UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Electric Storage Participation in Markets Operated by Regional Transmission Organizations and Independent System Operators	Docket Nos. AD16-20-000 RM16-23-000

COMMENTS OF PUBLIC INTEREST ORGANIZATIONS

On November 17, 2016, the Federal Energy Regulatory Commission (FERC), in the above-captioned dockets, issued a Notice of Proposed Rulemaking (NOPR) seeking comments on its proposal to remove barriers to the participation of electric storage resources and distributed energy resource (DER) aggregations in organized wholesale electric markets.[1] FERC proposes to require the Regional Transmission Organization and Independent System Operator (RTOs/ISOs) to (i) establish wholesale market rules that recognize the physical and operational characteristics of storage and DER aggregation resources and accommodate their market participation, and (ii) define DER aggregators as market participants that can participate in wholesale markets under a participation model that best accommodates their unique characteristics.

The undersigned Public Interest Organizations support the general framework FERC proposes in the NOPR with clarifications and modifications to avoid undue limitations and burdens on DER and storage market participation, as discussed below. These comments focus on the distinct benefits that DERs and storage can provide to organized wholesale electric markets, the market barriers that DERs and storage currently face, and the need to eliminate such barriers. We ask that FERC finalize its proposed framework, as modified by the recommendations

[1] *Electric Storage Participation in Markets Operated by Regional Transmission Organizations and Independent System Operators*, 157 FERC ¶ 61,121 (2016).

discussed below, to ensure that market rules enabling cost-effective storage and DER participation are just and reasonable, and not unduly discriminatory or preferential.

I. FERC should continue to ensure that its rules evolve with and appropriately anticipate trends in the changing resource mix

The amount of renewable, storage, and demand-side resources on the grid has been growing and this trend is expected to accelerate. Storage, growing faster than expected, is spurred in part by the growth of wind and solar, and the adoption of new DERs is accelerating.[2] DERs are expected to grow five times faster than new central generation by 2022 according to Navigant, and distributed generation increased by 400 percent between 2011 and 2015 in the U.S. commercial and industrial sector according to the U.S. Energy Information Administration.[3]

In recognition of the changing resource mix and the need to enhance competition, FERC has taken steps to remove market barriers to enable non-traditional resources to more effectively

[2] *See e.g.*, Morgan Stanley Research, Energy Storage, An Underappreciated Disruptor, February 5, 2017 (forecasting that "the US energy storage market will grow more quickly than the consensus expectation. … The rapid growth of solar supply has resulted in substantially lower midday power demand (net of solar power being produced), causing record excess power supply in some markets. The anticipated near- to medium-term growth of wind power supply is expected to result in a similar disruption to overnight power demand, given that wind production is typically strongest at night …. We expect storage to grow rapidly in the near term to 'balance' interday supply imbalances."); Rocky Mountain Institute, Eight Areas of Electricity Innovation to Watch in 2017, http://blog.rmi.org/blog_2017_01_31_eight_areas_of_electricity_innovation_to_watch_in_2017 (discussing the accelerating adoption of new DERs, such as electric vehicles, batteries, grid-interactive water heaters, and many other smart appliances beyond rooftop solar, as well as the decrease in the costs of DERs).

[3] Blue Pillar, Energy Network of Things Series, Taking Advantage of the Disruption at the Grid Edge, http://info.bluepillar.com/hubfs/Downloadable_Collateral_2016/Blue%20Pillar_Utility_Energy_eBook_2017_Final.pdf?t=1486591155673.

participate in wholesale markets.[4] FERC recently recognized that storage can concurrently provide multiple services (market services as well as cost-based services), pointing to examples of generation resources having the ability to do the same.[5] FERC has also previously conducted proceedings aimed at removing barriers and improving storage participation in wholesale electric markets,[6] and more recently looked into "whether barriers exist to the participation of electric storage resources in the capacity, energy, and ancillary service markets in the RTOs and ISOs potentially leading to unjust and unreasonable wholesale rates."[7] In a recent order, FERC found MISO's tariff "unnecessarily restricts competition" by preventing storage from providing all the services that they are technically capable of providing.[8] FERC required MISO to explore the participation of all forms of storage, "regardless of the technology, in all MISO markets that they

[4] *E.g.*, *Wholesale Competition in Regions with Organized Electric Markets*, Order No. 719, FERC Stats. & Regs. ¶ 31,281 (2008), *order on reh'g*, Order No. 719-A, 74 Fed. Reg. 37,776 (Jul. 29, 2009), FERC Stats. & Regs. ¶ 31,292 (2009), *order on reh'g*, Order No. 719-B, 129 FERC ¶ 61,252 (2009); *Demand Response Compensation in Organized Wholesale Energy Markets*, Order No. 745, FERC Stats. & Regs. ¶ 31,322, *order on reh'g and clarification,* Order No. 745-A, 137 FERC ¶ 61,215 (2011); *Frequency Regulation Compensation in Organized Wholesale Power Markets*, Order No. 755, 137 FERC ¶ 61,064 (2011).

[5] *Utilization of Electric Storage Resources for Multiple Services When Receiving Cost-Based Rate Recovery*, 158 FERC ¶ 61,051, January 19, 2017. For example, "many participating generation resources seek and are paid a cost-based rate for providing reactive supply, even as they make market-based rate sales into organized wholesale electric markets." *Id.* P 22.

