UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Technical Conference on Modernizing Electricity Market Design: Resource Adequacy in the Evolving Electricity Sector	)))	Docket No. AD21-10-000

COMMENTS OF CLEAN ENERGY ORGANIZATIONS

On September 14, 2021 and October 12, 2021, the Federal Energy Regulation Commission (FERC or Commission) convened staff-led technical conferences in the above referenced proceeding to discuss energy and ancillary services markets in the evolving electricity sector. Pursuant to the Commission's December 6, 2021 Notice Inviting Post-Technical Conference Comments (Notice),[1] Sierra Club, Natural Resources Defense Council, Sustainable FERC Project, NW Energy Coalition, Conservation Law Foundation, the American Council on Renewable Energy, and Enel North America, Inc. (Clean Energy Organizations) hereby submit the following comments.

I. INTRODUCTION AND OVERVIEW

We greatly appreciate the Commission's action on this critical issue by holding the September and October technical conferences and inviting post-technical conference comments. Energy and ancillary service markets form the foundation for efficient and reliable electric service, and the Commission must be vigilant to ensure that these markets are procuring what is

[1] Notice Inviting Post-Technical Conference Inviting Comments, Docket No. AD21-10 (Dec. 6, 2021).

needed for a reliable grid, allow all resources that are capable to provide the services to do so, and fairly and efficiently compensate all resources providing the needed services.

It is significant that the Commission undertakes this examination of energy and ancillary service markets under the auspices of its proceeding on "Resource Adequacy in the Evolving Electric Sector," and following two earlier phases that explored the shortcomings and heavily administrative nature of capacity markets. The best path forward is to reduce reliance on the capacity market and shift towards a more refined procurement of the particular services the grid needs at the times they are needed.[2] The design of capacity markets fundamentally drives the resource mix away from high capital cost, low operating cost resources towards low capital cost, high operating cost resources.[3] Over-reliance on capacity markets therefore can distort the resource mix in ways that are in tension with state policies and consumer demand for less polluting resources. NERC has defined a set of Essential Reliability Services[4] and "capacity" is not one of them. We support efforts by NERC, RTOs, and FERC to define products more precisely based on specific engineering needs, at the time and place they are needed.

Energy and ancillary service markets must allow participation by all resources that are technically capable of providing ancillary services, and send price signals that compensate resources for the full cost of producing and generating electricity and for being available as

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[2] *See* Clean Energy Advocates Protest to PJM Interconnection, L.L.C. Enhanced Price Formation in Reserve Markets filing in Docket No. ER19-1486-000, available at https://sustainableferc.org/wp-content/uploads/2020/08/EL19-58.pdf.

[3] Jacob Mays, et al., Asymmetric Risk and Fuel Neutrality in Capacity Markets, USAEE Working Paper No. 19-385, February 8, 2019, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3330932.

[4] NERC, Essential Reliability Services: Whitepaper on Sufficiency Guidelines (Dec. 2016), https://www.nerc.com/comm/Other/essntlrlbltysrvcstskfrcDL/ERSWG_Sufficiency_Guideline_Report.pdf

operating reserves, at the right time and place.[5] In contrast, the current capacity markets exacerbate the shortfalls in the existing paradigm by compensating resources for their contribution to meeting the projected peak demand, regardless of their ability to meet system needs on an hour-by-hour basis. A greater share of revenue flowing through energy and ancillary service markets, along with the use of shortage pricing, could better reflect the real-time needs of the system and send investment signals for flexible resources, including storage and price-responsive demand. Jacob Mays of Cornell University concluded in a recent paper that "[p]erhaps the largest flaw in current markets is the use of uniform capacity payments to supplement revenues from energy markets, calculated without reference to the flexibility characteristics of resources in the system."[6] NYU's Institute for Policy Integrity likewise found that "[i]mproving energy price formation by making prices more granular and, when appropriate, allowing them to rise higher, is crucial to pave the way for a renewable future. With the growing presence of renewables, flexibility will play an increasingly important role in grid balancing."[7] Moreover, such an approach can facilitate "investment without imposing capacity markets' bias in favor of gas-fired peaker plants. The higher the [energy market] price caps, the more the system will resemble an energy-only design, meaning that it will avoid to a greater degree

[5] *See, e.g.*, Michael Goggin et al., Customer Focused and Clean: Power Markets for the Future (Nov. 2018), at https://windsolaralliance.org/wp-content/uploads/2018/11/WSA_Market_Reform_report_online.pdf (discussing various energy market reforms generally needed in wholesale markets including but not limited to scarcity pricing, reducing the extent of inflexible self-scheduling, and pricing inflexibility costs of conventional generators).

[6] Jacob Mays, Missing Incentives for Flexibility in Wholesale Electricity Markets, at 21, Energy Pol'y 149, 112010 (June 10, 2020), https://ssrn.com/abstract=3623962.

[7] Sylwia Bialek et al., Resource Adequacy in a Decarbonized Future, Institute for Policy Integrity, at 35 (Mar. 2021) https://policyintegrity.org/publications/detail/resource-adequacy-in-a-decarbonized-future.

capacity markets' tendency to mis-specify capacity credit and apply coarse capacity product definitions."[8]

Our comments focus on a few high-level issues. First, all resources that are technically capable of providing ancillary services must be allowed to compete to provide those services. This is currently not the case in all regional transmission organizations (RTOs) and independent system operators (ISOs). For example, in the Midwest Independent Transmission System Operator (MISO), wind and solar resources are categorically excluded from providing ancillary services, which reduces competition and thereby harms consumers. This exclusion also provides a distorted picture of how these resources can contribute to the reliability of the system. This must change.

Second, FERC and the RTOs/ISOs should focus on improving the design of existing ancillary services before considering whether new products are needed. This should include modifying ancillary services so that reserves are dynamically determined over time and sized based on current forecasted conditions. To minimize costs to consumers, it is important to improve forecasting of weather and load, modeling of resources, and visibility of distributed energy resources ("DERs") so that only the amount needed at the time is procured rather than charging consumers day-in and day-out for the maximum amount of reserves that are ever needed. This should also include splitting bidirectional ancillary services into "up" and "down"

[8] *Id.* The signatories to this filing agree on the need for energy and ancillary services reform to send better price signals for flexibility. However, certain signatories believe that capacity markets are critical for the financing of flexible resources, and can send price signals for entry that energy and ancillary services markets cannot by themselves. These signatories agree that capacity markets favor legacy generation resources, but strongly prefer to see them evolve to send stronger exit signals for inefficient, inflexible generation and send better price signals for flexible resources rather than wither away to the point where they cannot provide project financing.

products to enable greater competition and more accurate pricing with respect to what are distinct services. Improving the design of existing products and then evaluating the remaining, un-procured needs will help to avoid redundancy across ancillary service products and capacity procurement that would impose excessive rates on consumers.

Third, the full value of needed services should be reflected in the price, in order to signal appropriate operations in the near term and investment in the long term. While long-term contracting is usually the main driver of investment rather than spot markets, RTOs cannot depend on load-serving entities to always have contracted for their full needs, so appropriate value-based prices in energy and ancillary services markets need to reflect the short- and long-term value of flexible resources. Scarcity pricing based on concepts of value of lost load and loss of load probability provide these signals.

Clean Energy Organizations recommend that FERC take several actions based on the record in this proceeding:

1. To more fully explore the issues raised in these comments, the Commission should require each RTO/ISO to submit information related to the ability for all resources to participate in energy and ancillary services in their markets.
2. Based upon these responses and the record in this proceeding, FERC should initiate targeted Federal Power Act (FPA) section 206 proceedings to remedy the fact that certain resources are arbitrarily deemed ineligible to provide ancillary services in some markets, like MISO.
3. FERC should require RTO/ISOs to develop energy and ancillary service market participation models for hybrid resources.
4. FERC should also require, potentially through a Policy Statement, that when

RTOs/ISOs file modifications to their energy and ancillary services rules, they demonstrate that there are no barriers to any resource providing these services if technically capable of doing so.

5. FERC should encourage, through a rulemaking or Policy Statement, certain policy principles that apply to energy and ancillary service market design across RTO/ISOs, such as those we list above.

II. RESPONSES TO QUESTIONS

A. Comments on Supplemental Notice for September 14, 2021 Technical Conference

Panel 1: Understanding the Need for Additional Operational Flexibility in RTO/ISO Energy and Ancillary Services Markets

Question 1: RTOs/ISOs and other industry experts generally agree that power systems will require greater flexibility from system resources in the future.[9] What operational capabilities or services will be most valuable to RTO/ISO operators in the future as the resource mix and net load profile changes and why? Is there a desirable reaction time, sustained performance duration, etc. expected from a resource?

