Energy and Ancillary Services Market Reforms to Address Changing System Needs

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Contents

I. Introduction: Summary of Market Design Concern

Regional transmission organizations and independent system operators (RTOs/ISOs) and industry experts are exploring whether RTO/ISO energy and ancillary services markets may require reforms in light of the changing resource mix and load profiles. Although the full nature and timing of those reforms are still under discussion, there is broad industry consensus that RTOs/ISOs will need more operational flexibility from resources to reliably serve loads as the resource mix evolves to include more weather dependent variable energy resources (VERs) and loads change due to weather-dependent distributed energy resources, electrification, and other factors.

Responding to these changing system needs involves several RTO/ISO market design considerations, including how to provide appropriate price signals that both reflect operational needs and incent resources to submit energy and ancillary services supply offers that increase the operational flexibility available on the system, and also encourage efficient investment and retirement decisions. RTOs/ISOs have taken steps to implement reforms to their energy and ancillary services markets and continue to do so. This report summarizes some of these recent energy and ancillary services markets reforms as well as reforms currently under consideration.

Commission staff prepared this whitepaper in an effort to frame discussions at two Commission technical conferences scheduled for September 14 and October 12, 2021, in Docket No. AD21-10-000.[1] Commission staff hopes discussions at these technical conferences will contribute to these ongoing efforts to develop a common understanding of the challenges ahead. The remainder of this paper is organized as follows: Section II summarizes studies analyzing the need for increased operational flexibility in RTOs/ISOs and defines key terms; Section III summarizes energy and ancillary services markets reforms that have been adopted by RTOs/ISOs; and Section IV summarizes energy and ancillary services markets reforms that RTO/ISO stakeholders are currently considering.

[1] *Notice of Technical Conferences Regarding Energy and Ancillary Services Markets*, Docket No. AD21-10-000 (July 14, 2021).

II. Background: Need for Increased Operational Flexibility in RTOs/ISOs

A. Background on Ancillary Services in RTO/ISO Markets

In Order No. 888,[2] the Commission required that a transmission provider's open access transmission tariff (OATT) include six ancillary services as part of providing basic transmission service to a customer: (1) Scheduling, System Control and Dispatch Service; (2) Reactive Supply and Voltage Control Service; (3) Regulation (Regulation Service) and Frequency Response Service; (4) Energy Imbalance Service; (5) Operating Reserve – Spinning Reserve Service (Spinning Reserve Service); and (6) Operating Reserve – Supplemental Reserve Service (Supplemental Reserve Service).[3] The Commission-accepted definitions of these traditional ancillary services are included in the Commission's *pro forma* OATT[4] and provided in the Appendix to this paper for ease of reference.

RTOs/ISOs ultimately implemented market-based mechanisms to procure four of these ancillary services: Energy Imbalance Service, Regulation Service, Spinning Reserve Service, and Supplemental Reserve Service. Specifically, RTOs/ISOs adopted centrally dispatched real-time energy markets and locational marginal pricing to provide Energy Imbalance Service.[5] Further, RTOs/ISOs adopted market-based ancillary services products corresponding to Regulation Service, Spinning Reserve Service, and Supplemental Reserve Service, and implemented market clearing mechanisms to procure these services on a co-optimized basis with energy to minimize total production costs. The market clearing processes in RTO/ISO energy and ancillary services markets

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[2] *Promoting Wholesale Competition Through Open Access Non-Discriminatory Transmission Services by Public Utilities; Recovery of Stranded Costs by Public Utilities and Transmitting Utilities*, Order No. 888, FERC Stats. & Regs. ¶ 31,036 (1996) (cross-referenced at 75 FERC ¶ 61,080), *order on reh'g*, Order No. 888-A, FERC Stats. & Regs. ¶ 31,048 (cross-referenced at 78 FERC ¶ 61,220), *order on reh'g*, Order No. 888-B, 81 FERC ¶ 61,248 (1997), *order on reh'g*, Order No. 888-C, 82 FERC ¶ 61,046 (1998), *aff'd in relevant part sub nom. Transmission Access Pol'y Study Grp. v. FERC*, 225 F.3d 667 (D.C. Cir. 2000), *aff'd sub nom. New York v. FERC*, 535 U.S. 1 (2002).

[3] Order No. 888, FERC Stats. & Regs. at 31,703.

[4] *See* FERC, Open Access Transmission Tariff (Pro Forma), at Schedules 1-6, https://www.ferc.gov/sites/default/files/2020-05/pro-forma-OATT.pdf.

[5] *See, e.g.*, ISO-NE, Open Access Transmission Tariff, Schedule 4 ("Energy Imbalance Service is not a service that is required in the New England Control Area. Energy-related charges for the New England Control Area are governed by a multi-settlement, locational-based energy market . . . .").

generally establish prices for energy based on the highest marginal cost of producing energy, and establish prices for ancillary services products based on the highest marginal opportunity cost incurred by a resource to provide the ancillary services rather than energy.

In Order No. 719,[6] the Commission found that existing RTO/ISO rules used to establish the price of operating reserves (i.e., Spinning Reserves and Supplemental Reserves) do not allow for prices to rise sufficiently during an operating reserve shortage to allow supply to meet demand, and are thus unjust and unreasonable.[7] The Commission specified four reforms that RTOs/ISOs could choose to pursue to remedy this issue: (1) increase the energy supply and demand bid caps above the current levels only during an emergency; (2) increase bid caps above the current level during an emergency only for demand bids while keeping generation bid caps in place; (3) establish an operating reserve demand curve (ORDC), which has the effect of raising prices in a previously agreed-upon way as operating reserves grow short; or (4) set the market clearing price during an emergency for all supply and DR resources dispatched equal to the payment made to participants in an emergency DR program.[8] All RTOs/ISOs ultimately adopted the third reform, i.e., implementation of an ORDC.[9] An ORDC establishes a predetermined schedule of prices according to the level of operating reserves, and increases the price as the availability of operating reserves decreases.[10] As discussed further below, ORDCs play an important role in ancillary services pricing.

While each RTO/ISO procures regulation and operating reserves products consistent with the requirements of Order No. 888 and sufficient to fulfill its reliability obligations, the specific products procured vary between the markets. All RTOs/ISOs procure spinning and supplemental reserves, defined herein as "contingency reserves," to

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[6] *Wholesale Competition in Regions with Organized Electric Markets*, Order No. 719, 125 FERC ¶ 61,071 (2008), *order on reh'g*, Order No. 719-A, 128 FERC ¶ 61,059 (2009), *order on reh'g*, Order No. 719-B, 129 FERC ¶ 61,252 (2009).

[7] Order No. 719, 125 FERC ¶ 61,071 at P 192.

