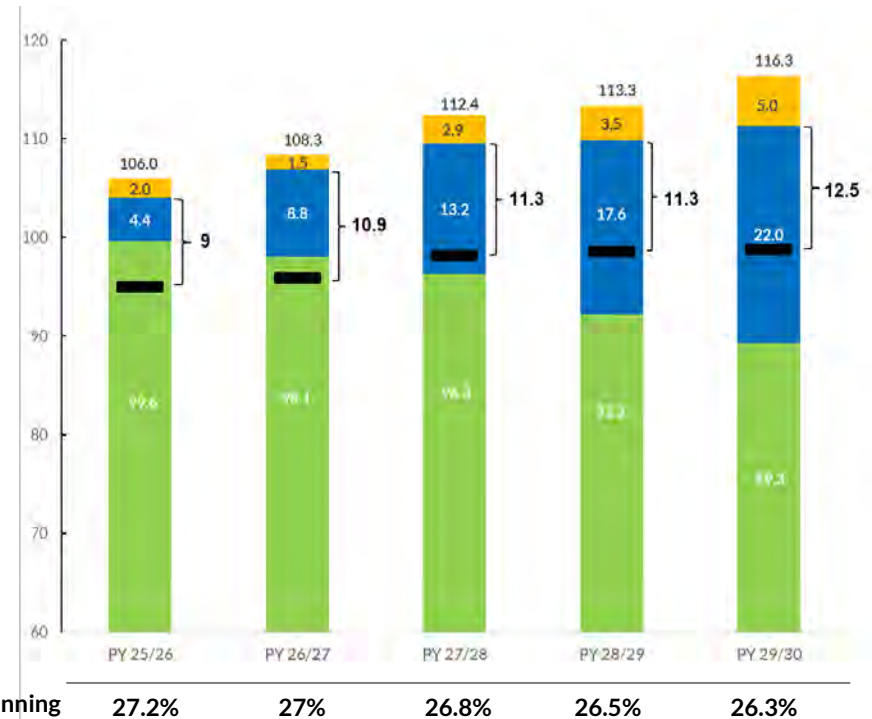


# The North/Central subregion capacity for Winter ranges from 6.3 GWs to 9 GWs of surplus in the prompt year

Assuming 2.3 GW/yr of Potential New Capacity added  
3-Year Historical Average\*



Assuming 6.1 GW/yr of Potential New Capacity added  
Alternative Projection\*



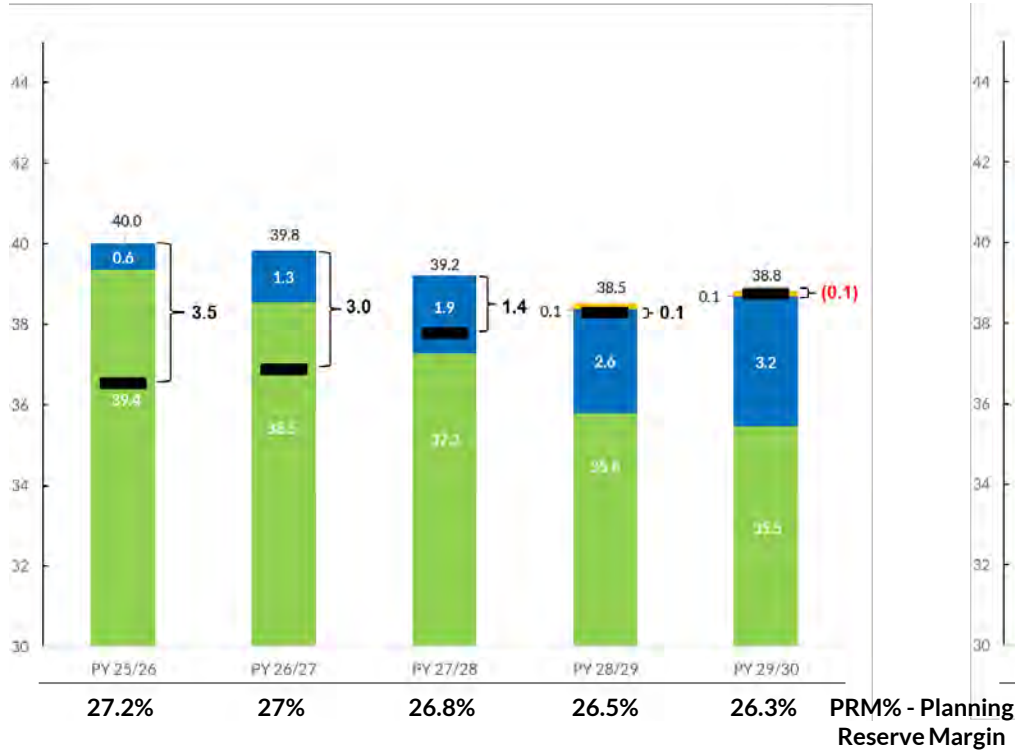
- Projected PRMR with LSE forecast
- Potentially Unavailable Resources
- Potential New Capacity
- Committed Capacity

\*Using Potential New Capacity as described on slide 6

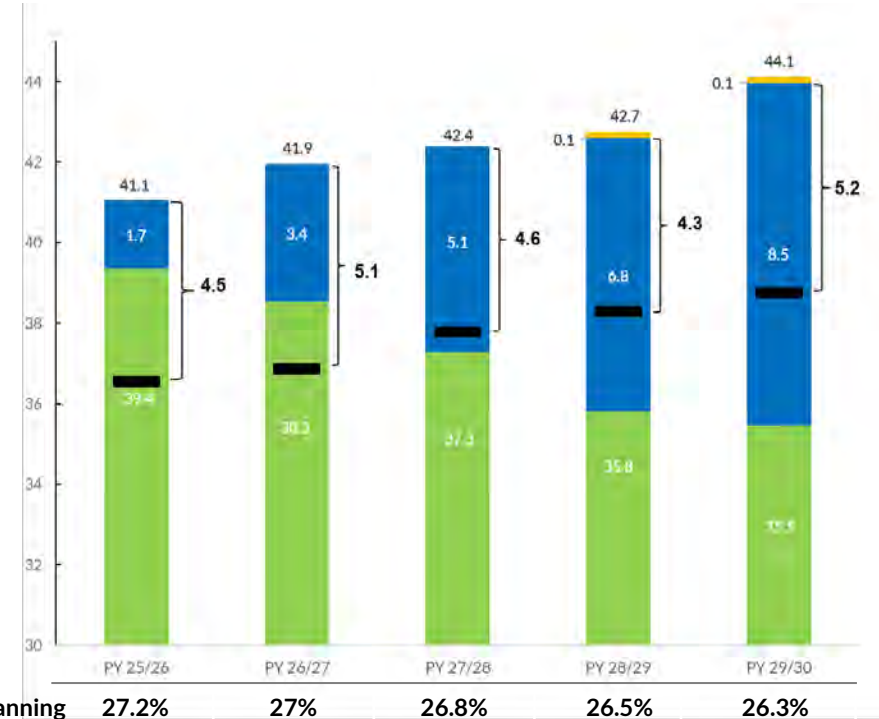
Note: Y-axis truncated in all capacity projection charts to accentuate capacity sufficiency/deficiency. While RDT is not reflected in these charts the limit is currently modeled at 1900 MW in Resource Adequacy. PRMR: Planning Reserve Margin Requirement.

# The South subregion capacity for Winter ranges from 3.5 GWs to 4.5 GWs of surplus in the prompt year

Assuming 2.3 GW/yr of Potential New Capacity added  
3-Year Historical Average \*



Assuming 6.1 GW/yr of Potential New Capacity added  
Alternative Projection\*



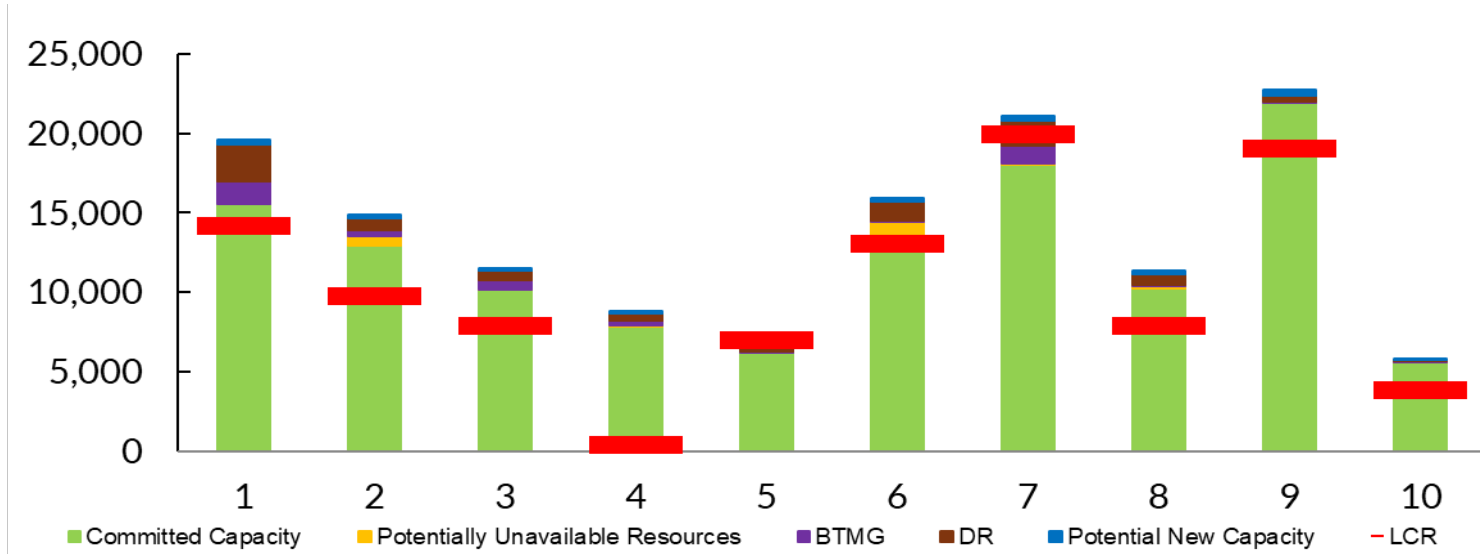
- Projected PRMR with LSE forecast
- Potentially Unavailable Resources
- Potential New Capacity
- Committed Capacity

\*Using Potential New Capacity as described on slide 6

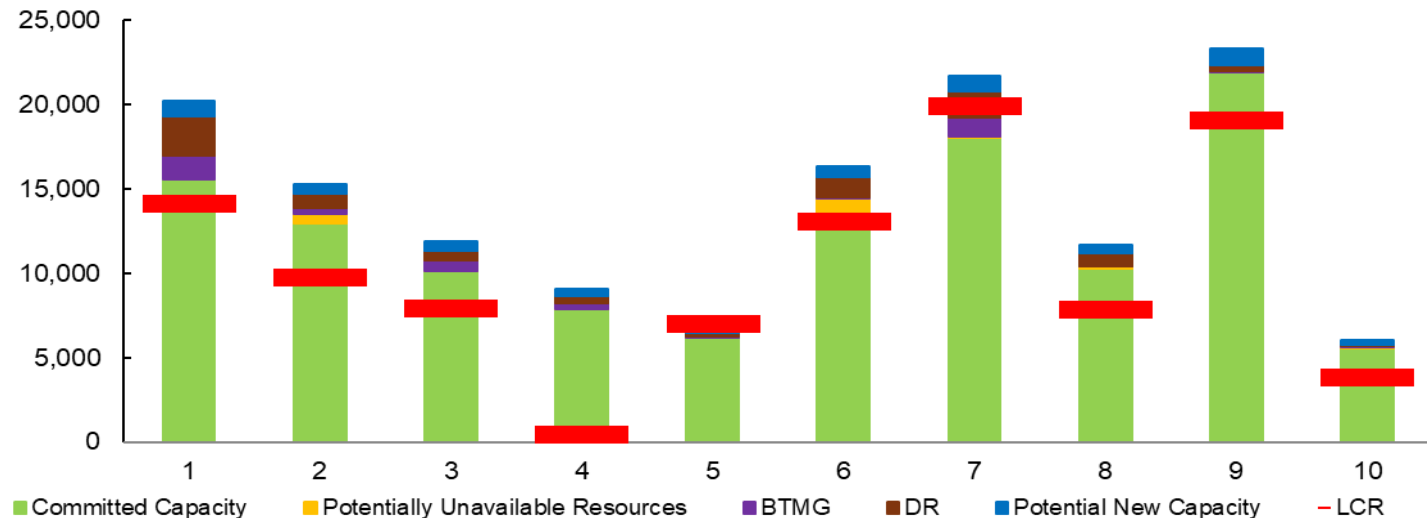
Note: Y-axis truncated in all capacity projection charts to accentuate capacity sufficiency/deficiency. While RDT is not reflected in these charts the limit is currently modeled at 1900 MW in Resource Adequacy. PRMR: Planning Reserve Margin Requirement.

# Summer PY 2025/26 Load Clearing Requirement (LCR) by zone

PY 2025/26 Summer  
by Zone vs. LCR (MW)  
Using 3-Year Historical  
average for new capacity\*



PY 2025/26 Summer  
by Zone vs. LCR (MW) Using  
Alternative Projection for  
new capacity\*

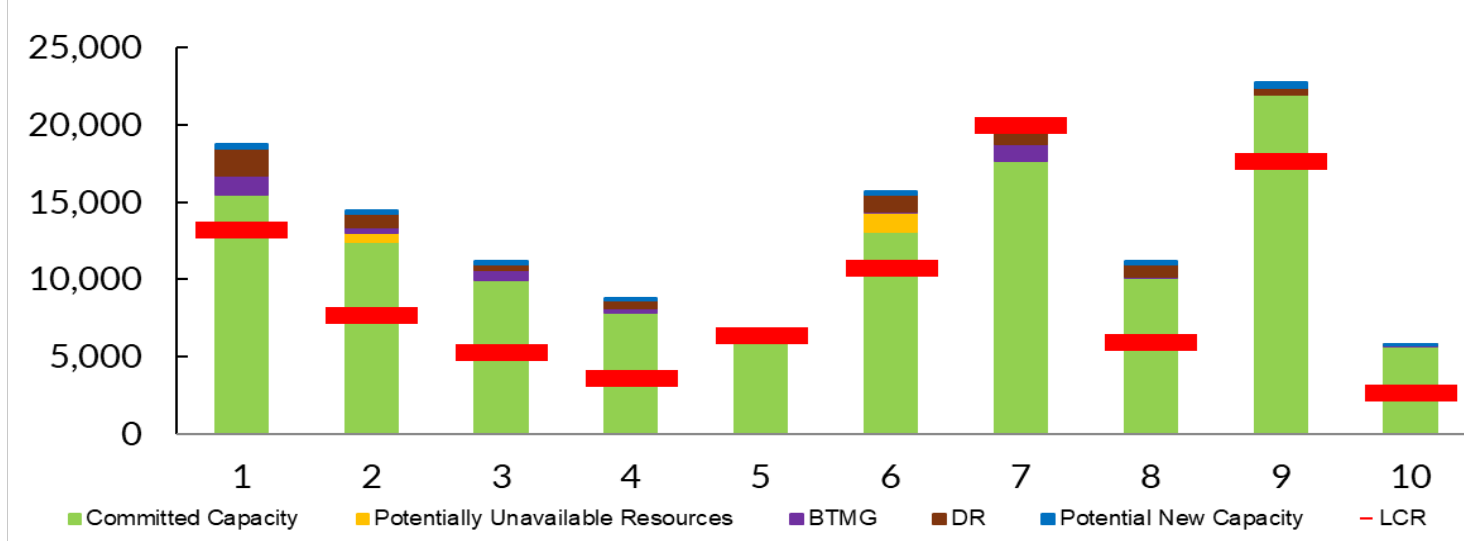


\*Using Potential New Capacity as described on slide 6

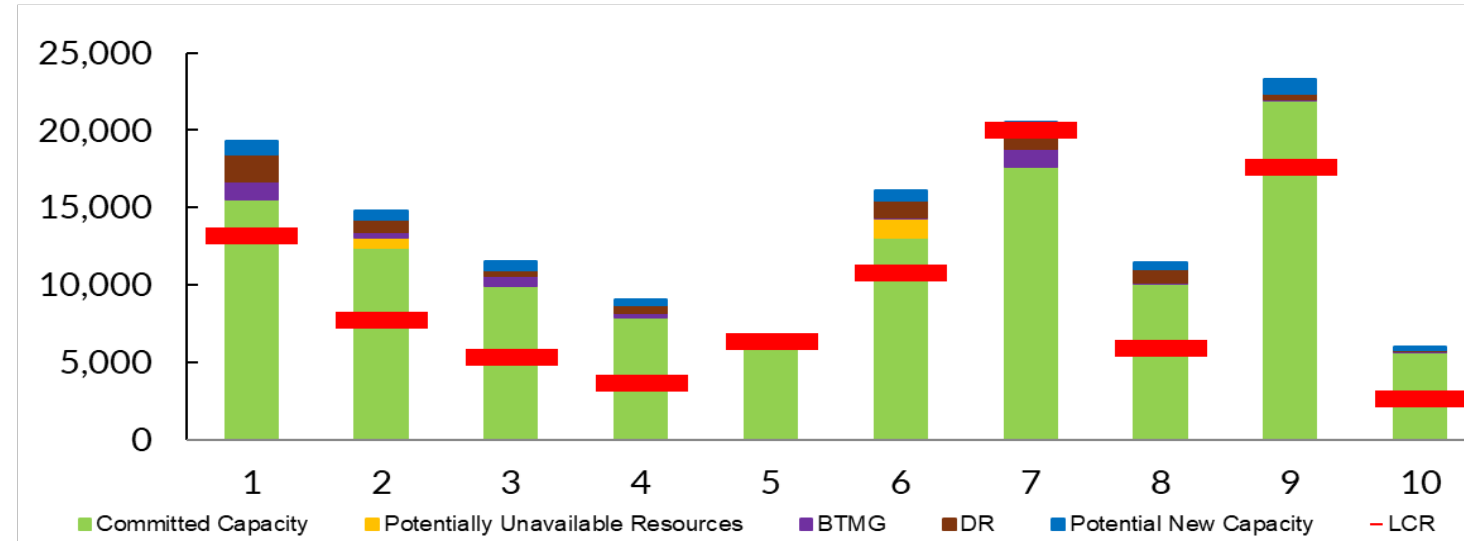
Includes only projected capacity resources within the zone (not imports and interzonal transfers). Potential Capacity for each zone is the average actual installed New Capacity used in the MISO overview slide proportional to that zones existing generation.

# Fall PY 25/26 Load Clearing Requirement (LCR) by Zone

PY 2025/26 Summer  
by Zone vs. LCR (MW)  
Using 3-Year Historical  
average for new capacity\*



PY 2025/26 Summer  
by Zone vs. LCR (MW) Using  
Alternative Projection for  
new capacity\*

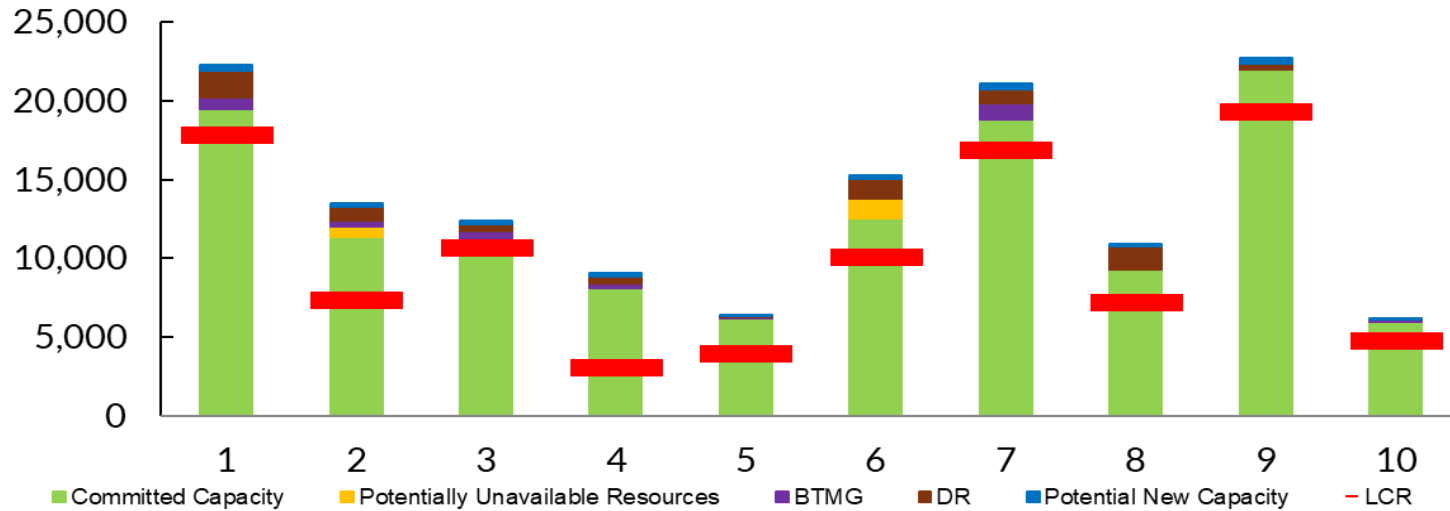


\*Using Potential New Capacity as described on slide 6

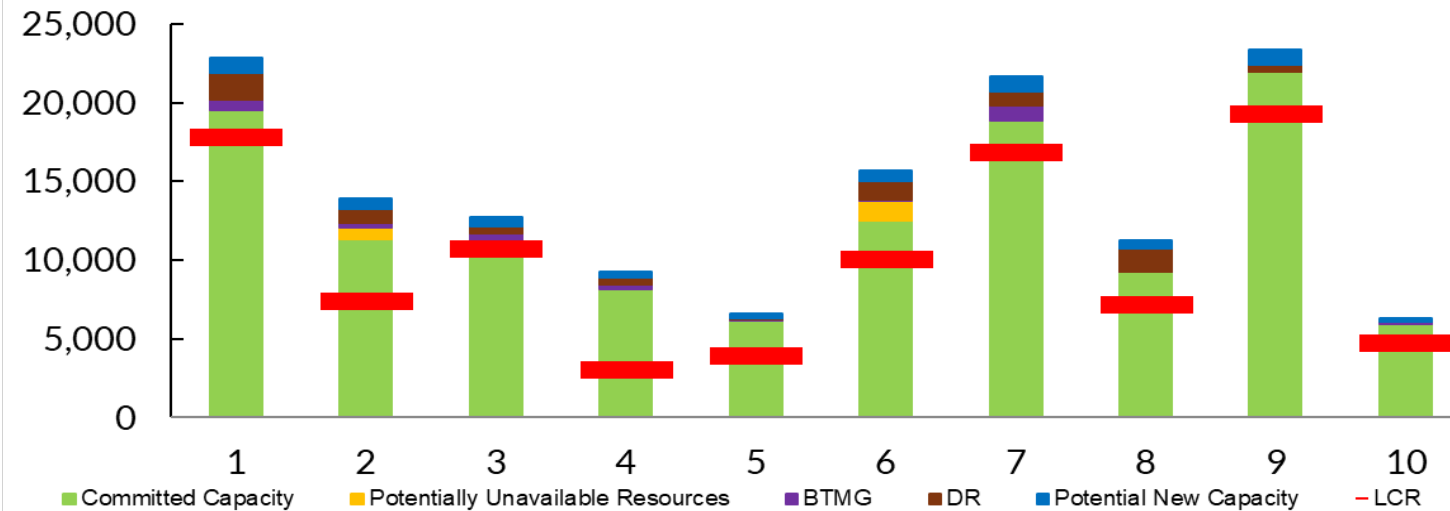
Includes only projected capacity resources within the zone (not imports and interzonal transfers). Potential Capacity for each zone is the average actual installed New Capacity used in the MISO overview slide proportional to that zones existing generation.

# Winter PY 25/26 Load Clearing Requirement (LCR) by Zone

PY 2025/26 Summer  
by Zone vs. LCR (MW)  
Using 3-Year Historical  
average for new capacity\*



PY 2025/26 Summer  
by Zone vs. LCR (MW) Using  
Alternative Projection for  
new capacity\*

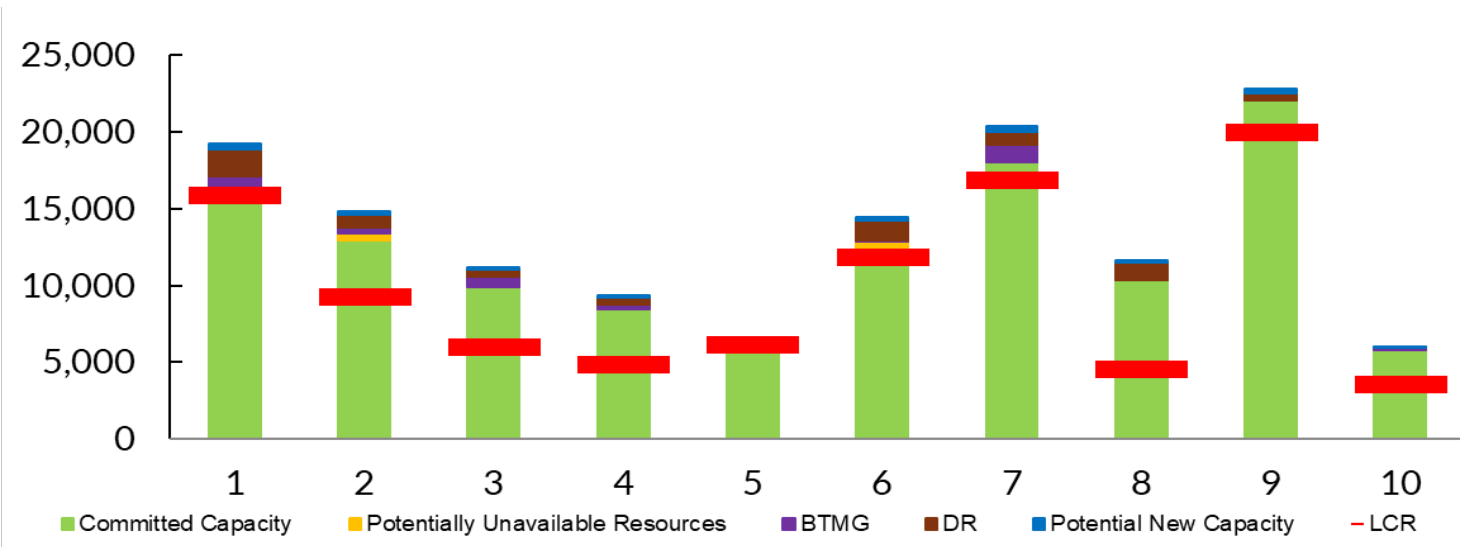


\*Using Potential New Capacity as described on slide 6

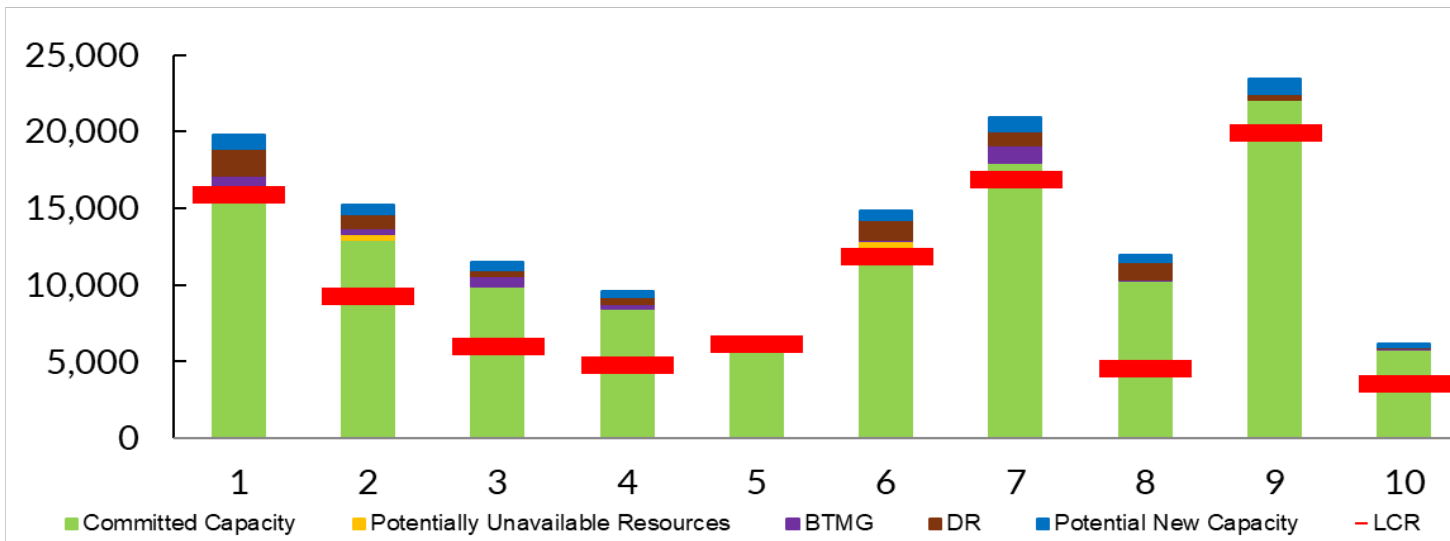
Includes only projected capacity resources within the zone (not imports and interzonal transfers). Potential Capacity for each zone is the average actual installed New Capacity used in the MISO overview slide proportional to that zones existing generation.

# Spring PY 25/26 Load Clearing Requirement (LCR) by Zone

PY 2025/26 Summer  
by Zone vs. LCR (MW)  
Using 3-Year Historical  
average for new capacity\*



PY 2025/26 Summer  
by Zone vs. LCR (MW) Using  
Alternative Projection for  
new capacity\*

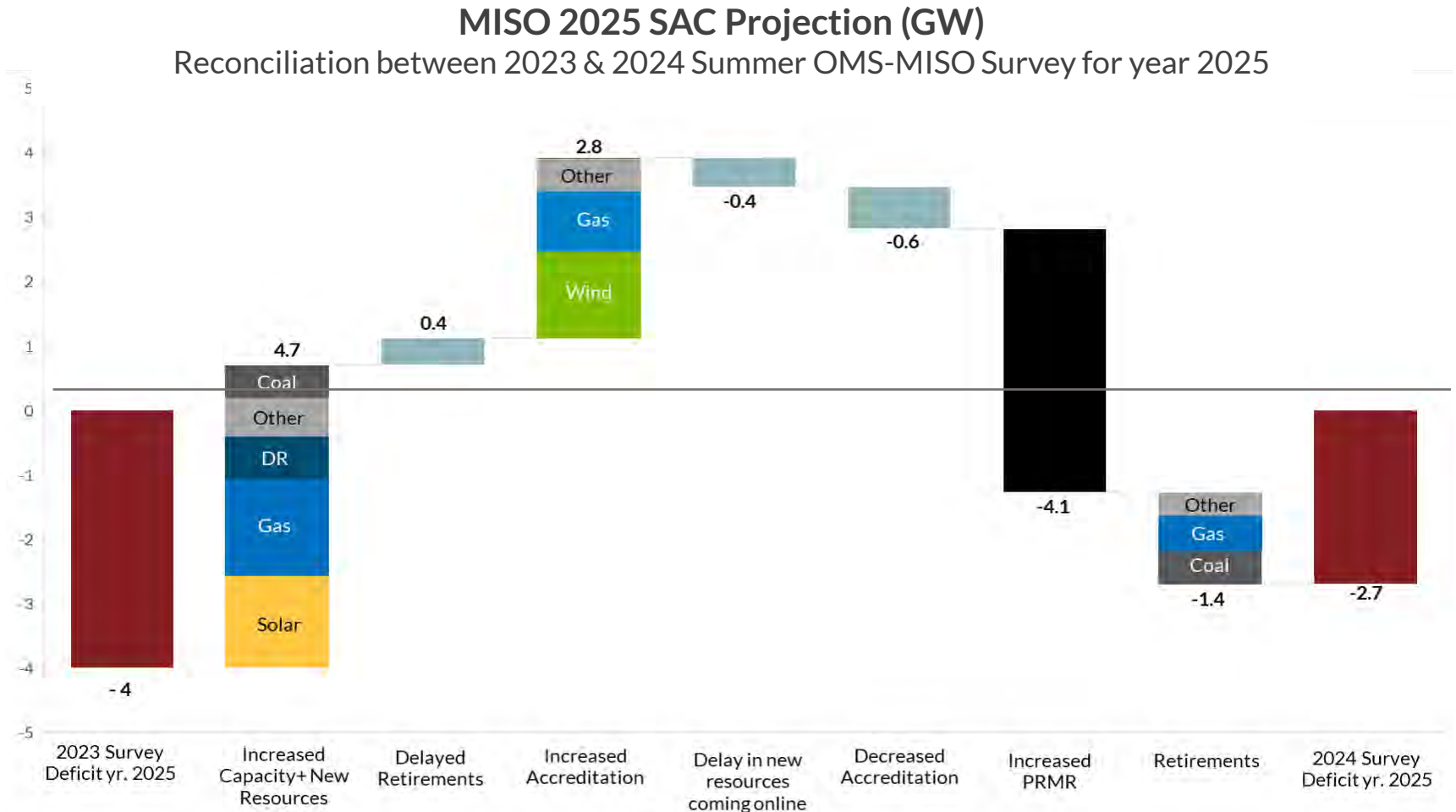


\*Using Potential New Capacity as described on slide 6

Includes only projected capacity resources within the zone (not imports and interzonal transfers). Potential Capacity for each zone is the average actual installed New Capacity used in the MISO overview slide proportional to that zones existing generation.