Flexibility in system resources is needed to address a wide range of emerging challenges to the grid, including but not limited to: the growth and integration of renewable resources, the greater variability and extremes in weather patterns (as noted in the Climate Change Technical Conference),[10] the correlated outages in thermal plants (especially natural gas), the changes in load as a result of weather and increased use of distributed resources, and the ramping limitations of an ever decreasing coal fleet. The specific system needs will vary across regions and over time

[9] *See, e.g.*, CAISO, *Day-Ahead Market Enhancements Revised Straw Proposal*, at 7 (June 2020); SPP, *Uncertainty Product Whitepaper*, at 6 (Mar. 2020); NYISO, *Reliability and Market Considerations for A Grid in Transition*, at 8-9 (Dec. 2019).

[10] *See generally*, Technical Conference to Discuss Climate Change, Extreme Weather, & Electric System Reliability, Docket No. AD21-13 (June 1-2, 2021).

based on the prevalence of the above factors on the bulk power and distribution systems.[11]

A key consideration in this context is that the resources that are expected to provide flexibility must themselves be reliable. For example, relying too heavily on natural gas to provide flexibility services will limit operators' options when gas supplies are constrained, as we saw with weather system Uri and previous winter storms.[12] Indeed, this point was made several times in the technical conference.[13] As Dominion Energy Virginia has explained, increasingly inflexible, ratable gas supply contracts that require a consistent rate of burn throughout the day "consequently limits flexibility provided by natural gas-fired generation," and "will hinder gas-fired generators' ability to operate and provide reserves during critical events."[14]

Because no resource is always available, grid operators must understand and account for the flexibility characteristics of all the resources on their system, and be especially attuned to circumstances where generator outages correspond to times of high demand for flexibility.

Furthermore, the Commission must recognize the beneficial role that renewable energy resources can play in addressing system performance by providing certain services. As Dr. Debra Lew noted at the technical conference, ERCOT's "regulation requirement has declined over the last decade, at the same time their wind has steadily increased, and that's partly because their

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[11] *See* Sept. 14, 2021 Tr. Technical Conference on Modernizing Electricity Market Design: Energy and Ancillary Services in the Evolving Electricity Sector (Docket No. AD21-10), at 30-31.

[12] *See* FERC/NERC Staff Report on the 2011 Southwest Cold Weather Event at 140, 170, 173 *available at* https://www.ferc.gov/sites/default/files/2020-04/08-16-11-report.pdf (citing 2011, 2003, and 1998 events in which gas curtailment to power plants caused generating units to trip).

[13] *See* Mark Karl, Sept. 14, 2021 Tr. at 33 (noting the uncertainty of natural gas: "[s]o in our case our balancing resources have some issues with sustainability, the same way that the intermittents do").

[14] https://www.pjm.com/-/media/committees-groups/task-forces/egcstf/2021/20211105/20211105-item-02-dominion-energy-presentation.ashx, at slide 4.

wind and solar is now providing a primary frequency response which is a finer control, which can help to reduce levels of regulation reserve."[15] Indeed, as noted in more detail below in the response to Question 1 of Panel 2, numerous studies have shown that intermittent resources, such as wind and solar, are fully capable of providing numerous ancillary services, including but not limited to: reactive and voltage support, frequency stabilization, frequency restoration, frequency regulation, disturbance ride-through, and slowing and arresting frequency declines.[16] Not only can renewables provide these services, many are able to provide these services more accurately and quickly than fuel burning resources.[17]

In addition to wind, solar, and storage, the Commission should focus on ensuring that market rules enable demand response to fully participate in providing reliable system flexibility. This means that RTOs/ISOs must enable the use and eligibility of demand response beyond just as a capacity market product for emergencies. Placing demand response in the narrow box of an emergency-only resource, rather than encouraging it to offer its full flexibility, hinders competition and leaves consumer savings on the table.

As Susan Bruce, on behalf of the PJM Industrial Customer Coalition, explained at the technical conference, "demand response is a tool that goes beyond emergency conditions," and can "provide needed flexibility for operators."[18] Furthermore, as noted by Public Interest

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[15] *Id*. at 30.
[16] *See* Milligan, Michael. 2018. "Sources of Grid Reliability Services." The Electricity Journal 31 (9): Table 1; *see also* California ISO, National Renewable Energy Laboratory, and Avangrid Renewables, "Demonstration of Capability to Provide Essential Grid Services," (March 2020); California ISO, National Renewable Energy Laboratory, and First Solar, "Using Renewables to Operate a Low-Carbon Grid: Demonstration of Advanced Reliability Services from a Utility-scale Solar PV Plant," (November 2017).
[17] *Id*.
[18] Susan Bruce, Sept. 14, 2021 Tr. at 17.

Organizations in their comments on the Demand Response Notice of Inquiry:[19]

> The Brattle Group noted in 2019 that along with the traditional use of DR for peak demand reductions "load can now be managed to provide additional high value services, such as geographically-targeted demand reductions, load building and system balancing," and that such load flexibility could provide $15 billion in annual benefits by 2030. But an overview of data on the RTO/ISO markets between 2009 and 2020 shows that DR participation has generally not moved beyond its use as a resource that is called upon during capacity shortages, rather than as an economic resource that responds to energy and ancillary services market prices throughout the year.[20]

Lastly, the growth in hybrid resources, much of which is solar plus storage, will itself provide some of the needed flexibility. The Commission should require RTO/ISOs to develop hybrid resource market participation models, as they will be essential to adding system flexibility. As noted in the FERC Staff Hybrid Resources White Paper, hybrid and co-located storage resources can enhance technical performance and capability by increasing operational flexibility.[21]

Question 2: To what extent will the "traditional ancillary services" defined in Order No. 888[22] and existing energy market designs continue to ensure reliability as the resource mix changes in RTO/ISO markets in the future?

a. Will traditional ancillary services provide the appropriate types and adequate quantities of operational flexibility RTOs/ISOs need to manage both expected

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[19] *Participation of Aggregators of Retail Demand Response Customers in Markets Operated by Regional Transmission Organizations and Independent System Operator*s, 174 FERC ¶ 61,198 (2021).

[20] *The National Potential for Load Flexibility*, The Brattle Group (June 2019) at P2, available at: https://www.brattle.com/wp-content/uploads/2021/05/16639nationalpotentialforloadflexibility-final.pdf.

[21] FERC Staff Hybrid Resources White Paper at 30, available at https://www.ferc.gov/media/hybrid-resources-white-paper.

[22] Order No. 888 required the following six ancillary services be offered in an open access transmission tariff: (1) Scheduling, System Control and Dispatch Service; (2) Reactive Supply and Voltage Control from Generation Sources Service; (3) Regulation and Frequency Response Service; (4) Energy Imbalance Service; (5) Operating Reserve - Spinning Reserve Service; and (6) Operating Reserve - Supplemental Reserve Service. Order No. 888, FERC Stats. and Regs. ¶ 31,036, at 31,703 (1996).

(e.g., reasonably predictable) and unexpected (e.g., inherently uncertain and captured in forecast errors) variability in net load?

The general principles of Order 888's ancillary services remain sound, but the product design details have changed everywhere, differ by region, and will continue to change over time. Further, the needs underlying the ancillary services have changed and the Commission should improve the design of the current ancillary services before considering whether new ancillary services are needed. For example, the capabilities required for a given system at a given time need to be specified in the product definition, and that should be based on an up-to-date needs assessment for that particular system. FERC should require the RTOs/ISOs to continuously evaluate of each region's ancillary service product definitions to ensure they meet the system's need and are efficient and non-discriminatory. An important part of this evaluation should be improving the design of ancillary services and to make sure that all resources that are technically capable of providing ancillary services are permitted to do so and be compensated at the same price as other resources. Further, we agree with multiple panelists who stressed that the Commission should make sure that there is not a duplication across the services provided by multiple ancillary services products.[23] In addition, it should go without saying that ancillary services should not reward resources that do not provide the needed service.[24]

Improving the design of existing ancillary services before considering whether new products are needed is a logical path. For example, if a certain amount of ramping within a specific time frame is needed for either a contingency or for weather-induced changes in system

[23] *See, e.g.*, Susan Bruce, Sept. 14, 2021 Tr. at 43; Mark Karl, Sept. 14, 2021 Tr. at 47; and Adam Keech, Sept. 14, 2021 Tr. at 51.
[24] *See, e.g.*, Susan Bruce, Sept. 14, 2021 Tr. at 44 (citing PJM operating reserves rewarding inflexibility).

generation output, there is no need for separate ramping products. Also as noted by Dr. Debra Lew at the September 14, 2021 conference, reserves should be dynamically determined over time and sized based on current forecasted conditions.[25] To minimize costs on consumers it is important to improve forecasting of weather and load[26] modeling of resource performance, and visibility of DERs and their impact so that only the amount needed at the time is procured rather than charging consumers day-in and day-out for the maximum amount of reserves that are ever needed.

Further, as discussed in more depth in response to September Panel 1, Question 3 below, separating ancillary services into "up" and "down" capabilities would address the specific needs of the system, and better allow for more renewable and load-side provision of ancillary services.

