



**Statement of Dr. Walter Graf, Senior Director – Economics
On behalf of PJM Interconnection, L.L.C.**

FERC Technical Conference on Modernizing Electricity Market Design:
Energy and Ancillary Services in the Evolving Electricity Sector,
Docket No. AD21-10-000

October 12, 2021

For Public Use

PJM is pleased to provide these comments for Commission consideration as part of its Oct. 12, 2021, Technical Conference entitled “Energy and Ancillary Services in the Evolving Electricity Sector.”

The objective of competitive wholesale electricity markets is to efficiently reinforce grid reliability and thereby achieve a reliable power system at the lowest reasonable cost. The PJM energy and ancillary services markets, in conjunction with PJM’s other markets, have achieved great benefits for customers, including reliability, affordability, reduced emissions, and incentivizing low-cost investments and operations. While much time and effort have been spent discussing reforms to energy and capacity markets, far less time has been invested in ancillary service market design.

As public policy efforts to address climate change continue to expand, resource costs for certain technologies continue to decline, the system resource mix shifts in response, and the penetration of distributed energy resources grows, PJM anticipates the power system shifting from one that has historically been predictable and controllable to one that is less so in the future. This rise in uncertainty must be met with flexibility to manage the grid reliably and cost-effectively. This responsibility, in part, falls on the ancillary services markets and is why PJM and others have pursued necessary ancillary service reforms. It is imperative to continue to evolve these markets to meet the emerging challenges to ensure the markets’ objectives are met.

Incentives vs. Requirements for Flexibility

Incentives for flexibility are a natural result of well-functioning energy and ancillary services markets that reflect the balance of supply and demand throughout the day. Increasing volatility of both supply-side and demand-side drivers will lead to more volatility in energy and reserve prices over time. This volatility reflects the fundamentals that the marginal cost of serving energy and reserves may be lower than today during certain less constrained periods and higher than today during more constrained periods. The higher volatility itself incentivizes flexibility in two ways. First, it incentivizes resources to offer and operate flexibly because those more flexible resources will be able to benefit more from high-price periods without incurring operating costs during low-price periods. Second, it incentivizes resources to invest in the capability to operate flexibly so they can maximize energy and ancillary service revenues net of costs.

These incentives to increase operational flexibility are efficient and are a natural byproduct of well-functioning markets that reflect fundamentals. However, *maximizing* flexibility from all resources through mandates may not be a long-term sustainable or efficient solution. It could theoretically be efficient if the benefit of flexibility far exceeds the cost of compliance across all resources. But for many resources, PJM anticipates that increasing flexibility will involve trade-offs.

Operating flexibly and investing in the capability to operate flexibly has real costs. These costs include both capital expenditures on equipment and increased operation and maintenance expenses from operating at or near physical equipment limitations.

PJM continues to believe in the ability of competitive markets to signal value – through prices – and the ability of competitive market participants to best make those tradeoffs. Resources will compete to offer the flexibility that is

needed at lowest cost. Not only is it more efficient to incentivize needed operational flexibility rather than *maximize* it through requirements, it may also lead to higher levels of flexibility as resources find new and innovative ways of unlocking latent flexibility when its value is properly reflected in the market. Thus, rules that help prices better reflect the need for and value of various market products will have the desirable effect of incentivizing flexibility, even without mandates for flexibility nor markets for additional flexibility products.

PJM's March 2019 filing on reserve market reform sought to improve the markets' ability to accurately reflect the value of flexibility in part by adding a downward slope to the Operating Reserve Demand Curves (ORDCs) for all reserve products. This proposal addressed the need for additional reserves due to uncertainty and for increasing penalty factors to ensure the willingness to pay to maintain reserves is appropriately reflected in prices. These necessary reforms are one step in a continuous process to improve the markets' ability to signal value where and when it exists and incentivize flexibility as described above.