# Year-over-year, the OMS-MISO Survey results show a decreased deficit due to increased response/new resources and increased accreditation, but a deficit remains largely driven by an increased Planning Reserve Margin Requirement



Higher load forecast included in 'Increased PRMR (Planning Reserve Margin Requirement)'

Other in 'Increased Response +New Resources': Wind, Battery, Hydro, and Oil

Other in 'Increased Accreditation' and Retirements: Other-Gas(CU ft), Water, Wood, Waste Heat



BEFORE THE UNITED STATES DEPARTMENT OF ENERGY

Federal Power Act Section 202(c)     )  
Emergency Order: Midcontinent     )  
Independent System Operator     )  
(MISO)     )  
\_\_\_\_\_

Order No. 202-25-7

Exhibit to  
Motion to Intervene and Request for Rehearing and Stay of  
Public Interest Organizations

Filed September 5, 2025

Exhibit 121  
  
Witmeier 2025  
ERAS Testimony

TAB C

**UNITED STATES OF AMERICA  
BEFORE THE  
FEDERAL ENERGY REGULATORY COMMISSION**

**Midcontinent Independent System                    )  
Operator, Inc.                                            )**                   **Docket No. ER25-\_\_\_\_-000**

**PREPARED DIRECT TESTIMONY OF ANDREW WITMEIER  
ON BEHALF OF THE MIDCONTINENT INDEPENDENT  
SYSTEM OPERATOR, INC.**

**June 6, 2025**

UNITED STATES OF AMERICA  
BEFORE THE  
FEDERAL ENERGY REGULATORY COMMISSION

Midcontinent Independent System                    )  
Operator, Inc.                                                )                   Docket No. ER25-\_\_\_\_-000

PREPARED DIRECT TESTIMONY OF  
ANDREW WITMEIER

1           **I.       PROFESSIONAL BACKGROUND AND QUALIFICATIONS**

2   **Q.     PLEASE STATE YOUR NAME, CURRENT POSITION AND YOUR BUSINESS**  
3       **ADDRESS.**

4   **A.**   My name is Andrew Witmeier. I am the Director of Resource Utilization for the  
5       Midcontinent Independent System Operator, Inc. (“MISO”). My business address is: 720  
6       City Center Drive, Carmel, IN 46032-7574.

7   **Q.     PLEASE BRIEFLY DESCRIBE YOUR EDUCATIONAL BACKGROUND AND**  
8       **PROFESSIONAL EXPERIENCE.**

9   **A.**   I joined MISO in 2003 after graduating from Purdue University with a bachelor's degree  
10       in electrical engineering. I spent the first 17 years of my career in various positions in  
11       MISO Operations. During that time, I worked as a North American Electric Reliability  
12       Corporation (“NERC”) certified system operator in scheduling, engineering, and as a  
13       reliability coordinator. I also led several groups within MISO Operations as a manager in  
14       engineering, reliability coordination, and seams administration. In January 2020, I was  
15       appointed to my current position where I have remained for the past five years.

1 **Q. PLEASE DESCRIBE YOUR JOB RESPONSIBILITIES WITH MISO AS THEY**  
2 **RELATE TO THIS FILING.**

3 **A.** As the Director of Resource Utilization, I am responsible for the administration of MISO's  
4 Generator Interconnection Procedures ("GIP"), which are set forth in Attachment X of  
5 MISO's Open Access Transmission, Energy and Operating Reserve Markets Tariff  
6 ("Tariff" or "MISO Tariff").<sup>1</sup> I oversee MISO's generation interconnection queue,  
7 including the negotiation and execution of Generator Interconnection Agreements  
8 ("GIAs"), which are based on MISO's *pro forma* GIA set forth in Appendix 6 of the GIP. I  
9 also oversee the group that manages and processes generation retirement, generator  
10 replacement, and Surplus Interconnection Service requests for generators connected to  
11 MISO's Transmission System. I have been directly involved in the preparation and  
12 development of the current proposals.

13 **Q. HAVE YOU PREVIOUSLY SUBMITTED TESTIMONY IN REGULATORY**  
14 **PROCEEDINGS?**

15 **A.** Yes. I have provided testimony in a number of proceedings before the Commission. The  
16 most recent testimonies are as follows:

- 17 • In March 2025, I provided testimony in Docket No. ER25-1674-000 to support  
18 MISO's original Expedited Resource Addition Study ("ERAS") proposal.
- 19 • In November 2024, I provided testimony in Docket No. ER25-507-000 to support  
20 MISO's generator interconnection cap proposal.

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<sup>1</sup> Unless otherwise indicated in my Testimony, all capitalized terms used herein have the meaning as set forth in the Tariff or the proposed Tariff revisions, as applicable.

- 1       •       In August 2024, I provided testimonies supporting the JOA and MISO Tariff  
2               revisions implementing the JTIQ initiative in Docket No. ER24-2797-000 and  
3               ER24-2871-000.
- 4       •       In November 2023, I sponsored testimony in Docket Nos. ER24-340-000 and  
5               ER24-341-000 supporting a package of reforms of MISO’s generator  
6               interconnection process.
- 7       •       In December 2021, I submitted testimony in Docket No. ER22-661-000 on issues  
8               relating to MISO’s generator queue reform and resource utilization.

9       **II.     OVERVIEW AND PURPOSE OF TESTIMONY**

10   **Q.     ARE YOU SUBMITTING YOUR TESTIMONY ON BEHALF OF MISO?**

11   **A.**     Yes.

12   **Q.     WHAT IS THE PURPOSE OF YOUR TESTIMONY?**

13   **A.**     My testimony supports the updated Tariff revisions that MISO is submitting in this docket  
14               to file certain urgent improvements to the GIP. MISO is proposing the creation of a new  
15               process—the Expedited Resource Addition Study (“ERAS”)—to facilitate the addition of  
16               projects to address certain near-term resource adequacy and reliability needs. This process  
17               will be separate from MISO’s generator interconnection queue process, which is referred  
18               to as the Definitive Planning Phase (“DPP”) process. As further discussed below, while  
19               MISO has been actively improving the efficiency of its generator interconnection queue  
20               with recent reforms, it will take several years for the impact of these changes to be fully  
21               realized and for MISO to reduce queue processing time to an approximately one-year  
22               timeframe. MISO has refined its original ERAS process, which will be more fully  
23               explained and addressed in my testimony.

**Q. CAN YOU BRIEFLY EXPLAIN THE REFINEMENTS THAT WERE MADE TO MISO’S ORIGINAL ERAS PROPOSAL?**

**A.** Yes. At a high level, MISO is now implementing a cap on ERAS projects to 68 total with carve outs for a maximum of 8 projects to serve retail choice load and a maximum of 10 projects from Independent Power Producers (“IPPs”). MISO is also implementing a requirement to only study 10 projects per ERAS Quarterly Study cycle.<sup>2</sup> In addition to the cap, MISO is changing the Relevant Electric Retail Rate Authority (“RERRA”) notification requirement to a RERRA verification so that the ERAS project will be more closely targeted to a resource adequacy and/or reliability need in the RERRA’s footprint. MISO is also limiting proposed ERAS project’s interconnection service to 150% of the identified MW need, is requiring the project to be in the same Local Resource Zone (“LRZ”) as the load need it is addressing (unless the project applicant can demonstrate that the use of a Generating Facility not in the same LRZ was included in a resource filing or other submission made to the relevant RERRA), and is now requiring additional information in the ERAS Interconnection Request application. Finally, MISO has proposed tariff language to incorporate the retail states into the ERAS process. In the rest of my testimony, I go into further detail and background on these refinements.

**Q. HOW DO THESE FILINGS RELATE TO MISO’S COMPLIANCE OBLIGATIONS UNDER ORDER NO. 2023/2023-A?**

**A.** At the time of this submission, MISO submitted its Order No. 2023-2023-A compliance filings pursuant to the independent entity variation requirements set forth in Order Nos.

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<sup>2</sup> MISO is requiring that projects proposed by IPPs must be with entities other than Load Serving Entities (“LSEs”).



2003 and 2023.<sup>3</sup> If the Commission accepts the proposed revisions, they will become part of the MISO Tariff.

**Q. IS MISO REQUESTING AN INDIVIDUAL ENTITY VARIATION?**

**A.** Yes. ERAS is a new and temporary process that is intended to exist separately from MISO's DPP cluster-based queue process. Unlike the DPP, ERAS will not employ a 3-phase process, cluster studies, use the same withdrawal penalties, or employ many of the other mechanisms associated with the DPP process. Given the unique nature of ERAS, the limited timeframe for which it will be in effect, and the comparatively small number of projects that MISO expects to process through ERAS, MISO submits ERAS as a necessary independent entity variation to MISO's compliance with Order No. 2023-2023-A.

Because ERAS is a standalone process, it should be viewed as one large independent entity variation with a defined rule set rather than individual independent entity variations for the numerous differences between the cluster-based process outlined in Order 2023-2023-A and ERAS serial-based study approach. This said, I briefly describe some of the more salient differences below and explain why these are appropriate.

- Serial study: Studying ERAS Interconnection Requests individually in serial fashion will increase the speed of analysis, remove uncertainty caused by other requests being included in those analyses, and allows Interconnection Customers to better replicate study results prior to submission. Cluster studies are more complex with increased uncertainty due to

---

<sup>3</sup> See *Standardization of Generator Interconnection Agreements and Procedures*, Order No. 2003, FERC Stats. & Regs. ¶ 31,146 (2003), *order on reh'g*, Order No. 2003-A, FERC Stats. & Regs. ¶ 31,160, *order on reh'g*, Order No. 2003-B, FERC Stats. & Regs. ¶ 31,171 (2004), *order on reh'g*, Order No. 2003-C, FERC Stats. & Regs. ¶ 31,190 (2005), *aff'd sub nom. Nat'l Ass'n of Regulatory Util. Comm'rs v. FERC*, 475 F.3d 1277 (D.C. Cir. 2007), *cert. denied*, 552 U.S. 1230 (2008), *Improvements to Generator Interconnection Procedures and Agreements*, 184 FERC ¶ 61,054 (2023), *order on reh'g*, Order No. 2023-A, 186 FERC ¶ 61,199 (2024).

1 withdrawal concerns since projects are reliant on those in front of them or within their  
2 cluster in the review process.

- 3 • Different timelines: Individual analysis of ERAS Interconnection Requests allows for a  
4 significantly reduced timeline to complete the process and allows for an Expedited  
5 Generator Interconnection Agreement (“EGIA”) to be executed in months rather than  
6 years.
- 7 • Higher deposits: ERAS requires higher non-refundable fees and higher milestone payments  
8 that must be made at application submission. The financial commitment required for  
9 ERAS ensures the level of certainty that the project is ready to move forward and the higher  
10 non-refundable fee is necessary to support the additional overhead MISO needs to facilitate  
11 the ERAS process.
- 12 • Financial commitment to fund Network Upgrades at EGIA: To further validate the  
13 certainty of ERAS Interconnection Requests and prevent impact on Interconnection  
14 Requests in the DPP that are relying on Network Upgrades identified in the ERAS process,  
15 ERAS Interconnection Requests will be required to fund all Network Upgrades once the  
16 EGIA is executed, even if that EGIA is later terminated.
- 17 • Enhanced Site Control: ERAS Interconnection Requests must present evidence of all  
18 necessary Site Control to ensure the project can be built on the generator site as well reach  
19 its Point of Interconnection (“POI”) on the transmission system.
- 20 • RERRA Verification: Interconnection Requests eligible to utilize ERAS must have a  
21 written verification from a RERRA, who is ultimately responsible for resource adequacy  
22 as noted in the Federal Power Act, that (i) the new, incremental load addition is valid and

is not currently included in a plan or other procedure under the RERRA’s purview or (ii) the Generating Facility will address an identified resource adequacy deficiency.

- Off-taker agreement: ERAS Interconnection Requests are required to show that the generation has an agreement with a specific load or is a Load Serving Entity (“LSE”) to ensure that generation will be utilized for known load.

**Q. IS MISO PROPOSING ANY TRANSITION PROVISIONS FOR THE ERAS FILING?**

**A.** Yes. The transition provisions are included in proposed section 5.13 of the GIP. Generally, the proposed reforms will apply only to ERAS Interconnection Requests submitted after the requested effective date of the reforms, which is August 6, 2025.

### **III. THE CURRENT MISO QUEUE AND THE ERAS PROCESS**

#### **A. ERAS is Necessary to Address Resource Adequacy and Reliability Needs**

**Q. PLEASE DESCRIBE THE CURRENT STATUS OF MISO’S GENERATOR INTERCONNECTION QUEUE.**

**A.** As of June 5, 2025, MISO’s generator interconnection queue contains 1,573 active Interconnection Requests comprising 291 GW of proposed new generator interconnection capacity. This considerable backlog of applications is spread over all five of MISO’s study regions and includes queue cycles going back to 2019. The queue size continues to be extraordinary and unprecedented—the 2023 queue cycle, the last to close in 2024, alone is 123 GW. Notably, almost 70% of the total generation capacity that entered the 2017 and 2018 queue cycles was eventually withdrawn. The remaining 30% obtained GIAs, but the actual amount of generating capacity that will be completed and energized will be less than

30% due to financial and construction challenges. Similar withdrawal rates are occurring in the later cycles as well.

**Q. DO YOU EXPECT THE CURRENT QUEUE DELAY TRENDS TO CONTINUE?**

**A.** Yes, as I noted in my previous ERAS testimony, I expect the delays to continue in the short-term, as the bulk of the recent proposed generating resources from the unprecedented queue sizes (e.g., the 2022 study cycle included over 956 application submittals totaling approximately 171 GW) continue through the MISO interconnection queue process, and only the 2023 study cycle takes advantage of the queue reforms approved in January 2024 under Docket No. ER24-341-000. Queue delays caused by restudies due to late-stage withdrawals are one of the latest issues negatively impacting Interconnection Customers' ability to timely execute a GIA. Additionally, ongoing delays to resource additions with signed interconnection agreements are caused by supply chain bottlenecks, permitting delays and commercial challenges. To further demonstrate this unprecedented backlog, MISO recently published a COD dashboard to help stakeholders determine when resources might attain commercial operation.<sup>4</sup> These resulting delays are currently interfering with the ability to plan for meeting growing resource adequacy needs and ultimately creates a major reliability concern. The ERAS proposal will help address some of these needs in the short term.

While MISO has taken targeted actions to help manage a highly active generator interconnection queue with process improvements and leveraging technology to speed up processing and studying of new interconnections requests, a temporary solution is required

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<sup>4</sup> MISO Generator Interconnection, *COD Report: Overview*, <https://app.powerbigov.us/view?r=eyJrIjojOTU1ODlhNTktMjZjZC00N2I2LWJhYjMtMDEwOGNmZDM5ODk0IiwidCI6IjYwNDA5MTVlLTlkZmYtNGQ0Ny1iYjM1LTlhYzljOWE1ZGMxOCJ9&pageName=983a2cc8ca3ccf63608a>.

in the short-term to address the immediate and urgent capacity needs until the queue backlog and study timelines are reduced.

**Q. IS ERAS A SEPARATE PROCESS FROM MISO’S QUEUE?**

**A.** Yes. ERAS is not a part of MISO’s Definitive Planning Phase (“DPP”) process. ERAS is also not another interconnection queue that will supplant the generator interconnection process. MISO understands the concerns that ERAS is enabling queue jumping but ERAS is a unique and separate process from the DPP process that is limited in size and scope. The process has extremely stringent eligibility requirements that will limit the projects that can participate in it to those with commercial viability, RERRA verification, and the ability to come online in the next few years. MISO sees ERAS as a complementary process to the generator interconnection queue and a solution that will assist in addressing resource adequacy and reliability needs in the next few years.

**Q. PLEASE DESCRIBE WHY ERAS IS NECESSARY.**

**A.** There is a growing critical reliability challenge facing the industry, which has been documented and highlighted in various MISO and non-MISO reports. Examples of such reports include:

1. MISO Futures Report Series 1A: posted in November 2023 and utilized for Long Range Transmission Planning Tranche 2.1 portfolio.<sup>5</sup>
2. MISO’s Reliability Imperative Report: 2024 MISO Regional Resource Assessment (RRA).<sup>6</sup>

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<sup>5</sup> *MISO Futures Report, Series 1A* (November 1, 2023), available at: [https://cdn.misoenergy.org/Series1A\\_Futures\\_Report630735.pdf](https://cdn.misoenergy.org/Series1A_Futures_Report630735.pdf).

<sup>6</sup> *2024 Regional Resource Assessment, A Reliability Imperative Report* (January 2025), available at: [https://cdn.misoenergy.org/2024%20RRA%20Report\\_Final676241.pdf](https://cdn.misoenergy.org/2024%20RRA%20Report_Final676241.pdf).

- 1                   3. The 2024 NERC Long-Term Reliability Assessment (LTRA).<sup>7</sup>
- 2                   4. The 2024 OMS-MISO Survey: As in previous years, MISO and the
- 3                   Organization of MISO States (OMS) completed a volunteer survey on resource
- 4                   adequacy to identify potential future resource adequacy needs in the MISO
- 5                   region.<sup>8</sup> The 2025 OMS-MISO Survey will be published on the same day as
- 6                   this refined ERAS filing and indicates a similar resource adequacy and/or
- 7                   reliability need trajectory.<sup>9</sup>
- 8                   5. NERC’s 2025 Summer Reliability Assessment.<sup>10</sup>
- 9                   6. Comments from FERC’s Technical Conference on Resource Adequacy.<sup>11</sup>

10           The reports all include the following elements:

- 11                   o The increasingly significant challenges facing the MISO footprint in meeting state
- 12                   energy goals and expectations.
- 13                         ▪ The RRA report noted that the MISO members and states may need to add
- 14                         capacity at 17 GW/year for 20 years.

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<sup>7</sup> NERC 2024 Long-Term Reliability Assessment (December 2024), available at:  
[https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC\\_Long%20Term%20Reliability%20Assessment\\_2024.pdf](https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_Long%20Term%20Reliability%20Assessment_2024.pdf).

<sup>8</sup> 2024 OMS-MISO Survey Results (June 20, 2024), available at:  
<https://cdn.misoenergy.org/OMS%20MISO%20Survey%20Results%20Workshop%20Presentation628355.pdf>.

<sup>9</sup> See 2025 OMS-MISO Survey Results (Updated June 2025), available at:  
<https://cdn.misoenergy.org/20250606%20OMS%20MISO%20Survey%20Results%20Workshop%20Presentation702311.pdf>.

<sup>10</sup> 2025 Summer Reliability Assessment, North American Electric Reliability Corporation, May 2025, (“NERC 2025 Assessment”),  
[https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC\\_SRA\\_2025.pdf](https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_SRA_2025.pdf).

<sup>11</sup> Comments of Todd Ramey on behalf of MISO at 9, Docket No. AD25-7, May 28, 2025 (“MISO RA Tech Conference Comments”); Prefiled Statement of Jim Robb, President and CEO of North American Electric Reliability Corporation at 1, Docket No. AD25-7, May 19, 2025 (“NERC RA Tech Conference Comments”).

o The critical timeframe and urgent need for resources on the horizon as demand growth continues to accelerate.

- The 2024 OMS-MISO Survey found that additional actions would be needed as soon as possible to expedite the addition of new capacity, coordinate resources for new load additions, and potentially moderate the pace of resource retirements.

- The 2025 OMS-MISO Survey indicates that “[a]t least 3.1 GW of new resources are needed by summer 2026/27 to avoid a resource deficiency, with greater needs in future years.”<sup>12</sup> The survey also states that survey responses show “increasing load forecasts year-over-year and are close to the high end of MISO Long-Term Load Forecast.”<sup>13</sup>

o Indications that MISO is at “high risk” for meeting upcoming resource adequacy requirements.

- The NERC LTRA report highlights that based on potential delays to generator construction, there is a potential in MISO’s footprint to see a 2.7 GW shortfall by 2029 if not earlier.

In further recognition of this issue, the Department of Energy recently introduced the GRID Modernization Initiative, which “envision[s] a fully integrated electric system from generation to transmission to load consumption ... with an emphasis on maintaining the

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<sup>12</sup> 2025 OMS-MISO Resource Adequacy Survey Results, Fact Sheet, available at: <https://cdn.misoenergy.org/2025%20OMS-MISO%20Survey%20Fact%20Sheet702641.pdf>.

<sup>13</sup> 2025 OMS-MISO Survey Results (June 6, 2025) at 10.



1 reliability and resilience of the grid.”<sup>14</sup> Concerns about resource adequacy in the MISO  
2 footprint have only increased since the publication of these reports. For instance, MISO  
3 initiated the process to redesign the Futures, last finalized in November 2023, as MISO and  
4 stakeholders have determined that the load forecasts represented in those Futures are too  
5 low. On February 28, 2025, MISO held the first of several workshops to redesign the  
6 assumptions within the Futures.<sup>15</sup>

7 In light of these industry-wide challenges, MISO realized it needed a more responsive  
8 process to work with the states to address these resource adequacy needs. The refined  
9 ERAS is intended to help maintain resource adequacy integrity within this short timeframe  
10 until it sunsets on August 31, 2027, or the completion of sixty-eight ERAS Interconnection  
11 Request studies, whichever occurs first. Ultimately, the purpose of ERAS is to provide a  
12 mechanism for addressing these resource adequacy and/or reliability needs within this short  
13 timeframe, rather than waiting until it is too late.

14 **Q. DOES MISO HAVE ADDITIONAL EVIDENCE TO SUPPORT ITS CLAIM FOR**  
15 **IMMEDIATE RESOURCE ADEQUACY NEEDS?**

16 **A.** Yes. MISO’s internal data supports the general claims about resource adequacy needs.  
17 The need for generation to serve load additions through the Expedited Project Review  
18 (“EPR”) illustrates this challenge and is addressed later in my testimony. MISO has been  
19 very vocal about communicating and presenting this impending concern. Simply glossing  
20 over this inevitable emerging need for generation only confuses the issue. Additionally,

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<sup>14</sup> *Grid Modernization Initiative*, U.S. Department of Energy (July 2024), available at:  
<https://www.energy.gov/sites/default/files/2024-12/Grid%20Modernization%20Strategy%202024.pdf>.

<sup>15</sup> MISO, *Futures Redesign Workshop* (Feb. 28, 2025), available at:  
<https://www.misoenergy.org/events/2025/futures-redesign-workshop---february-28-2025/>.

1        this issue of resource adequacy concerns has been the subject of numerous discussions  
2        throughout the MISO stakeholder process for some time now with considerable stakeholder  
3        support. MISO submitted comments prior to FERC’s Technical Conference on the  
4        challenge of resource adequacy in RTO and ISO regions, noting that “the MISO region  
5        faces resource adequacy and reliability challenges due to the changing characteristics of  
6        the electric generating fleet, insufficient transmission system infrastructure, growing  
7        pressures from extreme weather, and rapid load growth.”<sup>16</sup> MISO also recently published  
8        material from its System Planning Committee, which included updates to the Reliability  
9        Imperative.<sup>17</sup> The update noted that “[t]here is no single type of investment that will  
10       support all system needs; the necessity for near-term but large-scale transmission to support  
11       these large load additions recently came to the forefront.”<sup>18</sup> The 2025 OMS-MISO Survey  
12       will be published on the same day as this filing and its projection are in alignment with the  
13       resource adequacy and reliability needs that MISO has referenced in this filing.<sup>19</sup> The  
14       survey identifies ERAS as an in-progress initiative and one that will help address resource  
15       adequacy challenges.<sup>20</sup>

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<sup>16</sup> *Id.*

<sup>17</sup> *Reliability Imperative: Transmission Evolution*, System Planning Committee of the Board of Directors, Jun. 10, 2025, <https://cdn.misoenergy.org/20250610%20System%20Planning%20Committee%20of%20the%20BOD%20Item%2005%20Reliability%20Imperative%20Transmission%20Evolution701586.pdf>.

<sup>18</sup> *Id.* at 5.

<sup>19</sup> *See 2025 OMS-MISO Survey Results* (June 6, 2025).

<sup>20</sup> *Id.* at 16.

**Q. WHY WON'T ERAS PROJECTS BENEFIT FROM THE DPP QUEUE?**

**A.** As detailed in the following testimony and substantiated by multiple examples, a need exists in the near term to accelerate the interconnection process for resource adequacy and/or reliability projects that are unable to benefit from the impact of the recent MISO GIP improvements or Order No. 2023. These resource adequacy concerns are driven by the following: 1) significant growth in spot load; 2) the inability to study new necessary resources immediately upon entering the queue; 3) the accelerated retirement of generation resources; 4) the ongoing delays to resource additions with signed interconnection agreements due to supply chain bottlenecks, permitting delays, and commercial challenges; and 5) the continued large volumes of Generator Interconnection Queue requests and accumulating backlog. The increasing impact of these factors requires urgent improvements to the current GIP to ensure that MISO can meet the challenge. Accepting the proposed ERAS revisions will contribute to ensuring that MISO has sufficient new resources to meet these impending challenges in the coming years.

**Q. WHY ISN'T THE CURRENT QUEUE SUFFICIENT TO ADDRESS THESE RESOURCE ADEQUACY NEEDS?**

**A.** MISO successfully implemented several queue reforms improving various aspects of the generator interconnection queue or DPP process. Despite these efficiency updates, MISO's interconnection queue continues to experience significant delays. Due to the aforementioned delays in bringing resources online, the current interconnection queue jeopardizes the short-term availability of resource adequacy projects that are stuck in the queue or are yet to be submitted into the queue. The current DPP queue process will not ensure a timely executed GIA with known Network Upgrades until the backlog is cleared

1 and a new cycle can be processed with a yearly cadence. MISO is proposing the ERAS  
2 process to fill the gap in the short-term by expediting the approval of new generation  
3 needed to address resource adequacy and reliability needs.

4 **B. ERAS Projects Will Not Harm DPP Queue Projects**

5 **Q. WILL ACTIVE DPP PROJECTS STILL BE ABLE TO TRANSFER TO THE ERAS**  
6 **PROCESS?**

7 **A.** Yes. If the projects meet the eligibility requirements to enter the ERAS interconnection  
8 process, DPP projects in active DPP cycles at or before Decision Point 2 (anticipated only  
9 2022 and 2023 cycles) may transfer to the ERAS process. MISO will not allow  
10 Interconnection Requests to transfer from the existing interconnection queue after Decision  
11 Point 2 to avoid the Phase 3 restudies due to late withdrawals, which contribute to ongoing  
12 queue delays. If an Interconnection Request is beyond Decision Point 2, then it can still  
13 drop out of the DPP process; however, it cannot enter ERAS until a year has passed since  
14 the withdrawal. This limitation was implemented to maintain the integrity of the DPP  
15 process. Allowing active projects in the current queue to transfer to ERAS process also  
16 enables the faster completion of studies for projects that can address resource adequacy  
17 and/or reliability needs in the short term.

18 **Q. DOES MISO KNOW OF ANY EXISTING PROJECTS IN THE QUEUE THAT**  
19 **PLAN TO TRANSFER TO ERAS?**

20 **A.** Yes. MISO is aware of several projects that are interested in participating in ERAS and  
21 can meet the eligibility requirements. Upon transferring from the DPP process to ERAS,  
22 the projects will be subject to all existing withdrawal penalties and/or harm calculations  
23 stated in the Tariff. Based on stakeholder feedback, MISO determined that projects

1 withdrawing from the DPP to enter ERAS should not provide undue impact on  
2 Interconnection Requests remaining in the DPP process. That is why withdrawals can only  
3 occur at the existing off ramps (i.e. Decision Point 1 and/or Decision Point 2) and that they  
4 should be subject to any Automatic Withdrawal Penalty or harm calculation.

5 **Q. WHY ISN'T MISO EVALUATING PROJECTS IN THE DPP QUEUE TO**  
6 **DETERMINE WHETHER THEY CAN ADDRESS RESOURCE ADEQUACY**  
7 **AND/OR RELIABILITY NEEDS?**

8 **A.** MISO does not believe it is appropriate for it to decide which generation projects address  
9 an identified need. MISO is not the resource planner. Ultimately it is the states/RERRAs  
10 processes that determine which generation is utilized to meet a resource adequacy and/or  
11 reliability need. ERAS provides a means to determine Network Upgrades necessary to aid  
12 the states/RERRAs in their determination processes by providing a timely process to study  
13 certain Interconnection Requests that the RERRA has acknowledged. Without ERAS, the  
14 states/RERRAs need to make their determination after an Interconnection Request is out  
15 of the DPP process, which may be too late, or with unknown or incomplete transmission  
16 upgrade costs.

17 **Q. WILL ERAS TAKE NECESSARY RESOURCES AWAY FROM THE DPP**  
18 **QUEUE?**

19 **A.** No. ERAS will not take away resources from the DPP Queue as MISO is requiring  
20 significantly increased financial commitments from ERAS participants. First, the D1  
21 payment is \$100,000 and is non-refundable. The funds from this payment will provide the  
22 additional financial resources needed to help MISO manage the ERAS process. These  
23 resources may include additional software tools and enhancements to process ERAS.

1 Second, MISO has committed to hiring additional personnel or contractors as needed to  
2 help manage the ERAS requests. MISO is actively monitoring the workload and need for  
3 additional support to effectively process both ERAS and the DPP queue. The cap on 10  
4 projects per ERAS cycle will also make MISO's workload and resource needs easier to  
5 forecast and manage. While MISO believes that it has sufficient resources to manage  
6 ERAS even without the project cap, MISO recognizes that the project cap will further assist  
7 it in efficiently managing both the ERAS and DPP processes. No resources or staff time  
8 will be diverted from the DPP queue to ERAS or vice versa.

9 **Q. DO YOU AGREE WITH CLAIMS THAT ERAS WILL REDUCE THE**  
10 **TRANSMISSION CAPACITY HEADROOM AVAILABLE TO PROJECTS IN**  
11 **THE DPP QUEUE?**

12 **A.** No. As I previously explained in my testimony, ERAS projects will ultimately be studied  
13 on a different MTEP base case than projects currently in the MISO queue. An ERAS  
14 project that is studied in September 2025 will use the MTEP 2024 base case that is  
15 supplemented with changes since that base case was built with both approved EPR projects  
16 and new generators with signed GIAs. The 2022 DPP cycle that kicked off in March 2023  
17 used the 2022 base case from when the projects joined the queue. Those DPP projects will  
18 have access to the headroom existing in the 2022 base case, which is not impacted at all by  
19 the ERAS process.

20 **Q. WILL ERAS PROJECTS SHIFT OR INCREASE UPGRADE COSTS TO**  
21 **CUSTOMERS CURRENTLY IN THE DPP QUEUE?**

22 **A.** No. This speaks to a misunderstanding of how MISO will create the model for the serially  
23 studied ERAS projects. In building the model for new ERAS interconnection projects,

MISO will rely on the latest MTEP base case, including any recently approved EPR projects. In the normal DPP process, the base case is never updated once the study process is kicked off except for changes due to projects withdrawing at the Decision Points or generator retirements, which limits the Network Upgrades to only those introduced as part of the ERAS project.

**Q. WHY ARE PHASE 3 PROJECTS NOT INCLUDED IN THE BASE CASE FOR ERAS?**

**A.** MISO does not include Phase 3 projects in the base case for any study process because doing so would require it to deviate from its standard practice. MISO only includes projects that have obtained a GIA in the subsequent base model. MISO does not want to assume that these Phase 3 projects will obtain a GIA, then include them in the model, only to be proven wrong and negatively impact the base model. MISO does not consider projects to be “real” until they have obtained a GIA, at which point they are included in the next base case model.

**Q. WHY ARE LATE-STAGE DPP PROJECTS PROHIBITED FROM PARTICIPATING IN ERAS?**

**A.** Late-stage DPP projects are prohibited from participating in ERAS to prevent negative impacts on the DPP queue. To maintain the integrity of the queue, MISO must protect the projects already in the DPP process. Allowing late-stage DPP projects to transfer into ERAS would require their removal from the DPP queue, triggering re-studies. These re-studies would cause delays and adversely affect the remaining projects in the queue.