[6] *See*, *e.g.*, NOPR at 8; *Request for Comments Regarding Rates, Accounting and Financial Reporting for New Electric Storage Technologies, Letter Soliciting Comments* Docket No. AD10-13-000 (June 11, 2010) (requested comments regarding alternatives for categorizing and compensating storage services).

[7] *Electric Storage Participation in Regions with Organized Wholesale Electric Markets,* Docket No. AD16-20-000, FERC Letter (filed April 11, 2016) at 2.

[8] *Indianapolis Power & Light Co. v. Midcontinent Independent Sys. Operator, Inc.*, 158 FERC ¶ 61,107 at P 69 (2017).

are technically capable of participating in, taking into account their unique physical and operational characteristics."[9]

The North American Electric Reliability Corporation (NERC), FERC, and the RTOs/ISOs have similarly recognized the benefits DERs may offer to the bulk power system and have taken steps to facilitate their integration. NERC, as early as 2011, has noted the benefit of increasing visibility of DERs on the distribution system and highlighted the potential for many DERs to provide reliability services now and even more so in the future. NERC points out as an example that CAISO's 4,900 MW of DERs is its largest single resource when aggregated and could provide 163 MW of frequency response, which NERC acknowledged as "is a significant benefit" to CAISO.[10] CAISO developed tariff revisions to facilitate participation of aggregations of distribution-connected or distributed energy resources in CAISO's energy and ancillary services markets and to establish DER aggregators as a new type of market participant, which FERC has accepted.[11] NYISO is developing a "DER Roadmap for New York's Wholesale Electricity Markets" designed to fully integrate dispatchable DER resources into Energy, Ancillary Services and Capacity markets in the next three to five years.[12] NYISO is also integrating energy storage into the marketplace as "DER applications will be a more effective and complete solution for grid operators and system planners with increased grid-scale storage

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[9] *Id.* at P 2 (2017).

[10] NERC, Distributed Energy Resources Connection Modeling and Reliability Considerations, December 2016 at 4, http://www.nerc.com/comm/Other/essntlrlbltysrvcstskfrcDL/DERTF%20Draft%20Report%20-%20Connection%20Modeling%20and%20Reliability%20Considerations.pdf.

[11] *California Indep. Sys.Operator Corp.*, 155 FERC ¶ 61,229 (2016) (conditionally accepting tariff provisions to facilitate participation of aggregations of distribution-connected or distributed energy resources in CAISO's energy and ancillary service markets) (CAISO DER order).

[12] Distributed Energy Resources (DER) Roadmap for New York's Wholesale Electricity Markets: A Report by the New York Independent System Operator.

capability."[13] The DER Roadmap is a first step to fully integrating DERs, but it does not include plans to eliminate certain restrictions that may hinder DER development. NYISO's efforts, like those of other regions, can benefit from FERC's guidance.

While DER-related stakeholder processes are underway in some of the other RTOs/ISOs, incumbent interests tend not to be friendly to new competition, and DER-related issues tend not to be a high priority to the stakeholders at large.[14] Thus, we look to FERC to establish a framework set of rules for the RTOs/ISOs to eliminate barriers to market competition for storage and DERs and a timeline for doing so, pursuant to its authority and obligation to ensure just and reasonable rates and practices affecting such rates under the Federal Power Act. Even though storage and DERs are not yet a significant fraction of the resource mix generally, it's critical that we not wait for them to achieve significant penetrations on the distribution grid before determining how to fully integrate them at the wholesale level, to not only take advantage of the wholesale services they have to offer, but also address any informational, operational, and coordination needs. FERC's proposal in the NOPR to set a baseline framework on storage and aggregated DER market participation rules for the RTOs/ISOs to develop into regionally tailored rules is thus a timely and logical next step in a steady progression of removing barriers to new resource participation in the wholesale markets. In fact, FERC's statutory mandate requires that it take this step and ensure that the rules enable flexible participation and that limitations on

[13] DER Roadmap for New York's Wholesale Electricity Markets at 9.

[14] *See, e.g.*, *Indianapolis Power & Light Co. v. Midcontinent Independent Sys. Operator, Inc.*, 158 FERC ¶ 61,107 at PP 22, 30 (2017). We also support SEIA's comments regarding the challenges of the RTO/ISO stakeholder processes. FERC should protect against exclusionary conduct in the stakeholder processes– that is, conduct that "obstructs the achievement of competition's basic goals – lower prices, better products, and more efficient production methods" and "deprive[s] purchasers or consumers of the advantages which they derive from free competition." SEIA comments at 13 (internal citations omitted).

participation are narrowly tailored and based on factual determinations that they are needed.[15] This is consistent with FERC's "authority—and, indeed, [its] duty—to ensure that rules or practices 'affecting' wholesale rates are just and reasonable."[16]

II. Storage and DERs can cost effectively provide distinct wholesale services. Fully enabling and compensating these resources at wholesale for these services will encourage them to participate at an efficient level.

Energy storage and DERs can offer cost effective wholesale market services and complement other bulk power resources (for example, in providing grid flexibility to better accommodate variable renewable resources). These services include fast-responding energy and ancillary services as well as the ability to absorb excess solar and wind production for later use or reinjection into the grid when the system is low on supply. Storage can provide the grid operator flexibility to better match the needs of the system because it has no minimum run times, can ramp-up in seconds, has no direct emissions or emissions limitations, and can be sited almost anywhere.[17] DERs also have locational advantages compared to other resources in providing frequency regulation and voltage support.[18] These resources "provide opportunities to make the

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[15] We and other commenters support finalizing both the storage and DER proposed rules as scheduled, and should RTOs/ISOs and others need more time to work out compliance and implementation details, allow for the extra time during the RTO/ISO compliance filing and implementation process.