[8] *Id.* P 208.

[9] *See PJM Interconnection, L.L.C.*, 139 FERC ¶ 61,057 (2012); *N.Y. Indep. Sys. Operator, Inc.*, 129 FERC ¶ 61,164 (2009); *ISO New Eng. Inc.*, 130 FERC ¶ 61,054 (2010); *Cal. Indep. Sys. Operator Corp.*, 131 FERC ¶ 61,280 (2010); *Sw. Power Pool, Inc.*, 146 FERC ¶ 61,050 (2014). MISO adopted an ORDC prior to the issuance of Order No. 719. *See Midwest Indep. Transmission Sys. Operator, Inc.*, 122 FERC ¶ 61,172 (2008).

[10] Order No. 719, 125 FERC ¶ 61,071 at P 221.

comply with the Order No. 888 requirement to procure spinning and supplemental reserves. These contingency reserves have a required response time of 10 minutes to address their most severe single contingency and most procure additional reserves with a required response time of 30 minutes or less to replenish their 10-minute reserves and sometimes to address other operational issues. While all RTOs/ISOs procure operating reserves in the real-time market, most also procure reserves in the day-ahead market while ISO New England Inc. (ISO-NE) procures reserves further in advance in its Forward Reserve Market.

Additionally, while all RTOs/ISOs procure regulation in their day-ahead and real-time markets, some RTOs/ISOs procure a single regulation product, and others procure separate regulation "up" and "down" products, which provide the option for resources to offer and the RTO/ISO to procure different amounts of each product. Table 1 summarizes the timing and nature of Regulation, contingency reserve, and Supplemental Reserve products across the RTOs/ISOs.

Table 1: Summary of Regulation, Contingency Reserve, and Supplemental Reserve Products in RTOs/ISOs

	Regulation	**10-minute Contingency reserves**	**30-minute Supplemental reserves**
CAISO	Separate Up & Down products in DA & RT	DA & RT	DA & RT
ISO-NE	Single product in DA & RT	FRM & RT	FRM & RT
MISO	Single product in DA & RT	DA & RT	forthcoming in DA & RT
NYISO	Single product in DA & RT	DA & RT	DA & RT
PJM	Single product in DA & RT	RT	DA
SPP	Separate Up & Down Products in DA & RT	DA & RT	N/A

Notes. All RTOs/ISOs permit the 10-minute contingency reserve requirement to be met with either synchronized or non-synchronized resources, but most require at least half of the requirement to be met with synchronized resources. ISO-NE procures reserves in the Forward Reserve Market (FRM) through seasonal auctions that occur prior to the day-ahead market. While SPP does not procure 30 minute supplemental reserves, it does procure 10 minute reserves in excess of its contingency reserve requirement.

B. Evidence of the Need for Increased Operational Flexibility in RTOs/ISOs

The need for increased operational flexibility in RTO/ISO energy and ancillary services markets arises from operational challenges due to expected changes in the resource mix, such as more VERs, and changes in loads due to weather-dependent distributed energy resources, electrification, and other factors. We note that the resource fleet is changing to include higher penetrations of VERs, storage resources, and co-located and hybrid resources.[11] However, unless and until an adequate proportion of VERs are deployed or paired with storage or other technology that enables them to be dispatchable in both directions, a portion of current VER resources' output will be largely unable to respond to dispatch, or only able to respond to dispatch to a limited extent due to their weather dependence.[12] Additionally, customer electric loads are expected to change in the future due to the increased deployment of distributed energy resources, electrification, and more price responsive demand. Together, these developments are expected to introduce new uncertainties and thus create different operating conditions that RTO/ISO operators have not faced in the past.

These developments have also increasingly led RTOs/ISOs to focus on the need to serve "net load" in the future as opposed to simply serving customer loads. Net load is defined herein as load minus the output of "non-dispatchable resources."[13] Non-dispatchable resources are defined herein as resources that cannot respond to RTO/ISO

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[11] PJM Interconnection, L.L.C., *Reliability in PJM: Today and Tomorrow*, at 1 (2021), *available at* https://pjm.com/-/media/library/reports-notices/special-reports/2021/20210311-reliability-in-pjm-today-and-tomorrow.ashx; *see also* Federal Energy Regulatory Commission Staff, Hybrid Resources White Paper, Docket No. AD20-9-000 (2021), *available at* https://www.ferc.gov/media/hybrid-resources-white-paper.

[12] Some VERs, particularly more recent vintages, can respond to certain RTO/ISO dispatch instructions and provide essential reliability services. *See, e.g.*, CAISO, et al., *Avangrid Renewables Tule Wind Farm, Demonstration of Capability to Provide Essential Grid Services* (Mar. 2020), *available at* https://www.caiso.com/Documents/WindPowerPlantTestResults.pdf; Clyde Loutan, et al., *Demonstration of Essential Reliability Services by a 300-MW Solar Photovoltaic Power Plant* (Mar. 2017), *available at* https://www.nrel.gov/docs/fy17osti/67799.pdf.

[13] For example, CAISO explains that "The net load curves best illustrate this variability. The net load is calculated by taking the forecasted load and subtracting the forecasted electricity production from variable generation resources, wind and solar. These curves capture the forecast variability." CAISO, *What the duck curve tells us about managing a green grid*, at 2 (2016).

operator dispatch instructions. While there is not a uniform definition of net load used by RTOs/ISOs and others in industry, the definition used herein largely captures the nature of the challenges system operators, both within and outside of RTOs/ISOs, currently face and expect to face as system needs evolve.

For example, in a 2016 paper about the CAISO net load curve, coined the "duck curve" because it was forecasted to evolve in a way such that daytime solar reduced mid-day net load in such a way as to resemble a duck, CAISO defined net loads in terms of a load forecast: "With the growing penetration of renewables on the grid, there are higher levels of non-controllable, variable generation resources. Because of that, the ISO must direct controllable resources to match both variable demand and variable supply."[14] SPP explained in an April 2020 proposal to the Commission to reform energy and ancillary services that "[f]orecasting the net load has become increasingly challenging as the amount of VERs has increased. Wind moves rapidly, often without a known pattern, which renders the forecasting of the precise magnitude and timing of variations difficult."[15]

Net load variability is often described as having two dimensions: (1) expected and reasonably forecastable changes within the operating day and across seasons; and (2) unexpected changes that cannot be forecasted due to the inherent uncertainty of the components of net load (e.g., meteorological conditions).[16] Expected changes in net load, even if known in advance, can still create challenging conditions for operators, typically in the form of steep net load ramps.[17] The unexpected changes in net load, which are inherent given the uncertainty of the components of net loads, also introduce new operational challenges for RTO/ISO operators. This unavoidable uncertainty is generally captured in the net load forecast error term.