1 **Q. IN LIGHT OF THE RECENT QUEUE REFORMS, WHY IS IT NECESSARY TO**  
2 **IMPLEMENT ERAS NOW?**

3 **A.** The recent queue reforms are essential and will result in beneficial changes to the DPP  
4 queue, but on a longer time frame than is needed to address current resource adequacy and  
5 reliability needs. MISO views the refined ERAS process as complementary to the recent  
6 queue reforms but argues that it addresses a more imminent problem. ERAS is not  
7 redundant to the existing DPP queue as its purpose and structure is completely different.  
8 Several protestors to the original ERAS filing suggested that the SUGAR Software that  
9 MISO has been working to implement will solve the problem. However, these claims fail  
10 to consider that MISO is currently implementing the SUGAR software only for increasing  
11 the speed of the Phase 1 Study of the MISO DPP process, not for the more in-depth Phases  
12 2 and Phase 3, portions. MISO anticipates that it will utilize SUGAR for the later phases,  
13 but the software as currently developed is not designed to run the Phase 2 or Phase 3  
14 studies.

15 **Q WHY SHOULDN'T MISO UTILIZE PROVISIONAL GIAs TO ADDRESS THE**  
16 **RESOURCE ADEQUACY AND/OR RELIABILITY NEEDS?**

17 **A.** A Provisional Generator Interconnection Agreement or PGIA is another tool for  
18 Interconnection Customers to achieve a timely interconnection agreement; however, it is  
19 insufficient to address the problem on the scale or in the time frame that is needed.  
20 Provisional interconnection service, while available for interconnection projects to request  
21 as soon as they enter the DPP process, only provides for limited operation, and is  
22 conditional on DPP studies for full deliverability that 1) may not be available to recognize  
23 the new capacity and 2) can still take several years to finalize. Having a PGIA poses a

substantial risk on generator projects depending on the projects in the queue that may never go commercial or may not be built due to not having an off-taker or a load to serve. Some of the benefits of PGIAs such as increased financial commitments and an expedited timeframe to getting an EGIA were incorporated into the ERAS process. Ultimately, only the ERAS process will ensure that all the Network Upgrades on the MISO transmission system that are necessary to provide deliverability across the system are identified by the time the EGIA is executed.

**V. THE REFINED ERAS PROPOSAL**

**Q. WHY IS MISO REFINING THE ERAS PROCESS?**

**A.** Following the Commission's review of MISO's original ERAS process, it rejected MISO's proposal and made several recommendations for how to ameliorate the issues it identified in the original ERAS proposal. Thanks to this guidance from the Commission, MISO has changed several aspects of its original proposal and is now seeking Commission approval of its refined ERAS process. As explained earlier in my testimony, ERAS is MISO's solution to the near-term resource adequacy and reliability needs within its footprint. Due to unforeseen circumstances related to unexpected and dramatic load growth, MISO needs to implement a process that can enable the completion of projects addressing resource adequacy and/or reliability needs in the next few years. ERAS is not another interconnection queue; rather, it is a separate process that the states may utilize to address short-term resource adequacy and/or reliability needs.

**Q. HOW WAS THIS NEW ERAS PROPOSAL DEVELOPED?**

**A.** Following the Commission's Order on MISO's original ERAS filing and other stakeholder feedback, MISO worked quickly to refine its Expedited Resource Addition Study to

1 address the concerns identified by the Commission and to propose a framework for the  
2 accelerated study of generation projects that can address urgent resource adequacy and  
3 reliability needs in the near term. With the Commission's guidance, MISO made critical  
4 changes to its original ERAS proposal including adding a total project cap with carve outs  
5 for retail states and independent power producers. MISO has also added several  
6 requirements to establish a stronger connection between the proposed ERAS projects, and  
7 the resource adequacy needs that the projects will be addressing.

8 MISO developed this process and the accompanying Tariff language based on its resolve  
9 to address its urgent short-term resource adequacy needs and has provided extensive  
10 opportunities for all interested parties to comment during the stakeholder process. It should  
11 be noted though that these issues are complex and there is no set of reforms that will  
12 flawlessly meet the needs of every stakeholder affected by these updates, but the final  
13 ERAS proposal that MISO is submitting today incorporates many of the comments and  
14 recommendations we received through this process.

15 **Q. PLEASE DESCRIBE THE STAKEHOLDER PROCESS USED TO DEVELOP**  
16 **THIS PROPOSAL.**

17 **A.** MISO engaged in an extensive stakeholder process throughout the development of the  
18 original ERAS proposal. MISO obtained feedback through the Planning Advisory  
19 Committee (PAC), conducted dozens of calls with stakeholders across the MISO sectors,  
20 and received multiple rounds of both formal and informal written feedback. During the  
21 stakeholder process, MISO considered the advantages and disadvantages of multiple  
22 approaches for addressing the identified challenges and risks, collaborating with

1 stakeholders on identifying areas where flexibility could be increased. MISO revised its  
2 initial proposal considerably, incorporating the input received.

3 The key milestones of the original ERAS proposal stakeholder process were as follows:

- 4 • November 13, 2024: MISO presented an initial ERAS proposal to the PAC and  
5 requested written formal feedback from stakeholders from this meeting be included  
6 with feedback from the November 18<sup>th</sup> workshop.
- 7 • November 18, 2024: MISO and stakeholders participated in a special ERAS-  
8 specific workshop in which the parties continued to discuss ERAS details. MISO  
9 sought feedback on the ERAS proposal.
- 10 • December 6, 2024: MISO and stakeholders participated in a second ERAS-specific  
11 workshop in which the parties continued to discuss ERAS details. MISO sought  
12 written formal feedback on the updated proposal.
- 13 • January 22, 2025: MISO presented an updated ERAS proposal at the PAC.
- 14 • February 19, 2025: MISO posted proposed tariff redlines, presented an updated  
15 ERAS proposal, and sought written formal feedback at the PAC.
- 16 • March 7, 2025: MISO posted updated proposed tariff redlines and presented the  
17 final ERAS proposal at a special PAC meeting scheduled to review the final details  
18 of the ERAS proposal.

19 The key milestones for the refined ERAS proposal stakeholder process were as follows:

- May 28, 2025: MISO presented its refined ERAS proposal at the PAC.<sup>21</sup> MISO received feedback from this presentation through its informal feedback tool.<sup>22</sup>

- MISO conducted dozens of calls with stakeholders across the MISO sectors.

**Q. WHAT WAS MISO’S RESPONSE TO CONCERNS AND RECOMMENDATIONS FROM STAKEHOLDERS ON MISO’S ORIGINAL ERAS PROPOSAL?**

- A.** MISO supported many of the concerns and objectives identified by the stakeholders while crafting the original ERAS proposal and was committed to working with stakeholders to incorporate elements of their proposals to meet those objectives. MISO also considered the concerns and recommendations of stakeholders following the Commission’s rejection of its original ERAS proposal. The figure below demonstrates how MISO has worked with stakeholders to address concerns related to ERAS implementation and how its revised proposal responds to these concerns and Commission guidance.

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<sup>21</sup> See *Expedited Resource Addition Study (ERAS) Next Steps* (May 28, 2025), [https://cdn.misoenergy.org/20250528%20PAC%20Item%2008%20Expedited%20Resource%20Addition%20Study%20\(ERAS\)%20Next%20Steps%20\(PAC-2023-1\)699836.pdf](https://cdn.misoenergy.org/20250528%20PAC%20Item%2008%20Expedited%20Resource%20Addition%20Study%20(ERAS)%20Next%20Steps%20(PAC-2023-1)699836.pdf).

<sup>22</sup> *Informal Feedback (2025)*, MISO, available at: <https://www.misoenergy.org/engage/stakeholder-feedback/2025/informal-feedback-2025/>.

**Figure 1: ERAS Proposal Changes from First Iteration**

|                           | Where we began                            | Original ERAS filing                                                                                                                                                                                                                                                                                                                    | Refined ERAS filing                                                                                                                                                                                                                                                                                                                         |
|---------------------------|-------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cap                       | N/A                                       | N/A                                                                                                                                                                                                                                                                                                                                     | No more than 10 projects studied per quarter and no more than 68 projects studied overall with an 8 project carve out for restructured states and a 10 project carve out for IPPs with agreements with entities other than LSEs                                                                                                             |
| Applicants                | Load Serving Entities                     | LSEs, IPPs, and DPP transfer projects meeting all requirements                                                                                                                                                                                                                                                                          | No change                                                                                                                                                                                                                                                                                                                                   |
| Process timeline          | Project studied and GIA issued in 60 days | Quarterly cadence following established MISO timelines, receiving GIA in ~90 days                                                                                                                                                                                                                                                       | No change                                                                                                                                                                                                                                                                                                                                   |
| Required documentation    | RERRA acknowledgement                     | RERRA acknowledgement and one of the following: <ul style="list-style-type: none"> <li>LSE acknowledgment to self-supply</li> <li>PPA between IC and load or its LSE</li> <li>Build-Own-Transfer Agreement</li> <li>Other agreement between applicant and load, or its LSE, stating project will meet RA or reliability need</li> </ul> | RERRA <b>verification</b> and one of the following: <ul style="list-style-type: none"> <li>LSE acknowledgment to self-supply</li> <li>PPA between IC and load or its LSE</li> <li>Build-Own-Transfer Agreement</li> <li>Other agreement between applicant and load, or its LSE, stating project will meet RA or reliability need</li> </ul> |
| Identification of need    | N/A                                       | Description of need in ERAS application                                                                                                                                                                                                                                                                                                 | IC must identify specific load addition and/or RA deficiency the project will address (MW value band, approximate location, etc.) and this information will be made public                                                                                                                                                                  |
| Locational requirement    | N/A                                       | N/A                                                                                                                                                                                                                                                                                                                                     | Project and RA and/or reliability need must be within the same Local Resource Zone                                                                                                                                                                                                                                                          |
| Size requirement          | N/A                                       | N/A                                                                                                                                                                                                                                                                                                                                     | Interconnection Service must not exceed 150% of the identified MW need                                                                                                                                                                                                                                                                      |
| Commercial Operation Date | Expected COD with 2-5 years               | 2025/26 applicants: 3 years from submission plus 3-year grace period;<br>2027/28 applicants: 12/31/2028 COD plus 3-year grace period                                                                                                                                                                                                    | All applicants must have a COD within 3 years of submission plus a 3-year grace period                                                                                                                                                                                                                                                      |
| Penalties                 | Requested feedback after first PAC        | Projects transferring from DPP process will be subject existing tariff language (e.g. AWP and Harm Calculations)                                                                                                                                                                                                                        | No change                                                                                                                                                                                                                                                                                                                                   |
| Sunset                    | 2028 / 2029                               | 12/31/2028 or on the completion date of the 2027 DPP queue cycle, whichever first                                                                                                                                                                                                                                                       | ERAS will sunset at the earlier of the completion of the sixty-eighth ERAS study or on August 31, 2027                                                                                                                                                                                                                                      |

**Q. DID MISO CONSIDER ANY ALTERNATIVE ERAS PROPOSALS?**

**A.** Yes. During the stakeholder process in January and February of 2025, two parties submitted alternative ERAS proposals in the PAC meetings. Those proposals focused on improvements to the existing queue process and many suggestions were not relevant to the serial approach of ERAS as MISO has envisioned it. MISO believes the feedback was extremely beneficial but focused on improvements that MISO can make to its current cluster process and not the ERAS process. The refined ERAS proposal does align with a number of items from the Developer Coalition Counterproposal (February 12, 2025),

1 including limiting the number of ERAS projects allowed to participate and ensuring those  
2 projects are tied to a specific need.<sup>23</sup>

3 The proposals also recommended that MISO utilize a scoring system to evaluate ERAS  
4 Interconnection Requests. MISO has not adopted this recommendation because the states  
5 have authority over resource adequacy needs and MISO should not be ranking or selecting  
6 ERAS Interconnection Requests. It is not appropriate for MISO to be second guessing a  
7 RERRA determination that a project should be studied in ERAS.

8 **Q. PLEASE DESCRIBE THE CONCERNS RAISED BY THE COMMISSION’S**  
9 **ORDER AND HOW MISO IS RESPONDING TO THEM.**

10 **A.** The Commission raised numerous concerns when addressing MISO’s original ERAS  
11 proposal. The Commission found that MISO’s ERAS proposal was not “a just and  
12 reasonable and not unduly discriminatory or preferential approach for addressing MISO’s  
13 stated resource adequacy and reliability needs.”<sup>24</sup> The Commission identified two main  
14 concerns with ERAS: (1) there was “no limit on the number of projects that could be  
15 entered into the ERAS process,”<sup>25</sup> and (2) “the proposal does not sufficiently describe how  
16 the ERAS process is sufficiently targeted to study only interconnection requests needed to  
17 meet the anticipated shortfall in generating capacity described by MISO.”<sup>26</sup> The  
18 Commission also recognized that it was “appropriate for RERRAs to communicate to

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<sup>23</sup> See *Developer Coalition: ERAS Counter Proposal* (February 12, 2025)  
<https://cdn.misoenergy.org/20250219%20PAC%20Item%2008%20ERAS%20Alternative%20from%20Developer%20Coalition679607.pdf>.

<sup>24</sup> See *Midcontinent Independent System Operator, Inc.*, 191 FERC ¶ 61,131 at P 197 (2025) (“ERAS Order”).

<sup>25</sup> *Id.* at P 199.

<sup>26</sup> *Id.* at P 201.



1 MISO their resource adequacy and reliability needs, as well as their support for including  
2 interconnection requests in the ERAS process, to ensure that the RERRA's needs are met  
3 in a timely fashion."<sup>27</sup> Each of the Commissioners also filed individual statements urging  
4 MISO to revise and refile its ERAS proposal.<sup>28</sup>

5 MISO is extremely grateful for the Commission's guidance on how to better craft its ERAS  
6 proposal and has worked swiftly to develop a refined ERAS process that addressed the  
7 Commission's concerns. MISO is now proposing a refined ERAS process that can be  
8 implemented by September 2, 2025, to quickly address the looming resource adequacy and  
9 reliability needs that it highlighted in its original ERAS filing.

10 **A. Implementing an ERAS Cap**

11 **Q. WHY IS MISO IMPLEMENTING A CAP ON ERAS PROJECTS?**

12 **A.** After receiving feedback from stakeholders and guidance from the Commission in its  
13 ERAS order, MISO is implementing a cap on the total number of projects that can  
14 participate in ERAS. The Commission was concerned that MISO's original ERAS  
15 proposal was unlimited in size and asked that MISO place additional guardrails around  
16 ERAS.<sup>29</sup> MISO is now proposing to cap the total number of ERAS projects studied to 68  
17 Interconnection Requests. In addition, MISO is creating a carve out of a maximum of 8  
18 Interconnection Requests (of the total 68) that may be submitted to serve retail choice load  
19 and a carve out of a maximum of 10 Interconnection Requests (of the total 68) that may be

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<sup>27</sup> *Id.* at P 203.

<sup>28</sup> ERAS Order at P 3 (Christie, Comm'r, dissenting); P 6 (Rosner, Comm'r, concurring); P 8 (See, Comm'r, concurring).

<sup>29</sup> ERAS Order at P 203.

submitted by IPPs with agreements with entities other than LSEs. The remaining 50 Interconnection Requests may be utilized by the remaining states and developers for non-retail states. MISO recognizes that PJM’s Reliability Resource Initiative similarly capped its program at 50 projects and MISO is providing additional carve outs for certain groups that would otherwise have difficulty participating in ERAS. The Commission has previously recognized that an appropriately structured cap used in the interconnection processes can be consistent with open access principles.<sup>30</sup>

**Q. IS THERE A LIMIT ON THE NUMBER OF ERAS PROJECTS STUDIED PER CYCLE?**

**A.** Yes. MISO is also going to limit the number of projects studied *per* ERAS quarterly study cycle to 10 projects no matter who submits them. MISO believes that 10 projects per study cycle is a manageable number of projects for its team to study on a quarterly basis. This will allow MISO to spread the number of projects over a longer period of time, which will also help with the expedited review and management of MISO’s internal resources to serve ERAS.

**Q. HOW WILL THE 10 PROJECTS BE SELECTED FOR THE STUDY?**

**A.** Once the ERAS process is approved, MISO will process the ERAS Interconnection Requests using a serial “first-come, first-served” approach based on the date and time the application was submitted. The first ten projects to submit applications to be studied in ERAS will be tentatively selected until MISO has finalized its screening process of all ten projects to ensure that they (1) meet the ERAS eligibility requirements, and (2) are not

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<sup>30</sup> *Id.*

geographically located near another project in the group or impacting the same constraints. After the ten projects in a cycle are finalized, the remaining projects that applied in the cycle will be deferred to the next available ERAS cycle in order of submission time. Since only ten projects will be studied at a time, serial review of the applications will expedite the review process. MISO expects the ERAS Interconnection Requests to apply when they are ready and meet all the necessary eligibility requirements to participate. All application deadlines and ERAS Interconnection Requests will be posted on the MISO public website in a timely fashion.

**Q. WHY WILL MISO CREATE A WAITLIST OF ERAS PROJECTS?**

**A.** Projects that apply in a certain cycle but are not the first ten projects that are submitted will be studied in a future ERAS Quarterly Study Period and will remain on an ERAS “waitlist” until MISO has completed a screening process of the first ten projects. After the first ten projects are validated, the remaining projects on the waitlist will be deferred to the next available study quarter in order of when each project was submitted. As soon as the remaining ERAS applicants have gone through the screening process and are accepted into ERAS, MISO will publish the projects and their assigned quarters on the ERAS webpage.

**Q. WHAT DOES THE ERAS SCREENING PROCESS INVOLVE?**

**A.** MISO will complete a screening analysis to verify that the projects in a single ERAS study cycle are not in the same geographic area or do not impact the same constraints. If they are in the same area or do impact the same constraints, then the projects will be placed in different quarterly study cycles as separate serial studies. The first submitted project will be processed first, and the next highest priority project (based on submission time) will be processed in a future quarter study cycle.

1   **Q.    WHAT IF MULTIPLE ERAS REQUESTS HAVE CONTRACTS TO SERVE THE**  
2       **SAME LOAD?**

3   **A.**   There is a possibility that a very large load will need multiple generators to serve it and  
4       would potentially sign agreements with more than one generator. It is incumbent upon the  
5       load to determine whether it has negotiated for a sufficient amount of generation and to not  
6       rely upon the RERRA to match exact load amounts with generation amounts. It is  
7       important to note that these projects cannot be studied together in the ERAS serial process.  
8       Thus, the projects would be split over multiple ERAS quarterly study periods in order of  
9       submission time even if they are submitted within the same quarter and will serve the same  
10      load. MISO recognizes that this is less than ideal from a load need perspective, but in order  
11      to ensure that ERAS remains an expedited process that enables the efficient study of ERAS  
12      Interconnection Requests in serial order, it must spread out proposed requests that impact  
13      the same constraints or serve the same load. This also means that MISO could process a  
14      lower queued project ahead of one of these projects if it is a later submitted project that is  
15      not similarly situated geographically or if it does not impact any of the same constraints as  
16      a higher queued project.

17   **Q.    WILL DEFERRED ERAS PROJECTS LOSE THEIR NON-REFUNDABLE D1**  
18       **PAYMENT?**

19   **A.**   No. MISO will hold their D1, D2, and M2 in order for them to continue to be active  
20      requests that are not deficient. But proposed projects that do not meet the ERAS eligibility  
21      requirements and are rejected from the ERAS process will lose their D1 payment, but  
22      MISO will refund the remaining study and milestone deposits if they withdrawal.  
23      Otherwise, they will be automatically transferred into the DPP process. The ERAS projects

will be studied serially in order of submission time. MISO conducts a similar process for the queue cap and will be able to efficiently study the ten projects submitted per ERAS cycle.

**B. Updating the RERRA Notification Requirement**

**Q. WHY DID MISO CHANGE THE RERRA NOTIFICATION REQUIREMENT?**

**A.** Following the guidance provided in the Commission’s rejection of MISO’s original filing, MISO drafted updated language to better tailor and connect the resource adequacy needs with the ERAS projects as verified by the relevant RERRA. The Commissioners indicated that the previously proposed RERRA notification was insufficient to establish a true connection to the resource adequacy and/or reliability need. MISO is also now requiring that the load being addressed by the ERAS project be in the same LRZ region as the RERRA providing the verification, unless the project applicant can demonstrate that the use of a Generating Facility not in the same LRZ was included in a resource filing or other submission made to the RERRA. An example of a resource filing that was submitted to a RERRA is an Integrated Resource Plan. This is another way to more closely tie the ERAS project to the identified resource adequacy and/or reliability need.

**Q. HOW DID THE RERRA NOTIFICATION REQUIREMENT CHANGE?**

**A.** Following the Commission’s order, MISO recognized that it needed to change the RERRA requirement and has proposed updated language in the tariff. The Commission noted in its order that “MISO has not demonstrated that the proposed Tariff language is tailored to ensure that only those resources capable of addressing identified near-term resource

adequacy or reliability needs are eligible for expedited study through the ERAS process.”<sup>31</sup>

Under the new language, the ERAS Interconnection Request must be accompanied by a written verification from a RERRA that either the new, incremental load addition is valid and not otherwise included in a resource plan, or the Generating Facility proposed will address a resource adequacy deficiency as determined by the RERRA.<sup>32</sup> MISO changed the language to better tailor the RERRA notification requirement to a new resource adequacy and/or reliability need. The verification may only come from the RERRA where the load to be served is located and the Generating Facility must be in the same LRZ as the load needed as described above.

**Q. WHY IS IT REASONABLE TO REQUIRE A RERRA TO VERIFY TO MISO THAT A PROJECT SHOULD BE CONSIDERED FOR THE ERAS PROCESS?**

**A.** First and foremost, MISO is not a resource planner. It is the reliability and market operator for 15 states and one Canadian province. It is the state or RERRA that has jurisdiction over and determines the resource adequacy needs and/or policies that governs the retail electric service to end-customers. Rather, as noted in the Federal Power Act, the states are the ultimate authority for resource adequacy, hence their necessary inclusion in the ERAS process to address the need for these critical projects to maintain resource adequacy. In order to ensure that the proposed ERAS projects will address a resource adequacy and/or reliability need claimed by an Interconnection Customer, MISO needs the RERRA (or its documented representative) where the load is located to provide a written verification as described above for MISO to study the generation expected to serve that need.

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<sup>31</sup> ERAS Order at P 202.

<sup>32</sup> See Tab A Redlines, GIP Section 3.3.1.

This requirement will prohibit the submission of projects that have no connection to a verified load need thereby increasing the certainty that the project will reach completion and prevent speculative projects from using the ERAS process.

**Q. WHY IS MISO REQUIRING THE ERAS PROJECT AND THE IDENTIFIED RESOURCE ADEQUACY AND/OR RELIABILITY NEED BE LOCATED IN THE SAME LOCAL RESOURCE ZONE?**

**A.** MISO is requiring the load being addressed by the ERAS project be in the same LRZ as the Generating Facility unless the project applicant can demonstrate that the use of the Generating Facility was included in a resource filing made to the relevant RERRA. Requiring the proposed ERAS project to be located in the same LRZ as the RERRA-verified new, incremental load or resource adequacy deficiency ensures that the generation is going to support the load need in that area. This requirement also ensures that the proposed ERAS project is closely tied to a specific spot load or resource adequacy need. This requirement strengthens the nexus between the new load and the ERAS generation project and will serve as MISO's location criterion, which other RTOs have utilized in their similar proposals.<sup>33</sup>

**Q. DOES THE RERRA VERIFICATION CONSTITUTE EVIDENCE OF A DESIGNATION OF NEED OR A FINDING OF APPROPRIATENESS BY THE RERRA?**

**A.** No. The following language was included in the proposed tariff redlines as part of the RERRA verification requirement:

A RERRA's written verification is not intended to constitute or provide evidence of any final determination of need or suitability of the project for

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<sup>33</sup> ERAS Order at P 202.



1           any purpose by the issuing entity beyond requesting that the Transmission  
2           Provider apply the ERAS process for such project.<sup>34</sup>  
3

4           The purpose of the verification requirement is to confirm to MISO that the new,  
5           incremental load addition is valid and is not currently included in a plan or other procedure  
6           under the RERRA's purview or the Generating Facility will address an identified resource  
7           adequacy deficiency. After lengthy conversations with the states during the development  
8           of MISO's first ERAS filing, MISO understands that each RERRA has its own process and  
9           timeline for formally determining needs and approval processes and that part of these  
10          processes by necessity occur after the project has been studied by MISO.

11          It is important that the RERRA verification not prejudice the ability of the RERRA to make  
12          later determinations in accordance with applicable laws and regulations. The purpose of  
13          ERAS is to enable the states to meet their resource adequacy needs, while not acting as an  
14          impediment to their approval processes. For MISO's purposes, what is important is that it  
15          knows which projects to study on an expedited basis and to ensure any Network Upgrades  
16          identified in the study, and listed in an EGIA are constructed to provide certainty to later  
17          planning processes. The Tariff language meets this need while protecting the rights of the  
18          RERRA to make determinations in accordance with its own processes. This language was  
19          included to ensure that the RERRA's written verification to MISO that the new,  
20          incremental load addition is valid and is not currently included in a plan or other procedure  
21          under the RERRA's purview or the Generating Facility will address an identified resource  
22          adequacy deficiency could not be used by the Interconnection Customer in a subsequent  
23          state or RERRA regulatory process as proof or evidence that the project must be approved.

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<sup>34</sup> Section 3.9.1.

The RERRAs reserve the right to make a judgement on the need for a project after MISO has studied the project through ERAS as applicable state regulatory processes and approvals still apply. This ensures that MISO’s acceptance of the project into ERAS cannot be interpreted as MISO *directing* the state or RERRA to approve the project through their independent regulatory review process. The intention of the language noted above was also to ensure the notification does not pre-determine the outcome of any applicable state process.

In addition, any Network Upgrades identified in the ERAS process and included in an executed EGIA, or filed unexecuted EGIA, will be constructed regardless of whether that EGIA is later terminated due to the ERAS Interconnection Request not being constructed. This adds an additional layer of responsibility to the ERAS Interconnection Request to ensure its certainty and ensures that MISO can utilize that Network Upgrade(s) in later planning processes. For instance, projects within the DPP process can rely on approved MTEP projects, including Network Upgrades approved through the ERAS process, to mitigate constraints identified with the DPP process.<sup>35</sup>

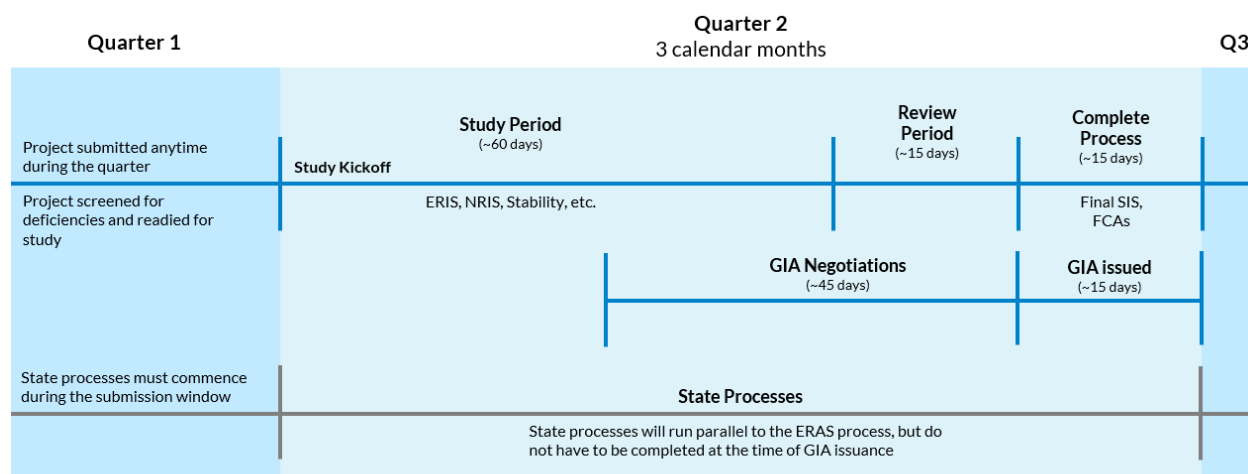
**Q. HOW DOES THE ERAS REVIEW PROCESS ALIGN WITH STATE REGULATORY REVIEW PROCESSES?**

**A.** State processes are expected to commence during the ERAS submission window and then work in parallel to ERAS, as presented in Figure 2. These processes may be completed after MISO has finalized the study and issued the EGIA, or potentially complete before the execution of an EGIA. If the state processes and ERAS are done in parallel it may allow

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<sup>35</sup> Generator Interconnection Business Practices Manual (BPM-015), Section 6.1.1.1.

for even distribution of work and ensures these critical, time-sensitive projects can proceed efficiently and come online as necessary.



Study will consist of stability, short circuit, voltage analysis, and IC Interconnection Facilities

**Figure 2: ERAS Quarterly Study Period Example**

**Q. WILL MORE THAN ONE RERRA NEED TO PROVIDE A VERIFICATION FOR A SINGLE PROJECT?**

**A.** No. MISO is only requiring verification from one RERRA for ERAS participation. The RERRA providing the written verification for the project must be the RERRA responsible for the load that the project is proposed to serve. Per the resource adequacy definition of a RERRA, an identified load can only be regulated by one RERRA.

**C. ERAS for Illinois and Part of Michigan**

**Q. WILL THE REFINED ERAS PROCESS INCLUDE ILLINOIS AND THE RESTRUCTURED PARTS OF MICHIGAN?**

**A.** Yes. MISO has drafted proposed language to incorporate the restructured states into the ERAS process. If an Interconnection Customer's new Generating Facility will address resource adequacy and will either: "(1) serve retail choice load located in a state that limits

1 the amount of load that can select retail choice to a percentage of the electric utility's  
2 average weather-adjusted retail sales; or (2) serve retail choice load and/or be located in a  
3 retail choice state other than one that limits the amount of load that can select retail choice  
4 to a percentage of the electric utility's average weather adjusted retail sales", the  
5 Generating Facility may qualify to participate in ERAS, given it meets all other ERAS  
6 requirements.<sup>36</sup> In these instances, the Interconnection Customer will indicate the specific  
7 retail choice load on the Interconnection Request and provide evidence of the  
8 determination of need, but will not be required to include a verification from a RERRA.  
9 MISO is proposing these changes to include Illinois and a small part of Michigan in the  
10 ERAS process.

11 **Q. WILL MISO'S PROPOSED LANGUAGE FOR ILLINOIS AND MICHIGAN GIVE**  
12 **PROJECTS AN ADVANTAGE OVER OTHER PROJECTS HOPING TO**  
13 **PARTICIPATE IN ERAS?**

14 **A.** No. Due to the way that Illinois is structured, it does not have a RERRA that could verify  
15 the resource adequacy and/or reliability need like the other states. At first glance, removing  
16 the RERRA verification requirement for retail states would seem to give these areas an  
17 advantage over other states in the MISO footprint. But MISO has crafted other limitations  
18 in the ERAS process that will limit the number of projects that can be proposed from  
19 developers in Illinois and Michigan that serve retail choice load. First, only 8 ERAS  
20 projects will be accepted to serve retail choice load and only 10 ERAS projects will be  
21 studied per cycle. Additionally, those studied within the same quarter cannot be  
22 geographically located near other projects or impact the same constraint. Second, the

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<sup>36</sup> See Tab A Redlines, GIP Section 3.9.1.

ERAS projects will be limited to LRZ regions where the need is located, which will further reduce the number of projects that can be proposed from retail choice states. Interconnection Customers will also still have to provide evidence of determination of need as outlined in the Tariff. MISO is working to level the playing field between the states in its footprint and also wants to ensure that the projects are spread out among the states to better address the resource adequacy and/or reliability needs that they may have.

**Q. DO ERAS PROJECTS IN RETAIL CHOICE STATES HAVE A DIFFERENT CAP?**

**A.** Yes. ERAS projects submitted in accordance with Section 3.9.1(1) will be separately limited to a maximum of 8 projects for resource adequacy deficiencies until the sunset of the ERAS process. Retail choice states are a small subset of the MISO footprint and require an ERAS process that is not bound by a RERRA verification due to the need to host an open auction process within those states. Since a RERRA will not be involved in providing a verification for projects proposed in restructured states, MISO needed to ensure that this restructured ERAS process was limited in scope. After an internal analysis and discussion with retail choice states, MISO determined that a cap of eight projects strikes the proper balance between the portion of MISO that the retail choice states represent and the number of projects that will be accepted into the ERAS process. These eight projects will be studied in addition to the 10 accepted by IPPs to serve non-LSE load and the 50 projects allocated for the remaining needs in the MISO footprint, but they will still be limited by the 10 project per quarterly study cycle cap. A member of the IPP sector proposed that MISO set aside a specific number of projects for IPPs to submit with agreements with non-

1 LSE load and MISO believes that 10 projects is an appropriate balance similar to the retail  
2 choice cap above.

3 **D. Changes to the Interconnection Application**

4 **Q. HOW HAS THE INTERCONNECTION REQUEST APPLICATION CHANGED**  
5 **FOR ERAS?**

6 **A.** MISO is requiring additional information from ERAS applicants as compared to other  
7 generation Interconnection Requests in order to better tie the ERAS project to the load need  
8 and the associated RERRA in the relevant LRZ. As part of the ERAS application process,  
9 project applicants will be required to supply a non-confidential summary of the following  
10 information: the developer of the ERAS project, the MW range of need the ERAS project  
11 is addressing, what LRZ region the project is located in, and a general description of what  
12 the load is serving (i.e., a data center, manufacturing plant, a reliability need, etc.). This  
13 information will provide MISO with the full picture of the proposed project including fuel  
14 source and MW size, details about the load it is serving, and what RERRA is involved in  
15 the project's proposal to ERAS. MISO is also planning to publish what cycles the ERAS  
16 projects will be studied in and which carve out they are requesting, if applicable. This  
17 information will be published on MISO's ERAS webpage as well.

