UNITED STATES OF AMERICA

BEFORE THE

FEDERAL ENERGY REGULATORY COMMISSION

PJM Interconnection L.L.C.,	)	
	)	
Revisions to Application of Minimum Offer Price Rule	)	**Docket No. ER21-2582-000**
	)	

WRITTEN TESTIMONY
OF
DR. KATHLEEN SPEES AND DR. SAMUEL A. NEWELL

Economic Impacts of the Expansive Minimum Offer Price Rule within the PJM Capacity Market

Our names are Dr. Kathleen Spees and Dr. Samuel A. Newell. We are employed by The Brattle Group as Principals. We submit this affidavit on behalf of the Natural Resource Defense Council, the Sustainable FERC Project, Earthjustice, Sierra Club, and Union of Concerned Scientists.

Our qualifications as experts derive from our extensive experience evaluating capacity markets and related market design questions. Our experience working for system operators across North America and internationally has given us a broad perspective on the practical implications of nuanced capacity market design rules under a range of different economic and policy conditions.[1] We have extensive experience supporting assessment and refinement of all aspects of the PJM Capacity Market; we have supported PJM Interconnection (PJM) by conducting every one of its periodic reviews of its capacity market and by comparing its capacity market with resource adequacy design alternatives.[2]

We are familiar with the history of the Minimum Offer Price Rule (MOPR) in PJM from its conception up through the current Expanded MOPR (MOPR-Ex) form. In 2011, as part of our

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[1] We have worked with regulators, market operators, and market participants on matters related to resource adequacy and investment incentives in PJM Interconnection, ISO New England, New York, Ontario, Alberta, California, Texas, Midcontinent ISO, Italy, Russia, Greece, Singapore, and Australia.

[2] See our four independent reviews of PJM's capacity market and associated design parameters published in 2008, 2011, 2014, and 2018. The most recent of these is: Samuel A. Newell, David Luke Oates, Johannes P. Pfeifenberger, Kathleen Spees, J. Michael Hagerty, John Imon Pedtke, Matthew Witkin, and Emily Shorin, *Fourth Review of PJM's Variable Resource Requirement Curve*, prepared for PJM Interconnection L.L.C., April 19, 2018. See also, Johannes Pfeifenberger, Kathleen Spees, and Adam Schumacher, *A Comparison of PJM's RPM with Alternative Energy and Capacity Market Designs*, prepared for PJM Interconnection L.L.C., September 2009.

triennial review for PJM, we recommended competitive and self-supply exemptions.[3] In 2012, Dr. Newell submitted testimony on behalf of the Competitive Markets Coalition of generating companies seeking to apply those recommendations but strengthen PJM's MOPR in its original purpose to prevent and mitigate the exercise of buyer market power.[4] In 2018, we testified on the need for competitive and self-supply exemptions to MOPR.[5] In 2020, Dr. Newell submitted testimony to the Federal Energy Regulatory Commission (FERC) on behalf of PJM on developing economic estimates of offer floor prices to implement its MOPR rules. Most recently, we have conducted analyses on behalf of the New Jersey Board of Public Utilities (NJ BPU) and the Maryland Energy Administration (MEA) to analyze the costs of MOPR-Ex and to assess alternative approaches for supporting resource adequacy in those states.[6]

We have examined the economic impacts of MOPR variations in several other capacity markets as well. In New York, we have conducted analyses on behalf of the New York State Energy Research and Development Authority (NYSERDA) and the New York State Department of Public Service (NYSDPS) to analyze the costs of Buyer Side Mitigation and potential expansions thereof, and to evaluate resource adequacy alternatives. In Alberta, Ontario, and Singapore, we have supported the market operators to develop capacity market rules to identify and prevent the exercise of buyer side market power in their proposed implementations of capacity markets.

Dr. Spees is an economic consultant with expertise in wholesale electric energy, capacity, and ancillary service market design and analysis. She earned a Ph.D. in Engineering and Public Policy, an M.S. in Electrical and Computer Engineering from Carnegie Mellon University, and a B.S. in Mechanical Engineering and Physics from Iowa State University. Dr. Newell is an economist and engineer with 23 years of experience analyzing and modeling electricity wholesale markets, the transmission system, and ISO/RTO market designs. He earned a Ph.D. in Technology Management and Policy from the Massachusetts Institute of Technology, an M.S. in Materials Science and Engineering from Stanford University, and a B.A. in Chemistry and Physics from Harvard College.

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[3] Pfeifenberger, Newell, Spees, Hajos, and Madjarov, *Second Performance Assessment of PJM's Reliability Pricing Model: Market Results 2007/08 through 2014/15*, prepared for PJM Interconnection LLC, August 26, 2011.