Given current and future changes in the resource mix and loads, RTOs/ISOs have pursued energy and ancillary services markets reforms. When RTO/ISO markets were first developed, the generation fleet was largely dispatchable (i.e., it could increase or decrease its output in response to operator instructions) and could generally be relied

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[14] *Id.*

[15] SPP, Transmittal, Docket No. ER20-1617-000, at 6 (filed Apr. 21, 2020).

[16] *See, e.g.*, SPP, *Uncertainty Product Whitepaper*, at 57 (Mar. 2020) (SPP Uncertainty Product Whitepaper).

[17] *See, e.g.*, *id.*; *see also*, Paul J. Hibbard, et al., Analysis Group, *Climate Change Impact and Resilience Study – Phase II*, at 11-12 (Sept. 2020), *available at* https://www.nyiso.com/documents/20142/10773574/NYISO-Climate-Impact-Study-Phase-2-Report.pdf/209bc753-3f69-8ab9-37b5-eae3698b0ed1.

upon to produce energy for a sustained duration, and market design reflected that fact. RTOs/ISOs have stated that the entry of increasing quantities of VERs in RTO/ISO markets creates additional operational uncertainties and drives the need for greater operational flexibility to manage that uncertainty. As CAISO explained,

> Historically, the CAISO balancing authority area consisted of a predictable generation fleet. Resources were scheduled hourly in the day-ahead market and changes (or "imbalances") were addressed in the real-time market. Over the last 10 years, variable energy resources (wind and solar) have become more prevalent. While these resources are critical in meeting Renewable Portfolio Standard (RPS) and carbon emission goals, they also introduce large amounts of operational uncertainty onto the grid and can create challenging conditions for system operators to manage.[18]

SPP made similar observations about the new operational challenges associated with the changing resource mix. A 2020 SPP report referred to VERs as "forecastable resources" and explained that, "[u]nlike traditional thermal resources, which generally have a reliable and consistent source of fuel, forecastable resources can deviate from forecast by many GWs in a short amount of time. This deviation requires SPP to have enough flexible capacity available to supplant the lost forecastable generation."[19]

In addition to the RTOs/ISOs themselves, key reliability organizations have noted that the changing resource mix will increase uncertainty for RTO/ISO operators and will change the RTO/ISO operational needs.[20] For example, the North American Electric Reliability Corporation (NERC) noted the issue in its 2020 Long Term Reliability Assessment:

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[18] CAISO, *Day-Ahead Market Enhancements Second Revised Straw Proposal*, at 11-12 (July 21, 2021).

[19] SPP Uncertainty Product Whitepaper at 6.

[20] *See, e.g.*, NERC, *2020 Long Term Reliability Assessment (LTRA)*, at 6 (Dec. 2020), *available at* https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_LTRA_2020.pdf (NERC 2020 LTRA); Western Electricity Coordinating Council, *The Western Assessment of Resource Adequacy Report*, at 3-4 (Dec. 2020), *available at* https://www.wecc.org/Administrative/Western%20Assessment%20of%20Resource%20Adequacy%20Report%2020201218.pdf. *See also* NERC, *2021 State of Reliability*, at 51-52 (Aug. 2021), *available at* https://www.nerc.com/pa/RAPA/PA/Performance%20Analysis%20DL/NERC_SOR_2021.pdf.

> The addition of variable energy resources, primarily wind and solar, and the retirement of conventional generation is fundamentally changing how the [Bulk Power System] is planned and operated. Resource planners must consider greater uncertainty across the resource fleet as well as uncertainty in electricity demand that is increasingly being affected by demand-side resources. As a result, reserve margins and capacity-based estimates can give a false sense of comfort and need to be supplemented with energy adequacy assessments.[21]

Other entities, such as research institutions,[22] academics,[23] as well as the Department of Energy National Laboratories[24] have also recognized that changing system needs will require increased operational flexibility.

Several RTOs/ISOs have highlighted flexible resource characteristics, such as the ability to quickly respond to dispatch, ramp up or down quickly, or start up quickly, as desirable resource capabilities that will increasingly be needed in the future.[25] For example, a 2019 NYISO report observed that "[q]uick start capability, ramping and load following are needed for a system comprised of a large percentage of intermittent resources."[26] In its 2021 State of Reliability Report, NERC observed that, "With

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[21] NERC 2020 LTRA at 6.

[22] EPRI, *Metrics for Quantifying Flexibility in Power System Planning* (2014), *available at* https://www.epri.com/research/products/000000003002004243; E. Ela, et al., *Wholesale electricity market design with increasing levels of renewable generation: Incentivizing flexibility in system operations*, The Electricity Journal Vol 29, Issue 4 (May 2016).

[23] *See, e.g.*, Paul Joskow, *Challenges for wholesale electricity markets with intermittent renewable generation at scale: the US experience*, Oxford Review of Economic Policy, Volume 35, Number 2, at 291–33 (2019).

[24] *See, e.g.*, G. Brinkman et al., *The North American Renewable Integration Study: A U.S. Perspective*, at 63-73 (Jun. 2021), *available at* https://www.nrel.gov/docs/fy21osti/79224.pdf; NREL, *Methods for Procuring Power System Flexibility* (2015) *available at* https://www.nrel.gov/docs/fy15osti/63040.pdf.

[25] *See, e.g.*, L. Zhao et al., *MISO reliability needs & patterns assessment*, at 12-16 (Jun. 2020), *available at* https://www.ferc.gov/sites/default/files/2020-06/T1-3_Zhao_et_al.pdf.

[26] NYISO, *Reliability and Market Considerations For A Grid in Transition*, at 8-9 (Dec. 2019), *available at* https://www.nyiso.com/documents/20142/9869531/Reliability%20and%20Market%20Co

increasing levels of variable renewable generation in the resource mix, there is a growing need to have resources available that can be reliably called upon on short notice to balance electricity supply and demand if shortfall conditions occur."[27]

RTO/ISO reports and filings to the Commission indicate that RTO/ISO operators have increasingly had to rely on out-of-market operator actions to address the limitations of conventional RTO/ISO market design and manage the increase in net load variability due to insufficient levels of operational flexibility. These out-of-market actions include such measures as manual commitments, posturing, or load biasing.[28] As CAISO explained,

> Large imbalances between the day-ahead and real-time market can result in challenging operating conditions for system operators. When there is potential for large imbalances that are not or cannot be addressed through the real-time market, system operators must rely on out-of-market actions to provide unloaded capacity. These actions may include increasing the load forecast in the market and/or exceptional dispatches.[29]

Additionally, SPP stated in a 2020 proposal to implement ramp products, that the increased penetration of VER resources, principally wind generation, resulted in a greater need for the systematic management of ramping capability through out-of-market mechanisms and often resulted in make-whole payments and uplift.[30] Such out-of-market actions can undermine price formation in energy and ancillary service markets, which in turn can reduce incentives for investments in the flexible resource capabilities needed to manage operational uncertainty. For example, CAISO noted that "[a]lthough

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nsiderations%20for%20a%20Grid%20in%20Transition%20-%2020191220%20Final.pdf/7846db9c-9113-a85c-8abf-1a0ffe971967.