[16] *FERC v. Elec. Power Supply Ass'n*, 136 S. Ct. 760, 774 (2016).

[17] Comments of the Energy Storage Association, Docket No. AD14-14 at 3 (March 6, 2015).

[18] *See, e.g.*, The Value of a VAr – Perspectives on Electric Grid Voltage Support, Memo to Patricia Hoffman, U.S. Department of Energy, from Susan Tierney, Electricity Advisory Committee, September 29, 2016 at 17 ("the reactive power functionality of inverters on distributed solar systems, have the potential to be powerful tools in replacing the need for spinning mass generators to provide VAr support. … Conventional solutions may be controversial in some locations."). *See also* Microgrid Resources Coalition,

electric system more secure, sustainable, and competitive."[19] Enabling these resources to participate in the wholesale markets can therefore contribute to a more flexible, efficient, reliable, and low-emitting grid.

Importantly, many of the services and benefits these resources can provide at wholesale are distinct from what they provide at retail. Therefore, without a means of enabling these resources' participation at wholesale, we lose the opportunity to gain from a large category of benefits from these resources.

A. DERs have significant penetration potential and can offer valuable wholesale grid services cost-effectively that are largely untapped

No one disputes that DERs on the grid are growing in number and variety due to the pace of innovation, decreasing costs of DER-related technologies, customer preferences for clean energy, and policy drivers for storage and DER adoption.[20] Because DERs are generally purchased for purposes other than to provide wholesale grid services, leveraging these resources for those purposes makes the most of existing grid assets and is a particularly cost effective way to supply these wholesale services. For example, customers may procure grid-enabled water heaters for water heating and electric vehicles for transportation, but beyond the customers' own needs, these devices can also provide frequency regulation or peak demand reduction services to the grid.

Motion to Intervene and Comments on CAISO's Distributed Energy Resource Provider Initiative, Docket No. ER16-1085 at 3, n.7 (March 25, 2016) (explaining that "[t]he provision of products such as frequency regulation and voltage support at the distribution level can gain performance via proximity to imbalances and avoidance of grid constraints").

[19] *California Independent Sys. Operator Corp.*, *Distributed Energy Resource Provider Tariff Amendment*, Docket No. ER16-1085 at 1 (March 4, 2016).

[20] MIT Energy Initiative, Utility of the Future (2016) at viii, http://energy.mit.edu/wp-content/uploads/2016/12/Utility-of-the-Future-Full-Report.pdf.

1. Grid-enabled electric water heaters

Grid-enabled electric water heaters are one example of distributed thermal storage that has a large potential and has successfully demonstrated their ability, if enabled to participate, to cost effectively provide wholesale market services. According to the Brattle Group, electric water heaters are essentially idle thermal batteries installed in more than 50 million homes across the U.S. The magnitude of this relatively untapped resource is significant: electric water heaters account for 9% of all electricity consumed by households nationally, the third single largest source of residential electricity consumption, and more than 40 percent of U.S. households have electric water heating.[21]

These water heaters can be controlled in real time to consume electricity when cheap renewable generation, such as wind and solar is producing (or overproducing) and thus help integrate variable renewable generation resources. In addition, recent advancements have enabled grid-interactive water heaters to provide frequency regulation and other grid balancing services.[22] The Brattle Group notes that the ability of grid-enabled electric water heaters to provide near-instantaneous response enables them to provide frequency regulation services, and when outfitted with the appropriate control technology, could follow a grid operator's regulation signal.[23] The Brattle Group report also describes how electric water heaters can reduce load for periods of time in excess of four hours, creating the potential to use these resources to meet

[21] Ryan Hledik, Judy Chang, and Roger Lueken, The Brattle Group, *The Hidden Battery; Opportunities in Electric Water Heating* (2016), http://www.nreca.coop/wp-content/uploads/2016/02/The-Hidden-Battery-01-25-2016.pdf (Hidden Battery Report).

[22] *Id*. at 6. Based on this Brattle study, the Rocky Mountain Institute estimated that a nationwide fleet would reap $3.6 billion/year in benefits (http://blog.rmi.org/blog_2016_02_24_water_heaters_as_sexy_as_a_tesla).

[23] Hidden Battery Report at 6.

capacity needs. This potential is beginning to be realized in RTOs with participation rules compatible with these resources. Already, Mosaic Power has demonstrated the viability of water heater market participation in PJM, where it has 6,000 water heaters providing over 6MW to PJM's frequency regulation market and is also capable of shifting load for peak demand reduction purposes for wholesale market or distribution grid needs.[24]

Grid-enabled water heaters can provide grid benefits cost effectively, and using these resources to provide grid services enables utilities to improve overall grid efficiency.[25] The incremental cost of market participation (a one-time cost related to enhanced communication and control technologies) was estimated in 2016 to be between $300 and $500 per water heater[26] and this cost is expected to fall, based on correspondence with commercial vendors and industry experts. With these and program costs, incremental water heater costs, equipment costs, and equipment installation costs, market participation still produced net positive economic benefits from market revenues, avoided transmission and distribution investments, avoided generation capacity investments, and avoided energy costs. [27]

To access the potential grid-enabled water heaters can provide to the wholesale markets, enabling aggregation is critical: despite their large collective potential, water heaters, with an estimated 0.5-4.5 kW of load available for coincident peak shaving or frequency regulation market participation each, cannot individually satisfy minimum size requirements to participate in the wholesale markets.[28] And because their capacities available to the wholesale markets at

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[24] https://mosaicpower.com/grid-operators/.

