Appendix A - Staff's Analysis of Ameren Missouri

Introduction:

On June 5, 2019, the Commission directed Staff to begin an investigation into the self-commit and self-scheduling practices of Missouri's investor-owned utilities.[1] The following report documents Staff's analysis and conclusions based on the information provided by Union Electric Company d/b/a Ameren Missouri ("Ameren Missouri").

Ameren Missouri's Operation Strategy:

At Staff's request, Ameren Missouri provided the general reasons behind its decisions to self-commit its power plants.

Ameren Missouri stated as follows:

> In general, Ameren Missouri utilizes a must run commit status for those units whose operating characteristics, such as high cost to restart, expected increase in forced outages if the units are not placed in must run commit status, and maintenance and capital costs due to unit cycling (again, if not placed in must run commit status), warrant such a designation. These units include all of Ameren Missouri's coal-fired units (other than those at the Meramec Energy Center) and the Callaway Nuclear Energy Center. Must run commit status is also utilized for Osage and Keokuk Energy Centers to ensure compliance with permit requirements regarding minimum flows. Must run commit status may also be used for other units not mentioned above when such a unit is scheduled for testing to ensure that the unit will be in operation for the test. Additionally, that status may be used for non-base load units in instances where the margin on the first day alone would not warrant committing the unit (due to its start-up cost) but where the expected margin over a longer period of time justifies committing the unit. Finally, a nuclear unit cannot be cycled and must remain online due to its unique operating requirements and consequently, Ameren Missouri designates it as a must run unit.

[1] EW-2019-0370, "Order Opening An Investigation of Missouri Jurisdictional Generator Self-Commitments And Self-Scheduling."

Regarding self-scheduling as noted earlier, Ameren Missouri does not generally use the self-scheduled dispatch status for energy. Rather, Ameren Missouri offers its units into the market with an economic dispatch status, thus allowing the operation of the MISO market to establish the level at which the unit is dispatched (for units that have been self-committed, that level will be at or above the unit minimum). MISO's dispatch will depend on its model's comparison of the as-offered unit cost for energy to the locational marginal price ("LMP") for the next dispatch segment. The as-offered costs are based on incremental cost, including fuel, associated transportation expense, an estimate of variable operations and maintenance ("O&M") costs, and emissions allowances. In the case of renewable energy resources, the as-offered cost will also account for foregone production tax credits and in the case of storage resources, the cost to replenish the resource is considered.

In making its commit status decisions, the Company's guiding principle is to clear (i.e., sell energy from) its units in the market when doing so benefits customers. Determining this benefit, however, is much more complex than simply comparing as-offered production costs to the prevailing market prices. In addition, the algorithm employed by MISO's model in its day-ahead market to commit units does not adequately account for certain factors that must be accounted for in order to determine what commit status is beneficial.[2]

Day Ahead Market Model:

Ameren Missouri stated as follows:

The MISO algorithm used in its day-ahead market has certain limitations in this regard which arise from the fact that the MISO day-ahead market only analyzes the 24-hour period of the next calendar day.

To illustrate the limitation of the MISO day-ahead model's 24-hour look ahead period, consider the operating and cost constraints of a Labadie Energy Center unit. These units

[2] Ameren Missouri's Response to Order Opening An Investigation Of Missouri Jurisdictional Generator Self-Commitments And Self Scheduling and to Order Directing Comments pgs. 3-4 B 6-8

each have a startup cost in excess of $70,000. If these units were to be offered as economic, they would be de-committed by MISO whenever the total market revenue for the next operating day was less than the as-offered cost for energy – regardless of market price projections for the remainder of the week, the cost to restart the unit, or cycling-related maintenance and capital costs. The unit would then only be committed by MISO if its margin is above the as-offered cost for energy and is enough to also cover the cost to restart the unit. Those restart costs are a significant hurdle to overcome and they were simply not considered by MISO's modeling when the model would decide to de-commit the unit, if the unit is in economic commit status. Putting dollars to the illustration, assume that the unit is offered on the last day of a month and that the MISO model predicts a revenue short fall on the first day of the next month of $1,000. Assume further, however, that for the remaining 29 days (assuming a 30-day month) of that month the actual revenues would exceed costs by $20,000 per day if the unit were to remain on-line. If the unit is offered as economic, MISO would de-commit the unit for the first day of the month and it would remain unavailable until the fourth day of the month due to the minimum down time. After that, the model would also keep it off-line because the potential daily margin of $20,000 would not cover the cost to start the unit. In this illustration, the unit would have foregone a total benefit to customers (and reflected in Ameren Missouri's fuel adjustment clause) of almost $600,000 if it had been in a must run status, but instead it received nothing, as it was offered as economic and never ran during the month.