[27] NERC, *2021 State of Reliability*, at 52 (Aug. 2021), *available at* https://www.nerc.com/pa/RAPA/PA/Performance%20Analysis%20DL/NERC_SOR_2021.pdf.

[28] Posturing occurs when an operator commits a resource to meet anticipated system needs. Load biasing occurs when the operator manually modifies the RTO's/ISO's load forecast to better reflect anticipated system needs.

[29] CAISO, *Day-Ahead Market Enhancements Second Revised Straw Proposal* at 12 (July 21, 2021).

[30] SPP, Transmittal, Docket No. ER20-1617-000, at 4-5 (filed Apr. 21, 2020).

these [out-of-market] actions are necessary for grid reliability, they also undermine market price formation and the resultant economic signals provided by market prices."[31]

As discussed further below, each Commission-jurisdictional RTO/ISO has either implemented or has proposed to implement reforms to address the expected operational challenges associated with the changing resource mix and load profiles. The Commission approved ramp capability products in CAISO, MISO, and most recently in SPP to manage operational uncertainty.[32] Additionally, CAISO and SPP continue to consider additional reforms, and, in mid-2018, NYISO presented a high level market design concept proposal to stakeholders entitled "Reserve Procurement for Resilience" aimed at addressing expected challenges as NYISO transitions to meet New York State's climate and energy policy goals.[33] NYISO stated that the goal of the effort was "to incent resource and demand flexibility that supports grid resilience as we prepare for increased levels of non-emitting, weather-dependent generation."[34] As discussed further in Section IV, this stakeholder effort resulted in NYISO proposing energy and ancillary services markets reforms to the Commission in April 2021, which the Commission accepted in part and rejected in part.[35]

The transition of the resource mix is underway in varying degrees in the RTOs/ISOs. For example, in 2020, VERs accounted for approximately one-third of annual energy generation in SPP,[36] over one-quarter in CAISO,[37] and almost 15% in

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[31] CAISO, *Day-Ahead Market Enhancements Second Revised Straw Proposal* at 12 (July 21, 2021).

[32] *See infra* section III.B of this report for a discussion of flexible ramp products.

[33] NYISO, *Reserves for Resource Flexibility* (May 2018), *available at* https://www.nyiso.com/documents/20142/6474763/5_9_2019_Reserves_for_Resource_Flexibility_FINAL.pdf/f5b74852-2b18-9233-a8fa-bfc488ed1238.

[34] *Id.* at 4.

[35] NYISO, Transmittal, Docket No. ER21-1018-000, at 3 (filed Feb. 2, 2021).

[36] SPP MMU, *State of the Market 2020*, at 97 (2021), *available at* https://www.spp.org/documents/65161/2020%20annual%20state%20of%20the%20market%20report.pdf.

[37] CAISO DMM, *2019 Annual Report on Market Issues and Performance*, at 41 (2020), *available at* http://www.caiso.com/Documents/2019AnnualReportonMarketIssuesandPerformance.pdf.

MISO,[38] but less than 5% in NYISO,[39] ISO-NE,[40] and PJM.[41] Further, the intermittent nature of VERs means these annual accounts can greatly understate their share of energy generation in certain intervals. For example, the maximum share of energy generation by VERs was 32% in MISO[42] and 74% in SPP.[43] Moreover, VERs are expected to be the predominant new resources in all the RTOs/ISOs. VERs account for almost 90% of nameplate MW of generation seeking interconnection to the transmission system across the United States.[44]

One operational challenge of VERs is managing the size and frequency of net load ramps necessary to accommodate both expected and unexpected changes in VER output and net loads.[45] Expected changes in VER output create predictable but nonetheless significant ramping needs for operators to manage in real-time. For example, in SPP net load volatility has increased since 2016 and is expected to further increase as wind

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[38] MISO IMM, *2020 State of the Market Report for the MISO Electricity Markets*, at 6 (2021), *available at* https://www.potomaceconomics.com/wp-content/uploads/2021/05/2020-MISO-SOM_Report_Body_Compiled_Final_rev-6-1-21.pdf.

[39] NYISO MMU, *2020 State of the Market Report for the New York ISO Markets*, at 6 (2021), *available at* https://www.potomaceconomics.com/wp-content/uploads/2021/05/NYISO-2020-SOM-Report.pdf.

[40] ISO-NE IMM, *2020 Annual Markets Report*, at 21 (2021), *available at* https://www.iso-ne.com/static-assets/documents/2021/06/2020-annual-markets-report.pdf.

[41] PJM IMM, *State of the Market Report for PJM Volume 2: Detailed Analysis*, at 50 (2021), *available at* https://www.monitoringanalytics.com/reports/PJM_State_of_the_Market/2020/2020-som-pjm-vol2.pdf.

[42] MISO IMM, *2020 State of the Market Report for the MISO Electricity Markets* at 18.

[43] SPP MMU, *State of the Market 2020* at 47.

[44] Lawrence Berkeley National Laboratory, *Generation, Storage, and Hybrid Capacity in Interconnection Queues*, https://emp.lbl.gov/generation-storage-and-hybrid-capacity (last visited July 14, 2021).

[45] SPP Uncertainty Product Whitepaper at 7.

generation increased the changes in net load in about three-quarters of the intervals in 2020.[46] Even where VER variability is forecasted accurately, the magnitude and speed of the daily fluctuations in many situations requires fast-ramping capability. For example, MISO frequently experiences daily wind output fluctuations in excess of 10 GW, with common occurrences of particularly sharp one-hour drops that approach 6 GW.[47] CAISO's generation often fluctuates 9 GW throughout the operating day.[48]

Another operational challenge associated with the changing net load profile is the uncertainty inherent in net load forecasts. This uncertainty is principally due to meteorological forecast errors. Unexpected (i.e., unforecasted) changes in net load leads to the need for other resources to either increase their generation to make up for VER production shortfalls (i.e., VER output below forecast) or reduce output (i.e., VER output exceeds forecast). RTOs/ISOs rely on resources that can quickly respond to dispatch instructions, which can include VER resources, to address such forecast errors.[49]

Meteorological forecast errors can create operational challenges for RTO/ISO operators. For example, on March 26, 2018, SPP experienced a large wind forecast error where the day-ahead forecast for wind output was 7,000 MW above the reliability unit commitment forecast. During this event, known in SPP as the "Wind Burn" event, SPP operators committed 54 units out-of-market to replace the unexpected decrease in wind generation and meet reliability needs.[50] SPP stated that the root cause of the forecast error was the poor performance of meteorological forecasts. The graph prepared by SPP in Figure 1 below shows the progression of wind output forecasts on March 26, 2018, when the Wind Burn event occurred. As Figure 1 shows, the intraday reliability unit commitment (IRUC) projections of wind output SPP uses in real-time improved as the

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[46] SPP MMU, *State of the Market 2020* at 98.