[25] Public Power Weekly, APPA, NRECA Applaud DOE Move on Water Heater, http://www.publicpower.org/Media/weekly/ArticleDetail.cfm?ItemNumber=35151.

[26] Hidden Battery Report at 19.

[27] Hidden Battery Report at ii, 18.

[28] Hidden Battery Report at 7, 15.

any time will vary during the day, aggregators play a critical role in managing the available capacity to bid.[29]

2. Plug-in electric vehicles with controlled charging

Plug-in electric vehicles with controlled charging also offer significant storage potential and have successfully demonstrated their ability to provide wholesale market services cost effectively. American drivers have already purchased approximately 11 gigawatt-hours (GWh) of advanced battery storage in the form of electric vehicle batteries, more than enough to power all the homes in the District of Columbia on an average day.[30] Moreover, as this "new" load continues to grow, it will be increasingly important to ensure it is added to off-peak hours which can be enabled through wholesale market mechanisms as well as retail programs to take into account potentially different coincident peaks.

Electric vehicles have demonstrated through pilot projects their abilities to provide load shifting to avoid coincident peak additions or reducing load when called upon as a demand response resource and provide frequency regulation services through the modulation of power drawn by individual electric vehicles while charging. Typical electric vehicles loads range from approximately 6kW to 20kW. While fast chargers, which can draw up to 150kW and beyond, are becoming more prevalent across the country, aggregation will still be necessary to enable most of these resources to participate in wholesale markets.

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[29] Note that flexible bidding parameter requirements from each market interval to the next would also facilitate participation.

[30] Assuming a sales-weighted average electric vehicle battery size of 24.6 kWh, based on sales by model provided by the Alternative Fuels Data Center, and cumulative sales of 440,924 (California Plug-in Electric Vehicle Collaborative, April 2016). U.S. Department of Energy (DOE), Energy Information Administration (EIA), "District of Columbia Electricity Profile 2012," accessed April 10, 2015, www.eia.gov/electricity/state/DistrictofColumbia/.

BMW North Americas and PJM are exploring the ability of electric vehicles to respond to price signals to change charging behavior, while GM and On Star are investigating the ability of EVs to charge based on renewable generation.[31] Also in PJM, the University of Delaware and NRG are working to demonstrate how electric vehicles can earn market revenues for providing grid services. After investing in about $400 worth of technology, the grid-connected cars can earn about $1,800 a year.[32]

In California, PG&E and BMW are running a demand reduction pilot which aggregated 100 electric vehicles, along with stationary repurposed BMW batteries as backup, to provide demand response load reduction capacity.[33] At the Los Angeles Air Force base, forty two vehicles are being aggregated to provide 700 kW of regulation services to Southern California Edison.[34] The National Renewable Energy Laboratory has been testing the ability of aggregated electric delivery trucks to deliver frequency regulation services through one-way smart charging practices in ERCOT.[35]

These pilots and studies illustrate the ability of these resources to provide wholesale grid services cost effectively. They have also identified recurring issues that encumber their scaled deployment, many of which are being addressed in this proceeding. Barriers include costly

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[31] https://learn.pjm.com/energy-innovations/plug-in-electric.aspx.

[32] New York Times, In Two-Way Charging, Electric Cars Begin to Earn Money From the Grid, April 25, 2013, http://www.nytimes.com/2013/04/26/business/energy-environment/electric-vehicles-begin-to-earn-money-from-the-grid.html.

[33] http://olivineinc.com/ssp/.

[34] http://smartgrid.ieee.org/resources/webinars/past-webinars?eid=61&m=d7ad069d3940ebcaaf9ce65812521293.

[35] IEEE Smart Grid. Questions and Answers on Storage and Vehicle Charging as Renewables Arrive with Mike Jacobs and Peter O'Connor. February 4, 2016. http://smartgrid.ieee.org/resources/webinars/past-webinars?eid=61&m=d7ad069d3940ebcaaf9ce65812521293.

metering and telemetry requirements and control over state of charge management, and well as difficulties aggregating the vehicles in some of the pilots and at current penetrations to meet a 100kW participation size limit by themselves. However, the ability to aggregate with other resources or across nodes would help.

B. Enabling storage and DER participation promotes competition

Allowing cost-effective storage and DERs to participate in wholesale markets helps ensure that prices are not artificially propped up through unnecessary restrictions to competition. For example, allowing demand response and energy efficiency resources to participate in PJM's capacity market has saved wholesale purchasers of energy billions of dollars in PJM alone. According to the PJM Independent Market Monitor, excluding demand response and energy efficiency would likely have increased capacity market costs by about $2 billion in the 2019/2020 Base Residual Auction (all else held constant), which is a cost increase of 30% compared to the actual results.[36]

C. Enabling storage and DER resources to participate can provide visibility and reliability benefits

NERC, as early as 2011, has noted the importance of addressing the impact of the rapid growth of DERs on the transmission system, and that "variability and uncertainty of DER can be better managed by increasing visibility."[37] More recently, NERC highlighted the potential for

[36] PJM Independent Market Monitor, Analysis of the 2019/2020 RPM Base Residual Auction (August 2016) at 9, http://www.monitoringanalytics.com/reports/Reports/2016/IMM_Analysis_of_the_20192020_RPM_BRA_20160831-Revised.pdf.