In his prepared statement for the September 30 Reliability Technical Conference, Mark Ahlstrom also addresses the importance of improving existing ancillary services products in ways that better reflect and compensate for the *quality* of that service:

> [B]efore we create new services or products, we should recognize the value of higher performance for existing services and align compensation with what we know is more valuable. . .
> We say that flexibility and ramping capabilities are valuable and becoming more important, yet current ramping products (and most ancillary services in general) are bid and largely valued at the opportunity cost of not delivering energy, meaning that at least at this time, there is little if any additional value placed on faster and more accurate capabilities. Inflexible units may be implicitly rewarded because we accommodate their startup times or slow ramp rates, while more flexible resources are held back. Indeed, if flexibility, response speed and response accuracy are more valuable to the system (and they are), it is time to align compensation with value.[27]

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[25] *See, e.g.*, Dr. Debra Lew, Sept. 14, 2021 Tr. at 30.
[26] *See, e.g.*, Anjali Patel, Sept. 14, 2021 Tr. at 116 ("Improving forecasting will likely result in greater benefits for consumers than procuring excessive resources.").
[27] Mark Ahlstrom, prepared statement for September 30 Reliability Technical Conference at 3,

Thus, before determining whether new ancillary services are needed, the Commission should ensure that all resources are allowed to provide ancillary services and that the current ancillary services are designed to flexibly and dynamically procure the services needed. Doing so will help to avoid the risk of duplicative services being procured, and improve operators' ability to respond to the price signals sent by the existing services.

Question 3: How should RTOs/ISOs define the system's need for operational flexibility, now and in the future?

In response to both Questions 3.a and 3.b, we believe that separating ancillary services into up and down capabilities is important to address the specific needs of the system, and better allow for greater supply and therefore more competition in providing these ancillary services, including from renewable energy and load resources. As an economic matter, up-ramp and down-ramp are different products and their supply curves have a very different shape and placement. Further, resources are capable of separating regulation up and down.[28] As a result, total consumer cost will be lower if they are separately procured. This is borne out by the conversation at the technical conference, during which a number of panelists noted that separate flexibility products are needed in up and down directions, given that resources have asymmetric abilities.[29] Grid operators are also likely to need different quantities of these up and down services at different times, depending on what contingencies or uncertainties are present.

available at https://ferc.gov/media/markahlstrom-nextera-panel4.

[28] *See, e.g.*, Dr. Debra Lew, Sept. 14, 2021 Tr. at 71 ("Xcel has been adding the wind to provide both regulation up and regulation down for over a decade.").

[29] Dr. Debra Lew, Sept. 14, 2021 Tr. at 55, Susan Bruce, Sept. 14, 2021 Tr. at 60; Rahul Kalaskar, Sept. 14, 2021 Tr. at 59.

Lawrence Berkeley National Lab (LBNL) issued a report on "Variable Renewable Energy Participation in U.S. Ancillary Services Markets" that highlights the system value of separate upward and downward regulation products.[30] Using a price-taker dispatch model and historical prices, LBNL found that more regulation service is provided in markets with separate upward and downward regulation products than it is in those with bidirectional regulation, even accounting for the fact that resources providing bidirectional regulation are providing it in both directions.[31] LBNL points out that this separation allows renewable resources to provide downward regulation in situations in which, with bidirectional regulation, regulation prices would have needed to exceed energy prices to have made it cost-effective for renewable resources to provide regulation reserves. As a result, allowing the bi-directional provision of ancillary services would increase competition and help put downward pressure on average regulation prices,[32] which would reduce consumer costs.

Thus, the RTOs/ISOs should allow ancillary services to be separated into up and down capabilities to address the specific needs of the system, and better allow for more renewable and load-side provision of ancillary services.

[30] LBNL, Variable Renewable Energy Participation in U.S. Ancillary Services Markets Economic Evaluation and Key Issues (Oct. 2021), available at https://eta-publications.lbl.gov/sites/default/files/vre_as_full_report_release.pdf ("LBNL Report").
[31] *Id.* at 18.
[32] *Id*. at 20.

Question 3: Could variable energy resources or new resource types (e.g., storage, hybrid, and co-located resources) be operated or dispatched differently from the status quo to provide greater operational flexibility to the RTO/ISO, if so, how? Given the evolving resource mix, are the current eligibility requirements for each resource type to provide ancillary services appropriate?

There is strong evidence that renewable resources, storage, and hybrids can provide most types of ancillary services, and often can do so more quickly or accurately than other resources. At the September conference, Dr. Debra Lew stated:

> [W]ind, PV, batteries, demand response can provide, they may be able to provide faster responses, more accurate responses, and higher magnitude of responses than conventional units can for some products…. ERCOT studies have shown in some conditions that one megawatt of a fast frequency response can be worth 2 to 2-and-a-half megawatts of a primary conventional frequency response…. Xcel has been adding the wind to provide both regulation up and regulation down for over a decade. And CAISO found that PV could follow a regulation signal more accurately than the conventional generators that they have, and more accurate response of course is better management of your area control error.[33]

Indeed, several recent reports bear this out, as more fully described in the answer to October Panel 2 Question 1 below.

Thus, the RTOs/ISOs should examine their ancillary services rules to determine whether they are allowing all capable resources to participate. For example, MISO does not allow "Dispatchable Intermittent Resources"', including wind and solar resources, to provide ancillary services and is considering removing the eligibility of Dispatchable Intermittent Resources to provide ramping.[34] Similarly, in SPP, wind resources cannot provide regulation up service. As noted above, other, less explicit market rules act as barriers to renewable resources and other emerging technologies from fully participating in wholesale markets. We urge FERC to take

[33] Dr. Debra Lew, Sept. 14, 2021 Tr. at 70-77.
[34] *See* MISO BPM-002-r19, at 145; *see also* answer to October Panel 2 Question 1 below.

several steps to identify and eliminate undue discrimination among resources capable of providing ancillary services:

- The Commission should require each RTO/ISO to submit information related to the ability for all resources to participate in energy and ancillary services in their markets and then require the RTOs/ISOs to remove any barriers that exist.
- Where resource types are categorically prevented from offering certain ancillary services, such as in MISO, the Commission should make a preliminary finding that this results in rates that are unduly discriminatory, and not just and reasonable.
- The Commission should require that any future filings by RTOs/ISOs updating ancillary service tariff provisions, or adding new ones, address the extent to which all resource types can offer the service and why any restrictions on participation, whether explicit or implicit, are warranted.

Clean Energy Organizations are not asking for separate products for renewable resources. Rather, we are suggesting that product eligibility be defined by reliability needs of the particular system at that point in time, and those needs be competitive procured from all supply and demand side resources on a non-discriminatory basis. These products will likely need to become more finely grained and dynamic than in the past and should be the subject of on-going evolution as system needs change.

Panel 2: Revising Existing Operating Reserve Demand Curves (ORDCs) to Address Operational Flexibility Needs in RTOs/ISOs

Question 1: Contingency reserves are provided by existing 10- and 30-minute reserve products and are designed to ensure the system can recover from a contingency (e.g., a generator or transmission outage). How will the procurement of additional contingency reserves help RTO/ISO operators manage routine operational flexibility needs (e.g. needs driven by net load variability and uncertainty)?

Contingency-based products should be reviewed to see if more routine variability causes the same need; if so, then the product should be defined based on the broader system need rather than whether a contingency or net load variability or something else causes the need. Consumers will pay less if procurement for a given system service can be met by a larger pool of all resources.

As discussed further in response to September Panel 1, Question 2, we support Dr. Debra Lew's assertion that the amount of reserves procured should be dynamic and sized based on current forecasted conditions.[35] Dr. Catherine Tyler expressed the view that an extended ORDC that creates a scarcity adder on energy prices under routine operations is inappropriate where a capacity market exists, and that RTOs/ISOs should instead target their reserve requirements when they're needed.[36] Dr. Tyler offers examples of when they may be needed: a cluster of solar resources that may "go out at the same time," or increased risk of summer peak load shortages when net load variability is higher. We agree that targeted reserve procurement is the better approach at this time, and that RTOs/ISOs should carefully examine all types of correlated outage risks, including those seen with thermal resources. Dr. Yonghong Chen also noted that MISO is examining whether to introduce a dynamic and increased ramping product, since

[35] *See, e.g.*, Dr. Debra Lew, Sept. 14, 2021 Tr. at 30.
[36] *See, e.g.*, Dr. Catherine Tyler, Sept. 14, 2021 Tr. at 89-90.

MISO's current reserve requirement is static and often not high enough to cover the more extreme events that do occur.[37]

Finally, at the conference, Mike DeSocio, Catherine Tyler, and Beth Garza all also noted that the quantity of needed reserves can change over time based on different circumstances.[38]

Given the emphasis on providing dynamic reserves, FERC should first focus on requiring the RTOs/ISOs to evolve contingency based products to also include other sources of the same need in terms of quantity of reserves in a given time step. However, once that step is taken, the RTOs/ISOs should still determine if a different product is needed – for example one that addresses uncertainty between the day-ahead and real-time markets, or provides ramping needs.

Question 2: What are the benefits of procuring contingency reserves beyond the minimum reserve requirement through a given ancillary service product?

a. If employing such a method, how should RTOs/ISOs determine the market's demand for contingency reserves (both the quantity and willingness to pay) beyond the minimum reserve requirement of a given contingency reserve product?