18 **Q. WHY IS MISO IMPLEMENTING THESE CHANGES TO THE APPLICATION**  
19 **FOR ERAS?**

20 **A.** To further create a tight nexus between the load need and the Generating Facility  
21 addressing the need, MISO is requiring additional information be submitted with the ERAS  
22 application. MISO is aiming to closely tailor the proposed ERAS project to the verified  
23 resource adequacy and/or reliability need and in a more transparent manner. These changes

1 aim to better connect the ERAS project with the need and the generator addressing that  
2 need. With the Interconnection Request application, along with the RERRA verification  
3 and the executed agreement, MISO will have a full picture of the ERAS project, the  
4 resource adequacy or reliability need it is proposing to address, and all the relevant parties  
5 involved with the project. MISO is making the ERAS process more transparent and  
6 believes that the additional information required on the Interconnection Request  
7 application will serve this purpose.

8 **Q. WHAT DOCUMENTS ARE REQUIRED WITH THE ERAS APPLICATION?**

9 **A.** Each ERAS applicant will need to submit the following: (1) the Interconnection Request  
10 application with detailed information regarding the project, the developer, and the load that  
11 will be served; (2) the RERRA verification validating the specific driver (new, incremental  
12 load or resource adequacy deficiency) in its footprint; and (3) an executed agreement that  
13 the project submitted for ERAS is intended to be used by the entity with an identified  
14 resource adequacy or reliability need. As explained above, the ERAS applicants are also  
15 required to submit a non-confidential summary of the proposed project that will be  
16 published on MISO's webpage.

17 **V. THE ERAS ELIGIBILITY REQUIREMENTS**

18 **Q. WHAT ENTITIES CAN SUBMIT PROJECTS TO PARTICIPATE IN ERAS**  
19 **PROCESS?**

20 **A.** Initially, MISO proposed that only LSEs could apply to participate in ERAS due to their  
21 responsibility to serve their load customers. However, based on stakeholder input during  
22 the development of the original ERAS proposal, MISO changed course and recognized that  
23 the vast majority of the Interconnection Requests, including those that would be submitted



1 through ERAS, may not be initially submitted by the LSE that ultimately used the resource  
2 to serve their load, but rather an Independent Power Producer (“IPP”) that would eventually  
3 transfer the resource over to an LSE via an offtake agreement. Given the importance of  
4 maintaining the inclusivity and open-access aspects of ERAS, MISO updated the eligibility  
5 requirements accordingly to ensure that any project developer can apply to participate in  
6 ERAS as long as the project meets all of the ERAS eligibility requirements. The refined  
7 ERAS proposal has not changed this.

8 **Q. PLEASE DESCRIBE THE ELIGIBILITY REQUIREMENTS FOR**  
9 **INTERCONNECTION SERVICE VIA ERAS.**

10 **A.** In determining what the necessary eligibility requirements were for ERAS, MISO  
11 established requirements that would allow a project to efficiently move through a study  
12 process while still being considered “shovel ready.” Based on multiple rounds of feedback  
13 from stakeholders and additional analysis, MISO is proposing the following technical  
14 requirements for ERAS that must be met at the time of application submission:

- 15 1. The project must be for new capacity.
- 16 2. The project must request Network Resource Interconnection Service (NRIS).
- 17 3. Evidence of a written verification from the RERRA where the load to be served  
18 is located by the Generating Facility that the new, incremental load addition is  
19 valid and is not currently included in a plan or other procedure under the  
20 RERRA’s purview or the Generating Facility will address an identified resource  
21 adequacy deficiency.

4. Evidence substantiating an executed agreement that the project submitted for ERAS is intended to be used by the entity with an identified resource adequacy or reliability need.
5. D1 and M2 payments will ensure increased financial commitment when the ERAS Interconnection Request is submitted. The D1 will be a \$100,000 non-refundable fee and the M2 will be \$24,000 per MW.
6. 100% Site Control for the generator as well as 100% Interconnection Customer's Interconnection Facilities (ICIF) Site Control will be required when the application is submitted.
7. COD requested in the ERAS application that is no more than 3 years from submission.
8. The project's requested Interconnection Service must not exceed 150% of the identified MW need.
9. The project and the identified resource adequacy and/or reliability need must be in the same Local Resource Zone (LRZ), unless as previously noted.

I provide additional details on each requirement below.

**Q. WHY IS MISO REQUIRING AN EXECUTED AGREEMENT TO ADDRESS THE RESOURCE ADEQUACY AND/OR RELIABILITY NEED?**

**A.** Requiring executed documentation by an authorized representative of the entity submitting an ERAS Interconnection Request is reasonable because it allows MISO to balance the appropriate level of "shovel ready" certainty for the critical project. The executed agreement with an off-taker requirement also reduces speculative projects and connects a specific project with a claimed resource adequacy and/or reliability need. Additionally, it

helps verify the accuracy of the information set forth in the ERAS application, which will ensure that MISO will be able to expeditiously transition to studying the project.

**Q. WHAT IS THE PURPOSE OF THE BROAD AGREEMENT DOCUMENTATION LANGUAGE IN PROPOSED TARIFF SECTION 3.9.1.2.d?**

**A.** The following language was added to the executed agreement requirement:

d. Other agreement between the entity submitting the Interconnection Request, including the RERRA verification letter as appropriate, and the entity with the load to be served (including, but not limited to, an Alternative Retail Electric Supplier, or its Load Serving Entity), stating that the ERAS project will be used to meet an identified resource adequacy and/or reliability need.

MISO recognizes this language is broad, but the intent of this subsection was to establish a minimum requirement that an arrangement exists between the driver of the need and the project to address that need. As MISO developed this language through the stakeholder process, we determined that requiring a “PPA” or other specified form of agreement, or specific terms, may prove too onerous, especially in jurisdictions where need determinations or commercial commitments are contingent on identified project costs or previous MISO study. What is important is a demonstration that an ERAS Interconnection Request is the solution intended by the entity with the need. The language balances two goals: 1) it prevents speculative requests by entities that are merely hoping to be selected to address a need later, and do not have buy in from the need driver, and 2) it avoids requirements for MISO to evaluate the details of commercial arrangements that may still be in development, which would frustrate use of the ERAS process in many cases. The addition of Alternative Retail Electric Supplier specifically allows agreements with such entities operating in retail choice states.

**Q. WHY IS MISO LIMITING ERAS PROJECTS TO 150% OF THE IDENTIFIED MW NEED BASED ON NAMEPLATE CAPACITY?**

**A.** In working to refine the ERAS process, MISO looked at how SPP, CAISO, and PJM structured their corresponding processes. The CAISO proposed a cap of 150% of total available transmission capacity for each of its Deliverable Zones arguing that the “percentage-based nature of the cap ensures that the studies are scaled to the resource and transmission planning completed by the State and local regulatory authorities, while still enabling competition.”<sup>37</sup> SPP took a different route – it plans to calculate a maximum amount of capacity that each LRE may propose for inclusion in ERAS and will use a “LRE Ceiling Capacity,” which is calculated using “the sum of the LRE’s projected capacity, and RAR obligations to obtain the Projected LRE Deficiency and then multiplying that number by the Ceiling Multiplier of 1.25 (i.e., 125%).”<sup>38</sup> MISO is proposing to limit ERAS projects to 150% of the identified need because MISO’s goal is to tighten the nexus between the load need and the proposed ERAS project. Understanding that accredited capacity, depending on the fuel type, is generally lower than 100% for many resources, MISO wanted to establish a closer connection between what is needed and what is being proposed by the ERAS project. The limitation of 150% of identified MW need will strike the proper balance between having a sufficient amount of interconnection service advancing through the study process to support the identified spot

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<sup>37</sup> *California Independent System Operator Corporation*, Docket No. ER24-2671-000, CAISO’s Transmittal Letter at 6 (filed Aug. 1, 2024).

<sup>38</sup> *Southwest Power Pool*, “Tariff Revisions to Implement the Expedited Resource Adequacy Study” at 29, Docket No. ER25-2296-000 (filed May 22, 2025).

1 load or resource adequacy deficiency and preventing the overbuilding of resources through  
2 ERAS.

3 **Q. HOW IS MISO MEASURING THE 150% OF THE IDENTIFIED MW NEED?**

4 **A.** MISO is measuring the identified MW need the amount of Interconnection Service  
5 requested. Interconnection studies are based on the amount and type of interconnection  
6 service requested and they do not assess a generator's potential accreditation. Also, the  
7 accreditation of a generator associated with any particular interconnection service may  
8 change over time based on the operating characteristics of the generator, the generators  
9 attributes, and whether surplus or replacement service is utilized. Additionally, the load an  
10 ERAS request will service could have some level of demand response and the ERAS  
11 process is fuel agnostic both of which can impact eventual accreditation needs. Based on  
12 these different elements, MISO determined that the maximum amount of Interconnection  
13 Service that can be associated with an ERAS request would be linked to the amount of load  
14 being served rather than on the generator's potential accreditation.

15 **Q. WHY IS MISO STILL REQUIRING HIGHER FINANCIAL COMMITMENTS TO**  
16 **PARTICIPATE IN THE ERAS PROCESS?**

17 **A.** First, a higher D1 application fee is necessary to implement the temporary ERAS process  
18 and cover costs related to processing ERAS Interconnection Requests such as tools  
19 improvement, including improvements to MISO's application portal, and/or any additional  
20 staffing. This higher and non-refundable application fee will also increase the financial  
21 obligations of the applicants, which will ensure that only "shovel ready" projects will be  
22 submitted to ERAS.

Second, it is critical that ERAS Interconnection Customers have a greater financial stake upfront for ERAS Interconnection Requests beyond study deposits spent in the study process, as it will encourage a higher level of due diligence and commercial readiness. The increased M2 financial exposure of \$24,000 per MW is based on the existing MISO Provisional Interconnection Service's milestones requirements as it represents the same level of upfront commitment for M2, M3, and M4 an Interconnection Customer would make in the DPP three phased process (i.e. \$8,000 per MW per phase). Figure 3 presented below demonstrates the differences between the refined ERAS proposal and existing DPP financial requirements. The red font indicates what requirements were added or changed since the original ERAS proposal.

**Figure 3: ERAS, DPP, and Common Requirements**

| ERAS requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | DPP requirements                                                                                                                                                                                                                                                                                                                                                                                         | Technical requirements                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>D1 = non-refundable \$100,000</li> <li>D2 = \$50,000 - \$640,000 (dependent on project size)</li> <li>M2 = \$24,000/MW</li> <li>100% site control (site and POI)</li> <li>Service type: NRIS</li> <li><b>RERRA Verification</b></li> <li>Executed agreement/PPA/BTA</li> <li><b>COD no later than 3 years from 2025/2026 submission</b></li> <li><b>No more than 68 total ERAS projects</b> <ul style="list-style-type: none"> <li>8 project carve out for restructured states</li> <li>10 project carve out for IPPs with agreement with entities other than LSEs</li> </ul> </li> <li><b>No more than 10 projects studied per quarter</b></li> <li><b>Interconnection Service must not exceed 150% of the identified MW need</b></li> <li><b>Project and RA/reliability need must be within the same Local Resource Zone</b></li> <li><b>IC must identify specific load addition and/or RA deficiency the project will address (MW value, location, etc.) – this information will be made public</b></li> </ul> | <ul style="list-style-type: none"> <li>D1 = \$7,000</li> <li>M2 = \$8,000/MW</li> <li>M3 = 20% of NU - M2</li> <li>M4 = 30% of NU - M2 and M3</li> <li>50% POI site control or \$80,000/line mile with 100% generating facility site control</li> <li>Service type: ERIS or NRIS</li> <li>COD no more than 5 years from submission, plus 3 years during negotiation, plus 3-year grace period</li> </ul> | <ul style="list-style-type: none"> <li>Synchronization Date</li> <li>Commercial Operation Date</li> <li>Interconnection Facilities In-Service Date</li> <li>Service Type (NRIS)</li> <li>Generator Output</li> <li>Primary Fuel Type</li> <li>Generator Manufacturer &amp; Model Number</li> <li>Library Stability Model</li> <li>One-Line Diagram</li> <li>Generating Facility Data</li> <li>Step-Up Transformer Data</li> </ul> |

**Q. WOULD ERIS REQUESTING NRIS QUALIFY UNDER ERAS?**

**A.** No. One of the eligibility requirements for ERAS is that it must represent new incremental capacity. In the instance of an interconnection request with ERIS working to add NRIS to

1        their request, this would not represent new capacity but rather an uprate to existing  
2        interconnection service. This type of request does qualify for an exemption to the queue  
3        cap though and can proceed through the next DPP cycle automatically.

4        **Q.     CAN EXTERNAL GENERATING RESOURCES REQUESTING NEW**  
5        **INCREMENTAL NEW CAPACITY REQUEST ERAS?**

6        **A.**     Yes. An ERAS request associated with an external generating resource, requesting  
7        External NRIS, would be studied under the standing NRIS study procedures covered under  
8        the proposed section 3.9.3 of Attachment X. This proposed project must still meet all the  
9        other ERAS eligibility requirements including providing a RERRA verification.

10       **Q.     WHY IS MISO STILL REQUIRING 100% SITE CONTROL FOR ERAS**  
11       **PROJECTS?**

12       **A.**     The increased gating requirements involving Site Control and financial milestones for  
13       ERAS Interconnection Requests are reasonable because they reflect the importance of  
14       preserving the integrity and certainty of these projects. It also helps to ensure that MISO  
15       will not get inundated with projects that are not shovel ready even with the new ERAS cap.  
16       Requiring 100% Site Control to the POI with the ERAS application submittal, along with  
17       the existing requirement of 100% Site Control for the Generating Facility encourages only  
18       shovel ready project applicants apply to ERAS. ERAS Interconnection Requests must  
19       address a resource adequacy and/or reliability need in the short-term, which essentially  
20       requires the project to be shovel ready in the next few years. The 100% Site Control  
21       requirement is also designed to discourage speculative and non-ready projects from



entering ERAS. To that end, MISO also determined that there would be no Financial Security option for the POI Site Control like is available within the DPP process.

**Q. WHY DOES AN ERAS INTERCONNECTION REQUEST NEED TO HAVE AN ACCELERATED COMMERCIAL OPERATIONS DATE (“COD”)?**

**A.** Under the current DPP timeline requirements, to use an example, an Interconnection Request submitted in the 2025 DPP study cycle would not need to come online before 2036. First the applicant into the DPP process can have a COD that is no more than 5 years out. Second, during GIA negotiations the Tariff allows the IC to extend the application COD by an additional 3 years. And finally, the *pro forma* GIA allows for a 3 year grace period beyond the COD documented in the GIA for a total of 11 years after initial submission.

Given the urgent resource adequacy needs identified earlier, another tool or mechanism is needed to ensure that the ERAS Interconnection Requests come online as soon as possible. MISO is requiring that ERAS projects have a COD within 3 years of their ERAS submission date unless the project is deferred to a later quarter at which point the COD can be adjusted during GIA negotiations to be no more than 3 years from the kickoff of that project’s ERAS quarterly study cycle. Interconnection Service granted through ERAS would continue to have an additional grace period of 3 years from the COD date in the EGIA to become commercial as noted in MISO Appendix 6 Generator Interconnection Agreement (i.e. the *pro forma* GIA). This COD requirement in addition to other eligibility requirements, including increased financial commitments and obtaining 100% Site Control, will ensure that only projects that can achieve commercial operations quickly participate in ERAS.

1 **Q. HAVE STAKEHOLDERS OR OTHER INTERESTED PARTIES EXPRESSED**  
2 **CONCERNS REGARDING THE COD REQUIREMENT?**

3 **A.** Yes. ERAS has ultimately been crafted in a transparent and collaborative manner to  
4 achieve a near term resource adequacy goal to maintain reliable grid operations. MISO  
5 worked to balance the end date to enable projects at differing points in the preparation  
6 process to participate in ERAS – some projects will be ready to participate this year, while  
7 others are working to have their projects ready to participate in 2026 or later. MISO will  
8 allow an extension on an ERAS project's COD deadline if it is deferred to a later study  
9 quarter.

10 **Q. HAS MISO CONSIDERED THAT ERAS INTERCONNECTION REQUESTS**  
11 **WILL BE SUBJECT TO THE POTENTIAL DELAYS (SUPPLY CHAIN,**  
12 **REGULATORY, SITE CONTROL, ETC.) THAT DPP PROJECTS ARE SUBJECT**  
13 **TO?**

14 **A.** Yes. MISO has taken these concerns into consideration. During the original ERAS  
15 discussions, we continued to hear from our Interconnection Customers that these issues  
16 persist. For this reason, MISO is proposing that Interconnection Service granted through  
17 ERAS would utilize the same grace period of 3 years from the COD date in the ERAS  
18 application to become commercial that all other Interconnection Customers have as noted  
19 in the MISO *pro forma* GIA. MISO recognizes there are numerous industry challenges  
20 outside of developers control and wanted to provide a sufficient amount of time for the  
21 developers to get their projects ready within this context. The current timeframe proposed

1 for ERAS should be sufficient to provide developers with time to overcome any supply  
2 chain or other unknown delays.

3 It should also be noted that as previously mentioned, given the increased gating  
4 requirements (Site Control, increased financial commitment), this ultimately helps to  
5 ensure that MISO will not get inundated with projects that are not shovel ready.

6 **Q. HOW WILL MISO CLOSE OUT THE ERAS PROCESS?**

7 **A.** The ERAS process will sunset at the earlier of the completion of sixty-eight ERAS  
8 Interconnection Request studies or by August 31, 2027. This time limitation also applies  
9 to the projects proposed by the retail choice states – if the eight projects are not submitted  
10 by the sunset date, the ERAS process will still close on August 31, 2027. The same is true  
11 for the projects proposed under the carve out for IPPs with agreements with entities other  
12 than LSEs – if the ten projects are not submitted by the sunset date, the ERAS process will  
13 still close as planned. MISO will only accept applications to be included in the last  
14 Quarterly Study Period prior to the sunset date. MISO will post the application deadline  
15 for each Quarterly Study Period on the MISO public website.

16 **VI. ERAS PROCESS COORDINATION**

17 **A. Coordinated Study Processes**

18 **Q. PLEASE DESCRIBE THE EXPEDITED PROCESSING OF THE EGIA.**

19 **A.** The refined ERAS process will still enable all parties to move expeditiously through EGIA  
20 negotiations. Because of the critical reliability need for ERAS Interconnection Requests  
21 and to ensure an overall expedited process for commercial operations, the EGIA follows  
22 an expedited timeline. The drafting of the EGIA by the MISO team will begin as soon as  
23 possible. Additionally, under the EGIA timing requirements for ERAS, MISO will tender

1 a draft EGIA within five (5) Business Days after the Interconnection Customer provides  
2 notice to proceed to EGIA negotiations. Following this, an EGIA would be tendered in  
3 less than 30 business days.

4 **Q. HOW WILL MISO PROVIDE INTERCONNECTION CUSTOMERS**  
5 **SUFFICIENT TIME TO EXECUTE A GIA?**

6 **A.** In crafting the ERAS process, MISO recognized the need to implement a shorter timeframe  
7 for the EGIA negotiation process to ensure that the overall ERAS process could be  
8 completed within 90 days. To that end, MISO will begin drafting an EGIA document as  
9 soon as possible. This ultimately enables the EGIA negotiation process to work in parallel  
10 with the study process and therefore the EGIA draft will be substantially further along at  
11 the end of the ERAS study process. As a result, after the Interconnection Customer issues  
12 their notice to proceed, an EGIA can be tendered for the execution in less than 30 business  
13 days.

14 **Q. CAN INTERCONNECTION CUSTOMERS WITHDRAW FROM ERAS?**

15 **A.** While there is a critical need for these ERAS Interconnection Requests, the proposed  
16 requirements still allow the Interconnection Customers an opportunity to withdraw once  
17 they are aware of the Network Upgrade costs. Moreover, it is possible that an  
18 Interconnection Customer may discover various issues with the proposed site in the ERAS  
19 process that would influence their desire to withdraw, or the RERRA could ultimately deny  
20 the project through their own processes. If the Interconnection Customer withdraws and  
21 terminates its EGIA after execution by all parties or after the EGIA is filed unexecuted, the  
22 Interconnection Customer will remain liable for the Network Upgrades documented in the  
23 EGIA and corresponding Facilities Construction Agreements (“FCAs”) or Multi-Party

1 Facilities Construction Agreements (“MPFCAs”), including those Network Upgrades  
2 arising from the Affected System Study process. If the ERAS Interconnection Request is  
3 withdrawn prior to EGIA execution, then there is no agreement to fund Network Upgrades  
4 and no impact on downstream planning processes. In these cases, the Interconnection  
5 Customer would be refunded their M2 payment and any remaining D2 payments not  
6 utilized to perform the study.

7 The increased penalties for Interconnection Customer withdrawals after the execution of  
8 the EGIA, along with the other requirements like the off-taker agreement and the RERRA  
9 notification, will help ensure that only critical projects needed for maintaining reliability  
10 and/or resource adequacy will apply to ERAS. Under the current effective GIP and DPP  
11 process, when an Interconnection Request is potentially withdrawn from the queue, there  
12 would be minimal financial exposure to the Network Upgrades. Given the urgent need for  
13 ERAS projects, MISO is requiring increased penalties to discourage Interconnection  
14 Customers from withdrawing from the ERAS process. More stringent requirements have  
15 the added benefit of reducing the potential speculation of the ERAS Interconnection  
16 Requests. Fewer speculative projects entering the ERAS process will result in shorter  
17 timelines for completing the ERAS Interconnection Studies. This requirement will also  
18 motivate developers to run their own studies beforehand.

19 **Q. PLEASE DESCRIBE HOW INTERCONNECTION SERVICE GRANTED**  
20 **THROUGH ERAS WILL BE STUDIED AND HOW IT WILL COORDINATE**  
21 **WITH THE CURRENT DPP PROCESS.**

22 **A.** The ERAS process will kick off starting September 2, 2025, and will integrate with existing  
23 processes without disrupting the ongoing DPP process. As explained previously in my

1 testimony, Interconnection Requests submitted through ERAS will be studied in a regional  
2 serial “first-come, first served” fashion based on the order the projects were submitted. It  
3 will follow a quarterly cadence established by proposed MISO timelines, ultimately  
4 culminating in the project receiving an EGIA in approximately 90 days. MISO proposes  
5 to utilize the existing engineering study process utilized in the DPP for ensuring full  
6 generator deliverability to the load. During the ERAS model build, all Existing Generating  
7 Facilities, included those from completed DPP cycles, the ERAS Interconnection Request,  
8 and the latest MTEP base case with all approved MTEP projects, including any recently  
9 approved Expedited Project Request (“EPR”) projects. This is the same process utilized  
10 for the DPP process except the DPP models include all higher queued Interconnection  
11 Requests from early cycle and all Interconnection Requests within that DPP cycle. ERAS  
12 studies will not include Interconnection Requests currently in the generator interconnection  
13 queue that do not have a GIA. This is important as many of the projects within the queue  
14 are speculative in nature given that more than 70% of the Interconnection Requests  
15 submitted into the DPP withdrawal or never get built.

16 Before every ERAS cycle, all Interconnection Requests with a GIA approved since the last  
17 base case was created will be added to the base case for the following ERAS cycle but are  
18 not included in any ongoing DPP studies. The base case for each DPP cycle is never  
19 updated once the study process is kicked off except for generation changes due to  
20 Interconnection Request withdraws or generator retirements. This ensures that the  
21 transmission capacity made available for DPP projects is not being taken away by ERAS  
22 Interconnection Requests approved outside of the DPP cycle.

Once the DPP cycle has concluded, the output from that process, and any completed ERAS and EPR projects will be used to populate a new MTEP base case. Any transmission issues identified by reconciling the cases will thus be addressed through the existing MTEP process. The next DPP cycle will then use the latest approved MTEP base case that has reconciled the models. This insulates existing DPP projects from negatives impacts or cost shifts due to the existence of the ERAS process. The contingent facilities listed in the EGIA would only be those facilities in the model used for the ERAS study and those Network Upgrades that come up as part of the ERAS study.

**Q. WILL ERAS PROJECTS NEGATIVELY IMPACT EXISTING PROJECTS IN THE GENERATOR INTERCONNECTION QUEUE?**

**A.** No. Under this model framework, the standing MISO DPP three phase process will not be impacted by ERAS as ERAS Interconnection Requests will not be included in ongoing DPP studies thereby not utilizing any available transmission capacity in those studies. The normal DPP process uses the most up to date MTEP base case when the study is kicked off and is not modified to include later approved MTEP projects or ERAS Interconnection Requests. Although these projects approved after the kickoff the DPP process are not included in the study, there is an existing process that allows these projects to mitigate constraints within the DPP process with MTEP projects. Network Upgrades approved through the ERAS process will also be used to mitigate constraints in the DPP process. ERAS will only positively impact the Network Upgrade identification process of these other processes.<sup>39</sup> This coordinated process is demonstrated in Figure 4 below.

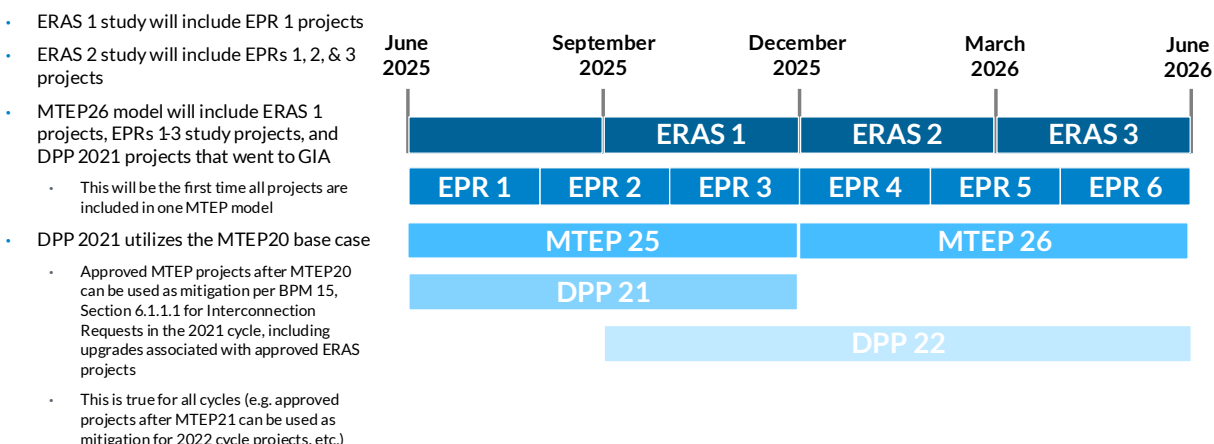
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<sup>39</sup> This is further addressed in section 6.1.1.1 of the BPM-015 Generator Interconnection Business Practice Manual.



**Figure 4: MISO Coordinated Study Processes**

The ERAS process will kickoff quarterly starting September 2025 and will integrate with existing processes without negatively impacting those ongoing studies



**Q. WHAT WILL HAPPEN IF TRANSMISSION CAPACITY IS OVERALLOCATED DUE TO AN APPROVED INTERCONNECTION REQUEST IN ERAS AND THE DPP?**

**A.** On the rare occasion that overallocation may occur, it would be discovered as part of the standing MTEP Deliverability Analysis. The process has been structured so that there cannot be any negative impact to the projects currently in the DPP process, but this can lead to a potential occasion of overallocation. There will be no negative implications for either the DPP Interconnection Request or the ERAS Interconnection Request due to this rare occurrence. Both will be allowed to proceed, and neither will be required to pay additional costs due to the overallocation. MISO performs generator deliverability analysis as a part of the current MTEP process to ensure continued deliverability of generating units with Network Resource Interconnection Service. Results of the assessment are based on an analysis of near-term (5-year) and long-term (10-year) summer peak scenarios. Any

constraints that are identified as needing mitigation would be formalized in a future MTEP project.

**Q. WHO IS ASSIGNED THE COST OF THE MTEP PROJECT APPROVED TO MITIGATE ANY OVERALLOCATION SCENARIO?**

**A.** The cost of the MTEP project will be allocated based on the existing Tariff rules, which is likely to be the load within the transmission pricing zone where the transmission upgrade is located. However, it is also expected that this load will include the load that is benefiting from the ERAS and DPP Interconnection Requests and benefits from the Network Upgrades that were funded by the generators that went through those processes. In addition, the cost shift is consistent with existing processes. In particular, MTEP projects that are approved after the start of a DPP cycle or even MTEP projects that are approved after the execution of a GIA, can be utilized to mitigate constraints identified in the DPP process. Therefore, an Interconnection Request can be contingent on that MTEP project instead of relying on the original Network Upgrade identified through the DPP process to mitigate that DPP constraint. As a result, the elimination of that Network Upgrade, the Interconnection Customer will not have to pay those costs. This is a cost shift where the load will pay for the MTEP project instead of the Interconnection Request paying for the Network Upgrade.

**Q. ARE THERE OTHER INSTANCES WHERE PREVIOUS PARALLEL STUDIES CAN RESULT IN NEW CONSTRAINTS THAT ARE IDENTIFIED LATER IN A FUTURE MTEP PROCESS?**

**A.** Yes. MISO has multiple planning processes, many performed in parallel. These processes have their own unique modeling assumptions that are vetted through the stakeholder

1 process. These processes also have different cost allocation methodologies based on “but  
2 for” and “beneficiary pay” principles that are vetted through the stakeholder process. Some  
3 examples are Baseline Reliability Projects, identified to meet standards for both NERC and  
4 regional reliability; Market Efficiency Projects, which address economic driven  
5 congestion; Multi-Value Projects, identified through the Long Range Transmission  
6 Planning process; Transmission Deliverability Service Projects, identified to support  
7 transmission service; Interregional Transmission Projects, identified to improve reliability  
8 and/or economic driven congestion within MISO and a neighboring RTO; Other Projects,  
9 identified to support local reliability issues like those identified to add load in the EPR  
10 process; Generator Interconnection Projects, which are Network Upgrades identified to  
11 reliably connect new Interconnection Requests; and new Generating Facilities that are  
12 approved through the DPP, surplus or replacement processes.

13 After all these projects are approved through their relevant processes, they are then  
14 included in the base cases of subsequent studies based on the modeling assumptions for  
15 those studies. It is not uncommon for new constraints to arise in subsequent studies driven  
16 by all of the approved transmission and generation projects, as well as due to new load  
17 growth, and the retirement of generation. Constraints could also be negatively impacted by  
18 similar processes in neighboring Transmission Providers. As these new constraints are  
19 identified new mitigation is identified, which could include another new transmission  
20 project necessary to ensure reliability.

1                    **B. ERAS and the EPR Process**

2    **Q.    WHY IS THERE AN EPR GENERATION SHORTAGE?**

3    **A.**    Expedited Project Reviews (“EPRs”) are requests by a Transmission Owner for MISO to  
4            quickly review the impacts of a proposed transmission project on the MISO Transmission  
5            System. A Transmission Owner requests these reviews when it determines that system  
6            conditions warrant the urgent development of system enhancements that would be  
7            jeopardized unless MISO performs an expedited review of the impacts of the project.<sup>40</sup> By  
8            default, MISO reviews such projects for inclusion in MTEP within a thirty-day timeframe.  
9            EPR requests generally reflect an emergent need on the Transmission System that must be  
10           evaluated more quickly than the normal MTEP planning process and timeline allow. The  
11           announcement of a large and concentrated load addition at a given point on the  
12           Transmission System, such as a data center, is a common driver for EPRs. The EPR  
13           process reflects the fact that this load must be served and that doing so may require rapid  
14           enhancements to the transmission system. Recently, MISO has had to rely on increased  
15           transfers to serve these large loads due to the lack of local generation to serve the load,  
16           thereby increasing the amount of transmission upgrades necessary to support the load  
17           additions. Additionally, Transmission Owners have been unable to support the full amount

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<sup>40</sup> EPRs are governed by Appendix B, Section VII of the Transmission Owners’ Agreement, Section I.D.1.c of Attachment FF to the Tariff and Section 4.1.4 of Business Planning Manual 20 (Transmission Planning).