[37] *See, e.g.*, NERC, Special Report on the Potential Bulk System Reliability Impacts of Distributed Resources (August 2011)

many DERs to provide reliability services in the future.[38] One way to gain visibility is to invite these resources to participate in the organized wholesale markets.

An event in PJM illustrates the importance of visibility, and how DERs can help bulk power reliability. Hot weather during September 2013 strained the power system around Lake Erie and west into Michigan that required selected shedding of firm loads to prevent wide-spread outages. This happened over the course of two days, and on the third day, PJM identified a 6MW behind-the-meter generator in a critical location that was able to come online to avert another day of load shedding. According to PJM, the generating resource was not available to PJM dispatch "because it was *not participating in PJM markets*."[39]

While a certain level of visibility on the distribution system is helpful to grid operators, FERC should be mindful to not impose undue burdens on individual DERs by requiring too much granularity in the information they must provide. The NOPR proposes that the participation models must establish market rules on metering and telemetry system requirements for DER aggregations.[40] While requiring individual metering/telemetry for traditional generation resources makes sense because the grid operator needs to know if a large generator trips offline,

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http://www.nerc.com/docs/pc/ivgtf/IVGTF_TF-1-8_Reliability-Impact-Distributed-Resources_Final-Draft_2011.pdf at 3.

[38] NERC Distributed Energy Resources Task Force, Essential Reliability Services Working Group, Distributed Energy Resources Connection Modeling and Reliability Considerations, http://www.nerc.com/comm/Other/essntlrlbltysrvcstskfrcDL/Distributed_Energy_Resources_Report.pdf.

[39] PJM, Technical Analysis of Operational Events and Market Impacts During the September 2013 Heat Wave, 2013, http://www.pjm.com/~/media/library/reports-notices/weather-related/20131223-technical-analysis-of-operational-events-and-market-impacts-during-the-september-2013-heat-wave.ashx (emphasis added).

[40] NOPR at P 5.

the same is not the case for smaller DERs (which may be as small as 1 kW).[41] Requiring metering and telemetry on individual DERs may be cost prohibitive for smaller resources, and the grid operator does not need information about every DER in an aggregation. FERC should make clear that this is not required.[42]

III. Unnecessary barriers to DER participation and proposed solutions

A. The DER definition should include all DERs capable of cost-effectively providing wholesale grid services

In the Public Interest Organizations' June 6 comments in Docket No. AD16-20-000, we supported FERC taking further steps to facilitate storage and other distributed resource's timely participation in the wholesale markets and recommended that FERC adopt a broader definition of electric storage or conduct a similar inquiry for distributed resources more broadly—including demand response, energy efficiency, and distributed generation—that can be aggregated and bid into the wholesale markets.

We appreciate that FERC has explicitly included DERs in this rulemaking and defined a DER as "as a source or sink of power that is located on the distribution system, any subsystem thereof, or behind a customer meter. These resources may include, but are not limited to, electric storage resources, distributed generation, thermal storage, and electric vehicles and their supply equipment."[43] We generally support FERC's proposed definition of DERs. The definition of DERs, however, should include the full range of cost-effective distributed resources capable of

[41] NOPR at P 86.

[42] We support AEE's comments regarding aggregated DERs' reliability benefits and impacts. We also support NY State Entities', STEM's, and the DER and Storage Developers' comments on telemetry/metering requirements.

[43] NOPR at P 1 n.2.

providing services to the wholesale markets, and it is unclear that FERC's proposed definition includes all of these potential resources.

For example, FERC's proposed DER definition does not explicitly include energy efficiency resources, which are currently allowed to participate in PJM's and ISO-NE's capacity markets and contribute significant benefits there (as noted in section II B above), but not NYISO's capacity market.[44] Energy efficiency resources can deliver long-term demand reductions that, like demand response, create analogous value to that provided by generation resources participating in capacity markets, but are barred from participation or face onerous requirements that hinder full compensation in those markets. Other than the revenue earned from participation in some wholesale markets, energy efficiency resources' main source of compensation is through state-level utility programs that have limited budgets, and which may impose eligibility requirements that are unrelated to a resource's ability to provide wholesale services. For these resources, enabling them to compete in wholesale markets could spur new cost-effective investments that will produce benefits in the wholesale markets. For these reasons, we support FERC explicitly including energy efficiency as a DER in its definition.

A couple of other clarifications would also help. We would support FERC clarifying that "thermal storage" includes but is not limited to grid-enabled water heaters, grid-enabled thermostats,[45] and ice storage.[46] This would be consistent with FERC's description of thermal

[44] *See* DER Roadmap for New York's Wholesale Electricity Markets at 28 ("NYISO will not be addressing energy efficiency in the DER Roadmap at this time."); PJM Open Access Transmission Tariff at Attachment DD, §§ 5.6, 6.6A, 8, 10A, Attachment DD-1, § L (setting forth rules for energy efficiency resource participation in PJM's Reliability Pricing Model); ISO NE Transmission, Markets, and Services Tariff at I (defining resources eligible to participate in ISO NE's Forward Capacity Market in a manner inclusive of energy efficiency resources and III.13 (providing for Forward Capacity Market participation rules).