[4] FERC Docket No. ER13-535-000, filed "The Competitive Markets Coalition's Supporting Comments, at Attach. A, Affidavit of Dr. Samuel A. Newell on Behalf of the 'Competitive Markets Coalition' Group Of Generating Companies," supporting PJM's proposed tariff revisions to change certain terms regarding the Minimum Offer Price Rule in the Reliability Pricing Model, December 28, 2012 ("Affidavit of Dr. Samuel A. Newell on Behalf of the Competitive Markets Coalition").

[5] Affidavit of Kathleen Spees and Samuel A. Newell Regarding the Need for a Self-Supply Exemption from Minimum Offer Price and Other Policy-Supported Resource Rules, Calpine Corporation, et al. v. PJM Interconnection, L.L.C, FERC Docket Nos. EL16-49-000, October 2, 2018.

[6] See Attachment A.

See also Kathleen Spees, Travis Carless, Walter Graf, Sam Newell, *et al.*, *Alternative Resource Adequacy Structures for Maryland: Review of the PJM Capacity Market and Options for Enhancing Alignment with Maryland's Clean Electricity Future*, prepared for Maryland Energy Administration, March 2021.

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Executive Summary

The original and proper economic purpose of the minimum offer price rule (MOPR) is to protect the capacity market from the exercise of buy-side market power. Buy-side market power can occur when a large net buyer of capacity develops (or contracts to develop) excess capacity resources and offers the additional supply into the market below cost in order to suppress market clearing prices.[7] By taking a loss on that small "uneconomic" position, a large net buyer could then benefit from a much larger short position in the market. The MOPR was designed to prevent this behavior. The concept was to ensure that entities with the incentive and ability to engage in manipulative price suppression would be unable to do so by requiring their capacity market offers to reflect full resource costs. Thus uneconomic new resources sponsored by large net buyers would fail to clear (or would set prices at a higher level) and prevent the would-be gaming entity from achieving the benefits of manipulative price suppression.[8]

More recently, the current Expansive MOPR (MOPR-Ex) has repurposed the original MOPR to exclude from the capacity market resources that earn revenues for supporting states' environmental and other policy goals. Resources developed to meet policy goals add supply in the market, which can cause lower capacity prices and displace other types of capacity that might otherwise have been built or retained. Advocates of MOPR-Ex assert that these outcomes unfairly reduce revenues to merchant capacity suppliers, undermine incentives for capacity investments, and threaten system reliability. Applying MOPR to policy resources, they assert, restores capacity prices to the "correct" level that would prevail in the absence of state policies. These arguments rest on flawed economic logic.

There is no sensible economic rationale for applying MOPR to all policy resources. States have many reasons to support capacity supply resources including to limit the harms of climate change, address environmental externalities, improve public health, create jobs, and support economic growth. The policy support awarded to such resources reflects their contributions to state policy objectives; they create environmental attributes or other benefits that states wish to buy and are remunerated for producing those benefits. Such resources are not "uneconomic" because their value is not derived from a scheme of manipulative capacity price suppression. Further, MOPR-Ex has not "leveled the playing field" because it fails to address the environmental and public health externalities that are the primary reason for most of the PJM states' policies in question. MOPR-Ex also does not attempt to undo the effects of all local, state, and federal policies that have always shaped the resource mix, including supporting the development of existing fossil plants and reducing the delivered cost of fossil fuels.

Applying MOPR to policy resources can prevent them from clearing the capacity market, with several undesirable effects. First, it can deprive policy resources of revenues commensurate with the capacity value they provide. Second, it favors the retention and development of uneconomic excess capacity supply that is not needed for reliability. Third, it distorts market clearing prices upward from the level corresponding to actual supply-demand conditions and thereby effectuates a wealth transfer from customers to incumbent suppliers. And fourth, applying MOPR to policy resources will eventually

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7 *See PJM Interconnection, L.L.C.*, 117 FERC ¶ 61,331 at P 103 (2006).