1 of load a customer would want to connect at a particular location due to the inability to  
2 quickly add local generation to support the load.

3 **Q. HOW ARE EPRs CONNECTED TO ERAS?**

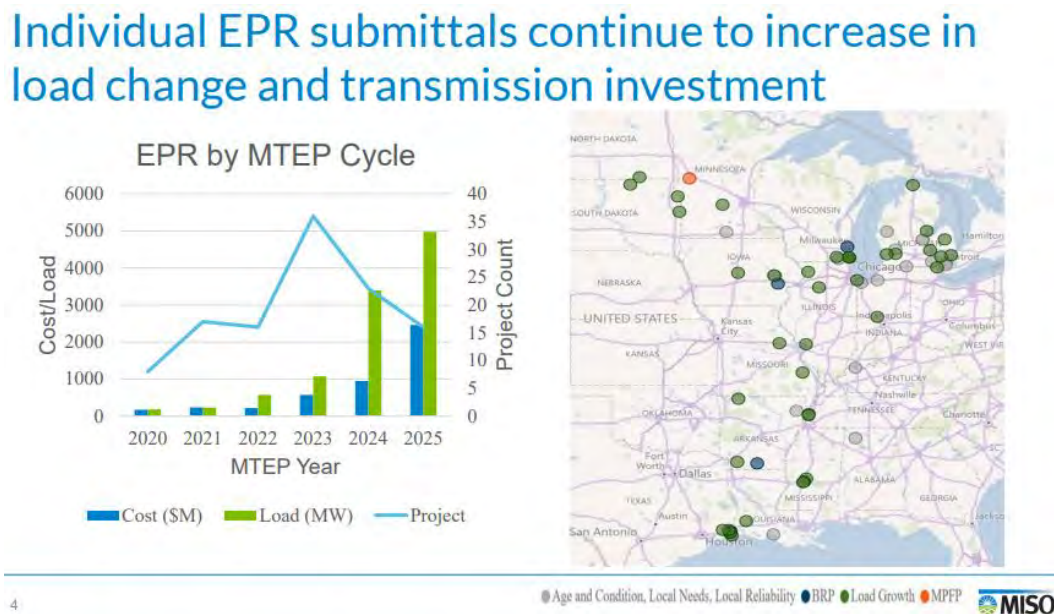
4 **A.** While EPRs address the transmission development demands associated with large load  
5 additions, these additions may also require a corresponding need to evaluate generation on  
6 an expedited basis to serve this load. The EPR process models generation that has a signed  
7 GIA, but there is no guarantee that new generation will be interconnected to the  
8 Transmission System at a point that can reliably and cost effectively serve the emergent  
9 load need. In fact, given the length of MISO's DPP queue delays and the typical generation  
10 development timeframe, it is unlikely such load demand was known at the time that any  
11 generation projects with a GIA were originally submitted into the queue. Thus, it is  
12 unlikely that a generating unit with a high degree of certainty of being online by the needed  
13 date of that load driver also happened to be situated in a place where it could reliability  
14 serve the emergent load need without significantly extending the length (and cost) of the  
15 EPR in order to connect at a point on the Transmission System where excess generation is  
16 available. This is especially true given the fact that the EPR can be the first and only  
17 connection from that load source to the Transmission System. The EPR process is about  
18 approving the transmission necessary to support new load growth, but not the load itself.  
19 The EPR process allows for a faster study method to allow these loads to connect sooner  
20 than going through the traditional MTEP process. A similar expedited process is needed  
21 to study new generation that is necessary to serve spot loads added through EPR. ERAS

supplies this previously missing and much needed connection that complements the EPR process.

**Q. HOW OFTEN DOES MISO RECEIVE EPRs?**

**A.** In the past, EPRs were comparatively uncommon. However, MISO's most recent data shows a sharp increase in the number of EPRs being submitted in the last few years. As an example, simply comparing the difference from the January PAC Meeting EPR presentation to the current version as of April PAC Meeting EPR presentation, which takes into account the new EPR projects that have recently been submitted, the following figures demonstrate the huge increase and the need for generation to cover this immediate spot load growth.

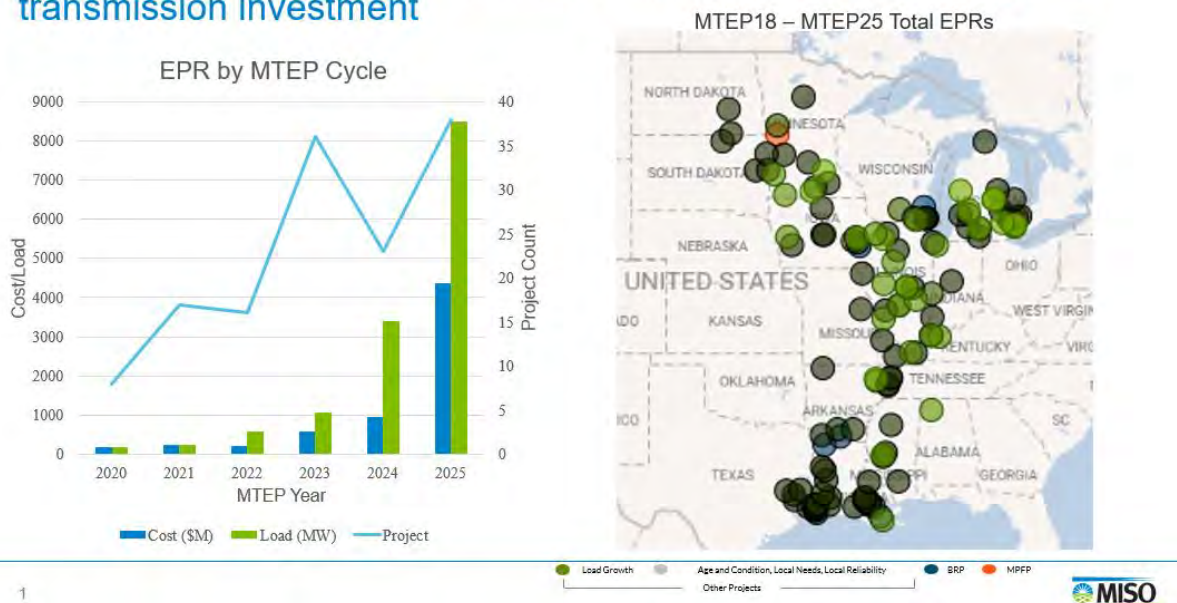
**Figure 5: January 2025 PAC EPR Presentation<sup>41</sup>**



<sup>41</sup> MISO EPR Process Improvement Update, PAC-2024-1, Planning Subcommittee, Jan. 29, 2025, available at: [https://cdn.misoenergy.org/20250129%20PSC%20Item%2004%20EPR%20Process%20Improvement%20\(PAC-2024-1\)674593.pdf](https://cdn.misoenergy.org/20250129%20PSC%20Item%2004%20EPR%20Process%20Improvement%20(PAC-2024-1)674593.pdf).

Figure 6: April 2025 PAC EPR Presentation<sup>42</sup>

## Individual EPR submittals continue to increase in load change and transmission investment



The data in these figures demonstrates two important trends. First, there has been a substantial increase in the number of EPRs being submitted to MISO. In MTEP 20 and MTEP 21, MISO received only 8 and 17 EPRs respectively. However, MISO has already received more than 38 such requests for MTEP 25. Second, this increase in EPRs is linked to a significant increase in the associated Network Upgrade costs needed to accommodate the EPRs – jumping from an average of \$13.7 million in 2022 to \$175 million so far in 2025 as shown in the graphics above. This is in part because there is insufficient local generation to serve this load.<sup>43</sup> Absent an accelerated process like ERAS, it is unlikely that

<sup>42</sup> MISO Sharing and Coordinating MTEP and DPP to Accommodate Large Loads, PAC 2024-7, Planning Subcommittee, Apr. 23, 2025, available at: [https://cdn.misoenergy.org/20250423%20PSC%20Item%20005%20Sharing%20and%20Coordinating%20MTEP%20and%20DPP%20to%20Accommodate%20Large%20Loads%20\(PAC-2024-7\)692381.pdf](https://cdn.misoenergy.org/20250423%20PSC%20Item%20005%20Sharing%20and%20Coordinating%20MTEP%20and%20DPP%20to%20Accommodate%20Large%20Loads%20(PAC-2024-7)692381.pdf).

<sup>43</sup> A further compilation of some of these projects was recently presented at the April PAC meeting. *Expedited Project Reviews*, Planning Advisory Committee (PAC), Apr. 16, 2025, available at: <https://cdn.misoenergy.org/20250416%20PAC%20Item%20004a%20Expedited%20Projects%20Reviews690477.pdf>.



the generation needed to support spot load will be located in close proximity to the load being added, thus increasing the need for and cost of additional transmission to bring in generation from remote areas.

**Q. WHY IS LOCAL GENERATION PREFERABLE WHEN ADDING LARGE SPOT LOADS?**

**A.** Local generation is preferable when adding large spot loads for multiple reasons. First, local generation will reduce the need for large transmission upgrades to support the new load and generation. Instead of making transmission investments around the remote generation to support the generation exports or making transmission investments to support importing power to serve the load, the load and generation rely on each other and negate the needed transmission investment. Second, there is a limited amount of import capabilities between Local Resource Zones. Relying on generation within the same zone will remove the need to import power from another zone, which benefits and helps all load within the zone. Third, relying on generation within the same zone removes price divergences between the load and generation. The EPR process uses whatever generation it can to support that load addition. ERAS will help reduce network upgrade costs by providing a process to quickly add local generation that the EPR process can rely on. The new LRZ requirement in the refined ERAS process will also ensure that the new generation is local to the resource adequacy and/or reliability need.

**Q. WHY IS ERAS NEEDED TO ADDRESS THE EPR GENERATION SHORTAGE?**

**A.** Some protestors in the original MISO ERAS filing argued that MISO should not attempt to meet the load need by its anticipated need-by date. Instead, they argue that MISO should wait and utilize the existing 53 GWs or more of generation with signed GIAs that are

1 currently delayed in coming online in the time period needed to address the imminent  
2 resource adequacy and/or reliability needs.<sup>44</sup> I have evaluated this approach and have  
3 concluded it is impractical and unreasonable for several reasons.

4 First, the EPR process already includes in its models any generation units with signed GIAs  
5 that may or may not come online in time. Thus, even with MISO taking into account these  
6 GIAs, there is still a local generation deficiency to meet the load need. Second, it is not  
7 reasonable to assume in all cases that generation coming online will meet the specific needs  
8 of emerging spot load. For example, while a superficial glance at the number of units with  
9 signed GIAs may suggest that there is a sufficient number of MW somewhere on the MISO  
10 system, these specific units may not always be sufficient to meet the load need. For  
11 instance, if a data center with a 2 GW load need plans to run continuously (or mostly at  
12 night), the fact that there are 2 GW of uncommitted solar with a near term Commercial  
13 Operation Date is likely insufficient to reliably meet this need. Third, these generation  
14 units with signed GIAs may not be geographically situated in proximity to the spot load  
15 and, due to the nature of their agreements, are precluded from modifying their designated  
16 Points of Interconnection. Finally, there is no guarantee that these units with a near-term  
17 Commercial Operation Date will actually come online by that necessary start date. I have  
18 observed a significant increase in the number of units with GIAs that are not in service by  
19 their Commercial Operation Date and are using or expect to use much of the three-year  
20 grace period allowed by the *pro forma* GIA.<sup>45</sup> In addition, an increasing number of these

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<sup>44</sup> A dashboard of this 50 GW in generation is available in MISO Generator Interconnection COD Report: Overview, last updated June 5, 2025.

<sup>45</sup> MISO Generator Interconnection COD Report: Overview, last updated June 5, 2025, available at: <https://app.powerbigov.us/view?r=eyJrIjojOTU1ODlhNTktMjZjZC00N2I2LWJhYjMtMDEwOGNmZDM5OD>

units are requesting extensions of their Commercial Operation Date through waivers. These facts lead me to conclude that there is an urgent need for a specialized interconnection process that can deliver highly certain generation that is tailored towards the specific load need and already has some level of commercial arrangement to serve it, on an accelerated basis. Absent the ERAS tool, I expect to see: (1) a continued escalating number of EPR submissions relying on remote generation; (2) increasing Network Upgrade costs associated with EPRs; (3) and instances where load that cannot be served as of the date it plans to come online.

**Q. WHAT CAN BE DONE TO IMPROVE THIS IMPENDING SITUATION?**

**A.** It is necessary for MISO to establish a new process from the existing that can enable Interconnection Customers to work with RERRAs to identify load needs and work with LSEs or other developers to address them. After working together to develop the best project to address a resource adequacy and/or reliability need, the Interconnection Customers can propose highly certain projects to participate in ERAS and ideally be brought online on an expedited basis to meet the load need. A new process is needed that will enable potential Interconnection Customers to confer with RERRAs and load drivers about urgent reliability or resource adequacy needs; scope and present their proposed projects to the RERRA and need/driver or LSE; and then come to MISO with highly certain projects that can be studied and brought online on an expedited basis to meet the load need. While MISO expects that the vast majority of Interconnection Customers and resource adequacy needs will not require such a process, as they will continue to rely on

1 the DPP queue, MISO still requires a temporary and specialized process to rapidly study  
2 those few projects that are slated to address those critical and urgent needs. MISO cannot  
3 force generation to come online, or cherry pick which generation projects should be  
4 expedited over others. But what it can do is create a pathway for generation that is shovel  
5 ready, slated to meet specific needs that the applicable RERRA has validated, and for  
6 which MISO should study on an accelerated basis. This process should have the guardrails  
7 proposed in this refined ERAS filing to ensure that the process is available to those  
8 critically needed projects with commercial certainty without otherwise becoming a  
9 substitute for the DPP.

10 **C. ERAS and the Affected System Studies Process**

11 **Q. WHAT IS THE PROCESS FOR CONDUCTING ERAS AFFECTED SYSTEM**  
12 **STUDIES?**

13 **A.** The refined ERAS proposal was designed with the expectation that MISO would utilize  
14 existing affected system studies processes. MISO is actively working with multiple seams  
15 partners to develop additional seams procedures to incorporate the ERAS process. MISO  
16 is committed to and planning to be able to deliver those on an expedited basis consistent  
17 with ERAS even before specific processes are addressed and would follow the existing  
18 tariff language and does not prevent MISO from doing this faster.

19 **Q. IS MISO CONTINUING TO IMPROVE QUEUE COORDINATION WITH**  
20 **INTERCONNECTION CUSTOMERS AND TRANSMISSION OWNERS?**

21 **A.** Yes. MISO always seeks proactive continuous improvement of its interconnection queue.  
22 In addition to these proposed Tariff changes, MISO has multiple efforts underway to  
23 enhance the queue experience. Examples of ongoing or completed initiatives include the

1 queue reforms approved in January 2024 to increase readiness, the queue cap approved in  
2 January 2025, implementation of SUGAR software to automate and increase the speed of  
3 the Phase I study, further improvements to the generator interconnection portal which  
4 automates some manual processes in the interconnection application process, and the  
5 Commercial Operation Date tracker, which debuted in early 2025 and provides greater  
6 transparency into the status of future Generating Facilities in MISO.<sup>46</sup> These initiatives  
7 will strengthen Interconnection Customer workflow throughout the Interconnection  
8 Request lifecycle. MISO is coordinating the development of these enhancements through  
9 the stakeholder process and outside vendors. MISO is also working to identify additional  
10 processes and tool improvements to improve the overall DPP process.

11 **Q. WILL ERAS INTERCONNECTION REQUESTS GO THROUGH THE**  
12 **AFFECTED SYSTEM EVALUATION PROCESS?**

13 **A.** Yes. MISO must coordinate the impact of these projects with its existing Affected Systems  
14 partners to ensure they do not cause reliability impacts on non-MISO transmission systems.  
15 The Affected System Studies analysis is an important part of the standing interconnection  
16 process and must be performed as part of this evaluation. Subsequently, where available,  
17 MISO will incorporate the results of the associated Affected System Studies analysis in the  
18 EGIA. For those instances where the results from the Affected System Study analysis are  
19 not available to incorporate, given the accelerated timeframe for ERAS, the results will be  
20 provided at a later date.

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<sup>46</sup> MISO, *SUGAR Implementation* (Mar. 4, 2025), available at:  
<https://cdn.misoenergy.org/20250304%20IPWG%20Item%2005%20SUGAR%20Implementation682016.pdf>  
MISO, *Liaison Report* (Mar. 4, 2025), available at:  
<https://cdn.misoenergy.org/20250304%20IPWG%20Item%2002%20Liaison%20Report681818.pdf>.

1 It should be noted that in the event that the Interconnection Customer withdraws and  
2 terminates its EGIA after execution of the EGIA by all parties or after EGIA is filed  
3 unexecuted, the Interconnection Customer will be liable for the Network Upgrades  
4 documented in the EGIA and corresponding Facilities Construction Agreements or Multi-  
5 Party Facilities Construction Agreements, including those Network Upgrades arising from  
6 the Affected System Study process. This will ensure that MISO will be able to  
7 expeditiously process the shovel ready ERAS Interconnection Requests while providing a  
8 protection mechanism to the existing Affected Systems coordination process.  
9 Additionally, ERAS Interconnection Requests will be subject to JTIQ requirements if they  
10 meet the criteria for inclusion in the JTIQ Screening Group or Participation Group on the  
11 same basis as projects in the DPP. Participation in JTIQ will serve as Affected System  
12 process with the Southwest Power Pool (“SPP”).

13 **Q. WILL THE AFFECTED SYSTEM STUDIES BE CONDUCTED IN A CLUSTER?**

14 **A.** MISO will request that these studies be completed on a serial basis, but MISO is unable to  
15 control how an affected system will perform its own studies or on what timeframe. MISO  
16 will explicitly request that these be studied on a serial basis and MISO will transfer ERAS  
17 projects to the affected system serially and not as a cluster in order to enable the affected  
18 system to study the proposed projects serially. At the end of the day, only the affected  
19 system can determine for itself how and when it will carry out these studies. MISO will  
20 work with its seams partners to determine if changes to relative queue priority are necessary  
21 for ERAS. For those seams partners that utilize a close of study phase or decision point to  
22 establish queue priority, MISO will assert a queue priority date of when the ERAS quarterly  
23 study cycle is kicked off.

1   **Q.   DOES REQUIRING ERAS CUSTOMERS TO SIGN EGIAS WITHOUT**  
2       **POTENTIALLY HAVING THE AFFECTED SYSTEM STUDY RESULTS**  
3       **VIOLATE ORDER NO. 2023?**

4   **A.**   No. This is a separate limited process that was created outside the traditional DPP process  
5       and thus is out of scope of Order No. 2023, which is designed for cluster-based studies.  
6       ERAS is not a traditional queue process but is still consistent with the goals of Order No.  
7       2023 which included enabling reforms of current generator interconnection procedures.  
8       Moreover, ERAS project participants are aware of the EGIA requirements prior to  
9       submitting their projects to the ERAS process. As MISO noted in its transmittal letter,  
10      because ERAS is a standalone process, it should be viewed as one large independent entity  
11      variation with a defined rule set rather than individual independent entity variations for the  
12      numerous differences between the cluster-based process outlined in Order 2023-2023-A  
13      and ERAS serial-based study approach.

14               **D. A Transparent ERAS Process**

15   **Q.   WILL MISO PUBLICIZE THE ERAS INTERONNECTION REQUESTS?**

16   **A.**   Yes. MISO commits to transparency in the refined ERAS process due to the critical nature  
17      of these projects. Similar to the EPR process, the ERAS information will be posted on the  
18      ERAS webpage located on the MISO public website, including the name of the  
19      Interconnection Customer that has submitted the ERAS Interconnection Request along  
20      with other details of the ERAS projects.



1 **Q. WHAT INFORMATION DOES MISO PLAN TO POST ON ITS ERAS**  
2 **WEBPAGE?**

3 **A.** On the newly created ERAS webpage, MISO plans to publish an informational guide  
4 regarding the requirements and process for participation in ERAS. After the first  
5 submission deadline for an ERAS quarterly study cycle, MISO plans to publish all ERAS  
6 projects that have been reviewed and accepted into the ERAS process. MISO will provide  
7 information similar to that found in its GI Interactive Queue for DPP projects, including  
8 items like the project number, request status, application in-service date, and fuel type.<sup>47</sup>  
9 And as previously explained in my testimony, MISO will additionally publish the non-  
10 confidential summary of the following information supplied by the applicant: the developer  
11 of the ERAS project, details of the need the ERAS project is addressing, what cap carve  
12 out was requested (if applicable), what LRZ region the project is located in, and a general  
13 description of what the load it is serving (i.e., a data center, manufacturing plant, a  
14 reliability need, etc.). MISO is also planning to publish what quarters each of the approved  
15 ERAS projects will be studied in.

16 **Q. HOW DID YOU ACCOUNT FOR OPEN ACCESS REQUIREMENTS WHEN**  
17 **DEVELOPING THE ERAS PROCESS?**

18 **A.** The ERAS requirements are facially neutral, fuel agnostic and allow for the potential  
19 inclusion of any resource regardless of technology. These are shovel ready projects to meet

---

<sup>47</sup> MISO GI Interactive Queue, last updated June 5, 2025, available at:  
<https://www.misoenergy.org/planning/resource-utilization/GI-Queue/gi-interactive-queue/>.

1 an urgent resource adequacy and/or reliability need within the MISO footprint. MISO also  
2 expanded who could apply to ERAS to include a wide variety of applicants.  
3 ERAS Interconnection Requests will be subject to more stringent criteria than projects  
4 entering the generator interconnection queue. MISO's ERAS requirements will inevitably  
5 limit entry which strikes a reasonable balance between allowing project developers to help  
6 address the urgent reliability needs of the MISO footprint, while avoiding an influx of  
7 projects that could overwhelm the normal DPP queue and lead to further delays,  
8 exacerbating the current inability of projects to come online.

9 **Q. WHAT ARE THE BENEFITS OF ESTABLISHING AN ERAS PROCESS?**

10 **A.** If the proposed temporary requirements for the refined ERAS process are adopted, MISO  
11 expects to comprehensively address significant near-term resource adequacy and reliability  
12 concerns in the MISO footprint. ERAS is a temporary process designed to help speed up  
13 the time to obtain an executed EGIA so urgent reliability projects can be built more quickly  
14 until the DPP interconnection queue process improved timeliness takes effect. The queue  
15 will remain the standard way to add new resources to the system; ERAS is a temporary and  
16 targeted process to complement the generator interconnection queue process. With ERAS,  
17 MISO will be able to efficiently and effectively address near-term resource adequacy  
18 and/or reliability needs with specific projects that are tied to those needs.

19 **IV. CONCLUSION**

20 **Q. IN YOUR OPINION, IS MISO'S FILING JUST AND REASONABLE?**

21 **A.** Yes. This Filing addresses certain specific needs that MISO, the state Commissions, and  
22 the stakeholder process identified. To ensure that MISO is on the right track to resolving  
23 its resource adequacy shortfall potential, MISO requests that the Commission approve this

1           proposal. The proposed Tariff revisions enable MISO to take the necessary steps to ensure  
2           reliability on the Transmission System.

3   **Q.     DOES THIS CONCLUDE YOUR TESTIMONY?**

4   **A.     Yes, it does.**

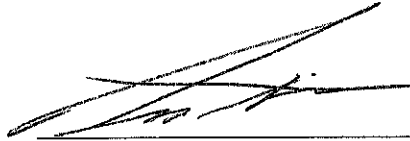
Affidavit of Andrew Witmeier

COUNTY OF HAMILTON )

)

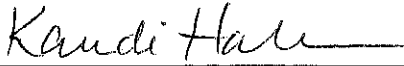
STATE OF INDIANA )

Andrew Witmeier, being duly sworn, deposes and states that he prepared the Prepared Direct Testimony of Andrew Witmeier, and the statements contained therein are true and correct to the best of his knowledge and belief.

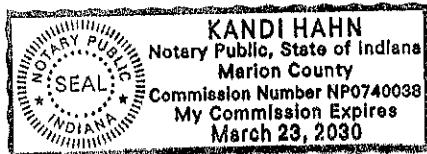


Andrew Witmeier

SUBSCRIBED AND SWORN BEFORE ME, this 4<sup>th</sup> day of June, 2025.



Kandi Hahn



BEFORE THE UNITED STATES DEPARTMENT OF ENERGY

Federal Power Act Section 202(c)     )  
Emergency Order: Midcontinent     )  
Independent System Operator     )  
(MISO)     )  
\_\_\_\_\_

Order No. 202-25-7

Exhibit to  
Motion to Intervene and Request for Rehearing and Stay of  
Public Interest Organizations

Filed September 5, 2025

# Exhibit 122

## GridLab Report



# GridLab Analysis: Department of Energy Resource Adequacy Report



**Ric OConnell**

**Rethinking Reliability**

 **July 11, 2025**

## Overview:

This memo provides a high-level overview of the recently released [Department of Energy \(DOE\) Resource Adequacy Report, released on July 7, 2025](#). This report is a result of the [Executive Order from the Trump Administration on Strengthening the Reliability and Security of the Grid](#), which directed the agency to develop and publish a methodology for “analyzing current and anticipated reserve margins for all regions of the bulk power system regulated by the Federal Energy Regulatory Commission and shall utilize this methodology to identify current and anticipated regions with reserve margins below acceptable thresholds as identified by the Secretary of Energy.”

The Executive Order also directs the DOE to prevent generation sources exceeding 50 MW from retiring or converting fuel sources if it would reduce generating capacity in at-risk regions, based on the new methodology. The DOE has so far issued two emergency orders under section 202(c) of the Federal Power Act. These orders directed plant owners and grid operators to delay by 90 days the retirement of the Campbell coal plant in Michigan owned by Consumers Energy and the Eddystone gas and oil plant in Pennsylvania, owned by Constellation. The EO and its methodology report did not include a mechanism for public input.

## Bottomline of the DOE report:

The report warns of a 100X increased risk of outages if the forecasted retirements by 2030 take place. The report blames the lack of “firm” generation replacement in the planned supply.

## Bottomline of GridLab analysis:

The report’s conclusions are problematic since the **report undercounts the resources that are likely to be added to the grid**, and **overstates** the retirements expected. Utilities and markets *already* have plans to meet increased load growth, yet the DOE report assumes they are doing nothing after 2025.

the DOE report assumes they are doing nothing after 2026.

## DOE Report Analysis – Key Takeaways:

- The report is based on three key assumptions: (1) the amount of load that will be added to the grid over the next five years, (2) the number of plants assumed to retire, and (3) the amount of new capacity added to the grid. The study used aggressive assumptions regarding load growth and retirements, but conservative assumptions about how much new generation capacity will be added, even assuming no new resources after 2026.
  - Load Growth: The report assumes 50 GW of data center load and allocates it regionally. It does not address flexibility of this load, however, which was recently demonstrated in a [report from Duke University](#) to allow for 100 GW of large load additions today with minimal grid impact. The DOE report then adds 51 GW of non-data center load, which means overall load growth by 2030 is 101 GW or 15%. For comparison, EIA assumed 6% growth in their Annual Energy Outlook 2025 high growth case. This is very aggressive load growth, although not necessarily unreasonable, as it is collected from each of the RTOs and utilities.
  - Retirements: The report assumed 104 GW of retirements by 2030, with 3/4 of this coal and 1/4 gas. But the most recent data from the U.S. Energy Information Administration released in June (the [EIA 860](#)) has just **half** of this capacity retiring. In the report, the DOE assumed these 50 GW of likely retirements, but included another 50 GW of *announced* retirements, inconsistent with their assumption around capacity additions. Most likely many plants will choose



not to retire due to the changing regulatory and economic landscape, driven by the administration's policies.

- Capacity Additions: The report assumes just 22 GW of new "firm" capacity (narrowly defined as gas) is added which is based on NERC LTRA "Tier 1" – projects with a very high likelihood of success. The report assumes no projects are built post 2026, which is not realistic for a report forecasting to 2030. A more reasonable assumption for capacity additions is the [EIA 860](#) released in June, which has 35 GW of gas additions, and another 53 GW of batteries – **88 GW of firm additions by 2030.**
- The study ignores both utility plans for meeting increased load growth and how markets will respond. In fact, markets and utilities have already responded with plans to add new capacity and fast track new resources. These include PJM's Reliability Resource Initiative, which plans on adding 11 GW of new firm resources by 2030. SPP and MISO both have proposals at FERC (called ERAS) that will likely add another 30 GW of firm resources. Those three regional efforts alone would add roughly twice what the DOE assumed for the entire nation.
- This national report attempts to address what is primarily a regional issue with regional solutions. A handful of regions face pressure due to rising load growth, and those regions have already enacted plans to address this growth. For example, MISO, SPP and PJM have all instituted "fast track" processes to get firm generation online (gas and batteries), which is expected to install 43 GW of new resources by 2030. The DOE report, however, shows just 13.5 GW of new firm resources in those three regions.

## DOE Report Assumptions vs. U.S.

# Energy information Administration

## Data:

|                            |                         |         |
|----------------------------|-------------------------|---------|
|                            | DOE Report              | EIA 860 |
| Load growth:               | Previous post<br>101 GW | N/A     |
| Capacity Additions         | 209 GW                  | 200 GW  |
| Gas Capacity Additions     | 22 GW                   | 35 GW   |
| Battery Capacity Additions | 31 GW                   | 53 GW   |
| Retirements                | 104 GW                  | 52 GW   |

## Conclusion:

If the DOE report had used more consistent assumptions, it would have likely come to very different conclusions. Utilities and RTOs have planning processes and market mechanisms in place to build new resources in response to higher load growth and the retirement of older, uneconomic plants. The DOE’s solution to keep older units online past retirement dates is a crude and expensive approach. The DOE should defer to state planning processes and regional markets to meet the challenge.

GridLAB

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BEFORE THE UNITED STATES DEPARTMENT OF ENERGY

Federal Power Act Section 202(c)     )  
Emergency Order: Midcontinent     )  
Independent System Operator     )  
(MISO)     )  
\_\_\_\_\_

Order No. 202-25-7

Exhibit to  
Motion to Intervene and Request for Rehearing and Stay of  
Public Interest Organizations

Filed September 5, 2025

Exhibit 123

Duke University  
Rethinking Load  
Growth Study



# Rethinking Load Growth

## Assessing the Potential for Integration of Large Flexible Loads in US Power Systems

Tyler H. Norris, Tim Profeta, Dalia Patino-Echeverri, and Adam Cowie-Haskell

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<https://nicholasinstitute.duke.edu/publications/rethinking-load-growth>

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## INTRODUCTION

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### A New Era of Electricity Demand

Rapid US load growth—driven by unprecedented electricity demand from data centers, industrial manufacturing, and electrification of transportation and heating—is colliding with barriers to timely resource expansion. Protracted interconnection queues, supply chain constraints, and extended permitting processes, among other obstacles, are limiting the development of new power generation and transmission infrastructure. Against this backdrop, there is increasing urgency to identify strategies that accommodate rising demand without compromising reliability, affordability, or progress on decarbonization.

Aggregated US winter peak load is forecasted to grow by 21.5% over the next decade, rising from approximately 694 GW in 2024 to 843 GW by 2034, according to the *2024 Long-Term Reliability Assessment* of the North American Electric Reliability Corporation. This represents a 10-year compound annual growth rate (CAGR) of 2.0%, higher than any period since the 1980s ([NERC 2024](#)). Meanwhile, the Federal Energy Regulatory Commission's (FERC) latest five-year outlook forecasts 128 GW in peak load growth as early as 2029—a CAGR of 3.0% ([FERC 2024b](#)).

The primary catalyst for these updated forecasts is the surge in electricity demand from large commercial customers. While significant uncertainty remains, particularly following the release of DeepSeek, data centers are expected to account for the single largest growth segment, adding as much as 65 GW through 2029 and up to 44% of US electricity load growth through 2028 ([Wilson et al. 2024](#); [Rouch et al. 2024](#)). Artificial intelligence (AI) workloads are projected to represent 50% to 70% of data center demand by 2030—up from less than 3% at the start of this decade—with generative AI driving 40% to 60% of this growth ([Srivathsan et al. 2024](#); [Lee et al. 2025](#)).

Analysts have drawn parallels to the 1950s through the 1970s, when the United States achieved comparable electric power sector growth rates ([Wilson et al. 2024](#)). Yet these comparisons arguably understate the nature of today's challenge in the face of stricter permitting obstacles, higher population density, less land availability, skilled labor shortages, persistent supply chain bottlenecks, and demand for decarbonization and greater power reliability. While historical growth rates offer a useful benchmark, the sheer volume of required new generation, transmission, and distribution capacity forecasted for the United States within a condensed timeframe appears unprecedented.