The discussion above has ignored the potentially detrimental effects of market power on resource owners' incentives to operate flexibly. In certain circumstances, locked-in latent flexibility may represent a form of withholding, and it is properly the role of PJM and other RTOs to mitigate market power and its detrimental effects on the market. Thus, in addition to improving price signals, it will be important to continue to monitor and mitigate market power to ensure that changing patterns in market prices properly translate to incentives for flexibility rather than opportunities to withhold.

Alternative Ancillary Services Product Definitions To Enable Flexibility

There may be value in rethinking the design of certain ancillary services products to enable latent flexibility, especially in new and emerging resource types. In general, PJM believes that operational needs should guide the design of needed services and should not be compromised to accommodate resources unable to comply. However, there may be cases where value can be unlocked without compromising on these operational needs.

One example that PJM is considering is the potential to redefine certain ancillary services products as separate “up” and “down” products. This could have at least two distinct benefits. First, it allows the demand for those products to be differentiated if that is warranted by system conditions. It may not be necessary to procure as much up-ramp as down-ramp, or vice versa, under certain conditions. Second, it allows different resources to supply different parts of what is today a single product when that is a more efficient use of resource capabilities. For example, intermittent resources operating at their full available capability can offer fast-responding down-ramp capability without first curtailing to a lower level of operation. At the same time, thermal resources dispatched to their Economic Minimum can offer fast-responding up-ramp capability. Together, these resources can provide the total needed ancillary service at lower cost than would be possible under a single product definition.

Overall, the definition of the various ancillary services products should be informed by both *system requirements* and *resource capabilities*. As new and emerging resources become more widespread, it will be important to continue to evolve product definitions. By respecting both, we can efficiently enable the flexibility inherent in each technology without compromising operational needs.

Opportunities To Improve Market Models To Address Operational Flexibility Needs

More efficient utilization of the flexibility available on the system at any time is important. PJM's current dispatch is a single interval solution that minimizes bid production cost using all online units. This type of solution does not consider reserving flexibility for future periods when it is needed most by taking steps like pre-ramping less flexible generators. Reconfiguring existing dispatch algorithms to take steps like pre-ramping requires reforms to locational marginal pricing calculations and settlements to make sure there is no incentive to deviate from the multi-interval dispatch. PJM believes a critical step in fully developing these multi-interval approaches is determining how to calculate prices that are incentive compatible with the multi-interval dispatch.

Under a multi-interval dispatch model, the unit-commitment and dispatch problem would consider multiple, coupled periods in advance of the immediate dispatch interval and position a system in a way that minimizes cost while meeting system needs over the modeled intervals. The dispatch solution in each interval is linked to the others to ensure the ramping of generators across all periods is feasible. There are two primary questions that arise under these models. The first is regarding how to structure the intervals observed in the dispatch problem. The second, and more complicated one, is how to set prices and settle the market in a manner that does not result in the incentive to deviate from dispatch. The ramping products in place today typically look forward one interval ahead of the immediate dispatch interval and aim to ensure ramp feasibility over that period. This solution is adequate for short-term flexibility needs. However, if the flexibility needs are spread over a longer period of time, for example an hour, a multi-interval approach should be strongly considered. The benefit of the multi-interval approach is in linking multiple intervals to create a dispatch trajectory over an hour that not only meets the ramping needs in an hour, but also ensures ramping adequacy throughout the hour. Pricing and settlement under this model becomes complex because the dispatch, and necessarily the prices, for the settlement interval are linked to the pricing and dispatch in the look-ahead intervals.

More research needs to be conducted to further develop these models, but they represent a potential opportunity to improve market models to better address operational flexibility needs, especially needs for flexibility to address forecastable future ramping constraints. This approach could substitute for separately defined products that address similar needs and complement other reforms to reserve products and pricing, discussed above, to improve price formation and incentives for flexibility.

With these thoughts in mind, PJM looks forward to further discussion of these issues at this Technical Conference.