[47] MISO IMM, *2020 State of the Market Report for the MISO Electricity Markets* at 20. MISO's average annual load is approximately 80 GW and peak load approximately 120 GW. *Id.* at 7.

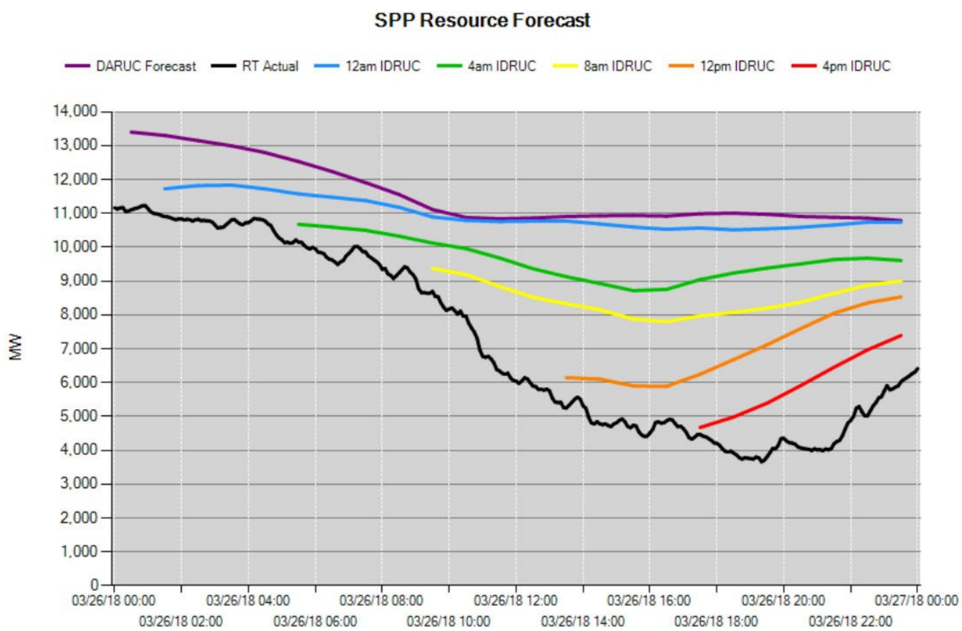
[48] CAISO DMM, *2019 Annual Report on Market Issues and Performance* at 40. CAISO's average annual load is approximately 25 GW and peak load approximately 45 GW. *Id.* at 32, 34.

[49] *See, e.g.*, SPP Uncertainty Product Whitepaper at 35-36; NYISO, Transmittal, Docket No. ER21-1018-000, at 9 (filed Feb. 2, 2021).

[50] SPP Uncertainty Product Whitepaper at 32-34.

projections got closer to the actual event, but none of the forecasts accurately predicted the severity of the drop off in wind generation.[51]

Figure 1 SPP Wind Output Forecasts on March 23, 2018 "Wind Burn" Event



Source: SPP, Uncertainty Product Whitepaper, March 13, 2020, Figure 24.

As noted above, another operational challenge some RTOs/ISOs have identified associated with the changing resource mix is transitory shortages due to ramping constraints. Improved intertemporal management of the flexibility of system resources (e.g., ramp capability) can increase reliability, and reduce the instance of shortages and the associated costs of shortage prices. For example, in SPP's April 2020 proposal to introduce a ramp product, discussed further below, SPP explained that, "[VERs] impose challenges on the SPP Transmission System as their magnitude increases. The resulting scarcity of certain reserve products can result in higher costs to load during shortage periods."[52]

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[51] *Id.*

[52] SPP Uncertainty Product Whitepaper at 10.

Some RTOs/ISOs are already examining the increased need for operational flexibility in the future. For example, MISO indicates that there will be an increasing future need for flexibility to address short-term market-wide reserve requirements as the mix of different types of resources in MISO continues to evolve, including the replacement of coal-fired power plants with VERs and natural gas power plants. Although natural gas is expected to become the primary energy source for electricity generation in MISO, MISO states that generation from VERs by wind and solar energy are also expected to expand. Registered and in-service wind generation in MISO has increased from approximately 1 GW to 19 GW from 2005 to 2019. Solar generation is estimated to reach 11 GW in 2032 if the MISO's resource fleet continues to evolve at its current pace.[53]

III. Summary of RTO/ISO Energy and Ancillary Services Markets Reforms to Increase Operational Flexibility that the Commission has Approved or that Have Been Taken Unilaterally by the RTOs/ISO

RTOs/ISOs and their stakeholders are actively evaluating options to reform energy and ancillary services markets to address the need for greater operational flexibility. These approaches largely consist of reforms of energy and ancillary services markets rules in the areas of increasing shortage prices, procuring higher quantities of existing or "traditional" ancillary services products (referred to collectively herein as ORDC revisions), and creating new ancillary services products. Examples of reforms designed to increase operational flexibility that RTOs/ISOs have proposed or implemented to date are described in this section.

We note that the definition of flexibility differs across RTOs/ISOs in their details, but all definitions generally refer to a resource's availability to increase or reduce energy output (or reduce demand in the case of a DR resource) in a short timeframe. For example, according to SPP, "[f]lexibility refers to the available amount of rampable online and offline capacity that can be delivered within a certain period of time."[54] CAISO's Day Ahead Energy Market Enhancement proposal, discussed further below, would create a new day-ahead ancillary service product called an imbalance reserve that would ensure "sufficient real-time dispatch capability to meet net load imbalances that materialize between the day-ahead and real-time markets."[55] And in a 2017 report,

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[53] MISO, Transmittal, Docket No. ER20-42-000, at 10 (filed Oct. 4, 2019).

[54] *Id.*

[55] CAISO, *Day-Ahead Market Enhancements Second Revised Straw Proposal* at 5 (July 21, 2021).