The immensity of the challenge underscores the importance of deploying every available tool, especially those that can more swiftly, affordably, and sustainably integrate large loads. The time-sensitivity for solutions is amplified by the market pressure for many of these loads to interconnect as quickly as possible. In recent months, the US Secretary of Energy Advisory Board (SEAB) and the Electrical Power Research Institute (EPRI) have highlighted a key solution: load flexibility ([SEAB 2024](#), [Walton 2024a](#)). The promise is that the unique profile of AI data centers can facilitate more flexible operations, supported by ongoing advancements in distributed energy resources (DERs).

Flexibility, in this context, refers to the ability of end-use customers to temporarily reduce their electricity consumption from the grid during periods of system stress by using on-site generators, shifting workload to other facilities, or reducing operations.<sup>1</sup> When system planners can reliably anticipate the availability of this load flexibility, the immediate pressure to expand generation capacity and transmission infrastructure can potentially be alleviated, mitigating or deferring costly expenditures. By facilitating near-term load growth without prematurely committing to large-scale capacity expansion, this approach offers a hedge against mounting uncertainty in the US data center market in light of the release of Deep-Seek and related developments (Kearney and Hampton 2025).

## Summary of Analysis and Findings

To support evaluation of potential solutions, this study presents an analysis of the existing US electrical power system's ability to accommodate new flexible loads. The analysis, which encompasses 22 of the largest balancing authorities serving 95% of the country's peak load, provides a first-order estimate of the potential for accommodating such loads with minimal capacity expansion or impact on demand-supply balance.<sup>2</sup>

Specifically, we estimate the gigawatts of new load that could be added in each balancing authority (BA) before total load exceeds what system planners are prepared to serve, provided the new load can be temporarily curtailed as needed. This serves as a proxy for the system's ability to integrate new load, which we term *curtailment-enabled headroom*.

Key results include (see [Figure 1](#)):

- 76 GW of new load—equivalent to 10% of the nation's current aggregate peak demand—could be integrated with an average annual load curtailment rate of 0.25% (i.e., if new loads can be curtailed for 0.25% of their maximum uptime)
- 98 GW of new load could be integrated at an average annual load curtailment rate of 0.5%, and 126 GW at a rate of 1.0%
- The number of hours during which curtailment of new loads would be necessary per year, on average, is comparable to those of existing US demand response programs
- The average duration of load curtailment (i.e., the length of time the new load is curtailed during curtailment events) would be relatively short, at 1.7 hours when average annual load curtailment is limited to 0.25%, 2.1 hours at a 0.5% limit, and 2.5 hours at a 1.0% limit
- Nearly 90% of hours during which load curtailment is required retain at least half of the new load (i.e., less than 50% curtailment of the new load is required)
- The five balancing authorities with the largest potential load integration at 0.5% annual curtailment are PJM at 18 GW, MISO at 15 GW, ERCOT at 10 GW, SPP at 10 GW, and Southern Company at 8 GW<sup>3</sup>

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1 Note that while *curtailment* and *flexibility* are used interchangeably in this paper, *flexibility* can refer to a broader range of capabilities and services, such as the provision of down-reserves and other ancillary services.

2 For further discussion on the nuances regarding generation versus transmission capacity, see the [section on limitations](#).

3 A [complete list of abbreviations](#) and their definitions can be found at the end of the report.

Overall, these results suggest the US power system's existing headroom, resulting from intentional planning decisions to maintain sizable reserves during infrequent peak demand events, is sufficient to accommodate significant constant new loads, provided such loads can be safely scaled back during some hours of the year. In addition, they underscore the potential for leveraging flexible load as a complement to supply-side investments, enabling growth while mitigating the need for large expenditures on new capacity.

We further demonstrate that a system's potential to serve new electricity demand without capacity expansion is determined primarily by the system's load factor (i.e., a measure of the level of use of system capacity) and grows in proportion to the flexibility of such load (i.e., what percentage of its maximal potential annual consumption can be curtailed). For this reason, in this paper we assess the technical potential for a system to serve new load under different curtailment limit scenarios (i.e., varying curtailment tolerance levels for new loads).

The analysis does not consider the technical constraints of power plants that impose intertemporal constraints on their operations (e.g., minimum downtime, minimum uptime, startup time, ramping capability, etc.) and does not account for transmission constraints. However, it ensures that the estimate of load accommodation capacity is such that total demand does not exceed the peak demand already anticipated for each season by system planners, and it discounts existing installed reserve margins capable of accommodating load that exceeds historical peaks. It also assumes that new load is constant throughout all hours.

This analysis should not be interpreted to suggest the United States can fully meet its near- and medium-term electricity demands without building new peaking capacity or expanding the grid. Rather, it highlights that flexible load strategies can help tap existing headroom to more quickly integrate new loads, reduce the cost of capacity expansion, and enable greater focus on the highest-value investments in the electric power system.

This paper proceeds as follows: [the following section provides background](#) on the opportunities and challenges to integrating large new data centers onto the grid. It explores how load flexibility can accelerate interconnection, reduce ratepayer costs through higher system utilization, and expand the role of demand response, particularly for AI-specialized data centers. We then detail the [methods and results for estimating curtailment-enabled headroom](#), highlighting key trends and variations in system headroom and its correlation with load factors across regions. The paper concludes with a [brief overview of key findings, limitations, and near-term implications](#).

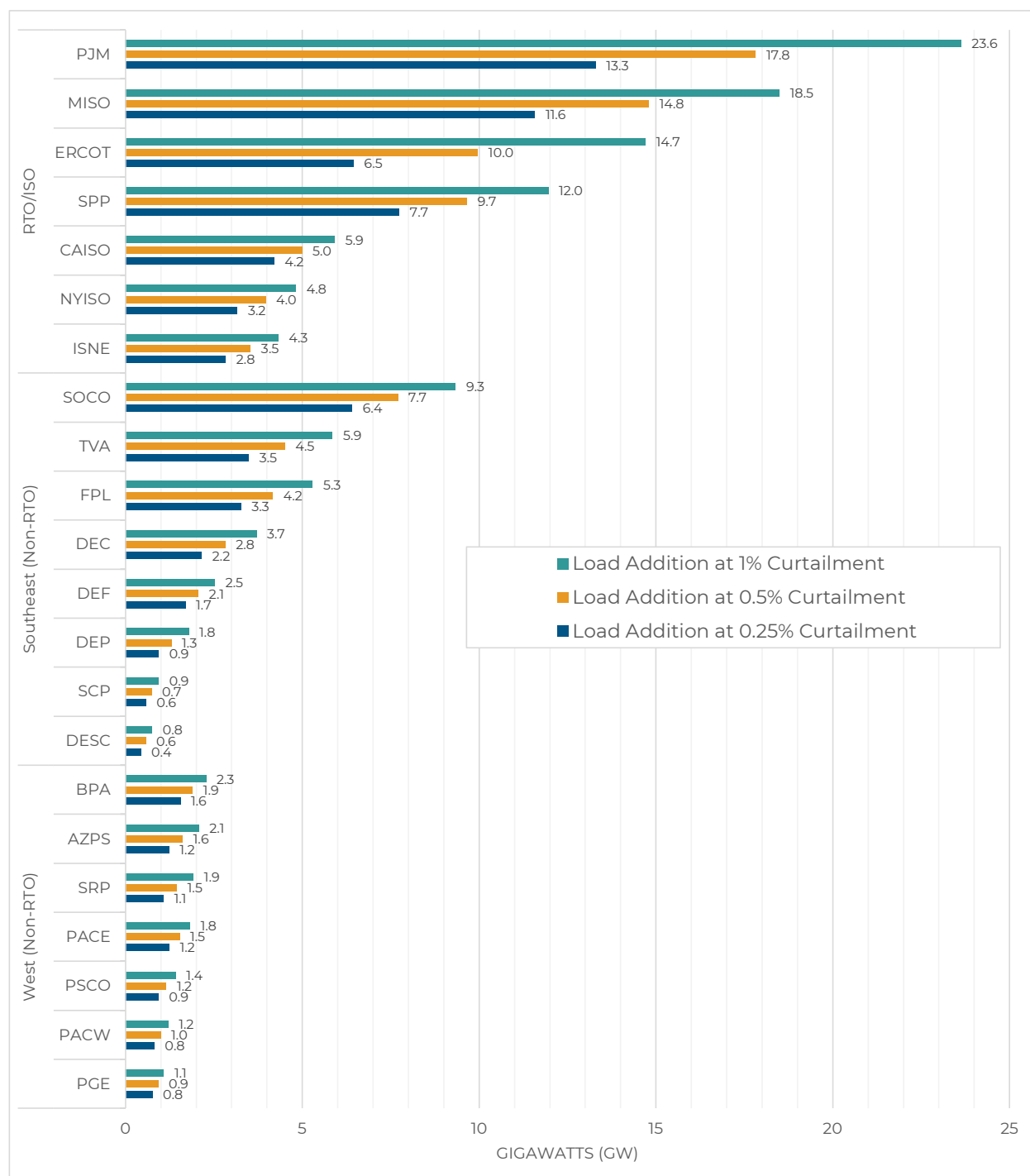
## BACKGROUND

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### Load Flexibility Can Accelerate Grid Interconnection

The growing demand for grid access by new large loads has significantly increased interconnection wait times, with some utilities reporting delays up to 7 to 10 years ([Li et al. 2024](#); [Saul 2024](#); [WECC 2024](#)). These wait times are exacerbated by increasingly severe transmission equipment supply chain constraints. In June 2024, the President's National Infrastructure Advisory Council highlighted that transformer order lead times had ballooned to two to five years—up from less than one year in 2020—while costs surged by 80% ([NIAC 2024](#)). Circuit breakers have seen similar delays: last year, the Western Area Power Administration

**Figure 1. System Headroom Enabled by Load Curtailment of New Load by Balancing Authority, GW**



Note: *System headroom* refers to the amount of GW by which a BA's load can be augmented every hour in the absence of capacity expansion so that, provided a certain volume of curtailment of the new load, the total demand does not exceed the supply provisioned by system planners to withstand the expected highest peak. The headroom calculation assumes the new load is constant and hence increases the total load by the same GW hour-by-hour.

reported lead times of up to four and a half years for lower voltage classes and five and a half years for higher voltage classes, alongside a 140% price hike over two years (Rohrer 2024). Wood Mackenzie reported in May 2024 that lead times for high-voltage circuit breakers reached 151 weeks in late 2023, marking a 130% year-over-year increase (Boucher 2024).

Large load interconnection delays have recently led to growing interest among data centers in colocating with existing generation facilities. At a FERC technical conference on the subject in late 2024 (FERC 2024c), several participants highlighted the potential benefits of colocation for expedited interconnection,<sup>4</sup> a view echoed in recent grey literature (Schatzki et al. 2024). Colocation, however, represents only a portion of load interconnections and is not viewed as a long-term, system-wide solution.

Load flexibility similarly offers a practical solution to accelerating the interconnection of large demand loads (SIP 2024, Jabeck 2023). The most time-intensive and costly infrastructure upgrades required for new interconnections are often associated with expanding the transmission system to deliver electricity during the most stressed grid conditions (Gorman et al. 2024). If a new load is assumed to require firm interconnection service and operate at 100% of its maximum electricity draw at all times, including during system-wide peaks, it is far more likely to trigger the need for significant upgrades, such as new transformers, transmission line reconductoring, circuit breakers, or other substation equipment.

To the extent a new load can temporarily reduce (i.e., curtail) its electricity consumption from the grid during these peak stress periods, however, it may be able to connect while deferring—or even avoiding—the need for certain upgrades (ERCOT 2023b). A recent study on Virginia’s data center electricity load growth noted, “Flexibility in load is generally expected to offset the need for capacity additions in a system, which could help mitigate the pressure of rapid resource and transmission expansion” (K. Patel et al. 2024). The extent and frequency of required curtailment would depend on the specific nature of the upgrades; in some cases, curtailment may only be necessary if a contingency event occurs, such as an unplanned transmission line or generator outage. For loads that pay for firm interconnection service, any period requiring occasional curtailment would be temporary, ending once necessary network upgrades are completed.<sup>5</sup> Such “partially firm,” flexible service was also highlighted by participants in FERC’s 2024 technical conference on colocation.<sup>6</sup>

Traditionally, such arrangements have been known as *interruptible* electric service. More recently, some utilities have pursued *flexible* load interconnection options. In March 2022, for example, ERCOT implemented an interim interconnection process for large loads seeking to connect in two years or less, proposing to allow loads seeking to qualify as controllable load resources (CLRs) “to be studied as flexible and potentially interconnect more MWs” (ERCOT 2023b). More recently, ERCOT stated that “the optimal solution for grid reliability is for

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4 For example, the Clean Energy Buyers Association (2024) noted, “Flexibility of co-located demand is a key asset that can enable rapid, reliable interconnection.”

5 Such an arrangement is analogous to provisional interconnection service available to large generators, as defined in Section 5.9.2 of FERC’s *Pro Forma Large Generator Interconnection Agreement* (LGIA).

6 MISO’s market monitor representative stated, “instead of being a network firm customer, could [large flexible loads] be a non-firm, or partial non-firm [customer], and that could come with certain configuration requirements that make them truly non-firm, or partially non-firm. But, all those things are the things that could enable some loads to get on the system quicker” (FERC 2024c).

more loads to participate in economic dispatch as CLRs” (Springer 2024). Similarly, Pacific Gas and Electric (PG&E) recently introduced a Flex Connect program to allow certain loads faster access to the grid (Allsup 2024).

These options resemble interconnection services available to large generators that forgo capacity compensation, and potentially higher curtailment risk, in exchange for expedited lower-cost grid access (Norris 2023). FERC codified this approach with Energy Resource Interconnection Service (ERIS) in Order 2003 and revisited the concept during a 2024 technical workshop to explore potential improvements (Norris 2024). Some market participants have since proposed modifying ERIS to facilitate the colocation of new generators with large loads (Intersect Power 2024).

## Ratepayers Benefit from Higher System Utilization

The US electric power system is characterized by a relatively low utilization rate, often referred to as the *load factor*. The load factor is the ratio of average demand to peak demand over a given period and provides a measure of the utilization of system capacity (Cerna et al. 2023). A system with a high load factor operates closer to its peak system load for more hours throughout the year, while a system with a low load factor generally experiences demand spikes that are higher than its typical demand levels (Cerna et al. 2022). This discrepancy means that, for much of the year, a significant portion of a system’s available generation and transmission infrastructure is underutilized (Cochran et al. 2015).

The power system is designed to handle the highest demand peaks, which in some cases may occur less than once per year, on average, due to extreme weather events. As a result, the bulk of the year sees demand levels well below that peak, leaving substantial headroom in installed capacity. Seasonal shifts add another layer of complexity: some balancing authorities may show higher load factors in summer, yet experience significantly lower utilization in winter, and vice versa.

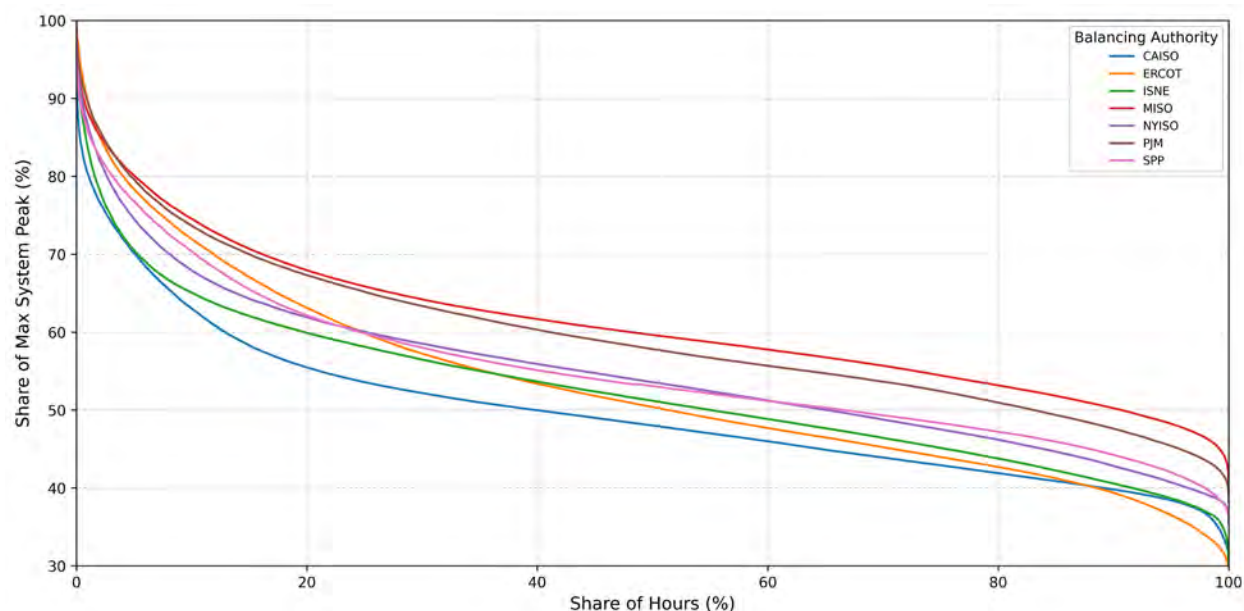
The *load duration curve* (LDC) illustrates system utilization by ranking demand from highest to lowest over a given period. It provides a visual representation of how often certain demand levels occur, highlighting the frequency and magnitude of peak demand relative to average load. A steep LDC suggests high demand variability, with peaks significantly exceeding typical loads, while a flatter LDC indicates more consistent usage. Figure 2 presents LDCs for each US RTO/ISO based on hourly load between 2016 and 2024, standardized as a percentage of each system’s maximum peak demand to allow cross-market comparisons.

A system utilization rate below 100% is expected for most large-scale infrastructure designed to withstand occasional surges in demand. Nevertheless, when the gap between average demand and peak demand is consistently large, it implies that substantial portions of the electric power system—generation assets, transmission infrastructure, and distribution networks—remain idle for much of the year (Riu et al. 2024). These assets are expensive to build and maintain, and ratepayers ultimately bear the cost.

Once the infrastructure is in place, however, there is a strong economic incentive to increase usage and spread these fixed costs over more kilowatt-hours of delivered electricity. An important consideration is therefore the potential for additional load to be added without significant new investment, provided the additional load does not raise the system’s overall



**Figure 2. Load Duration Curve for US RTO/ISOs, 2016–2024**



This figure is adapted from the [analysis section of this paper](#), which contains additional detail on the data and method.

peak demand and thereby trigger system expansion.<sup>7</sup> When new loads are flexible enough to avoid a high coincident load factor, thereby mitigating contribution to the highest-demand hours, they fit within the existing grid’s headroom.<sup>8</sup> By strategically timing or curtailing demand, these flexible loads can minimize their impact on peak periods. In doing so, they help existing customers by improving the overall utilization rate—thereby lowering the per-unit cost of electricity—and reduce the likelihood that expensive new peaking plants or network expansions may be needed.

In contrast, inflexible new loads that increase the system’s absolute peak demand can drive substantial additional needs for generation and transmission capacity. Even a modest rise in peak demand may trigger capital investments in peaking plants, fuel supply infrastructure, and reliability enhancements. These cost implications have contributed to increasingly contentious disputes in which regulators or ratepayer advocates seek to create mechanisms to pass the costs of serving large loads directly to those loads and otherwise ensure data centers do not shift costs via longer contract commitments, billing minimums, and upfront investment ([Howland 2024a](#); [Riu et al. 2024](#)). Some examples include:

- The **Georgia Public Service Commission (GPSC)**, citing “staggering” large load growth and the need to protect ratepayers from the costs of serving those customers, recently implemented changes to customer contract provisions if peak draw exceeds 100 MW, mandating a GPSC review and allowing the utility to seek longer contracts and minimum billing for cost recovery ([GPSC 2025](#)). This follows GPSC’s approval

<sup>7</sup> See the [discussion on limitations and further analysis](#) in the following section for additional nuance.

<sup>8</sup> Demand charges are often based on coincident consumption (e.g., ERCOT’s Four Coincident Peak charge uses the load’s coincident consumption at the system’s expected seasonal peak to determine an averaged demand charge that may account for >30% of a user’s annual bill).

of 1.4 GW of gas capacity proposed by Georgia Power in response to load growth “approximately 17 times greater than previously forecasted” through 2030/2031, a forecast it revised upward in late 2024 (GPC 2023, 2024).

- **Ohio**, where American Electric Power issued a moratorium on data center service requests, followed by a settlement agreement with the Public Service Commission staff and consumer advocates that calls for longer contract terms, load ramping schedules, a minimum demand charge, and collateral for service from data centers exceeding 25 MW (Ohio Power Company 2024).
- **Indiana**, where 4.4 GW of interconnection requests from a “handful” of data centers represents a 157% increase in peak load for Indiana Michigan Power over the next six years. Stakeholders there have proposed “firewalling” the associated cost of service from the rest of the rate base, wherein the utility would procure a separate energy, capacity, and ancillary resource portfolio for large loads and recover that portfolio’s costs from only the qualifying large loads (Inskip 2024).
- **Illinois**, where Commonwealth Edison reported that large loads have paid 8.2% of their interconnection costs while the remaining 91.8% is socialized across general customers (ComEd 2024).

These examples underscore the significance of exploring how flexible loads can mitigate peak increases, optimize the utilization of existing infrastructure, and reduce the urgency for costly and time-consuming capacity expansions.

## Demand Response and Data Centers

*Demand response* refers to changes in electricity usage by end-use customers to provide grid services in response to economic signals, reliability events, or other conditions. Originally developed to reduce peak loads (also called *peak shaving*), demand response programs have evolved to encompass a variety of grid services, including balancing services, ancillary services, targeted deferral of grid upgrades, and even variable renewable integration (Hurley et al. 2013; Ruggles et al. 2021). Demand response is often referred to as a form of *demand-side management* or *demand flexibility* (Nethercutt 2023).

Demand response is the largest and most established form of virtual power plant (Downing et al. 2023), with 33 GW of registered capacity in wholesale RTO/ISO programs and 31 GW in retail programs as of 2023 (FERC 2024a).<sup>9</sup> As a share of peak demand, participation in RTO/ISO programs ranges from a high of 10.1% in MISO to a low of 1.4% in SPP. A majority of enrolled capacity in demand response programs are industrial or commercial customers, representing nearly 70% of registered capacity in retail (EIA 2024).

Following a decade of expansion, growth in demand response program participation stalled in the mid-2010s partially because of depressed capacity prices, forecasted over-capacity, and increasingly restrictive wholesale market participation rules (Hledik et al. 2019). However, the resurgence of load growth and increasing capacity prices, coupled with ongoing advancements in DERs and grid information and communication technologies (ICT) appears likely to reverse this trend.

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9 RTO/ISO and retail data may overlap.



Studies of national demand response potential have identified a range of potential scenarios (Becker et al. 2024), ranging as high as 200 GW by 2030 in a 2019 study, comprising 20% of the then-forecasted system peak and yielding \$15 billion in annual benefits primarily via avoided generation and transmission and distribution (T&D) capacity (Hledik et al. 2019). Notably, this research was conducted before recent load growth forecasts.

### The Participation Gap: Data Centers and Demand Response

For nearly two decades, computational loads—and data centers in particular—have been identified as a promising area for demand response. Early studies explored these capabilities, such as a two-phase Lawrence Berkeley National Laboratory study drawing on six years of research, which concluded in 2010 that “data centers, on the basis of their operational characteristics and energy use, have significant potential for demand response” (Ghatikar et al. 2010) and in 2012 that “[certain] data centers can participate in demand response programs with no impact to operations or service-level agreements” (Ghatikar et al. 2012). The 2012 study provided one of the earliest demonstrations of computational load responsiveness, finding that 10% load shed can typically occur within 6 to 15 minutes.

Despite this promise, data centers have historically exhibited low participation rates in demand response programs as a result of operational priorities and economic incentives (Basmadjian 2019; Clausen et al. 2019; Wierman et al. 2014). Data centers are designed to provide reliable, uninterrupted service and generally operate under service-level agreements (SLAs) that mandate specific performance benchmarks, including uptime, latency, and overall quality of service. Deviation from these standards can result in financial penalties and reputational harm, creating a high-stakes environment where operators are averse to operational changes that introduce uncertainty or risk (Basmadjian et al. 2018).

Compounding this challenge is the increasing prevalence of large-scale colocated data centers, which represent a significant share of the data center market (Shehabi et al. 2024). These facilities house multiple tenants, each with varying operational requirements. Coordinating demand response participation in such environments introduces layers of administrative and logistical complexity, as operators must mediate cost- and reward-sharing agreements among tenants. Further, while data centers possess significant technical capabilities, tapping these capabilities for demand response requires sophisticated planning and expertise, which some operators may not have needed to date (Silva et al. 2024).

Economic considerations have further compounded this reluctance. Implementing a demand response program requires investments in advanced energy management systems, staff training, and integration with utility platforms for which costs can be material, particularly for smaller or midsized facilities. At the same time, financial incentives provided by most demand response programs have historically been modest and insufficient to offset the expenses and opportunity costs associated with curtailed operations. For operators focused on maintaining high utilization rates and controlling costs, the economic proposition of demand response participation may be unattractive.

Existing demand response program designs may inadvertently discourage participation. Many programs were originally created with traditional industrial consumers in mind, with different incentives and operational specifications. Price-based programs may require high price variability to elicit meaningful responses, while direct control programs without sufficient guardrails may introduce unacceptable risks related to uptime and performance. The

complexity of active participation in demand response markets, including bidding processes and navigating market mechanisms, adds another layer of difficulty. Without streamlined participation structures, tailored incentives, and metrics that reflect the scale and responsiveness of data centers, many existing demand response programs may be ill-suited to the operational realities of modern data centers.

Table 1. Key Data Center Terms

| Term                                  | Definition                                                                                                                                                                                                                                                                 |
|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AI workload                           | A broad category encompassing computational tasks related to machine learning, natural language processing, generative AI, deep learning, and other AI-driven applications.                                                                                                |
| AI-specialized data center            | Typically developed by hyperscalers, this type of facility is optimized for AI workloads and relies heavily on high-performance graphics processing units (GPUs) and advanced central processing units (CPUs) to handle intensive computing demands.                       |
| Computational load                    | A category of electrical demand primarily driven by computing and data processing activities, ranging from general-purpose computing to specialized AI model training, cryptographic processing, and high-performance computing (HPC).                                     |
| Conventional data center              | A facility that could range from a small enterprise-run server room to a large-scale cloud data center that handles diverse non-AI workloads, including file sharing, transaction processing, and application hosting. These facilities are predominantly powered by CPUs. |
| Conventional work-load                | A diverse array of computing tasks typically handled by CPUs, including file sharing, transaction processing, application hosting, and similar operations.                                                                                                                 |
| Cryptomine                            | A dedicated server farm optimized for high-throughput operations on blockchain networks, typically focused on validating and generating cryptocurrency.                                                                                                                    |
| Hyperscalers/hyper-scale data centers | Large, well-capitalized cloud service providers that build hyperscale data centers to achieve scalability and high performance at multihundred megawatt scale or larger ( <a href="#">Howland 2024b</a> , <a href="#">Miller 2024</a> ).                                   |
| Inferencing                           | The ongoing application of an AI model, where users prompt the model to provide responses or outputs. According to EPRI, inferencing represents 60% of an AI model’s annual energy consumption ( <a href="#">Aljbour and Wilson 2024</a> ).                                |
| Model training                        | The process of developing and training AI models by processing vast amounts of data. Model training accounts for 30–40% of annual AI power consumption and can take weeks or months to complete ( <a href="#">Aljbour and Wilson 2024</a> ).                               |

## Rethinking Data Centers with AI-Driven Flexibility

Limited documentation of commercial data center participation in demand response has reinforced a perception that these facilities' demands are inherently inflexible loads. A variety of recent developments in computational load profiles, operational capabilities, and broader market conditions, however, suggest that a new phase of opportunity and necessity is emerging.

In a July 2024 memo on data center electricity demand, the SEAB recommended the Department of Energy prioritize initiatives to characterize and advance data center load flexibility, including the development of a “flexibility taxonomy and framework that explores the financial incentives and policy changes needed to drive flexible operation” (SEAB 2024). Building on these recommendations, EPRI announced a multi-year Data Center Flexible Load Initiative (DCFlex) in October 2024 with an objective “to spark change through hands-on and experiential demonstrations that showcase the full potential of data center operational flexibility and facility asset utilization,” in partnership with multiple tech companies, electric utilities, and independent system operators (Walton 2024a).<sup>10</sup>

The central hypothesis is that the evolving computational load profiles of AI-specialized data centers facilitate operational capabilities that are more amenable to load flexibility. Unlike the many real-time processing demands typical of conventional data center workloads, such as cloud services and enterprise applications, the training of neural networks that power large language models and other machine learning algorithms is deferrable. This flexibility in timing, often referred to as *temporal flexibility*, allows for the strategic scheduling of training as well as other delay-tolerant tasks, both AI and non-AI alike. These delay-tolerant tasks are also referred to as *batch processing* and are typically not user-prompted (AWS 2025).

This temporal flexibility complements the developing interest in *spatial flexibility*, the ability to dynamically distribute workloads across one or multiple data centers in different geographic locations, optimizing resource utilization and operational efficiency. As stated by EPRI in a May 2024 report, “optimizing data center computation and geographic location to respond to electricity supply conditions, electricity carbon intensity, and other factors in addition to minimizing latency enables data centers to actively adjust their electricity consumption ... some could achieve significant cost savings—as much as 15%—by optimizing computation to capitalize on lower electric rates during off-peak hours, reducing strain on the grid during high-demand periods” (EPRI 2024). For instance, having already developed a temporal workload shifting system, Google is seeking to implement spatial flexibility as well (Radovanović 2020).

In addition to temporal and spatial flexibility, other temporary load reduction methods may also enable data center flexibility. One approach is dynamic voltage and frequency scaling, which reduces server power consumption by lowering voltage or frequency at the expense of processing speed (Moons et al. 2017; Basmadjian 2019; Basmadjian and de Meer 2018). Another is server optimization, which consolidates workloads onto fewer servers while idling or shutting down underutilized ones, thereby reducing energy waste (Basmadjian 2019; Chaurasia et al. 2021). These load reduction methods are driven by advances in virtual workload management, made possible by the “virtualization” of hardware (Pantazoglou et al. 2016).

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<sup>10</sup> Pointing to EPRI's new DCFlex Initiative, Michael Liebreich noted in a recent essay, “For instance, when they see how much it costs to work 24/7 at full power, perhaps data-center owners will see a benefit to providing some demand response capacity...” (Liebreich 2024).

Finally, temperature flexibility leverages the fact that cooling systems account for 30% to 40% of data center energy consumption (EPRI 2024). For instance, operators can increase cooling during midday when solar energy is abundant and reduce cooling during peak evening demand.<sup>11</sup> While these methods may be perceived as uneconomic due to potential impacts on performance, hardware lifespan, or SLAs, they are not intended for continuous use. Instead, they are best suited for deployment during critical hours when grid demand reduction is most valuable.

Beyond peak shaving, data centers also hold potential to participate in ancillary services, particularly those requiring rapid response, such as frequency regulation. Studies have described how data centers can dynamically adjust workloads to provide real-time support to the grid, effectively acting as “virtual spinning reserves” that help stabilize grid frequency and integrate intermittent renewable resources (McClurg et al. 2016; Al Kez et al. 2021; Wang et al. 2019). This capability extends beyond traditional demand response by providing near-instantaneous balancing resources (Zhang et al. 2022).

Three overarching market trends create further opportunities for load flexibility now than in the past. The first is constrained supply-side market conditions that raise costs and lead times for the interconnecting large inflexible loads, when speed to market is paramount for AI developers. The second is advancements in on-site generation and storage technologies that have lowered costs and expanded the availability of cleaner and more commercially viable behind-the-meter solutions, increasing their appeal to data center operators (Baumann et al. 2020). The third is the growing concentration of computational load in colocated or hyper-scale data centers—accounting for roughly 80% of the market in 2023—which is lending scale and specialization to more sophisticated data center operators. These operators, seeking speed to market, may be more likely to adopt flexibility in return for faster interconnection (Shehabi et al. 2024; Basmadjian et al. 2018). The overarching trends underpinning this thesis are summarized in Table 2.

An important consideration for future data center load profiles is the balance between AI-specialized data centers focused on model development and those oriented toward inferencing. If fewer AI models are developed, a larger proportion of computing resources will shift toward inferencing tasks, which is delay-intolerant and variable (Riu et al. 2024). According to EPRI, training an AI model accounts for 30% of its annual footprint, compared to 60% for inferencing the same model (EPRI 2024).

In the absence of regulatory guidance, most advancements in data center flexibility to date are being driven by voluntary private-sector initiatives. Some hyperscalers and data center developers are taking steps to mitigate grid constraints by prioritizing near-term solutions for load flexibility. For example, one such company, Verrus, has established its business model around the premise that flexible data center operations offer an effective solution for growth needs (SIP 2024). Table 3 highlights additional initiatives related to facilitating or demonstrating data center flexibility.