As more fully discussed in sub-part 2.b below, ORDC design should be based upon the reliability value of reserves for consumers, and not on parameters unrelated to that value. The benefits, in terms of marginal reliability value, of procuring contingency reserves beyond the minimum reserve requirement (and even at that requirement) may be relatively small, depending on the characteristics of the system.[39] If the minimum reserve requirement is above the level of

[37] Dr. Yonghong Chen, Sept. 14, 2021 Tr. at 156.
[38] Beth Garza, Sept. 14, 2021 Tr. at 86, Dr. Catherine Tyler, Sept. 14, 2021 Tr. at 90-91, Mike DeSocio, Sept. 14, 2021 Tr. at 101.
[39] *See, e.g.*, *See* Affidavit of James F. Wilson in Support of the Protest of Clean Energy

reserves at which firm load curtailment would occur, then the loss of load probability, and consumers' willingness to pay to avoid that probability, are low. At the technical conference, several panelists questioned whether additional reserves brought value. For example, Beth Garza questioned whether the markets need to pay for more reserves when they are less needed, particularly since those payments would be received regardless of whether they are "helpful reserves or non-helpful reserves."[40] Dr. Catherine Tyler shared similar concerns, stating that "PJM's analysis about the value of excess reserves does not justify demanding that customers pay for them all the time."[41] We understand Dr. Tyler's comment to refer to PJM's then-approved ORDC, which established high penalty factors at reserve levels less than the minimum reserve requirement (MRR), and would have paid amounts for reserves in excess of the MRR well above a price based on the Value of Lost Load (VOLL).

b. What principles should RTOs/ISOs follow if they consider revising the shape of the ORDC for a given contingency reserve product (e.g., introducing additional steps or graduation to the ORDC curve)? For example, should the willingness to pay for such additional reserves be based on the Value of Lost Load times the loss of load probability with a given quantity of the reserve product associated with the ORDC, the cost of actions operators would take to procure additional reserves, or some other valuation method? How should customer willingness to pay be incorporated?

Advocates (Wilson Aff. – ORDC), ¶29, attached to Clean Energy Advocates Protest to PJM Interconnection, L.L.C. Enhanced Price Formation in Reserve Markets filing in Docket No. ER19-1486-000, available at https://sustainableferc.org/wp-content/uploads/2020/08/EL19-58.pdf ("The fact that PJM's current ORDC has been in place for many years with only minor changes suggests that PJM's system operators have generally been comfortable with this program for acquiring reserves (noting that in a subset of intervals there have been out-of-market procurements or schedule "biasing.") That suggests that at or near the MRR, the risk of a situation requiring firm load curtailment must generally be very low (that is, at this reserve level the LOLP(r) is very low").

[40] Beth Garza, Sept. 14, 2021 Tr. at 88.

[41] Dr. Catherine Tyler, Sept. 14, 2021 Tr. at 90.

ORDC design should be based upon the reliability value of reserves for consumers, and not on administrative parameters unrelated to the value of reserves to consumers. Economist James Wilson has articulated the well-established design principles for ORDCs in a recent proceeding.[42] As Wilson explains, the ORDC is needed because the demand side of the market is insufficiently engaged; the purpose of the ORDC is essentially to represent the prices above which various end users would choose not to consume rather than pay the higher price, were they more engaged in the markets in real time. Mr. Wilson states that "in principle, prices along an ORDC should rise, at the lowest reserve levels, to approach the value of service to consumers, because when reserves are depleted the system operator will have to call for firm load curtailment. The value of service is often called the Value of Lost Load, or "VOLL". Prices along the ORDC should actually approach not VOLL, but VOLL minus the marginal cost of the highest cost generation . . . ."[43]

As discussed at the technical conference, while the VOLL is an essential part of the equation, it can be very hard to pin down and can vary by customer, weather, and other factors.[44] In report provided to PJM, Dr. Bill Hogan and Dr. Susan Pope explain that the appropriate value of VOLL for use in an order should reflect the average value for the customers most likely to be curtailed in the event of a rotating outage, not the higher value representing customers that would not be curtailed (such as hospitals).[45] Assuming that actions other than load curtailment are

[42] *See* Wilson Aff. – ORDC ¶¶10-24.
[43] *Id.* ¶12, citing Hogan, William H. and Pope, Susan L., Priorities for the Evolution of an Energy-Only Electricity Market Design in ERCOT, May 9, 2017 at 16 ("Hogan/Pope ERCOT Report") available at https://hepg.hks.harvard.edu/files/hepg/files/hogan_pope_ercot_050917.pdf.
[44] *See, e.g.*, Mike DeSocio, Sept. 14, 2021 Tr. at 103-04.
[45] Wilson Aff. – ORDC, ¶16 (citing Hogan/Pope ERCOT Report p. 21). In the long term, RTOs and FERC should endeavor to have actual consumer valuation through demand-side bids replace

available to system operators in the event of a load shortage (such as calling on emergency load response), then some sections of the curve could reflect the (presumably lower) cost of these actions rather than the VOLL.[46]

In addition, as discussed by Anjali Patel and Beth Garza, it is essential to have circuit breakers in emergencies to avoid extended periods of extreme pricing that do not provide benefits.[47] Ms. Patel explained that "extreme pricing for an extended or indefinite period during emergency does not benefit customers, and it likely far exceeds the value of any contribution to preserving grid reliability."[48] Ms. Garza echoed this point, noting that this dynamic was observed in ERCOT during Winter Storm Uri in February 2021,[49] where real-time prices sat at or near the very high system-wide offer cap for nearly four days.[50]

James Wilson has also noted the need for a circuit breaker mechanism, concurrent with the introduction of an ORDC, to address the scenario where "a substantial loss of generation could expose market design flaws that are then exploited by some market participants."[51] Noting PJM's authority "to take prompt action when faced with 'imminent harm to system reliability or imminent severe economic harm to electric consumers,'" Mr. Wilson notes that such action is unlikely if no fallback market rules have been worked out in advance. Thus, it is critical for

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the administrative proxies that are needed in the interim.

[46] *Id.* (citing Hogan/Pope ERCOT Report p. 20).

[47] *See* Anjali Patel and Beth Garza, Sept. 14, 2021 Tr. at 116-17.

[48] *Id.* at 116:15-18.

[49] *Id.* at 117:2-4.

[50] The need for a "circuit breaker" with any ORDC, and lessons learned from ERCOT, is discussed further Joint Movants' Renewed Request for Rehearing and Motion to Lodge, ER19-58-006 (filed Dec. 7, 2021).

[51] *See* Affidavit of James F. Wilson in Support of the Protest of Clean Energy Advocates (Wilson Aff. – Transition), ¶36, attached to Clean Energy Advocates Protest to PJM Interconnection, L.L.C. Enhanced Price Formation in Reserve Markets filing in Docket No. ER19-1486-000, available at https://sustainableferc.org/wp-content/uploads/2020/08/EL19-58.pdf.

market operators and stakeholders to determine elements of these fallback rules in advance, including alternative ORDCs or stop-loss rules for consumers, as well as triggers for when these alternatives would go into effect.[52]

Question 3: Reserve shortage prices are administratively determined penalty factors invoked when the system falls below the minimum requirement of one or more reserve products. To what extent can higher reserve shortage prices inform investment decisions and reflect the value of flexible resource capabilities?

While market design should be focused primarily on signaling efficient short-term behavior,[53] the signals will and should influence investment decisions. This is true both in systems with long-term power purchase agreements and procurement (in which those spot prices will likely remain low because of ample supply) and in systems without much forward hedging. For example, Dr. J. Arnold Quinn noted that "ORDC isn't meant to drive all entry and exit, but it can influence it on the margin. On the other hand for a ramp product, that's really meant to get the most out of the operational flexibility of the resource, the resource mix that exists at the moment in time when you've got it…That said, any pricing that sends a consistent message, or a consistent price signal that values the resources that are operating when the system in the most need, is a system that will improve entry and exit."[54]

In response to sub-parts a. and b. of this question, a number of panelists cautioned against a "false precision" of the design of scarcity pricing.[55] The key will be to ensure all resources capable of meeting the scarcity need are able to participate, avoiding excess compensation for

[52] Wilson Affidavit - Transition ¶¶39-46.
[53] *See, e.g.*, Greg Cook, Sept. 14, 2021 Tr. at 158 ("the flexible ramping product was really not designed to provide investment signals for flexible resources, [but instead] a primary benefit of ensuring that we're able to reliably and efficiently dispatch the available plate of resources").
[54] Dr. J. Arnold Quinn, Sept. 14, 2021 Tr. at 216.
[55] *See, e.g.*, *id.* at 215.

resources providing little value, and expanding the opportunities for load-side participation. That said, shortage prices should provide accurate pricing reflective of the supply (cost) and demand (value) generally providing a higher demand curve for higher valued products (fast responding) than lower value (slower responding) products. They should also aim to protect consumers, including through the use of circuit breakers, avoid rewarding resources that do not provide the product the ORDC is intended to incent, and ensure that demand-side resources are able to participate in order to discipline prices, consistent with Order No. 719.