NYISO stated that, "'[f]lexible' units are generators with different upper and lower operating limits that can supply a range of output into the energy markets."[56]

Additionally, most RTOs/ISOs have tended to focus on energy and ancillary services markets reforms as opposed to capacity market reforms or other RTO/ISO market reforms. For example, NYISO observed that, "[w]hile the capacity market is designed to meet resource adequacy, the energy and ancillary services markets provide the primary incentive for units to perform in real time and respond to rapidly changing system conditions."[57] Additionally, panelists in the March and May 2021 FERC technical conferences concerning capacity markets emphasized the need to review energy and ancillary services markets in addition to capacity market reforms.[58] However, capacity markets could also incent and reward flexibility, but to date, with the exception of CAISO, RTO/ISO capacity and resource adequacy constructs do not explicitly require capacity resources to be flexible.[59]

A. <u>Operating Reserve Demand Curve Revisions</u>

Some RTOs/ISOs have proposed reforms to change the quantity of existing reserve products and the pricing of those reserves to address the changing operational needs associated with net load variability and uncertainty. Both NYISO and PJM have proposed ORDC revisions to: (1) increase shortage prices; and (2) procure reserves beyond the minimum reserve requirement. The Commission partially accepted

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[56] NYISO, *Integrating Public Policy: A Wholesale Market Assessment of the Impact of 50% Renewable Generation*, at 10 (Dec. 2017).

[57] NYISO, *Reliability and Market Considerations For A Grid in Transition*, at 7 (Dec. 2019), *available at* https://www.nyiso.com/documents/20142/9869531/Reliability%20and%20Market%20Considerations%20for%20a%20Grid%20in%20Transition%20-%2020191220%20Final.pdf.

[58] *See, e.g.*, Public Interest Organizations Comments at 23, Docket No. AD21-10-000 (filed Apr. 26, 2021); Advanced Energy Economy Comments, at 23, Docket No. AD21-10-000 (filed Apr. 26, 2021); Edison Electric Institute Comments at 3, Docket No. AD21-10-000 (filed Apr. 26, 2021); Institute for Policy Integrity Comments at 12, Docket No. AD21-10-000 (filed Apr. 26, 2021).

[59] The California Resource Adequacy program, which is administered by the California Public Utilities Commission, requires a portion of capacity resources to be flexible.

NYISO's[60] and is still considering PJM's proposed ORDC revisions.[61] MISO is also considering ORDC enhancements that, according to MISO, are "intended to better price and manage growing uncertainty, incent flexibility, visibility, and availability needs, and address issues identified during recent emergency events."[62]

With regard to NYISO's proposal, in April 2021, NYISO proposed ORDC revisions to, among other things, increase certain shortage prices and procure additional "supplemental reserves" beyond the minimum reserve requirement.[63] According to NYISO, its proposed revisions to shortage prices were designed to: (1) improve pricing efficiency; (2) provide for better alignment with the cost of actions that may be taken to preserve sufficient availability of reserves and maintain system reliability; and (3) reduce historical occurrences of reserve shortages.[64] NYISO explained that the supplemental reserves proposal was "designed to primarily address potential needs that could arise quickly from NYISO's expected forecasting accuracy of load and production capability from Intermittent Power Resources that depend on wind or solar energy as their fuel."[65] The Commission rejected the Supplemental Reserves portion of the proposal, which would have procured reserves beyond the minimum reserve requirement at certain times to address uncertainties, without prejudice on the grounds that the proposal lacked

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[60] *N.Y. Indep. Sys. Operator, Inc.*, 175 FERC ¶ 61,241 (2021).

[61] The Commission originally issued an order on PJM's filing in May 2020. *See PJM Interconnection, L.L.C.*, 171 FERC ¶ 61,153, *reh'ng denied*, 173 FERC ¶ 61,123 (2020) (finding PJM's existing tariff unjust and unreasonable, largely adopting PJM's replacement rate as just and reasonable subject to modification and compliance, and reaching the same result on rehearing). The Court subsequently granted the Commission's motion for voluntary remand in the ensuing appeal. *See Am. Municipal Power, Inc. v. FERC*, Nos. 20-1372, et al. (D.C. Cir. Aug. 23, 2021) (granting Commission motion for voluntary remand).

[62] MISO, Scarcity Pricing Evaluation, at *i* (May 2021), *available at* https://cdn.misoenergy.org/20210513%20MSC%20Item%20XX%20Scarcity%20Pricing%20Evaluation%20Paper550162.pdf.

[63] *N.Y. Indep. Sys. Operator, Inc.*, 175 FERC ¶ 61,241 (2021) P 1. NYISO also proposed revisions to the New York Control Area (NYCA) 30-minute reserve demand curve that applies in real-time during activations of certain DR programs.

[64] *Id.* P 2; *see also* NYISO, Transmittal, Docket No. ER21-1018-000, at 4 (filed Feb. 2, 2021).

[65] NYISO, Transmittal, Docket No. ER21-1018-000, at 9 (filed Feb. 2, 2021) (citations omitted).

sufficient detail in the NYISO tariff. The Commission also noted that it could be just and reasonable to procure reserves beyond the minimum reserve requirement.[66]

Thus, the Commission has found it can be just and reasonable to address operational uncertainties by revising the shape of ORDCs to increase reserve shortage prices and procure reserves beyond the minimum reserve requirement. However, the Commission has also found alternative RTO/ISO energy and ancillary services markets reforms to address operational uncertainties are just and reasonable, such as ramp products. These alternative strategies are discussed further below.

B. New Ancillary Services

CAISO, MISO, and SPP have developed new ancillary services products that provide short-term ramp capability to manage the changing system needs described above and reduce out-of-market actions by operators. The ramp products in CAISO and MISO have been in place for several years but SPP's ramp product is not yet implemented.[67] Although the three ramp products differ, they share several similar features. The ramp products are bi-directional in that they procure and price upward and downward ramp capability as separate products. The ramp products add a constraint (i.e., a "ramp constraint") to the energy and ancillary services market clearing process that simultaneously procures and prices energy, traditional ancillary services, and the ramp products on a co-optimized basis. The ramp constraint holds back the ramp capability of certain resources, as needed, to ensure that the system can meet expected ramping needs in future intervals.

In all three markets, the ramp product prices are based on the opportunity cost resources incur from providing ramp rather than energy and the other ancillary services. In the event the system is economically or physically short of a ramp product, the ramp price is set by an administratively determined demand curve for the ramp product, with separate demand curves for upward or downward ramp capability. As discussed further below, the demand curves for the three ramp products differ across the markets, as does the timing. Additionally, MISO (and SPP, once implemented) include the ramp product in both the day-ahead and real-time markets, while CAISO only has a ramp product in real-time.