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<sup>11</sup> Cooling demand for servers is inherently dependent on server workloads. Therefore, reducing workloads saves on cooling needs as well.

**Table 2. Trends Enabling Data Center Load Flexibility**

| Category                   | Legacy                                                                                                                                                                                                                                                                                                                                                                                                              | Future                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Computational load profile | <ul style="list-style-type: none"> <li>Conventional servers with CPU-dominated workloads (<a href="#">Shehabi et al. 2024</a>)</li> <li>Real-time, delay-intolerant, and unscheduled processing (e.g., cloud services, enterprise apps)</li> <li>Low latency critical</li> </ul>                                                                                                                                    | <ul style="list-style-type: none"> <li>AI-specialized servers with GPU or tensor processing unit (TPU)-favored workloads (<a href="#">Shehabi et al. 2024</a>)</li> <li>Greater portion of delay-tolerant and scheduled machine learning workloads (model training, non-interactive services)</li> <li>Higher share of model training affords greater demand predictability</li> <li>Highly parallelized workloads (<a href="#">Shehabi et al. 2024</a>)</li> </ul>                                                                   |
| Operational capabilities   | <ul style="list-style-type: none"> <li>Minimal temporal load shifting</li> <li>Minimal spatial load migration</li> <li>High proximity to end users for latency-sensitive tasks</li> <li>Reliance on Tier 2 diesel generators for backup</li> <li>Limited utilization of on-site power resulting from pollution concerns and regulatory restrictions (<a href="#">Cary 2023</a>)</li> </ul>                          | <ul style="list-style-type: none"> <li>More robust and intelligent temporal workload shifting (<a href="#">Radovanović et al. 2022</a>)</li> <li>Advanced spatial load migration and multi-data center training (<a href="#">D. Patel et al. 2024</a>)</li> <li>Flexibility in location for model training</li> <li>Backup power diversified (storage, renewables, natural gas, cleaner diesel)</li> <li>Cleaner on-site power enables greater utilization</li> </ul>                                                                 |
| Market conditions          | <ul style="list-style-type: none"> <li>Minimal electric load growth</li> <li>High availability of T&amp;D network headroom</li> <li>Standard interconnection timelines and queue volumes</li> <li>Low supply chain bottlenecks for T&amp;D equipment</li> <li>Low capacity prices and forecasted overcapacity</li> <li>High cost of clean on-site power options</li> <li>Small-scale “server room” model</li> </ul> | <ul style="list-style-type: none"> <li>High electric load growth</li> <li>Low availability of T&amp;D network headroom</li> <li>Long interconnection timelines and overloaded queues</li> <li>High supply chain bottlenecks for T&amp;D equipment</li> <li>High capacity prices and forecasted undercapacity (<a href="#">Walton 2024b</a>)</li> <li>Lower cost of clean on-site power options (<a href="#">Baranko et al. 2024</a>)</li> <li>Data center operations concentrating in large-scale facilities and operators</li> </ul> |

Table 3. Implementations of Computational Load Flexibility

| Category                           | Examples                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operational flexibility            | <ul style="list-style-type: none"><li>• Google deployed a “carbon-aware” temporal workload-shifting algorithm and is now seeking to develop geographic distribution capabilities (<a href="#">Radovanović 2020</a>).</li><li>• Google data centers have participated in demand response by reducing non-urgent compute tasks during grid stress events in Oregon, Nebraska, the US Southeast, Europe, and Taiwan (<a href="#">Mehra and Hasegawa 2023</a>).</li><li>• Enel X has supported demand response participation by data centers in North America, Ireland, Australia, South Korea, and Japan, including use of on-site batteries and generators to enable islanding within minutes (<a href="#">Enel X 2024</a>).</li><li>• Startup companies like <a href="#">Emerald AI</a> are developing software to enable large-scale demand response from data centers through recent advances in computational resource management to precisely deliver grid services while preserving acceptable quality of service for compute users</li></ul> |
| On-site power                      | <ul style="list-style-type: none"><li>• Enchanted Rock, an energy solutions provider that supported Microsoft in building a renewable natural gas plant for a data center in San Jose, CA, created a behind-the-meter solution called Bridge-to-Grid, which seeks to provide intermediate power until primary service can be switched to the utility. At that point, the on-site power transitions to flexible backup power (<a href="#">Enchanted Rock 2024, 2025</a>).</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Market design and utility programs | <ul style="list-style-type: none"><li>• ERCOT established the Large Flexible Load Task Force and began to require the registration of large, interruptible loads seeking to interconnect with ERCOT for better visibility into their energy demand over the next five years (<a href="#">Hodge 2024</a>).</li><li>• ERCOT’s demand response program shows promise for data center flexibility, with 750+ MW of data mining load registered as CLRs, which are dispatched by ERCOT within preset conditions (<a href="#">ERCOT 2023a</a>).</li><li>• PG&amp;E debuted Flex Connect, a pilot that provides quicker interconnection service to large loads in return for flexibility at the margin when the system is constrained (<a href="#">Allsup 2024, St. John 2024</a>).</li></ul>                                                                                                                                                                                                                                                            |
| Cryptomining                       | <ul style="list-style-type: none"><li>• A company generated more revenue from its demand response participation in ERCOT than from Bitcoin mining in one month, at times accommodating a 95% load reduction during peak demands (<a href="#">Riot Platforms 2023</a>).</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

ANALYSIS OF CURTAILMENT-ENABLED HEADROOM

In this section we describe the method for estimating the gigawatts of new load that could be added to existing US power system load before the total exceeds what system planners are prepared to serve, provided that load curtailment is applied as needed. This serves as a proxy for the system’s ability to integrate new load, which we term *curtailment-enabled headroom*.<sup>12</sup> We first investigated the aggregate and seasonal load factor for each of the 22 investigated balancing authorities, which measures a system’s average utilization rate. Second, we computed the curtailment-enabled headroom for different assumptions of ac-

12 SEAB proposed a similar term, *available flex capacity*, in its July 2024 report [Recommendations on Powering Artificial Intelligence and Data Center Infrastructure](#).



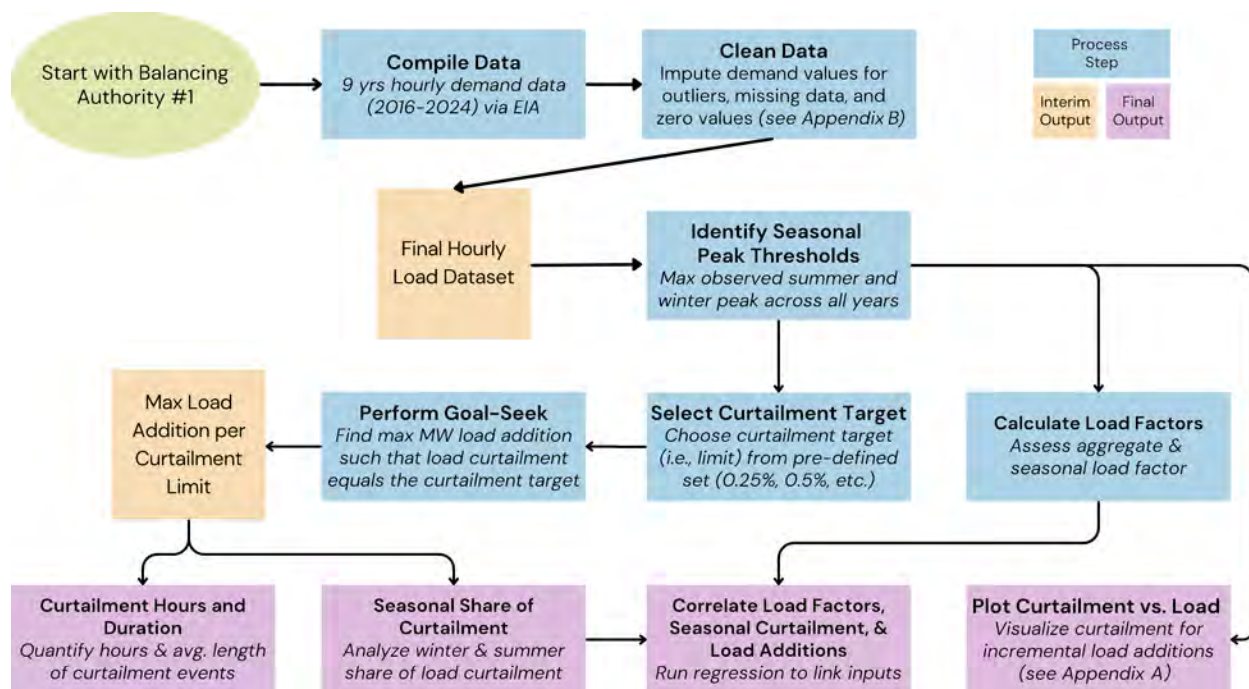
ceptable new load curtailment rates. In this context, *curtailment* refers to instances where the new load temporarily reduces its electricity draw—such as by using on-site generation resources, shifting load temporally or spatially, or otherwise reducing operations—to ensure system demand does not exceed historical peak thresholds. Third, we quantified the magnitude, duration, and seasonal concentration of the load curtailment for each balancing authority. Finally, we examined the correlation between load factor, seasonal curtailment, and max potential load additions. This process is summarized in Figure 3.

## Data and Method

### Data

We considered nine years of hourly load data aggregated for each of the 22 balancing authorities, encompassing seven RTO/ISOs,<sup>13</sup> eight non-RTO Southeastern BAs,<sup>14</sup> and seven non-RTO Western BAs.<sup>15</sup> Together, these balancing authorities represent 744 of the approximate 777 GW of summer peak load (95%) across the continental United States. The dataset, sourced from the EIA Hourly Load Monitor (EIA-930), contains one demand value per hour

**Figure 3. Steps for Calculating Headroom and Related Metrics**



13 CAISO, ERCOT, ISO-NE, MISO, NYISO, PJM, and SPP.

14 DEC; DEP; DEF; DESC; FPL; Santee Cooper, SCP; Southern Company (SOCO); and TVA. Note the different BA codes used by EIA: DUK for DEC, CPLE for DEP, SCEG for DESC, FPC for DEF, and SC for SCP. Also note that Southern Company includes Georgia Power, Alabama Power, and Mississippi Power. A complete [list of abbreviations and their definitions](#) can be found at the end of the paper.

15 AZPS, BPA, PACE, PACW, PGE, PSCO, and SRP. Note that EIA uses the code BPAT for BPA. A complete [list of abbreviations and their definitions](#) can be found at the end of the paper.

and spans January 1, 2016, through December 31, 2024.<sup>16</sup> Data from 2015 were excluded because of incomplete reporting.<sup>17</sup> The dataset was cleaned to identify and impute values for samples with missing or outlier demand values (see details in [Appendix B](#)).

### Determining Load Additions for Curtailment Limits

An analysis was conducted to determine the maximum load addition for each balancing authority that can be integrated while staying within predefined curtailment limits applied to the new load. The load curtailment limits (0.25%, 0.5%, 1.0%, and 5.0%) were selected within the range of maximum curtailment caps for existing interruptible demand response programs.<sup>18</sup> The analysis focused on finding the load addition volume in megawatts that results in an average annual load curtailment rate per balancing authority that matches the specified limit. To achieve this, a goal-seek technique was used to solve for the load addition that satisfies this condition,<sup>19</sup> for which the mathematical expression is presented in [Appendix C](#). The calculation assumed the new load is constant and hence increases the total system load by the same gigawatt volume hour-by-hour. To complement this analysis and visualize the relationship between load addition volume and curtailment, curtailment rates were also calculated across small incremental load additions (i.e., 0.25% of the BA's peak load).

### Load Curtailment Definition and Calculation

*Load curtailment* is defined as the megawatt-hour reduction of load required to prevent the augmented system demand (existing load + new load) from exceeding the maximum seasonal system peak threshold (e.g., see [Figure 4](#)). Curtailment was calculated hourly as the difference between the augmented demand and the seasonal peak threshold. These hourly curtailments in megawatt-hours were aggregated for all hours in a year to determine the total annual curtailment. The curtailment rate for each load increment was defined as the total annual curtailed megawatt-hours divided by the new load's maximum potential annual consumption, assuming continuous operation at full capacity.

### Peak Thresholds and Seasonal Differentiation

Balancing authorities develop resource expansion plans to support different peak loads in winter and summer. To account for variation, we defined seasonal peak thresholds for each balancing authority. Specifically, we identified the maximum summer peak and the maximum winter peak observed from 2016 to 2024 for each balancing authority.<sup>20</sup> These thresholds serve as the upper limits for system demand during their respective seasons, and all

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16 Additional detail on EIA's hourly load data collection is available at <https://www.eia.gov/electricity/gridmonitor/about>.

17 Fewer than half of the year's load hours were available, making the data unsuitable for inclusion.

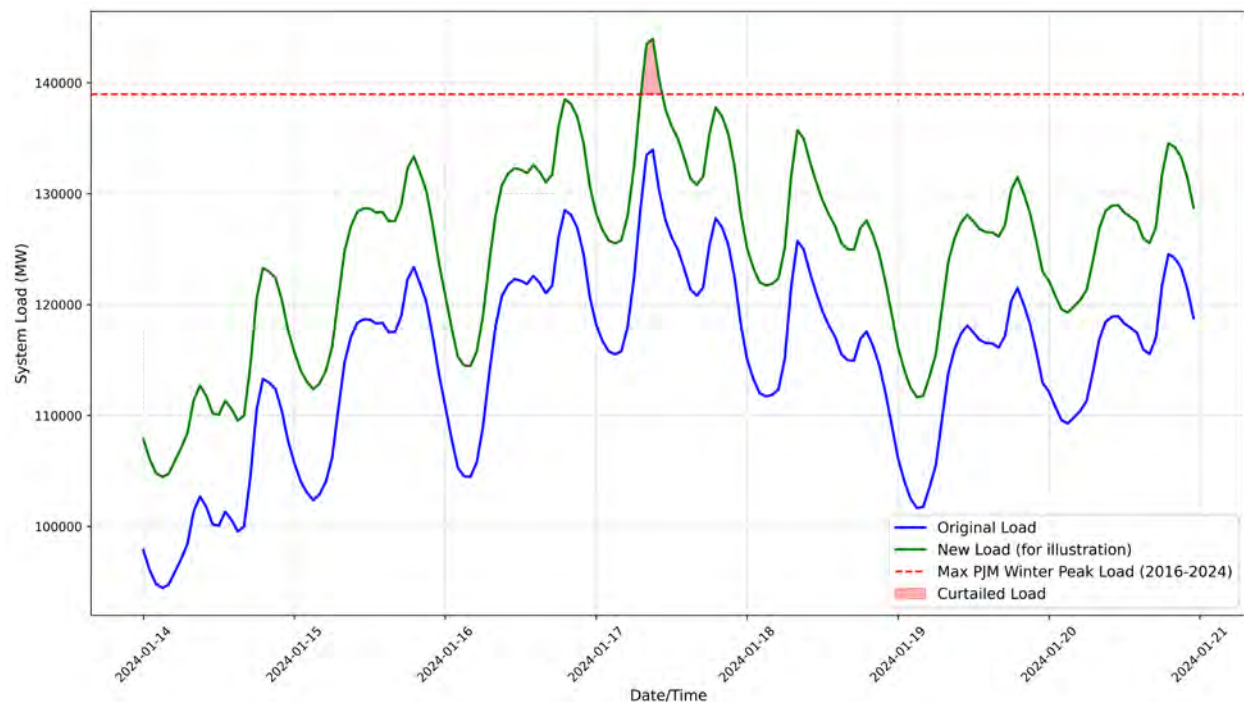
18 For example, PG&E's and Southern California Edison's Base Interruptible Programs limit annual interruption for registered customers to a maximum of 180 hours (2.0% of all annual hours) or 10 events per month.

19 The goal-seek approach was implemented using Python's `scipy.optimize.root_scalar` function from the SciPy library. This tool is designed for solving one-dimensional root-finding problems, where the goal is to determine the input value that satisfies a specified equation within a defined range.

20 To identify the max seasonal peak load, summer was defined as June–August, while winter encompassed December–February. In a few cases, the BA's seasonal peak occurred within one month of these periods (AZPS winter, FPL winter, CAISO summer, CAISO winter), which were used as their max seasonal peak. To account for potential (albeit less likely) curtailment in shoulder months, the applicable summer peak was applied to April–May and September–October and the winter peak to November and March.



**Figure 4. Illustrative Load Flexibility in PJM**



megawatt-hours that exceeded these thresholds was counted as curtailed energy. This seasonal differentiation captures the distinct demand characteristics of regions dominated by cooling loads (summer peaks) versus heating loads (winter peaks).

### Year-by-Year Curtailment Analysis

Curtailment was analyzed independently for each year from 2016 to 2024. This year-by-year approach captures temporal variability in demand patterns, including the effects of extreme weather events and economic conditions. For each year, curtailment volumes were calculated across all load addition increments, resulting in a list of annual curtailment rates corresponding to each load increment. To synthesize results across years, we calculated the average curtailment rate for each load addition increment by averaging annual curtailment rates over the nine years. This averaging process smooths out year-specific anomalies and provides an estimate of the typical system response to additional load. This analysis was also used to calculate the average number of hours of curtailment for each curtailment limit and the seasonal allocation of curtailed generation.<sup>21</sup> We also assessed the magnitude of load curtailment required during these hours as a share of the new load's maximum potential draw to calculate the number of hours when 90%, 75%, and 50% or more of the load would still be available.

<sup>21</sup> Consistent with the curtailment analysis, summer was defined as June–August and winter as December–February. For BAs located on the Pacific coast (BPA, CAISO, PGE, PACE, PACW), November was counted as winter given the region's unique seasonal load profile.

**Figure 5. Load Factor by Balancing Authority and Season, 2016–2024**

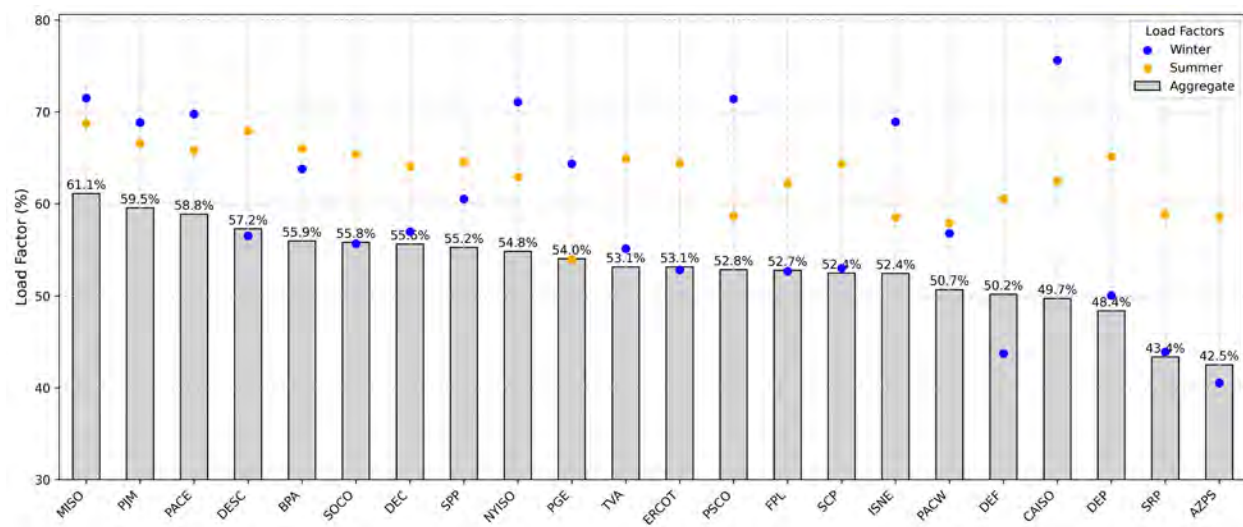
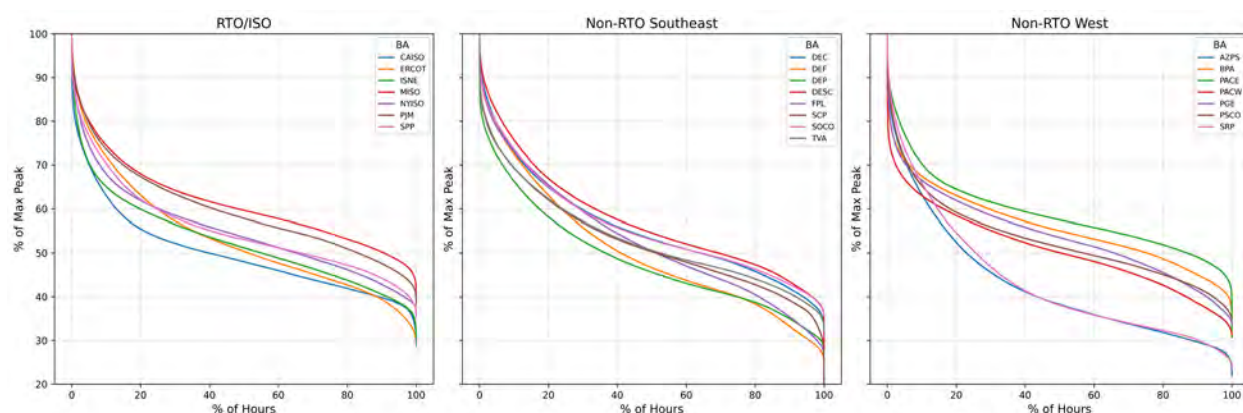


**Figure 6. Load Duration Curves by Balancing Authority, 2016–2024**



## Results

### Load Factor

In examining data for 22 balancing authorities, we found that aggregate load factors ranged between 43% to 61% (Figures 5 and 6), with an average and median value of 53%. The BAs with the lowest aggregate load factors were those in the desert southwest, Arizona Public Service Company (AZPS) and Salt River Project Agricultural Improvement and Power District (SRP). In terms of seasonal load factor, defined here as the average seasonal load as a share of seasonal maximum load (i.e., not as a share of the maximum all-time system load), winter load factors were notably lower than summer. The average and median winter load factor was 59% and 57% respectively, compared to 63% and 64% for summer. A majority of the balancing authorities had higher summer load factors (14) than winter (8).

### Headroom Volume

Results show that the headroom across the 22 analyzed balancing authorities is between 76 to 215 GW, depending on the applicable load curtailment limit. This means that 76 to 215 GW of load could be added to the US power system and yet the total cumulative load would remain below the historical peak load, except for a limited number of hours per year

**Figure 7. Headroom Enabled by Load Curtailment Thresholds, GW**

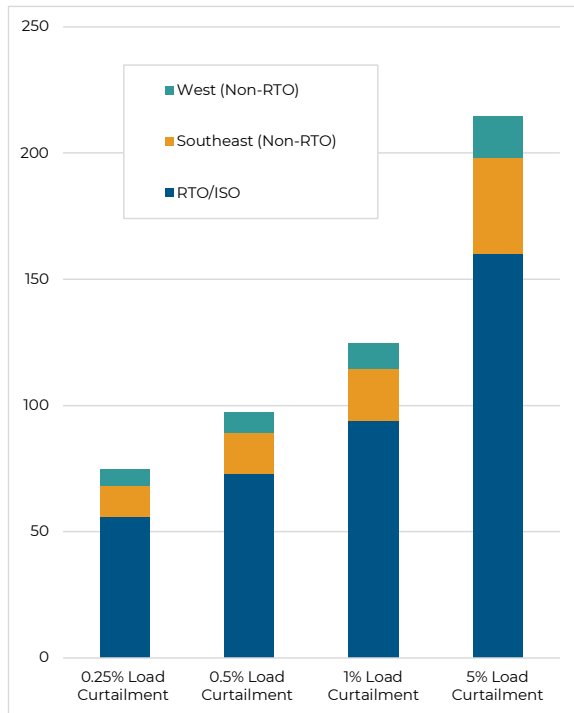


**Figure 8. Headroom Enabled by 0.5% Load Curtailment by Balancing Authority, GW**

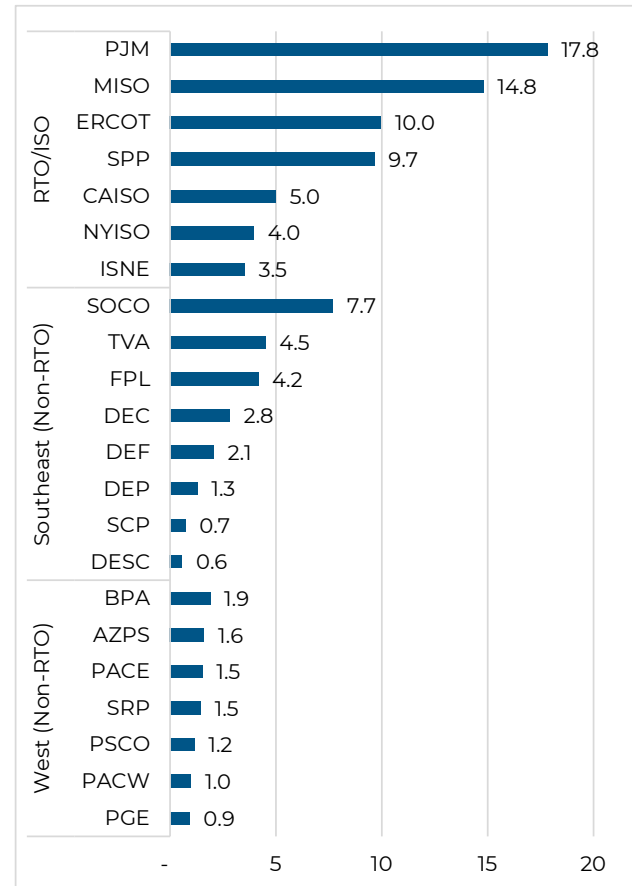
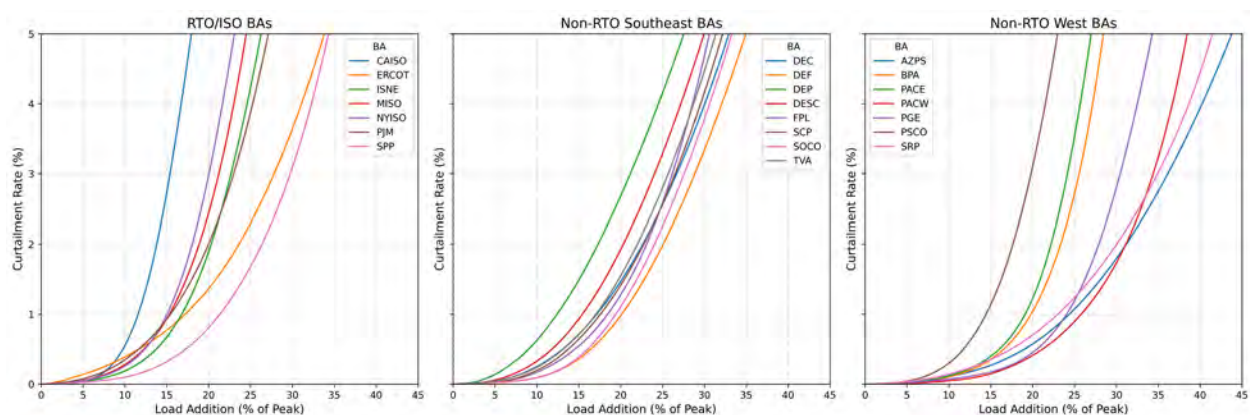


**Figure 9. Load Curtailment Rate Due to Load Addition, % of System Peak**



when the new load would be unserved. Specifically, 76 GW of headroom is available at an expected load curtailment rate of 0.25% (i.e., if 0.25% of the maximum potential annual energy consumption of the new load is curtailed during the highest load hours, or 1,643 out of 657,000 GWh). This headroom increases to 98 GW at 0.5% curtailment, 126 GW at 1.0% curtailment, and 215 GW at 5.0% curtailment (Figure 7). Headroom varies by balancing authority (Figure 8), including as a share of system peak (Figure 9). The five balancing authorities with the highest potential volume at 0.5% annual curtailment are PJM at 18 GW, MISO at 15 GW, ERCOT at 10 GW, SPP at 10 GW, and Southern Company at 8 GW. Detailed plots for each balancing authority, including results for each year, can be found in Appendix A.

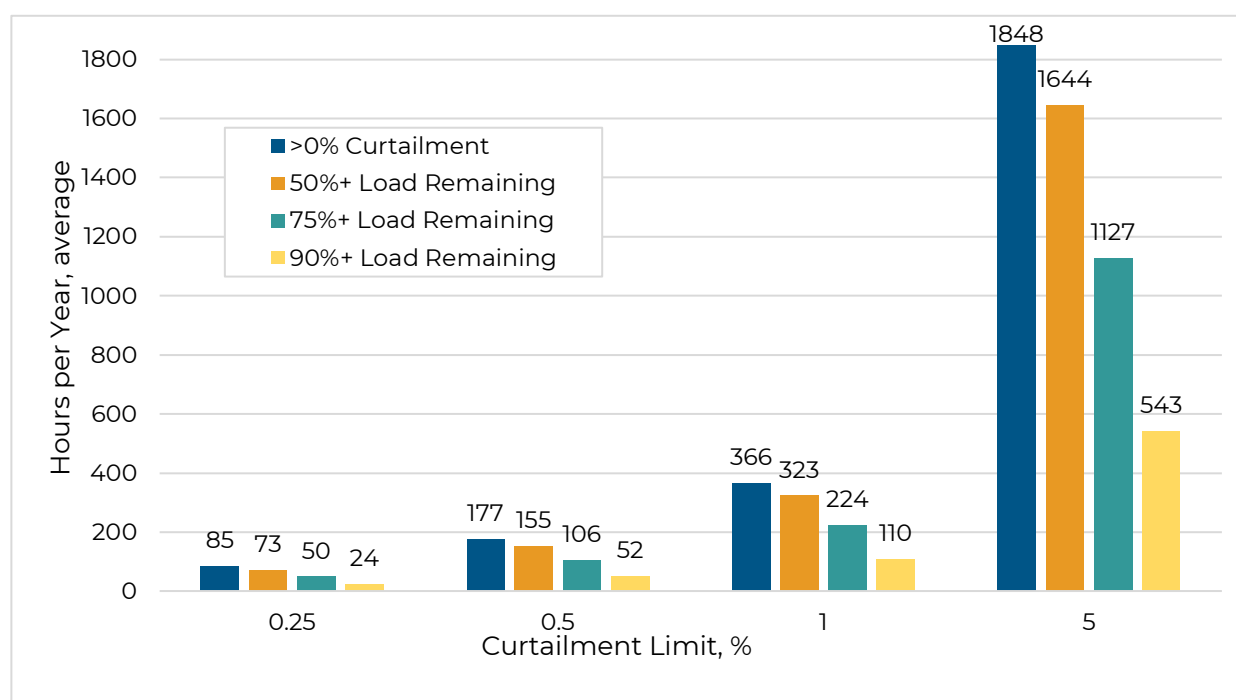
### Curtailment Hours

A large majority of curtailment hours retain most of the new load. Most hours during which load reduction is required entail a curtailment rate below 50% of the new load. Across all 22 BAs, the average required load curtailment times are 85 hours under the 0.25% curtailment rate (~1% of the hours in a year), 177 hours under the 0.5% curtailment rate, 366 hours under the 1.0% curtailment rate, and 1,848 hours under the 5.0% curtailment rate (i.e., ~21% of the hours). On average, 88% of these hours retain at least 50% of the new load (i.e., less than 50% curtailment of the load is required), 60% of the hours retain at least 75% of the load, and 29% retain at least 90% of the load (see Figure 10).

### Curtailment Duration

The analysis calculated the average hourly duration of curtailment events (i.e., the length of time the new load is curtailed during curtailment events). All hours in which any curtailment occurred were included, regardless of magnitude. The results for each balancing authority and curtailment limit are presented in Figure 11. The average duration across BAs was 1.7 hours for the 0.25% limit, 2.1 hours for the 0.5% limit, 2.5 hours for the 1.0% limit, and 4.5 hours for the 5.0% limit.