Panel 3: Creating New Products to Address Operational Flexibility Needs in RTOs/ISOs

Question 4: The Electric Reliability Council of Texas, Inc. (ERCOT) has proposed to procure fast-responding, limited duration products to address primary frequency control issues associated with declining system inertia. CAISO also intends to initiate a stakeholder process to discuss, among other options, compensating internal resources for the provision of primary frequency response. What are the merits of such reforms and should they be considered in other regions?

Needs will differ from region to region and over time. Frequency support needs are much less in large interconnections like the Eastern Interconnect compared to the smaller ERCOT system. Regions with a large (>1 GW) nuclear plant will need to procure enough reserves to cover a loss of that unit almost instantaneously while regions with only smaller units will not. Regions facing the solar "duck curve" might need to ramp up 20 percent of their generation in a few evening hours, while other regions may not have a demand for that particular quantity and speed of ramping at this time. All operators should review their needs over time and evolve products or define new products that are technology neutral based on those engineering needs.

Question 5: What other new products not yet discussed at this conference, do you think could increase operational flexibility in RTOs/ISOs?

a. Can capacity markets or other, potentially new, "intermediate" forward market constructs that clear between existing capacity market auctions and the day-ahead timeframe help ensure that RTO/ISO operators have sufficient operational flexibility in real time?

A forward market that is more of a call option than a full capacity market, such as for products like firm energy or flexible capacity could be beneficial. This would have the advantage of only relying on the signals from energy and ancillary services value and pricing which can be very finely tuned, compared to very crudely defined capacity markets, while providing valuable hedging to the benefit of consumers and suppliers.[56] Again, this product should be open to all resources capable of providing it, including demand response, renewable energy, and hybrid resources.

As discussed in response to Panel 4, Question 4 below, capacity markets are poorly suited to ensuring that RTO/ISO operators have sufficient operational flexibility in real time.

b. For example, can a new shorter-term forward market to procure expected operational flexibility needs held closer to the delivery period (e.g., three months ahead as opposed to three years ahead) and with a more granular delivery period than the annual capacity market (e.g., monthly or seasonal delivery period, or a delivery period based on the hours of an RTO/ISO's morning or evening ramp as opposed to the annual delivery period of most RTO/ISO capacity markets) help ensure that RTO/ISO operators have sufficient operational flexibility in real time?

See prior response. Yes, it would make sense for any new, shorter-term forward market to have a granular delivery period, which is in line with meeting the needs of expected unserved energy during all time periods, rather than planning just for summer peak. Such markets can help

[56] *See* Gramlich, Robert, Designing the 21st Century Electricity System: How Electricity Buyers Can Accelerate Change (Mar. 2021), https://gridprogress.files.wordpress.com/2021/03/desiging-the-21st-century-electricity-system.pdf, p. 74.

to address operational needs that arise only in certain seasons (such as winter energy adequacy). For RTO/ISOs with mandatory capacity markets, it is critical that expected revenues from any new forward markets be promptly reflected in capacity market demand curves and offer rules, so that consumers do not pay more for capacity than needed.[57]

Panel 4: Market Design Issues and Tradeoffs to Consider in Reforms to Increase Operational Flexibility in RTO/ISO Energy and Ancillary Services Markets

Question 2: Some entities have observed that offering additional resource capabilities into energy and ancillary services markets may not be in the financial interest of certain resources because doing so could lower energy prices by either avoiding scarcity conditions or obviating the need to commit more expensive units, and thus reduce their expected energy and ancillary services markets revenue. Are such incentive issues relevant in the context of reforming energy and ancillary services markets to address operational flexibility needs? If so, how should such issues be addressed?

This type of incentive has long been a factor in FERC-jurisdictional markets, as seen in the dynamic that investment in new generation where LMPs are typically high will decrease the prices that attracted the investment. However, to the extent that resources have the capability to provide a service, but either physically or economically withhold it as a result of the incentive noted in the question, the Commission has the tools it needs to prevent this type of manipulation. Given that the Commission has an existing framework to address the withholding problem, we do not think this issue should be a factor in the reform of energy and ancillary service markets. The Commission should remain focused on ensuring that the markets provide the most efficient market signals through clear definitions. The system will be efficient and encourage bidding of

[57] *See, e.g.*, PJM Interconnection, LLC, 171 FERC ¶ 61,153 PP 308-324 (May 21, 2020) (requiring PJM to move to a forward-looking E&AS offset in setting its capacity market demand curve, coincident with implementation of an expanded ORDC, so as to prevent excessive revenue recovery for generators).

all capabilities as long as the services are well defined, the system co-optimizes the products, market power is mitigated, and all resources are allowed to provide the services.

Question 4: What are the tradeoffs to consider in procuring flexibility in the energy and ancillary services markets versus the capacity market or another new shorter-term forward market construct?

A capacity construct is not the appropriate vehicle to procure flexibility,[58] although a shorter-term forward market that is based on actual products with performance requirements might make sense. Capacity constructs, whether centralized or decentralized, LSE-procured, procure a vague set of attributes based on a single point in time, and it is resource availability and flexibility that are the key products. Many of the resources currently procured through the capacity markets are relatively inflexible, as seen by some operators' efforts to expand procurement and increase prices for ancillary service products, despite excessive reserve margins.

Proposals to require capacity resources to be flexible, or to require a tranche of the cleared capacity to meet certain flexibility characteristics, will make the already byzantine capacity markets even more complicated and less competitive. Moreover, a resource's ability to perform flexibly at times of system stress bears no relationship to its overall capacity accreditation; tying the two together would artificially limit the apparent pool of resources that

[58] *See, e.g.*, Dr. Nicole Bouchez, Oct. 12, 2021 Tr. for Technical Conference on Modernizing Electricity Market Design: Energy and Ancillary Services in the Evolving Electricity Sector (Docket No. AD21-10), at 75:2-6 ("We don't see that the right answer is to focus on capacity market compensation for flexibility because it's just not at the right time when we need it, and it's hard at that point to match sort of performance with what it is that was purchased."). It would be preferable for load-serving entities to perform this advance hedging rather than putting RTO/ISOs in this role, but we understand many LSEs have monopsony power and many states have not assigned this responsibility to the LSEs they oversee.

can supply real-time operational flexibility. Most critically, building flexibility into the capacity market would be difficult when the needs for these products are granular and based on specific times of day within seasons. Moreover, as discussed, requirements need to be dynamic and adaptable as forecasts are closer to real-time system needs; the three-year forward period of many capacity markets is thus incompatible.

B. Comments on Supplemental Notice for October 12, 2021 Technical Conference

Panel 1: Incenting Resources to Reflect Their Full Operational Flexibility in Energy and Ancillary Services Offers

Question 1: Do any existing RTO/ISO energy and ancillary services market participation rules, supply offer rules, eligibility requirements, and relevant procedures encourage certain resources to offer into the market inflexibly (i.e., without reflecting the full range of their physical operating capabilities)? For example, are any changes to resource supply offer rules or uplift eligibility requirements needed to ensure resources submit physical offer parameters (e.g., notification time, minimum run time, ramp rates) that reflect their flexible capabilities? To what extent do RTOs/ISOs account for existing fuel limitations, like natural gas supplies, that have the potential to impact resource flexibility?

Generally, there seem to be insufficient incentives for many suppliers to offer into the market flexibly. Dr. Catherine Tyler demonstrated this with respect to the PJM markets, noting that: "There's a general lack of accountability to perform flexibly in the market. PJM has a rule to establish physical offer parameters that must be included in parameter limited offers. These should be used in market power mitigation and during stress market conditions consistently. But PJM implements the rules in a way that makes it very easy for resources to avoid commitment on those offers."[59]

This may be more of an issue of accountability and market monitoring than developing incentives. As Joseph Daniel said, vertically integrated utilities are largely insulated from price

[59] Dr. Catherine Tyler, Oct 12, 2021 Tr. at 33.

signals, and that "we're not limited to sort of price signal-based solutions. Market monitors are authorized to conduct a range of oversight and regulatory functions in order to prevent [...] market manipulation, and help ensure just and reasonable rates."[60] In his prepared statement, Mr. Daniel provided solid recommendations for Commission action, including (1) Hold a technical conference to examine the broader impact of self-commitment; (2) Direct RTOs and market monitors to scrutinize the operating constraints reported by market participants (specifically P-min) and study uneconomic self-commitment; and (3) Conduct a Commission investigation of self-commitment and report to Congress.[61]

As we saw with Uri and previous winter storms, when natural gas supplies are constrained, gas curtailment may cause generating units to trip offline.[62] Yet, the RTOs/ISOs generally do not account for these fuel limitations. Relying too heavily on natural gas to provide flexibility services will limit operators' options when gas supplies are constrained, and the RTO/ISO rules need to be modified to reflect this reality.

There are also a number of market rules that accommodate the inflexibility of conventional units, such as allowing long start-up times and compensating for startup and no-load costs.[63] These are inefficient and provide an implicit subsidy for these resources.