In 2014, the Commission approved MISO's proposal to introduce two Ramp Capability Products, Up-Ramp Capability and Down-Ramp Capability, to address short-term expected and unexpected variations in net load.[68] The MISO Up-Ramp and Down-

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[66] *N.Y. Indep. Sys. Operator, Inc.*, 175 FERC ¶ 61,241 at PP 39-40.

[67] An official term for a ramp product in CAISO is Flexible Ramping Product; Ramp Capability Product in MISO; and Ramp Product in SPP.

[68] *Midcontinent Indep. Sys. Operator, Inc.*, 149 FERC ¶ 61,095 (2014). MISO

Ramp Capability products procure ramp capability within a 10-minute timeframe. When MISO is unable to meet the system's ramp requirements, a demand curve with a maximum price of $5/MWh sets the price for the Ramp Capability Products.[69] However, MISO is currently considering revising the demand curve for the Up-Ramp Capability product to "better reflect net load uncertainty and continue to track with this uncertainty as it changes with the evolving resource mix."[70]

CAISO implemented its Flexible Ramping Product in 2016 to its Fifteen-Minute Market and Real-Time Markets.[71] CAISO's demand for the Flexible Ramping Product is based on the system's most recent net load forecast errors. Unlike MISO, CAISO does not currently have a day-ahead market for its ramp product, but as discussed further below, is considering procuring a product similar to its ramp product in the day-ahead market. Additionally, CAISO is currently considering changes to the Flexible Ramping Product because it does not consider locational constraints, which can result in ramp awards to resources that are not fully deliverable to meet the system's ramping needs.[72] CAISO proposes to revise the Flexible Ramping Product to clear at the nodal level (rather than the system level), which would result in Flexible Ramping Product prices that include the locational value of flexible ramping capability.

In May 2020, the Commission approved SPP's proposal to implement a new ramp product, composed of Up Ramp and Down Ramp Products, that procure ramp capability available within a 10-minute timeframe.[73] SPP is working to implement the ramp products. In the ramp product proposal, SPP explained that the extensive and continued penetration of VERs on the system had increased uncertainty driven by the "rapid movement and variability of VERs," which resulted in a need for SPP to increasingly address net load uncertainty through out-of-market actions. In addition, according to

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implemented the ramp product in the spring of 2016.

[69] *Id.*

[70] MISO, *Scarcity Pricing Evaluation* at 14.

[71] *Cal. Indep. Sys. Operator Corp.*, 156 FERC ¶ 61,226 (2016).

[72] CAISO, *Flexible Ramping Product Refinements Final Proposal*, at 11 (Aug. 2020), *available at* http://www.caiso.com/InitiativeDocuments/FinalProposal-FlexibleRampingProductRefinements.pdf.

[73] *Sw. Power Pool, Inc.*, 172 FERC ¶ 61,027 (2020).

SPP, increased uncertainty in SPP's projected net load resulted in more frequent transient periods of reserve shortages, increasing price volatility, and rising costs to load.[74]

SPP's ramp products' amount of procurement will be based on forecasted net load changes and historical net load forecast error over a rolling 20-minute period (10 minutes for traditional real-time solution look ahead and an additional 10 minutes for ramp and net load optimization), averaged into an hourly requirement. In times when SPP is unable to procure sufficient ramp products, the ramp products' clearing prices will be set by a downward-sloping stepped demand curve with a maximum price based on the average cost of committing fast-start resources to cure the ramp deficiency.

In January 2020, the Commission accepted MISO's proposed tariff revisions to add a 30-minute reserve product, called the Short-Term Reserve product.[75] MISO explained in its proposal that the Short-Term Reserve product will address short-term reserve and capacity needs that are local, sub-regional, or market-wide in scope by creating a 30-minute reserve product that will be co-optimized with MISO's energy and existing ancillary services products. Once implemented, the demand curve for the Short-Term Reserve product will be set at $100/MWh and the quantity will be based on an analysis of the system's need for 30-minute reserve capacity.

MISO explained that due to changes in the resource mix and fuel prices, the system's relatively more flexible natural gas resources were increasingly being committed and dispatched in the day-ahead market ahead of less flexible resources. MISO stated this dynamic results in less flexible and off-line resources being the only resources available to meet system needs in real-time, which could challenge MISO's ability to quickly respond to uncertainties and contingencies in real-time. MISO explained this challenge prompted the ISO to propose the Short-Term Reserve product.[76] At the time of its filing, MISO did not have a 30-minute reserve product and relied instead on regulation, 10-minute spinning and supplemental reserves, and the Up Ramp and Down Ramp products to satisfy reliability requirements and meet system needs.

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[74] SPP, Transmittal, Docket No. ER20-1617-000, at 4-5 (filed Apr. 21, 2020).

[75] *Midcontinent Indep. Sys. Operator, Inc.*, 170 FERC ¶ 61,075 (2020).

[76] MISO, Transmittal, Docket No. ER20-42-000, at 10 (filed Oct. 4, 2019).

IV. Reforms under Consideration in RTO/ISO Stakeholder Processes

CAISO and SPP are currently considering new ancillary services products to meet changing system needs. CAISO is currently considering adding new day-ahead ancillary service products and revising its reliability unit commitment process to better optimize system resources and provide needed flexibility. SPP is considering developing a longer term "Uncertainty Product" to manage the system's ramping needs over a longer time horizon than would the recently approved 10-minute ramp product. Finally, as noted above, MISO is considering reforms to its ORDC. These reforms are discussed in turn below.

In the July 2021 version of its Day-Ahead Market Enhancements proposal, CAISO proposes to add two new ancillary services products that would clear in the day-ahead market on a co-optimized basis with CAISO's existing energy and ancillary services products.[77] The new Imbalance Reserves Up and Imbalance Reserves Down products would "procure flexible capacity to cover real-time ramping needs that are not covered by hourly day-ahead market schedules and to cover real-time net load uncertainty."[78] CAISO states that Imbalance Reserves would reflect locational constraints and enable the day-ahead market to compensate resources that provide flexible capacity to manage real-time net load uncertainty and reduce out-of-market actions by incorporating the costs of doing so into the day-ahead market.[79]

CAISO also proposes to reform its reliability unit commitment process as part of the Day-Ahead Market Enhancements proposal. Specifically, CAISO would create Reliability Capacity Up and Reliability Capacity Down products that would be incremental capacity procurements to meet the positive (Reliability Capacity Up) and negative (Reliability Capacity Down) difference between the net load forecast and cleared non-VER physical supply.[80] The Reliability Capacity Up and Reliability Capacity Down products would be awarded through the reliability unit commitment process, which runs after the day-ahead market process. CAISO would also revise its

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[77] *See* CAISO, *Day-Ahead Market Enhancements Second Revised Straw Proposal* at 5 (July 21, 2021).