Another consequence of the model's limited forward period for analysis is that market participants do not have a clear means of informing MISO of what the cost to shut down a unit is expected to be (such costs include the cost to restart the unit, foregone expected positive margins during minimum down times, and increases in maintenance and capital costs related to unit cycling (i.e., committing/de-committing/committing again).[3]

[3] Ameren Missouri's Response to Order Opening An Investigation Of Missouri Jurisdictional Generator Self-Commitments And Self Scheduling and to Order Directing Comments, pgs. 6 B6-12, B6-13

1. **Operating and Maintenance Costs:**

Ameren Missouri stated as follows:

> As the Commission is likely aware, Ameren Missouri's coal-fired units are primarily designed for baseload (continuous) operation. However, cycling them on a frequent basis decreases unit availability, and shortens component life expectancies resulting in increased maintenance and capital costs. Each time a power plant is cycled, its major and minor auxiliary components experience significant thermal and pressure stresses, which cause damage. This is most concerning for equipment that is subjected to high temperatures and pressures, and other mechanical forces. Over time and repeated cycles, this can result in failure of critical components. Under a frequent cycling dispatch model, component life can be expected to be shortened. In addition, frequent cycling can be expected to result in more forced outages than would otherwise be the case; which reduces the margins that the unit can produce and increases net energy costs for customers.
>
> The impact on maintenance and capital costs resulting from increased forced outages, component failure, and shortened component life is significant. This is in addition to foregone market margins when units are out of service. Increased cycling is reasonably expected to result in increased turbine fouling which is a leading cause of unit derates. Correcting this condition can cost several million dollars during a two to three-month long outage period. The number of tube leaks experienced by a unit which is cycled frequently would also be expected to increase. As a conservative estimate, a tube leak outage can cost as much as $50,000 per day in repair costs. A shortening of the inspection intervals for generator field windings to approximately every five (5) years versus the current approximately ten (10) years is yet another expected result of frequent cycling. This is significant, since generator inspections can cost more than $1,000,000 and take over four weeks to perform. Components which are more vulnerable to damage as a result of more frequent cycling (e.g., condensers and feedwater heaters from thermal stresses or air heaters

and precipitators from corrosion as air temperatures fall below the dew point when shut down) would be expected to fail or otherwise require service at more frequent intervals.[4]

Staff Analysis:

Staff's task was to investigate whether the self-commit and self-scheduling practices of Missouri's investor owned electric utilities benefit their ratepayers.

It is important to take into account the entire bid when evaluating the revenue in excess of generation costs. Each variable that a utility changes in its offer curve that is not tied to physical constraints or realities can and will influence the amount a unit may be dispatched above the self-commit economic minimum and thus impact the revenue in excess of generation costs.

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Ameren Missouri's coal plant fleet is listed in Table 1.

Generation Facility	Ownership	2016	Name Plate Capacity 2017	2,018	Source
Labadie Energy Ctr	Owned	2,428	2,428	2,428	FERC Form 1
Meramec Energy Ctr	Owned	891	891	891	FERC Form 1
Rush Island Energy Ctr	Owned	1,339	1,339	1,339	FERC Form 1
Sioux Energy Ctr	Owned	1,000	1,000	1,000	FERC Form 1

Table 1: Ameren Missouri Coal Facilities

[4] Ameren Missouri's Response to Order Opening An Investigation Of Missouri Jurisdictional Generator Self-Commitments And Self Scheduling and to Order Directing Comments, pgs. 4-6 B 6-9, B6-11, B6-12 .

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Staff Conclusion:

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