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[60] Joseph Daniel, Oct 12, 2021 Tr. at 17.
[61] Joseph Daniel, prepared statement for Oct 12, 2021 at 5-6, available at https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20211008-4002&optimized=false).
[62] *See* FERC/NERC Staff Report on the 2011 Southwest Cold Weather Event at 140, 170, 173 available at https://www.ferc.gov/sites/default/files/2020-04/08-16-11-report.pdf (citing 2011, 2003, and 1998 events in which gas curtailment to power plants caused generating units to trip).
[63] *See, e.g.*, Jason Burwen, Oct. 12, 2021 Tr. at 89 (contrasting circumstances in which system operators prevent energy storage from dispatching under circumstances where it would be economic to do so, and without compensation with circumstances in which thermal generators are paid to remain at Pmin value, despite lack of benefit to the system).

Question 2: Do any existing RTO/ISO energy and ancillary services market rules exhibit an undue preference for certain resource types over other resource types? If so, please explain how and provide examples.

Yes, existing RTO/ISO energy and ancillary services market rules exhibit undue preference for conventional resources. As Betsy Beck said at the October 12 technical conference, "[E]nergy and ancillary service markets have historically been designed around system needs and operating characteristics stemming from conventional resources."[64] In many cases, there are still barriers to renewable resources, electric storage resources, hybrid resources, and demand response participation in energy and ancillary services markets.

As discussed more fully in response to October Panel 2, Question 1, MISO is a good example of this. While MISO requires solar and wind resources to be dispatchable, it does not allow them to provide ancillary services at all. This is in contrast to conventional resources and even energy storage resources. There is no technical basis for this difference.

In addition, Commission staff itself has established that hybrid resources cannot fully participate in energy and ancillary service markets, even though they can provide value.[65] Specifically, Commission staff stated that "[w]hile the specific dynamics may vary by RTO/ISO market, existing market rules limit co-located hybrid or integrated hybrid resources' ability to fully participate in energy, capacity, and ancillary services markets. For example, existing energy market rules may limit an integrated hybrid resource's ability to fully control its output or submit

[64] Betsy Beck, Oct 12, 2021 Tr. at 82.
[65] Commission Staff, Hybrid Resources White Paper at 29-31 (May 2021), available at https://www.ferc.gov/sites/default/files/2021-05/white-paper-hybrid-resources.pdf. (FERC Hybrid White Paper).

a single energy supply offer, and it may have limited flexibility while placing bids in real time."[66]

To more fully explore this issue, Clean Energy Organizations recommend that the Commission require each RTO/ISO to submit information related to the ability for all resources to participate in energy and ancillary services in their markets. FERC has previously issued such directives via staff data request or order directing reports to seek information on the ability of specific resource types to participate in its markets, and it should do so more generally here.[67] FERC should take the opportunity to require each RTO/ISO to provide public information on what restrictions their tariffs include on the provision of energy and ancillary services and how those restrictions affect specific resource types. FERC should also require, potentially through a Policy Statement, that when RTOs/ISOs file modifications to their energy and ancillary services rules, they demonstrate that there are no barriers to any resource providing these services if technically capable of doing so.[68]

Question 3: To what extent do existing self-scheduling or self-commitment rules in RTO/ISO markets reduce the amount of operational flexibility available to the RTO/ISO in real time and the system's need for operational flexibility? Are options for self-scheduling and self-commitment needed to allow resource owners to make the best use of their assets over time?

Self-commitment and self-scheduling rules in many RTO/ISO markets enable inflexible

[66] *Id.* at 29-30.
[67] *See*, *e.g.*, FERC Hybrid White Paper, 174 FERC ¶ 61,034 (2021); FERC staff data requests to each RTO (April 11, 2016; AD16-20-000).
[68] The Commission has required RTO/ISOs to either eliminate discrimination among resource types in other programs, or to provide an explanation of its efforts to do so. *See, e.g.*, ISO New England, Order on Rehearing, 151 FERC ¶ 61,052 at P 17 (Apr. 17, 2015) (requiring ISO-NE to either make its winter reliability program fuel neutral, or to provide a detailed description of the options it considered to make the program fuel neutral and why those options were ultimately not included).

generators to operate when their costs of doing so are above current energy prices. Self-scheduling may address an engineering problem of inflexible resources but it comes with costs that far outweigh any engineering efficiencies. For example, if a coal unit is turned on and self-committed into the market, it has to operate at or above its minimum operating level ("P-min") even if there are cheaper resources available.

In SPP, this has led to significant curtailment of wind energy which would have otherwise reduced costs and offered more flexibility to the system. SPP has investigated this issue specifically and has recommended that SPP and its stakeholder should, "work to reduce the incidence of self-commitments" to "improve price formation and market efficiency."[69] Coal units make up the majority of self-committed resources in SPP, primarily because coal units are relatively inflexible resources that cannot be turned on and off or ramped up and down quickly. Although there is wind energy that is self-committed in SPP, these self-commitments result in essentially no impact on flexibility and production costs. As Joseph Daniel explains in his written submission to this docket, this is because the P-min for wind is set at zero meaning that it can be dispatched all the way down to being completely turned off. This is not the case for coal resources that cannot turn off and have P-mins ranging from 25-75% of their operating capacity. That means wind units can effectively be turned off but for coal the grid operator can't turn the coal plant off even if it might reduce overall system costs.[70]

Betsy Beck from Enel North America, Inc., argued in her technical conference comments

[69] Southwest Power Pool, Market Monitoring Unit, Self-committing in SPP markets: Overview, impact, and recommendations (Dec. 2019), https://spp.org/documents/61118/spp%20mmu%20self-commit%20whitepaper.pdf.
[70] Written Statement of Joseph Daniel for Oct 12, 2021 technical conference at 4, available at https://www.ferc.gov/media/joseph-daniel-union-concerned-scientists-panel-1.

that, "parameters like P-min and minimum run times are other elements of energy market dispatch protocols that need to be examined to evaluate their bias towards conventional resources, and the impact that it's having on efficient pricing and flexibility. While these parameters were once necessary to run the market and solve for blocky resources, but continuing to solve around these characteristics we ultimately compensate resources for their costs of inflexibility."[71] We concur with Ms. Beck's statement and echo her call for FERC to require RTOs to ensure fairness in self-scheduling rules.

Question 4: Do current RTO/ISO offer rules, market power mitigation practices, and reference levels prevent or discourage resources from including in their offers the additional costs, if any, that resources incur from being more flexible (e.g., longer-term wear and tear on natural gas resources due to increased cycling, battery warranty considerations, etc.)? Are such costs difficult to quantify? If so, please explain why. How should RTOs/ISOs review such costs to ensure that resources' energy and ancillary services supply offers are competitive?

Consistent with its directives in Order 841, the Commission should make sure that market power mitigation rules do not inefficiently hinder storage units in particular from offering their full flexibility and opportunity cost. For example, if a battery owner expects a high price in two hours, it should be able to bid an opportunity cost based on that expected revenue into the current hour, so that the market does not prematurely dispatch it and drain its charge.

Panel 2: Maximizing the Operational Flexibility Available from New and Emerging Resource Types

Question 1: Do existing RTO/ISO energy and ancillary services market rules, practices, or procedures prevent or otherwise obstruct relatively new and emerging resource types from fully participating in RTO/ISO markets and offering the operational flexibility they are technically capable of providing?

[71] Betsy Beck, Oct 12, 2021 Tr. at 83.

Many RTO/ISO regulations and market rules implicitly act as barriers to advanced renewable energy technologies' providing all of the services they are capable of providing. For example, existing rules often assume that power plants operate as large-scale, centralized generation facilities, like coal, gas, or conventional nuclear plants. This misconception can result in market rules and operational practices that do not account for the technical and operational characteristics of other resources, including wind, solar, energy storage, fuel cells, distributed energy systems, and other advanced energy technologies. Such rules therefore act as implicit barriers to those technologies. But there are also other instances where resources are explicitly prohibited from providing certain services in wholesale markets with no reasoned justification, and instead reflect an anachronistic view of resource capability. There are no excuses for allowing such clearly discriminatory market rules to remain in effect. For example, MISO's restrictive tariff provisions that prohibits wind and solar resources from providing ancillary services in MISO's wholesale market is a prototypical example of such unnecessary and unjustified restrictions.

In MISO, Dispatchable Intermittent Resources ("DIRs") are generation resources whose maximum limit is dependent on a forecast of their variable fuel source.[72] Resources that are fueled by wind, solar, or other types of variable energy are DIRs.[73] "DIRs *are not eligible* to provide Operating Reserves to the Day-Ahead or Real-Time Energy and Operating Reserves Markets. For this reason, DIRs do not submit Dispatch Statuses for Regulating, Spinning, On-Line Supplemental, or Off-line Supplemental Reserves."[74] Therefore, MISO's tariff prohibits

[72] *See* MISO BPM-002-r19, at 145.
[73] *Id*.
[74] *Id*. (emphasis added); *see also id*. at 94 ("[DIRs] . . . do not provide Dispatch Statuses for Operating Reserve products"); *id*. at 76 (Exhibit 1-7).

dispatchable wind and solar resources from providing a number of important ancillary grid services for which they may be compensated.[75] There is no parallel prohibition for battery storage, demand response resources, or thermal generation resources.