[78] *Id.* at 5.

[79] *Id*. at 12, 16.

[80] *Id*. at 19-20. Reliability Up Capacity and Reliability Down Capacity awards would be based on their 60-minute ramp capability and cleared resources would be subject to a must-offer obligation in CAISO's real-time market. *Id*. at 21.

reliability unit commitment process to include mitigation[81] and allow the residual unit commitment to adjust the configuration of multi-stage generating resources to reduce their output, but not turn them off completely.[82]

As noted above, the daily net load profile will experience both expected and unexpected variability. The expected RTO/ISO net load variability often materializes as sustained multi-hour net-load ramps (e.g., decrease in solar generation as the sun sets, which increases net loads). This longer-term known variability may not be managed optimally with the short-term ramp products described above because current (and approved) ramp products are designed to optimize system resources on a short time horizon (e.g., 10 or 15-minutes) in CAISO, MISO, and SPP (Section III). Therefore, the shorter-term ramp products may be too myopic to manage sustained multi-hour ramps, which can result in sub-optimal use of the system's ramp capability over the course of the operating day.

As SPP observed, longer-term ramp products could result in more efficient use of the system's ramp capability.[83] Although FERC approved SPP's ramp products in May 2020, SPP is also considering an "Uncertainty Product" to address ramping needs in future periods beyond the 10-minute time frame of SPP's forthcoming ramp product.[84] The longer-term ramp capability procured through the Uncertainty Product could be used for energy or reserves as warranted by system conditions and the cost of procuring the longer-term ramp capability. Like the shorter-term ramp products discussed in Section III.B, SPP would impute an offer based on the resource's opportunity cost from providing the longer-term ramp.[85] The CAISO Department of Market Monitoring recommended adding a longer-term ramp product to manage the uncertainty associated with multi-hour forecasts of VER output, which tend to have higher forecast errors than shorter-term forecasts of VER output.[86]

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[81] *Id*. at 30-31.

[82] *Id*. at 32.

[83] SPP Uncertainty Product Whitepaper at 10.

[84] *Id.* at 57.

[85] *Id*. at 60. Offline resources would be eligible to submit a separate non-zero offer price to provide the Uncertainty Product that reflects the incremental costs the resource would incur to provide the product.

[86] CAISO Department of Market Monitoring, *2019 Annual Report on Market Issues and Performance*, at 11, 35-36 (June 2020). See also CAISO Department of Market Monitoring, Comments on Issue Paper on Extending the Day-Ahead Market to

MISO is currently considering reforms to its ORDC based on concerns that market prices during historical emergencies and shortage have not reflected system conditions. Specifically, MISO observed that system-wide and sub-regional shortage conditions may not be appropriately reflected in energy and reserve prices. MISO also observed that that price signals in MISO are insufficient to reflect forecasted shortage conditions and incent internal and external resources to respond.[87] MISO is also considering several possible energy and ancillary services reforms with stakeholders to address these concerns, including but not limited to, updating MISO's Value of Lost Load (VOLL) parameter and creating an ORDC based on that VOLL and updated Loss of Load Probabilities, revising its Up Ramp Capability product, and revising the eligibility of offline resources to set LMPs under the Extended LMP construct.[88]

V. <u>Conclusion</u>

The evolving resource mix and changes to loads are together expected to create new operational needs that current RTO/ISO energy and ancillary services market constructs were not originally designed to manage. As the need for operational flexibility in RTOs/ISOs continues to increase, the role of energy and ancillary services markets in providing price signals for the entry and retention of resources with flexible capabilities will likewise increase. Most RTOs/ISOs have already implemented changes to address these emerging needs. To date, these reforms have largely focused on revising ORDC for existing ancillary services products and creating new ancillary services products. However, most RTOs/ISOs continue to consider further reforms to energy and ancillary services markets to address changing system needs in their respective stakeholder processes. This experience indicates there are multiple paths to reform RTO/ISO energy and ancillary services markets. While the challenges are likely to differ across RTOs/ISOs over time as system needs change, assessing each market's unique experience to date and discussing the potential future reforms under consideration may promote more informed market design changes.

EIM Entities, at 8 (Nov. 22, 2019), *available at* http://www.caiso.com/initiativedocuments/dmmcomments-extendedday-aheadmarket-issuepaper.pdf.

[87] MISO, *Scarcity Pricing Evaluation* at 7.

[88] *Id.* at *iii*.

Appendix

The following are definitions for the six ancillary services that the Commission required in Order No. 888 that a transmission provider's OATT include as part of providing basic transmission service to a customer.

Ancillary Service	*Pro Forma* OATT Definition
Scheduling, System Control and Dispatch Service	This service is required to schedule the movement of power through, out of, within, or into a Control Area. This service can be provided only by the operator of the Control Area in which the transmission facilities used for transmission service are located.
Reactive Supply and Voltage Control Service	In order to maintain transmission voltages on the Transmission Provider's transmission facilities within acceptable limits, generation facilities and non-generation resources capable of providing this service that are under the control of the control area operator are operated to produce (or absorb) reactive power.
Regulation and Frequency Response Service	Regulation and Frequency Response Service is necessary to provide for the continuous balancing of resources (generation and interchange) with load and for maintaining scheduled Interconnection frequency at sixty cycles per second (60 Hz). Regulation and Frequency Response Service is accomplished by committing on-line generation whose output is raised or lowered (predominantly through the use of automatic generating control equipment) and by other non-generation resources capable of providing this service as necessary to follow the moment-by-moment changes in load.
Energy Imbalance Service	Energy Imbalance Service is provided when a difference occurs between the scheduled and the actual delivery of energy to a load located within a Control Area over a single hour. The Transmission Provider must offer this service when the transmission service is used to serve load within its Control Area.
Operating Reserve – Spinning Reserve Service	Spinning Reserve Service is needed to serve load immediately in the event of a system contingency. Spinning Reserve Service may be provided by generating units that are on-line and loaded at less than maximum output and by non-generation resources capable of providing this service. The Transmission Provider must offer this service when the transmission service is used to serve load within its Control Area.

Operating Reserve – Supplemental Reserve Service	Supplemental Reserve Service is needed to serve load in the event of a system contingency; however, it is not available immediately to serve load but rather within a short period of time. Supplemental Reserve Service may be provided by generating units that are on-line but unloaded, by quick-start generation or by interruptible load or other non-generation resources capable of providing this service. The Transmission Provider must offer this service when the transmission service is used to serve load within its Control Area.