**Figure 10. Hours of Curtailment by Load Curtailment Limit**



## Seasonal Concentration of Curtailment

The analysis reveals significant variation in the seasonal concentration of curtailment hours across balancing authorities. The winter-summer split ranged from 92% to 1% for CAISO (California Independent System Operator), where curtailment is heavily winter-concentrated, to 0.2% to 92% for AZPS,<sup>22</sup> which exhibited a heavily summer-concentrated curtailment profile (Figure 12a).<sup>23</sup>

**Figure 11. Average Curtailment Duration by Balancing Authority and Curtailment Limit, Hours**

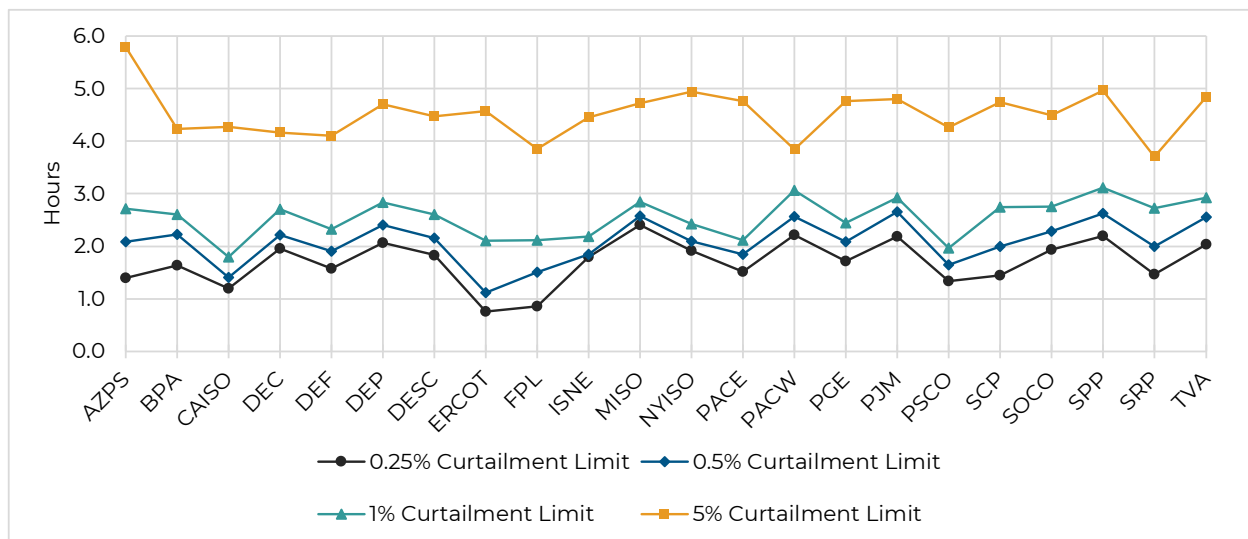
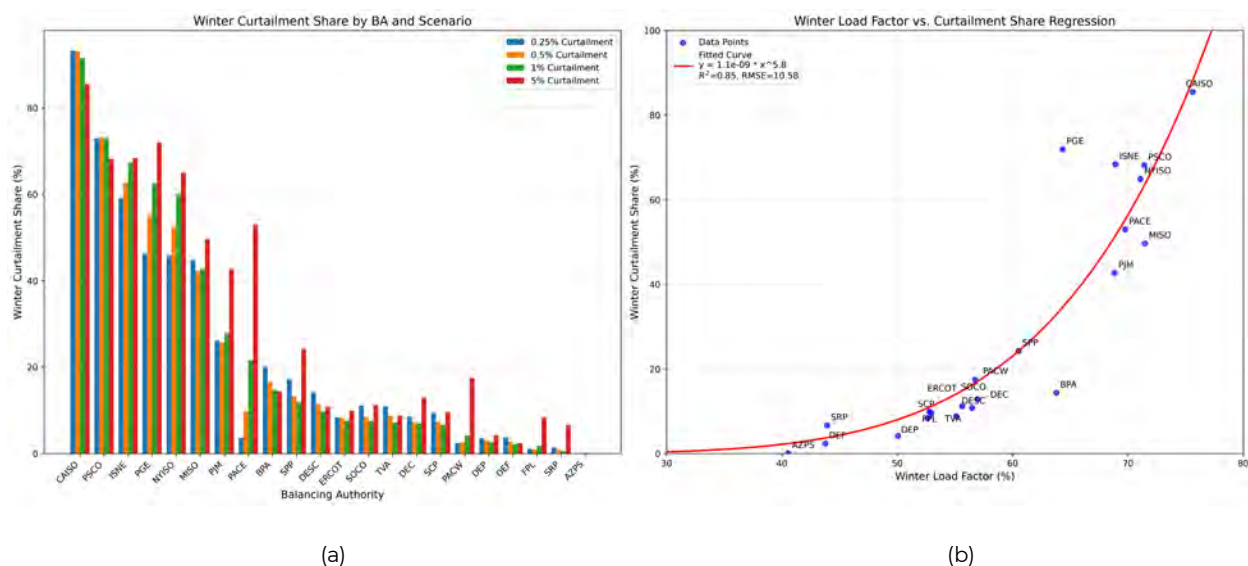


**Figure 12. Seasonal Curtailment Analysis**



22 Note the remainder of the curtailment occurred in these BAs in shoulder months (i.e., not summer, not winter).

23 These values correspond to the seasonal curtailment concentration for the 1% curtailment limit.



A key observation is the strong correlation between the winter load factor (system utilization during winter months) and the seasonal allocation of curtailment hours ([Figure 12b](#)). BAs with lower winter load factors—indicating reduced system utilization during winter—tend to have greater capacity to accommodate additional load in winter while experiencing a disproportionately higher share of curtailment during summer months. This trend is particularly pronounced in balancing authorities located in the Sun Belt region, resulting in a lower winter concentration of curtailment hours.

While most BAs exhibited relatively stable seasonal curtailment shares across increasing load addition thresholds, some demonstrated notable shifts in seasonal allocation as load additions increased (e.g., PACW, FPL, NYISO, ISO-NE, PACE, PGE). These shifts highlight the dynamic interplay between system demand patterns and the incremental addition of new load.

[Figure 12a](#) illustrates this variability, showcasing the relationship between winter load factor and winter curtailment share across curtailment scenarios.<sup>24</sup>

## Discussion

The results highlight that the significant headroom in US power systems—stemming from their by-design low load factors—could be tapped to enable the integration of substantial load additions with relatively low rates of load curtailment. They also underscore substantial variation in flexibility across balancing authorities, driven by differences in seasonal and aggregate load patterns. This variation suggests that seasonal load factors may be strongly linked to how much additional load a balancing authority can integrate without requiring high curtailment rates.

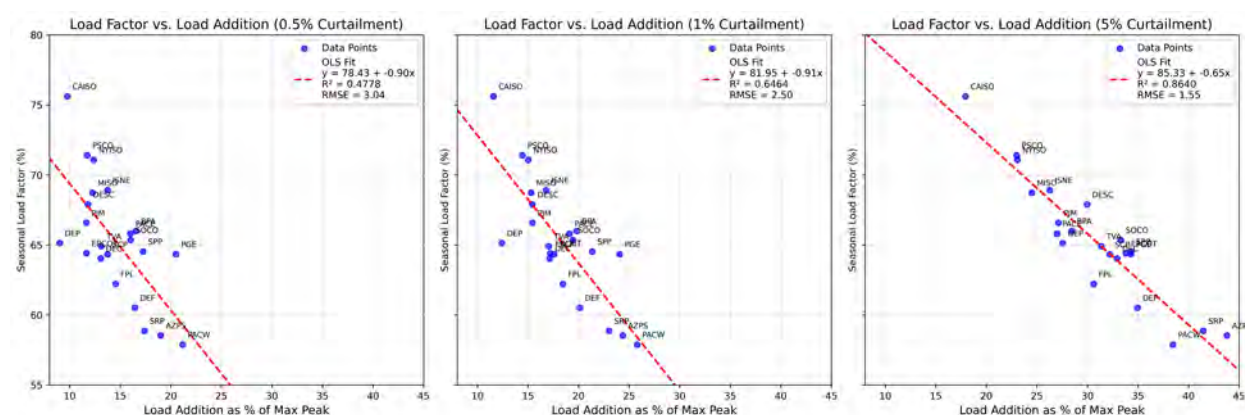
To explore this relationship, we analyzed system load factors in relation to the additional load that each balancing authority could accommodate while limiting the load curtailment rate to 0.5%, 1.0%, and 5.0% (i.e., the load curtailment limit). To allow for meaningful comparison across BAs, the additional load was standardized as a percentage of the BA's historical peak load. To account for whether a balancing authority's curtailment was concentrated in the summer or winter, the seasonal load factor was selected corresponding to the season with the highest share of curtailment.

The analysis revealed that BAs with higher seasonal load factors tended to have less headroom for the load curtailment limits examined ([Figure 13](#)). In simpler terms, systems with higher utilization during their busiest season had less power generation capacity planned to be available that could serve new load without hitting curtailment limits. For example, CAISO, with a seasonal load factor of 76%, could accommodate less additional load compared to PacifiCorp West (PACW) and AZPS, which exhibited lower seasonal load factors and supported larger load additions as a share of peak system load. This relationship grew in statistical significance as the load curtailment limit increased, yielding an  $R^2$  value of 0.48 and an RMSE of 3.04 at the 0.5% curtailment limit, and an  $R^2$  value of 0.86 and an RMSE of 1.55 at the 5% curtailment limit (i.e., 86% of the variation in load addition capacity across balancing authorities can be explained by differences in load factor at a curtailment limit of 5.0%).

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24 Note in [Figure 12b](#) that a high-degree polynomial function captures the nonlinear growth in the area under the load curve as curtailed load exceeds a fixed peak threshold. This fit generally aligns with expectations, demonstrating that higher-degree terms are necessary to capture the relationship between load factor and curtailed load.

**Figure 13. Load Factor Versus Max Load Addition as Share of Peak Load**



These findings emphasize the importance of load factor as a predictor of curtailment-enabled headroom. BAs with more uneven peak seasonal demand—characterized by relatively low system utilization in winter or summer—tend to have greater capacity to integrate new loads with limited curtailment. Conversely, systems with more consistent demand across the winter and summer face tighter limits, as their capacity to absorb additional load is already constrained by elevated baseline usage.

## Limitations

This analysis provides a first-order assessment of power generation capacity available for serving new curtailable loads, and hence is an exploration of the market potential for large-scale demand response. The primary focus of the analysis is to ensure that total demand, subject to curtailment limits for new load, stays below the system peak for which system planners have prepared. Other considerations important for planning—such as ensuring adequate transmission capacity, ramping capability, and ramp-feasible reserves, among others—are beyond the scope of this study and therefore the results cannot be taken as an accurate estimate of the load that can be added to the system. Additionally, the analysis assumes the new loads do not change current demand patterns but rather shift the existing demand curves upward, and a more precise assessment of the potential for integration of new loads would require detailed characterization of the temporal patterns of the load. There is significant variation in how system operators forecast and plan for system peaks, accounting for potential demand response, and as a result there will be differences in the methods used to estimate potential to accommodate new load. Despite these limitations, the results presented here signal a vast potential that, even if overstated, warrants further research.

On the other hand, some aspects of this study may have contributed to an underestimation of available headroom. First, the analysis assumes that each BA's maximum servable load in the winter and summer is equivalent to the BA's highest realized seasonal peak demand based on the available historical data. However, the available generation capacity in each balancing authority should materially exceed this volume when accounting for the installed reserve margin. In other words, system operators have already planned their systems to accommodate load volume that exceeds their highest realized peak. Second, the analysis removed outlier demand values in some BAs to avoid using unreasonably high maximum peak thresholds, which would understate the curtailment rates. However, if some of the removed outliers properly represent a level of system load that the system is prepared to serve reliably,

this analysis may have understated the curtailment-enabled headroom. Third, the analysis assumed all new load is constant and hence increases the total system load by the same gigawatt hour-by-hour, which would tend to overstate the absolute level of required gigawatt hour curtailment for a load that is not constant.

## Future Analysis

Enhancing this analysis to more accurately assess the capacity to integrate large curtailable load would require addressing the following considerations:

### Network Constraints

This analysis does not account for network constraints, which would require a power flow simulation to evaluate the ability of the transmission system to accommodate additional load under various conditions. As such, the results should not be interpreted as an indication that the identified load volumes could be interconnected and served without any expansions in network capacity. While the existing systems are planned to reliably serve their peak loads, this planning is based on the current load topology and the spatial distribution of generation and demand across the transmission network. A large new load could avoid exceeding aggregate peak system demand by employing flexibility, yet still cause localized grid overloads as a result of insufficient transmission capacity in specific areas. Such overloads could necessitate network upgrades, including the expansion of transmission lines, substations, or other grid infrastructure. Alternatively, in the absence of network upgrades, localized congestion could be addressed through the addition of nearby generation capacity, potentially limiting the flexibility and economic benefits of the new load. These factors underscore the importance of incorporating network-level analyses to fully understand the operational implications of large flexible load additions.

### Intertemporal Constraints

This analysis does not account for intertemporal constraints related to load and generator operations. For load operations, response times affect system operations and management of operational reserves. Faster response times from flexible loads could alleviate system stress more effectively during peak demand periods, potentially reducing the reliance on reserve capacity. Conversely, slower response times may require additional reserves to bridge the gap between the onset of system imbalances and the load's eventual response. Moreover, the rapid ramp-down of large flexible loads could lead to localized stability or voltage issues, particularly in regions with weaker grid infrastructure. These effects may necessitate more localized network analyses to evaluate stability risks and operational impacts. On the generation side, intertemporal constraints such as ramping limits, minimum up and down times, and startup times can affect the system's ability to integrate fast-response demand. For instance, ramping constraints may restrict how quickly generators can adjust output to align with the curtailment of flexible loads, while minimum uptime and downtime requirements can limit generator flexibility.

### Loss of Load Expectation

Peak load is a widely used proxy for resource adequacy and offers a reasonable indicative metric for high-level planning analyses. However, a more granular assessment would incorporate periods with the highest loss of load expectation (LOLE), which represent the times when the system is most likely to experience supply shortfalls. Historically, LOLE periods have aligned closely with peak load periods, making peak load a convenient and broadly



applicable metric. However, in markets with increasing renewable energy penetration, LOLE periods are beginning to shift away from traditional peak load periods. This shift is driven by the variability and timing of renewable generation, particularly solar and wind, which can alter the temporal distribution of system stress. As a result, analyses focused solely on peak load may understate or misrepresent the operational challenges associated with integrating large new loads into these evolving systems.

## CONCLUSION

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This study highlights extensive potential for leveraging large load flexibility to address the challenges posed by rapid load growth in the US power system. By estimating the curtailment-enabled headroom across balancing authorities, the analysis demonstrates that existing system capacity—intentionally designed to accommodate the extreme swings of peak demand—could accommodate significant new load additions with relatively modest curtailment, as measured by the average number, magnitude, and duration of curtailment hours.

The findings further emphasize the relationship between load factors and headroom availability. Balancing authorities with lower seasonal load factors exhibit greater capacity to integrate flexible loads, highlighting the importance of regional load patterns in determining system-level opportunities. These results suggest that load flexibility can play a significant role in improving system utilization, mitigating the need for costly infrastructure expansion and complementing supply-side investments to support load growth and decarbonization objectives.

This analysis provides a first-order assessment of market potential, with estimates that can be refined through further evaluation. In particular, network constraints, intertemporal operational dynamics, and shifts in loss-of-load expectation periods represent opportunities for future analyses that can offer a deeper understanding of the practical and operational implications of integrating large flexible loads.

In conclusion, the integration of flexible loads offers a promising, near-term strategy for addressing structural transformations in the US electric power system. By utilizing existing system headroom, regulators and market participants can expedite the accommodation of new loads, optimize resource utilization, and support the broader goals of reliability, affordability, and sustainability.

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## ABBREVIATIONS

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|         |                                                                |
|---------|----------------------------------------------------------------|
| AI      | Artificial intelligence                                        |
| AZPS    | Arizona Public Service Company                                 |
| BA      | balancing authority                                            |
| BPA     | Bonneville Power Administration                                |
| CAGR    | compound annual growth rate                                    |
| CAISO   | California Independent System Operator                         |
| CLRs    | controllable load resources                                    |
| CPUs    | central processing units                                       |
| DEC     | Duke Energy Carolinas                                          |
| DEF     | Duke Energy Florida                                            |
| DEP     | Duke Energy Progress East                                      |
| DERs    | distributed energy resources                                   |
| DESC    | Dominion Energy South Carolina                                 |
| EIA     | Energy Information Administration                              |
| EPRI    | Electrical Power Research Institute                            |
| ERCOT   | Electric Reliability Council of Texas                          |
| ERIS    | Energy Resource Interconnection Service                        |
| FERC    | Federal Energy Regulatory Commission's                         |
| FPL     | Florida Power & Light                                          |
| GPUs    | graphics processing units                                      |
| ICT     | information, and communication technology                      |
| ISO-NE  | ISO New England                                                |
| LGIA    | Large Generator Interconnection Agreement                      |
| LOLE    | loss of load expectation                                       |
| MISO    | Midcontinent Independent System Operator                       |
| NYISO   | New York Independent System Operator                           |
| PACE    | PacifiCorp East                                                |
| PACW    | PacifiCorp West                                                |
| PG&E    | Pacific Gas and Electric                                       |
| PGE     | Portland General Electric Company                              |
| PJM     | PJM Interconnection                                            |
| PSCO    | Public Service Company of Colorado                             |
| RMSE    | Root mean square error                                         |
| RTO/ISO | Regional transmission organization/independent system operator |
| SCP     | Santee Cooper, South Carolina Public Service Authority         |
| SEAB    | Secretary of Energy Advisory Board                             |
| SLAs    | service-level agreements                                       |
| SOCO    | Southern Company                                               |
| SPP     | Southwest Power Pool                                           |
| SRP     | Salt River Project Agricultural Improvement and Power District |
| TPU     | tensor processing unit                                         |
| TVA     | Tennessee Valley Authority                                     |

## APPENDIX A: CURTAILMENT-ENABLED HEADROOM PER BALANCING AUTHORITY

Figure A.1. Curtailment Rate Versus Load Addition by RTO/ISO, MW

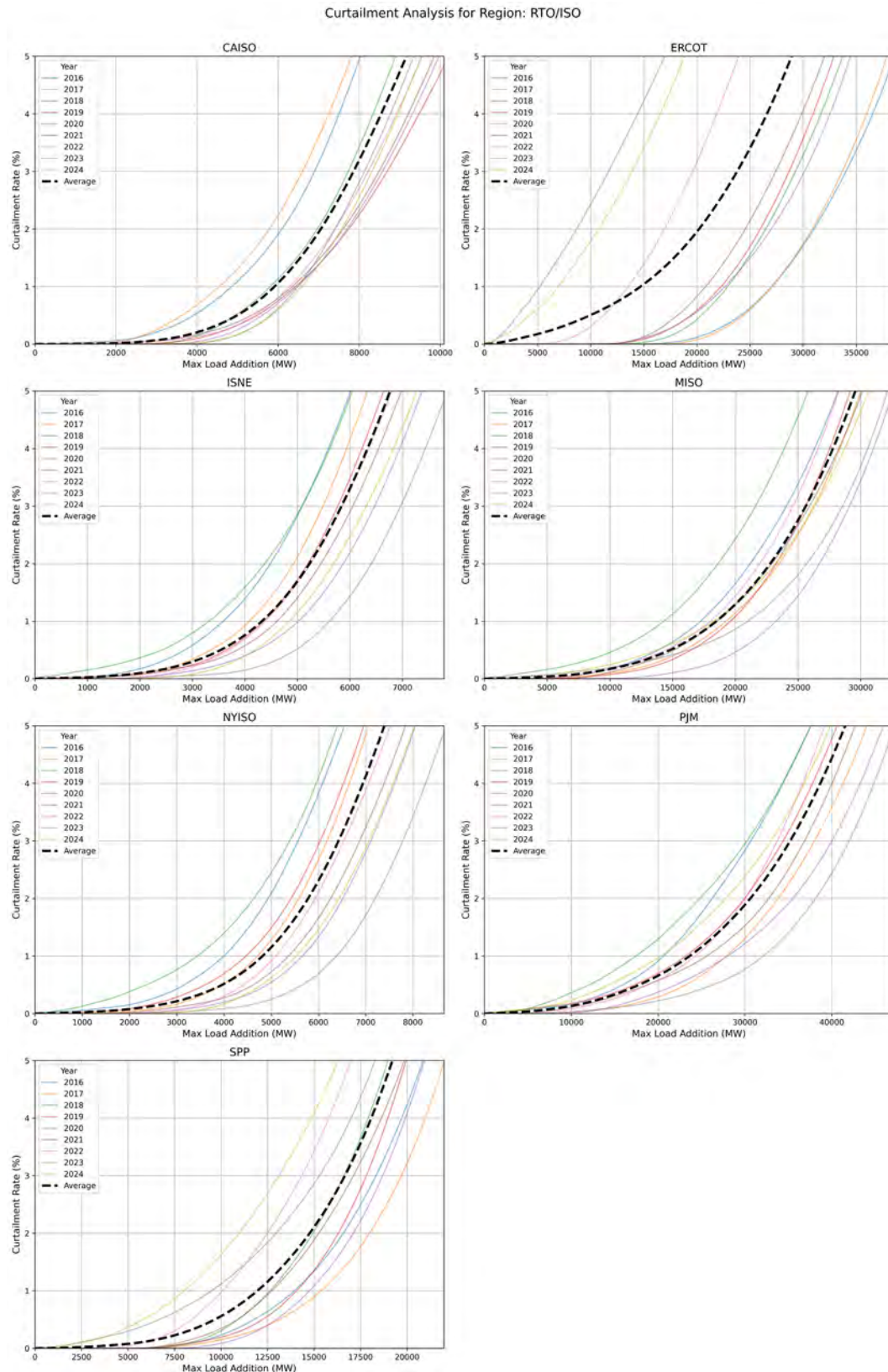


**Figure A.2. Curtailment Rate Versus Load Addition by Non-RTO Southeastern Balancing Authority, MW**

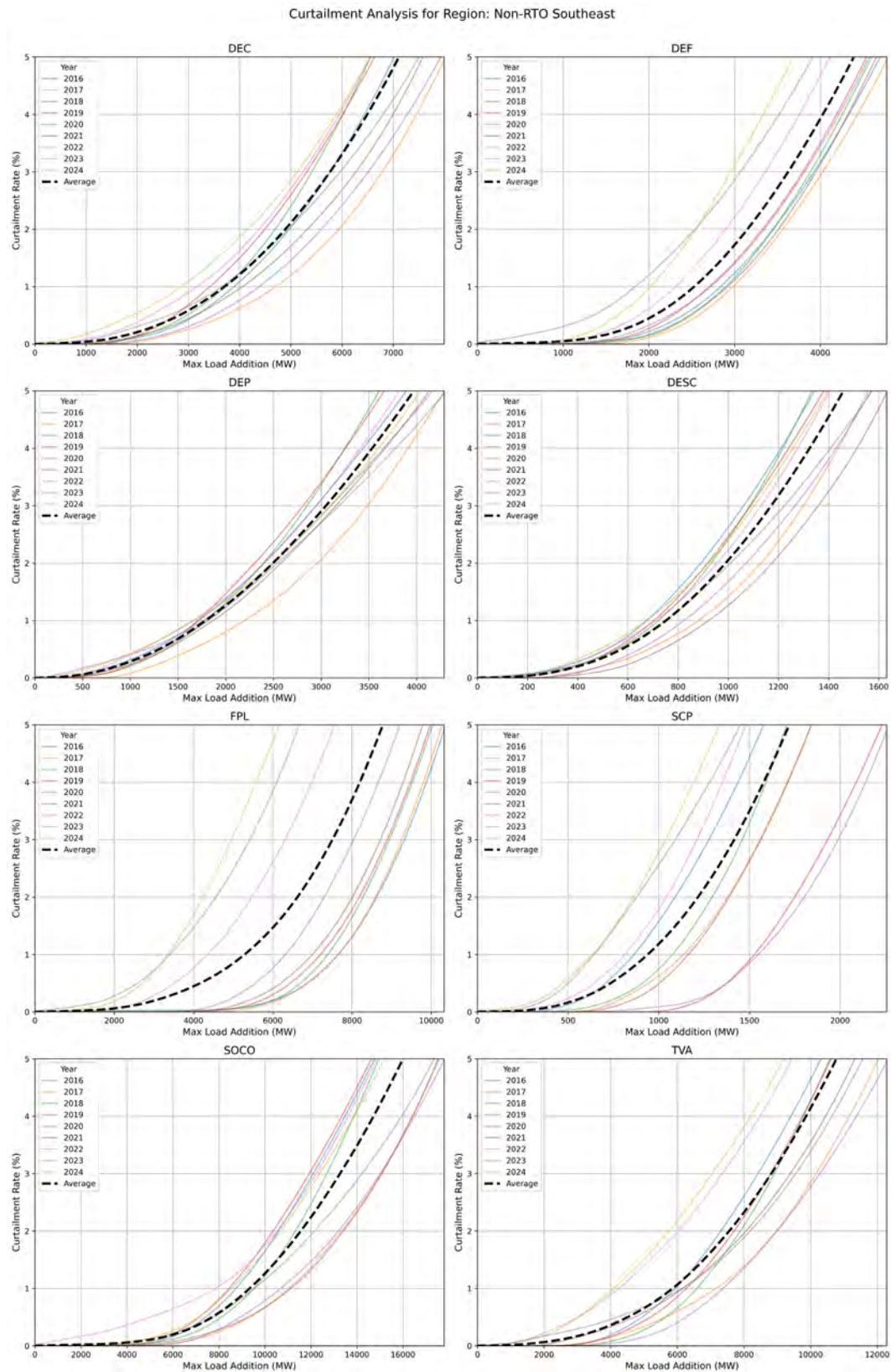
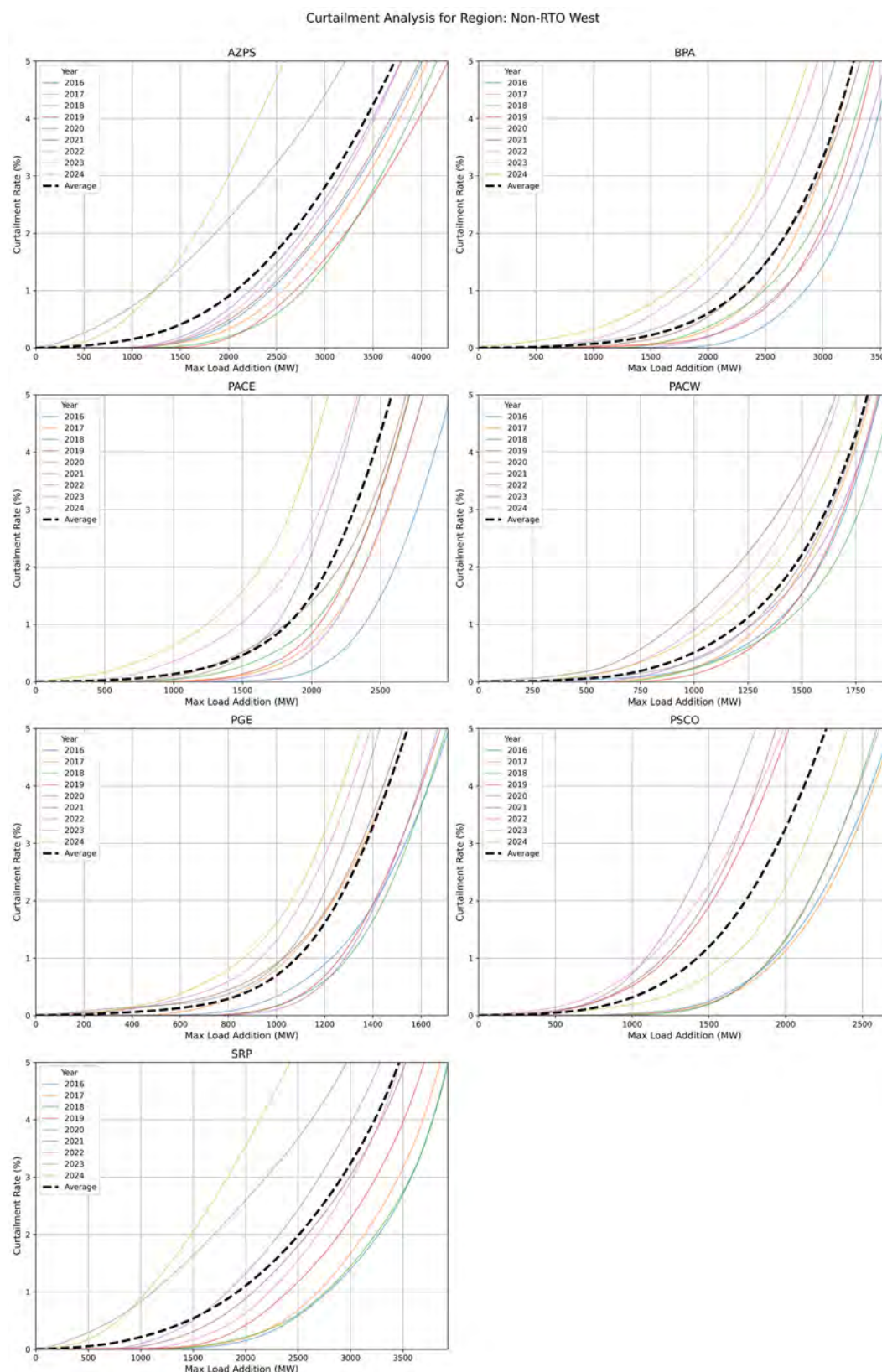




**Figure A.3. Curtailment Rate Versus Load Addition by Non-RTO Western Balancing Authority, MW**



## APPENDIX B: DATA CLEANING SUMMARY

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The data cleaning process attempted to improve the accuracy of nine years of hourly load data across the 22 balancing authorities, including the following steps:

### 1. Data normalization

- **Dates:** Date-time formats were verified to be uniform.
- **Demand data:** Where the balancing authority had an “Adjusted demand” value for a given hour, this value was used, otherwise its “Demand” value was used. The final selected values were saved as “Demand” and a log was kept.
- **BA labels:** Labels were mapped to align with widely used acronyms, including:
  - CPLE → DEP
  - DUK → DEC
  - SC → SCP
  - SWPP → SPP
  - SCEG → DESC
  - FPC → DEF
  - CISO → CAISO
  - BPAT → BPA
  - NYIS → NYISO
  - ERCO → ERCOT

### 2. Identifying and handling outliers

- **Missing and zero values:** Filled using linear interpolation between adjacent data points to maintain temporal consistency.
- **Low outliers:** Demand values below a predefined cutoff threshold (such as 0 or extremely low values inconsistent with historical data) were flagged. Imputation for flagged low outliers involved identifying the closest non-outlier value within the same balancing authority and time period and replacing the flagged value.
- **Spikes:** Sudden demand spikes that deviated significantly from historical patterns were flagged. Corrections were applied based on nearby, consistent data.
- **Erroneous peaks:** Specific known instances of demand peaks that are outliers (e.g., caused by reporting errors) are explicitly corrected or replaced with average values from adjacent time periods.

### 3. Data validation:

- Seasonal and annual peak loads, load factors, and other summary statistics were computed and inspected to ensure no unexpected results. Max peaks were compared to forecasted peaks collected by FERC to ensure none were out of range.
- Logs summarizing corrections, including the number of spikes or outliers addressed for each balancing authority, were saved as additional documentation.

## APPENDIX C: CURTAILMENT GOAL-SEEK FUNCTION

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Mathematically, the function can be expressed as

$$\frac{1}{N} \sum_{y=1}^N \left( \frac{Curtailment_y(L)}{L \cdot 8,760} \cdot 100 \right) = CurtailLimit$$

where

|                    |   |                                                                                              |
|--------------------|---|----------------------------------------------------------------------------------------------|
| $L$                | = | load addition in MW (constant load addition for all hours)                                   |
| $N$                | = | total number of years in the analysis (2016–2024)                                            |
| $Curtailment_y(L)$ | = | curtailed MWh for year $y$ at load addition $L$                                              |
| $L \cdot 8,760$    | = | maximum potential energy consumption of the new load operating continuously at full capacity |
| $CurtailLimit$     | = | predefined curtailment limit (e.g., 0.25%, 0.5%, 1.0%, or 5.0%).                             |

For each hour  $t$  in year  $y$ , the curtailment is defined as

$$Curtailment_t(L) = \max(0, Demand_t + L - Threshold_t)$$

where

|               |   |                                                                                                                  |
|---------------|---|------------------------------------------------------------------------------------------------------------------|
| $L$           | = | load addition being evaluated in MW                                                                              |
| $Demand_t$    | = | system demand at hour $t$ in MW                                                                                  |
| $Threshold_t$ | = | seasonal peak threshold applicable for hour $t$ in MW (i.e., the maximum winter or summer peak across all years) |

These hourly curtailments are aggregated to find the total annual curtailment

$$Curtailment_y(L) = \sum_{t \in T_y} Curtailment_t(L)$$

where

|       |   |                         |
|-------|---|-------------------------|
| $T_y$ | = | all hours in year $y$ . |
|-------|---|-------------------------|

Replacing  $Curtailment_y(L)$  in the original formula, the integrated formula becomes

$$\frac{1}{N} \sum_{y=1}^N \left( \frac{\sum_{t \in T_y} \max(0, Demand_t + L - Threshold_t)}{L \cdot 8,760} * 100 \right) = CurtailLimit$$