As the Commission has observed, the Federal Power Act "bristles with concern about undue discrimination."[76] One of the primary purposes of this principle is to ensure equality of treatment when similarly situated entities provide substantially similar services. Indeed, courts have long held that an "unjustifiable difference in rates for substantially similar service works an unlawful discrimination" that is prohibited under the Federal Power Act.[77]

Recent Commission orders make clear that discriminatory barriers that unreasonably prohibit resources from providing all the services they are technically capable of providing must be removed. For example, the Commission recently recognized in Order 841 "that market rules designed for traditional resources can create barriers to entry for emerging technologies."[78] Specifically, Order No. 841 required RTOs to revise their Tariffs to enable energy storage resources to provide all of the market services they are capable of providing.[79]

Allowing wind and solar resources to fully participate in MISO's ancillary services

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[75] *See also* Customer Focused and Clean: Power Markets for the Future (November 2018) at 23 ("MISO bars dispatchable renewables from providing frequency regulation, spinning reserves, and supplemental (non-spinning) reserves, though renewables can provide MISO's new ramping service").
[76] *AEP*, 67 FERC ¶ 61,168, at 61,490 (citing *Associated Gas Distributors v. FERC,* 824 F.2d 981, 998 (D.C. Cir. 1987) (in regards to the Natural Gas Act)).
[77] *Towns of Alexandria v. FPC,* 555 F.2d 1020, 1028 (D.C. Cir. 1977); *see also Preventing Undue Discrimination and Preference in Transmission Service,* Order No. 890, 72 Fed. Reg. 12,266, 12,318 (P 425) (Mar. 15, 2007) (the Commission "has a duty to prevent undue discrimination").
[78] *See* Order No. 841, 162 FERC ¶ 61,127.
[79] *See id.*

market is also consistent with Commission Order No. 755.[80] In that Order the Commission revised its regulations to remedy undue discrimination in the procurement of frequency regulation in the organized wholesale electricity markets by ensuring that providers of frequency regulation receive just and reasonable rates, including performance payments for both regulation up and regulation down.[81]

Removing this barrier would also be consistent with Order 2222, where the Commission directed RTO/ISOs not to prohibit heterogeneous aggregations of DER technologies, because such limits could become a barrier to emerging or future technologies and prevent them from being eligible to "provide all of the capacity, energy, and ancillary services that they are technically capable of providing."[82] Order 2222 goes to great lengths to recognize that it is not the nature of the technology that is central to its eligibility to participate in RTO/ISOs, but rather the ability of a resource to meet the qualification and performance requirements to provide the service they are offering to the market.[83]

Numerous studies have documented that wind and solar can capably provide ancillary services, including regulation, spinning, and supplemental reserves.[84] As noted, in the technical

[80] Order No. 755, 137 FERC ¶ 61,064 at P 1 (2011).
[81] *Id*.
[82] *Id*. at P 141.
[83] *Id*. at P 117.
[84] *See, e.g.*, Gao, Minhui; Gregory, Ben; He, Manfei; & Xu, Zhimin (2019), "*Essential Reliability Service Requirements from Utility-scale Solar and Wind in Bulk Power Markets,"* Master's project, Duke University; Milligan, Michael. 2018. "Sources of Grid Reliability Services." The Electricity Journal 31 (9): 1– 7; V. Gevorgian and B. O'Neill, "Advanced Grid-Friendly Controls Demonstration Project for Utility-Scale PV Power Plants," National Renewable Energy Laboratory, January 2016, https://www.nrel.gov/docs/fy16osti/65368.pdf; *see also* M. Morjaria, D. Anichkov, V. Chadliev and S. Soni, "A Grid-Friendly Plant: The Role of Utility-Scale Photovoltaic Plants in Grid Stability and Reliability," IEEE Power and Energy Magazine, vol. 12, no. 3, 2014; Nelson, Jimmy, Saamrat Kasina, John Stevens, Jack Moore, Arne Olson, Mahesh Morjaria, John

conference, these variable resources are "absolutely dispatchable."[85] Wind and solar can provide upward frequency regulation if (a) they are "pre-curtailed," running at less than maximum output for the given wind/solar fuel input, and (b) if there is sufficient wind/sun for the resource to respond. They can provide downward regulation whenever they are producing power. Obtaining this service from variable energy resources can result in cost savings to the extent expensive fuel-burning resources are only clearing the market to provide these services that would otherwise be displaced by a wind or solar resource.

The California Independent System Operator ("CAISO"), First Solar, and the U.S. Department of Energy's National Renewable Energy Laboratory recently engaged in a test project to demonstrate the technical abilities of solar generation in the context of ancillary service production.[86] The project utilized an un-named 300 MW solar plant in the footprint of CAISO.[87] On two dates in the summer of 2016, and using advanced inverter technology, the plant was able to demonstrate numerous types of ancillary services.[88]

Specifically, the data from this project showed how wind and solar projects with inverter controls can "provid[e] services that range from spinning reserves, load following, voltage support, ramping, frequency response, variability smoothing and frequency regulation . . . ."[89] The project tests also showed that regulation accuracy by the solar plant is significantly better

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Smolenski, and Jose Aponte. 2018. "Investigating the Economic Value of Flexible Solar Power Plant Operation," Energy+Environmental Economics.

[85] *See* Oct 12, 2021 Tr. at 115 ("Transcript"); *see also* Mike DeSocio, Oct. 12, 2021 Tr. at 116 ("New York has had renewables or variable resources on dispatch for quite some time").

[86] *See* California ISO, National Renewable Energy Laboratory, and First Solar, "Using Renewables to Operate a Low-Carbon Grid: Demonstration of Advanced Reliability Services from a Utility-scale Solar PV Plant," (November 2017) at 5.

[87] *Id*.

[88] *Id*.

[89] *Id*.

than fast-ramping gas turbine technologies.[90] The report further detailed that "[a]ll hardware components enabling [solar] power plants to provide a full suite of grid-friendly controls are already in existence in many utility-scale [solar] plants. It is mainly a matter of activating these controls and/or implementing communications upgrades to fully enable these."[91] While wind resources were not tested, the same inverter technology is largely available to wind resources. The report concludes that "unleashing these capabilities from the renewable resources helps achieving the broader objective of a resilient, reliable low-carbon grid."[92]

A follow-up report by some of the same entities later found parallel results with regard to wind resources.[93] "During several days in 2019, the team conducted a series of tests at Avangrid Renewables' Tule Wind Farm, located in CAISO's balancing authority in the McCain Valley, east of San Diego."[94] The results of the tests showed that wind resources "with an inverter-based smart controller can provide balancing or regulation up and down, voltage regulation control, active power control through ramping capability, and frequency response."[95] This test confirmed earlier findings that "[i]mprovements in smart inverter technology combined with advanced plant controls allow inverter-based resources to provide regulation, voltage support, and frequency response during various mode of operation."[96] Furthermore, the study found that "[w]ind resources with these advanced grid-friendly capabilities have unique operating characteristics that can enhance system reliability" including but not limited to: "[e]ssential reliability services

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[90] *Id*. at 30.
[91] *Id*. at 56.
[92] *Id*. at 15.
[93] *See generally* California ISO, National Renewable Energy Laboratory, and Avangrid Renewables, "Demonstration of Capability to Provide Essential Grid Services," (March 2020).
[94] *Id*. at 5.
[95] *Id*.
[96] *Id*. at 47.

during periods of oversupply," "[v]oltage support when the plant's output is at zero," "[f]ast frequency response (within the inertia response time frame)," and "[f]requency response for low- as well as high- frequency events."[97]

Additionally, NREL has found that a solar plant with advanced power controls "can provide essential reliability services related to different forms of active and reactive power controls, including plant participation in [automatic generation control, "AGC"], primary frequency control, ramp rate control, and voltage regulation. For AGC participation in particular, by comparing the PV plant testing results to the typical performance of individual conventional technologies, we showed that regulation accuracy by the PV plant is 24–30 points better than fast gas turbine technologies."[98]

[97] *Id*.
[98] NREL, Demonstration of Essential Reliability Services by a 300-MW Solar Photovoltaic Power Plant at v, available at https://www.nrel.gov/docs/fy17osti/67799.pdf.

Figure 1 below provides a summary of the types of services that wind and solar can provide, and the ***quality*** of those services.[99]

Figure 1.

As can be seen from the graphic, wind and solar can provide similar, and sometimes better and more accurate services than fuel burning resources.