[45] Like grid-enabled water heaters, grid-enabled thermostats could precool or preheat the air in rooms and homes to avoid using energy during peak demand. AEMA's comments discuss

storage in the NOPR.[47] It would also help to clarify in the final rule, as FERC suggests in the NOPR, that DERs may be aggregated across different resources as long as they have "common physical or operational characteristics" and/or if the operational characteristics of the aggregated resources complement each other.[48] FERC provides an example to illustrate this point: "Combining electric storage resources with distributed generation could allow the aggregate resource to achieve performance requirements (such as minimum run times) that an electric storage resource could not meet on its own and provide services (such as regulation) that distributed generation may not be able to provide on its own."[49] However, the ability to aggregate should not be a reason for RTOs/ISOs to impose unnecessarily restrictive participation rules to begin with. For example (and noting that PJM's capacity market aggregation mechanism is not the same thing as the DER aggregation discussed in this proceeding), a grid operator should not be able to impose a longer 12-month capacity commitment period when two 6-month commitment periods would accomplish the same goals and enable more resources to compete for the capacity commitments.

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direct control of smart-home energy management, which we would support as a resource include as a DER. We also support NextEra Resources' request that FERC clarify that DERs may participate through more than one aggregator.

[46] Making and storing ice to use as air conditioning is another innovative example of thermal energy storage. Ice Energy and NRG have a contract with Southern California Edison to procure 25.6 MWs of this type of storage (https://www.ice-energy.com/nrg-and-ice-energy-partner-for-southern-california-utility-storage-projects/).

[47] NOPR at P 30 n.66 ("resources such as thermal storage that can both increase and decrease their energy consumption").

[48] NOPR at n.66, P 125.

[49] NOPR n.231.

B. Key barriers and proposed solutions

We agree with FERC and support its conclusions on a number of findings and determinations: We agree that effective competition encourages efficient entry and exit of resources, promotes innovation, incentivizes the efficient operation of resources, and allocates risk appropriately between consumers and producers.[50] We agree with FERC that existing market rules may not account for the unique operating characteristics of DERs, thereby impeding them from participating and competing in the organized wholesale electric markets. We agree that reforms are needed to remove barriers to the effective participation of DERs in the wholesale electric markets and ensuring that the markets yield just and reasonable rates through effective competition.[51] And we agree rules that enable their participation should recognize their physical and operational characteristics and not create prohibitively expensive or otherwise burdensome requirements.[52]

Implicit barriers to storage and DER participation in wholesale markets are pervasive—market rules were largely designed with traditional generation in mind and can prohibit storage and DER participation even when the rule appears to be facially technology- or resource-neutral. These barriers to competition are unjustifiable when storage and DERs can cost-effectively provide the same or similar services (as the traditional resources contemplated by the rules) whether by themselves or aggregated across a transmission-constrained zone.[53] The record in

[50] NOPR at P 14.

[51] NOPR at PP 1, 9-12.

[52] NOPR at PP 13-16.

[53] PJM's Capacity Performance rules illustrate this clearly: while this participation model does not explicitly favor or prohibit certain resources, the requirement that all capacity resources must be procured in 12-month commitment periods three years in advance of the promised delivery year, in practice favors baseload thermal resources with that investment or construction timescale. At the same time, PJM's capacity market rules do not value capacity with other

this proceeding documents that some RTOs/ISOs have acknowledged that certain of their market rules, which while not discriminatory on their face, were designed with traditional generators in mind and may restrict storage and DER participation.[54]

Individually smaller but more numerous resources, such as DERs, are excluded by minimum size and duration requirements for resources to be eligible to participate as generation, demand response, or other asset classes in the markets. Minimum size limits vary across RTOs/ISOs, and thus could be arbitrary.[55] Even though FERC's proposal to adopt a 100kW ceiling to the minimum size requirements RTOs/ISOs can set may not address the arbitrariness of choosing a particular minimum size, we support the proposal as a means to help lower the barrier to smaller storage resources. In addition, the transaction costs of participating in the wholesale markets are relatively more burdensome to smaller resources.[56] The ability to

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desirable attributes, such as flexibility, fast response, or the ability to provide reliable and effective seasonal capacity to more cheaply meet seasonal peaks. Altering the commitment period in the capacity participation model from 12-month commitment period to two 6-month commitments, for example, would help alleviate the implicit discrimination, because it would at least allow seasonal resources (such as summer air conditioning demand response programs, or strong winter wind generation) that could commit to 6-months at a time, but not 12-months at a time to participate. *See* Wilson Testimony, Protest by Advanced Energy Management Alliance, Natural Resources Defense Council, Rockland Electric Company, Sierra Club, and Environmental Law & Policy Center, *PJM Interconnection, L.L.C.*, Docket No. ER17-367-000 (Dec. 8, 2016).

[54] *See, e.g.*, Response of PJM Interconnection, L.L.C., FERC Docket No. AD16-20-000 at 2 (May 16, 2016) ("there are commercial and/or technical limitations that may currently restrict participation of electric storage resources (and in particular batteries and flywheels) in PJM's wholesale markets."). *See also* Responses of the Midcontinent Independent System Operator, Inc., FERC Docket No. AD16-20 at 3 (May 16, 2016) ("when MISO originally developed the non-Storage Energy Resource categories, MISO did not specifically consider whether such categories could accommodate the unique features of various storage technologies.").

[55] *See, e.g.*, CAISO report at 10; ISO-NE report at 4-8; NYISO report at 4, 9; PJM report at 10; MISO report at 10 in *Electric Storage Participation in Regions with Organized Wholesale Electric Markets*, Docket No. AD16-20-000.