Other reports have identified restrictive grid operator market rules, as opposed to technical system capabilities, are the primary barrier to deploying ancillary grid services from wind and solar resources. For example, a white paper by Advanced Energy Economy found that MISO's Tariff included market rules that explicitly prohibit wind and solar from providing a

[99] Milligan, Michael. 2018. "Sources of Grid Reliability Services." The Electricity Journal 31 (9): Table 1.

number of ancillary services, including "frequency regulation, spinning reserves, and supplemental (non-spinning) reserves" even though they can do so "on a comparable basis to traditional power plants."[100]

In June of 2018 an Issue Submission form was filed at MISO specifically identifying this problem.[101] In MISO's 2020 prioritization survey this issue was identified and ranked as the second most important issue by the Environmental Sector, however, MISO has ignored it and has relegated the issue to "parking lot" status. FERC should make clear to MISO and other RTO/ISOs that such discriminatory rules will not be tolerated.

Tariffs and market rules must be designed to compensate all resources capable of providing services needed by the grid without specifying eligibility requirements or operating procedures that exclude innovative or new technologies capable of providing the same service. The Commission should move expeditiously to address the identified barriers to participation of advanced wind and solar technologies in MISO's Tariff, and require MISO to adopt a technology-neutral approach that allows for innovative technologies to provide critical grid reliability services.

As noted above, there are numerous other examples of less explicit market rules that act

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[100] Wholesale Market Barriers To Advanced Energy – And How To Remove Them, Advanced Energy Economy (May 2019) at 11-12; *see also* "Using Renewables to Operate a Low-Carbon Grid: Demonstration of Advanced Reliability Services from a Utility-scale Solar PV Plant," at 11-12 (noting that "[m]any of the PV control capabilities that were demonstrated in this project have already generally been proven to be technically feasible, and a few areas throughout the world have already started to request or require PV power plants to provide some of them. However, in the United States, utility-scale PV plants are rarely recognized as having these capabilities and typically are not used by utilities or system operators for electrical grid services").

[101] MISO, Allow Dispatchable Intermittent Resources (DIRs) to Provide Regulation Service, at https://extranet.misoenergy.org/stakeholder-engagement/MISO-Dashboard/allow-dispatchable-intermittent-resources-dirs-to-provide-regulation-service/ (last modified July 1, 2020).

as barriers to renewable resources and other emerging technologies from fully participating in wholesale markets. For example, there are barriers in other RTO/ISOs as a result of unduly burdensome or outdated operational/eligibility requirements, (e.g., long fixed duration time requirements) that were designed for traditional thermal resources. Additionally, as discussed at the technical conference, storage resources are being uneconomically dispatched in CAISO because there is a disconnect between slower bidding parameters and the fast and frequent change in dispatch or potential dispatch instructions.[102] This is yet another instance where market rules that were designed to accommodate legacy resources prove to be ill equipped to take advantage of the flexibility of emerging technologies.

Question 2: To what extent do existing RTO/ISO energy and ancillary services market rules require standalone variable energy resources to respond to dispatch instructions (e.g., curtailment)?

a. To what extent are standalone variable energy resources technically capable of being "dispatchable?" Is there a distinction between being dispatched down and being curtailed?

Standalone variable energy resources are technically capable of being dispatchable. For example, PJM has been working to enable intermittent and variable energy resources to respond to dispatch instructions.[103] Dr. Graf also suggests that we currently say something is "curtailed" when the operator takes manual action and "dispatched" when it is a result of economic dispatch. He proposes that it would be better "to move away from manual operator actions to enable that flexibility within the economic dispatch engine."[104]

[102] *See* Jason Burwen, Oct. 12, 2021 Tr. at 87-89.
[103] *See* Dr. Walter Graf, Oct 12 Tr. at 114-15.
[104] *Id.*

Question 4: To what extent are emerging resource types, such as hybrids, storage resources, and distributed energy resource aggregations technically capable of providing existing ancillary service products or other reliability services? Acknowledging that some market rules are evolving due to Order Nos. 841 and 2222, do current RTO/ISO market rules for ancillary services and other reliability services, such as eligibility requirements, align with these emerging resource types' capabilities?

As discussed in more detail in response to the September Technical Conference Panel 1, Question 3 and October Technical Conference Panel 1, Question 2, both the LBNL report on Variable Renewable Energy Participation in U.S. Ancillary Services Markets and the FERC Hybrid White Paper the Commission's proceeding on hybrid resources show that new resources, including hybrid resources, are technically capable of providing existing ancillary service products or other reliability services. However, as discussed throughout these comments, in certain circumstances, RTO/ISO market rules prohibit them from doing so. Therefore, certain market rule changes will be needed to better allow the participation of these resources, which are occupying a greater share of the interconnection queue.[105]

Panel 3: Revising RTO/ISO Market Models, Optimization, and Other Software Elements to Address Operational Flexibility Needs

Question 1: What are the challenges to incorporating uncertainty within the current RTO/ISO market software? For example, how can improvements in forecasting, the use of intra-day commitment processes that include a range of forecasts, or longer look-ahead commitment and dispatch horizons result in more efficient unit commitment and dispatch in real time?

FERC took action to remove barriers to the participation of distributed energy resources in its markets through Order No. 2222. But more can be done to leverage these resources to increase reliability and improve competition. The wholesale markets currently do not

[105] *See* Jason Burwen, Oct. 12 Tr. at 109-10 and Betsy Beck, Oct. 12 Tr. at 110-11 for discussion of hybrid resource needs.

appropriately value fast responding resources, particularly small resources such as DERs. As discussed in a paper by Jonathan Newman and Pamela MacDougall, an intraday market would provide financial incentives to correct forecasts more efficiently, which would, among other things, tap into the valuable benefits of DERs.[106] In turn, these more flexible resources will help the market better integrate the variable resources like wind and solar power that are currently planned to come online, respond to other contingencies, and generally improve the flexibility and efficiency of the grid.

As discussed in the Newman/MacDougall paper, DERs often do not participate in the day-ahead market because the financial risks are too great relative to the limited benefit. Consequently, more energy is purchased in the day-ahead market than may be needed, the grid is less flexible than it otherwise could be, grid reliability costs are higher, and the clean energy transition is slower. Intraday markets could resolve these issues by aligning expected performance closer to dispatch in the real-time market, but with a price certain (just as with the day ahead market). Resources will have more information about their ability to perform within a few hours of the real-time market. The intraday market would give them the financial motivation to participate in the market by providing the opportunity for additional financially and operationally binding market settlements between the existing day ahead market and real-time market. An intraday market also gives market participants better information closer to the real time in areas like energy demand and weather forecasts and unexpected generation and

[106] Newman and MacDougall, Increasing DER integration through discrete intraday settlements (2021), available at https://www.sciencedirect.com/science/article/pii/S1040619021000233. *See also* John Moore, Unlocking Distributed Energy's Power with Intraday Markets (2021), available at https://sustainableferc.org/unlocking-distributed-energys-power-with-intraday-markets/.

transmission outages. Thus, an intraday market would unlock additional flexibility, increasing reliability and competition for the benefit of consumers.

Question 4: Can multi-day-ahead markets or hour-ahead markets help address operational flexibility needs in RTOs/ISOs? What is the objective of such approaches, and are there potential drawbacks?

Multi-day-ahead markets would conceivably allow certain long-lead-time resources to be economically committed, rather than self-committed, which is a common approach now. However, it is unclear whether this change would provide any benefit in terms of operational flexibility. It could possibly be counterproductive since, as Joseph Daniel explained, there are "serious concerns that a multi-day market could actually facilitate the preservation of more inflexible resources in the near term."[107] In addition, he raised the concern that "If a multi-day market product is proposed and is predicated on the need for multi-day markets to help resolve issues related to self-commitment, and if the Commission approves such a market design, then it should take steps to ensure that these market changes are paired with restrictions on self-commitment due to long resource lead times."[108] Many operators of inflexible units make self-commitment decisions 7-10 days out, far longer than most multi-day-ahead markets that have been discussed; thus it is questionable whether providing a longer time horizon for economic commitment would actually affect many of these entrenched practices.

Panel 4: Out-of-Market Operator Actions Used to Manage Net Load Variability and Uncertainty

In lieu of answering the specific questions posed by the Commission on out of market actions, we believe that to the maximum extent possible, all operator actions should be

[107] Joseph Daniel, Oct. 12, 2021 Tr. at 4.
[108] *Id.* at 6.

incorporated into products and pricing to provide signals to ALL supply and demand resources capable of providing the service rather than the one that the operator may be used to calling upon. Providing a general transparent price signal provides incentives for all resources to operate efficiently and long-term signals for investment. That said, the presence of some non-market operator actions does not necessarily render existing rates for ancillary services unjust and unreasonable.[109]

III. Conclusion

Clean Energy Organizations appreciate the opportunity to submit these comments and urge the Commission to prioritize progress on energy and ancillary service market design to ensure that these markets are procuring what is needed for a reliable grid, allow all resources that are capable to provide the services to do so, and fairly and efficiently compensate all resources providing the needed services.

Respectfully submitted,

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[109] *See, e.g.*, PJM Interconnection LLC, 177 FERC ¶ 61,209, at P 38.

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CERTIFICATE OF SERVICE

I hereby certify that the foregoing has been served in accordance with 18 C.F.R. § 385.2010 upon each party designated on the official service list in this proceeding by email.

Dated: February 4, 2022.

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