[56] NOPR at P 126.

aggregate distributed resources to offer services into the markets could help mitigate minimum size and duration requirements as well as transaction costs, but the ability to do so is currently lacking or unclear in some RTOs/ISOs. We thus support FERC's proposal to enable DERs to aggregate to overcome minimum size and transactional costs barriers and enable DER aggregators be able to qualify as market participants in the RTOs/ISOs.

To fully value and take advantage of the ability for storage and DERs to absorb excess electricity, shift load, and reinject electricity onto the grid at peak times would require flexible participation models enabling these resources to act as a demand-side resource (either absorbing excess electricity or not consuming at peak) and/or as generation – and not have to choose between one or the other participation model exclusively. This is currently a problem in PJM, for example, because a DER has only two avenues to participate: (1) interconnect as generation under the normal PJM queue process and agreements, which is time consuming and cost prohibitive for DERs; or (2) register as demand response, which has its own process and is prohibited from injecting beyond the load meter.[57] Distributed storage can serve as both generation and load, but PJM's two options only allow them to participate as one or the other and not both, which means that distributed storage registered as one type of resource cannot produce or be compensated for benefits associated with the other. The other RTOs/ISOs appear to be split on whether a load resource can also operate as generation.[58]

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[57] A.F. Mensah, presentation to PJM Markets and Reliability Committee stakeholder meeting http://www.pjm.com/~/media/committees-groups/committees/mrc/20160418-special/20160418-item-02b-problem-statement-af-mensah-presentation.ashx. PJM, in its report, notes that when any resource operating behind a customer's meter injects energy onto the distribution or PJM transmission system past the applicable customer meter, they are deemed to be making a wholesale sale of electricity pursuant to FERC Order No. 2003. *Standardization of Generator Interconnection Agreements and Procedures*, 104 FERC ¶ 61,103 (2003).

[58] *See e.g.*, CAISO report at 3; ISO-NE report at 2; NYISO report at 3, 16.

For storage and DERs to participate at an efficient level in the market, it is therefore critically important that participation models do not unjustifiably impose conditions that implicitly or explicitly restrict or preclude their participation. FERC rightly recognized in the NOPR that these participation models must take into account "the physical and operational characteristics" of storage and aggregated DERs while ensuring that these resources can "provide all capacity, energy and ancillary services that they are technically capable of providing in the organized wholesale markets."[59] We support FERC requiring each RTO/ISO to develop participation models and market rules that work for both storage and aggregated DERs to most flexibly contribute the wholesale services they are capable of cost effectively providing. While FERC did not explicitly require RTOs/ISOs to develop a participation model specific to aggregated DERs, we agree with other commenters that RTOs/ISOs should consider doing so.

C. FERC should not introduce new unreasonable barriers

The NOPR aims to establish market rules that enable DERs to participate in the organized wholesale electric markets to the full extent of their technical capabilities and to eliminate unreasonable barriers to participation.[60] However, the NOPR itself introduces a market barrier by limiting DER aggregation to resources that are not already participating in "one or more retail compensation programs such as net metering or another wholesale market participation program."[61] The only justification provided for this limitation in the NOPR is the concern that allowing DERs participating in a retail program or another wholesale program to also participate in an aggregation program might result in double compensating these resources

[59] NOPR at P 3-5.

[60] NOPR at PP 1, 9-12.

[61] NOPR at P 134.

for the "same services."[62] While this outcome could be a possibility, and one we would want to avoid, the NOPR did not provide any factual determination or other rationale for imposing such a broad limitation. Such a broad limitation could preclude a DER aggregation from "provid[ing] all capacity, energy and ancillary services that they are technically capable of providing in the organized wholesale markets"[63] because they may have to choose to participate in another wholesale program or a retail program over an aggregation program.

In fact, it is easy to come up with scenarios and examples of DERs providing services at both retail and wholesale that are clearly distinct and thus these resources could be restricted from providing all wholesale services they are technically capable of providing.

One class of examples of wholesale and retail services that are clearly not the "same services" consists of services provided at different times. For example, DERs can reduce distribution-system peak demand (reducing the need for distribution infrastructure), but can also reduce peak demand at the transmission system level. As FERC recognized in a recent order regarding participation in NYISO markets by demand response resources that also participate in state-level programs, distribution-level and transmission-level peak demand reduction are "separate and distinct" services,[64] distinguishable in part because retail-level programs can be "called on at different times."[65] In NYISO, for example, "over 75 percent of ConEd's networks

[62] NOPR at P 134.

[63] NOPR at PP 3-5.

[64] "While the wholesale- and the retail-level demand response programs may complement each other, they serve different purposes, provide different benefits, and compensate distinctly different services." Docket No. EL16-92, *Order Granting Complaint in Part and Denying in Part*, 158 FERC ¶ 61,137 at P 33 (2017).

[65] *Id.* at n 63.

peak at times that differ from the [NYISO] peak load, with some networks peaking mid-day and others peaking in the late evening."[66]

Another class of examples of DERs providing distinct wholesale and retail services consists of those where the services are uniquely wholesale or retail. Uniquely wholesale services include provision of frequency regulation, frequency response, or synchronous reserves for the bulk transmission system. Because providing these services requires responding to the wholesale grid operator, they cannot be provided through a retail tariff based on avoided costs. For example, a resource consisting of rooftop solar combined with storage can provide wholesale frequency regulation, and/or be dispatched by the RTO/ISO in response to system-wide constraints.[67]

Thus, if DERs have to choose between aggregation and retail programs or other wholesale programs, they may not be able to sell non-duplicative services at the wholesale level. Given that wholesale- and the retail-level services can "serve different purposes" and "provide different benefits,"[68] a blanket prohibition on providing wholesale services through an aggregation program for the sole reason that a resource is also providing retail benefits is an unreasonable barrier to aggregated DER participation. The same holds for barring DERs from participating in aggregation as well as other wholesale programs. FERC's proposed limitation would be inconsistent with FERC's precedent recognizing the distinct nature of such benefits

[66] *Id.* at P 33.

[67] *See, e.g.*, PJM, Benefits from Generation and Storage on the Distribution System at 5, http://www.pjm.com/~/media/committees-groups/committees/mrc/20160824-special/20160824-item-01a-benefits-from-generation-and-storage-on-distribution-system.ashx.

[68] *See* 158 FERC ¶ 61,137 at P 33.

and the need to “avoid the creation of unnecessary barriers to[] the participation of” DERs “in the wholesale markets.”[69]

To the extent that the NOPR adopted this blanket limitation from the CAISO DER order, we do not think the justification for the limitation provided by CAISO[70] is applicable to other regions because CAISO’s rationale is specific to *California’s* net energy metering policy and only discusses potential double counting for the energy provided by a net energy metered resource—CAISO’s rationale did not discuss whether such a resource could also provide other services, such as ancillary services.

Thus, FERC should not impose a broad blanket limitation. Instead, FERC should provide guidance to RTOs/ISOs should they choose to develop their own rules to prevent double compensation, taking into account their own market structures and state policies. FERC’s guidance should provide that any restrictions or regulatory burdens must be justified and adopted after identifying specific problems or demonstrable risks, and that any restrictive measures be narrowly tailored to address the specified problem or risk.

While we do not specifically opine on all of the requests for comments in the NOPR, we do support the general principle that restrictions or regulatory burdens imposed on storage and DER participation be based on specific and identified needs, problems, and/or demonstrable risks. Our suggestion above for FERC’s proposed limitations on net energy metered resources more broadly applies to other parts of the proposed rule: FERC should avoid imposing blanket restrictions, allow RTOs/ISOs in coordination with stakeholders and states to make their own

[69] 158 FERC ¶ 61,137 at PP 33, 34.

[70] CAISO’s justification was that “under California’s current net energy metering program, a participating resource already receives benefits from netting its excess energy against subsequent electricity bills; therefore there is no energy available to offer into the CAISO markets because excess energy is banked for later withdrawl.” CAISO DER order at P 6.

determinations on what restrictions should be required, and provide guidance to the RTOs/ISOs to ensure that their solutions are narrowly tailored to their identified needs. This principle applies to potential informational, visibility, registration, operational, and coordination requirements that may be imposed on storage and DERs.[71] For example, aggregation should be enabled across nodes unless it would create a demonstrable risk or problem, and the granularity of telemetry and metering requirements should strike a sensible balance between legitimate informational needs and burdens imposed on DERs.

Eliminating unreasonable barriers will fully enable participation and compensation of these resources for services provided at wholesale, allow these resources to flexibly toggle between services offered, and encourage these resources to participate at wholesale at an efficient level.[72] FERC should thus act to fulfill its mandate to enable broader competition from reliable, cost-effective resources to compete in the markets and ensure just and reasonable rates.[73]

[71] The DER and Storage Developers letter, and Next Era Resources' and STEM's comments go into more detail on how this principle applies to specific aspects of the NOPR, and we support these comments.

[72] Currently in PJM, various resources offering wholesale services are able to toggle subject to restrictions. *See, e.g.*, http://www.pjm.com/~/media/committees-groups/committees/mrc/20160617-special/20160617-item-06-distributed-energy-resource-scenarios.ashx at 5.

[73] *FERC v. Elec. Power Supply Ass'n*, 136 S. Ct. 760, 768, 774, 781 (2016) (observing that the Commission "undertakes to ensure just and reasonable wholesale rates by enhancing competition—attempting ...to break down regulatory and economic barriers that hinder a free market in wholesale electricity") (internal quotation marks and citations omitted).

IV. Conclusion

DER and storage resources are typically capable of providing distinct distribution and wholesale system benefits; thus, their ability to flexibly access both markets depending on economic signals promotes the most economic outcome and helps ensure that rates are just and reasonable. FERC's proposal appropriately uses its authority to enable DERs to provide distinct wholesale services and be compensated accordingly from the wholesale market, while leaving it to state and local entities to regulate DER participation at retail.[74] Given that it is FERC's duty to ensure that wholesale rates are just and reasonable, FERC cannot decline to remove barriers to cost-effective resources' participation in the wholesale markets. These resources would be unduly restricted from offering competitive services at wholesale and that would result in unjust and unreasonable rates.

For the foregoing reasons, we support FERC's proposals to eliminate market barriers that impede effective competition from storage and DER aggregations by establishing a framework set of rules for RTOs/ISOs to more fully develop. We ask that FERC clarify its definition of DERs and DER aggregations to more explicitly include all distributed resources that can provide wholesale services. We also ask that FERC provide guidance to the RTOs/ISOs that the requirements and restrictions imposed on storage and DER participation be based on identified needs, problems, and/or demonstrable risks in order to maximize flexible participation by these resources.

[74] The Federal Power Act allows for this "collaborative federalism" and "envisions a federal-state relationship marked by interdependence." *Hughes v. Talen Energy Mktg., LLC*, 136 S. Ct. 1288, 1300 (2016) (Sotomayor, J., concurring).

Respectfully submitted this 14th day of February, 2017,

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