8 In addition to its buy-side market power provisions to protect the market from uncompetitively low prices, the PJM capacity market also has supply-side market power provisions to protect the market from uncompetitively high prices. Absent protections, large sellers of capacity could offer a small amount of capacity at a high price above their costs, intentionally fail to clear (losing money on a small transaction), and benefit from a higher capacity price (gaining money on a much larger position). To prevent such economic withholding, offer caps can be placed on large capacity sellers. Must-offer requirements also apply, to prevent physical withholding.

render the market unsustainable as these distortions become larger over time as states across the PJM footprint pursue their clean energy and other policy objectives. Across the PJM footprint, 92% of customer demand is within states that have adopted renewable portfolio standard (RPS) or other clean energy requirements whose resources could be excluded by MOPR-Ex.[9] Customers in states with the largest policy resources may face the greatest share of the costs from MOPR-Ex (but even customers in states with no policy resources will bear the costs of higher capacity prices caused by MOPR-Ex). Several PJM states have among the most ambitious climate goals in the country, including Washington DC at 100% renewable by 2032, Virginia at 100% renewable by 2045/2050, New Jersey at 100% economy-wide clean energy by 2050, Delaware at 40% renewable by 2035, Maryland at 50% renewable by 2030, and Illinois considering 100% clean energy as early as 2030.[10] The end state of applying MOPR to clean energy resources in these states is absurd: it would be a capacity market that excludes a large majority of the fleet, with market clearing outcomes having no relationship to the physical reality of the grid mix.

In the present docket, PJM has proposed to replace MOPR-Ex with a more focused MOPR.[11] For policy resources, PJM proposes to substantially narrow the circumstances when MOPR could be applied so as to explicitly exempt resources supported under all existing state policies and by any future state policy mechanisms similar to those in common use across the PJM footprint. For non-policy resources, the MOPR will only be applied to resources owned by or contracted to large net buyers, and only if the buyer is deemed to have the incentive and ability to exercise buy-side market power.

PJM's proposed narrow MOPR should produce reliable and efficient capacity market outcomes that align pricing with supply-demand fundamentals and eliminate large inefficiencies associated with the current MOPR-Ex. If PJM's proposal is implemented, the capacity market will once again be able to fulfill its role to support economically efficient entry and exit decisions among a wide range of public and private actors across the regional footprint.

The Application of MOPR to Policy Resources Is Based on Flawed Economic Reasoning

In its filing, PJM explains why the current MOPR-Ex is unnecessary and will substantially erode the efficacy and efficiency of its capacity market. We agree with PJM's analysis of these flaws.

We supplement PJM's arguments with our own economic analysis of MOPR-Ex. We further explain why the rationale for applying MOPR to policy resources in the first place was based on incomplete and flawed economic logic. A corrected economic analysis should consider that:

- The majority of the policies in question across the PJM footprint address a well-understood market failure to reflect environmental and public health externalities. The environmental value of policy-supported resources should not be considered an illegitimate distortion of markets that must be excluded, but rather a correction that is needed to achieve a more efficient outcome;

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9 Eleven of the 14 PJM states and the District of Columbia have RPS requirements; Kentucky, Tennessee, and West Virginia do not. Calculated from Monitoring Analytics, Data, Percentage of PJM Load by State, 2021.

10 *See* PJM-EIS, "Comparison of Renewable Portfolio Standards (RPS) Programs in PJM States," and "What is the Clean Energy Jobs Act," Illinois Citizens Utility Board.

11 Letter to Kimberly D. Bose from Craig Glazer, Chenchao Lu (PJM); Paul M. Flynn, Ryan J. Collins, Elizabeth P. Trinkle (Wright & Talisman), Re: PJM Interconnection L.L.C., Docket No. ER21-2582-000, Revisions to Application of Minimum Offer Price Rule July30, 2021 with attachments A–G.

- The "correct" price for capacity is one that aligns supply and demand, not the price that would prevail in the absence of state policies as MOPR-Ex is presently designed to produce;
- Capacity markets with sloping demand curves cannot simultaneously produce low prices and poor resource adequacy as MOPR-Ex advocates have claimed;
- Merchant generation investors operate in a market and regulatory context that has always required them to face uncertainties associated with a wide range of energy and environmental regulations at the federal, state, and local levels. These policies and associated economic subsidies have influenced the resource mix (some in favor of incumbent fossil resources and others in favor of clean energy resources). Merchant investors should never have expected to be indemnified against risks associated with these policies (nor should they be required to return revenues to customers when policy changes favor their own investments); and
- Broad application of MOPR to policy resources has amplified (not mitigated) the regulatory risks affecting capacity investments.

Overall, MOPR-Ex advocates aim to solve a problem that doesn't exist. Their primary concern appears to be that as incumbent capacity resource owners, they no longer expect to earn a satisfactory return on their investments. While certainly a concern for incumbents, low capacity prices are not a problem from a societal or market design perspective. Low prices are simply a reflection of market conditions indicating ample capacity supply; they appropriately signal that no new capacity is needed and that high-cost existing resources should retire.

The MOPR should be maintained only for its narrow original purpose of addressing manipulative price suppression, not applied to state policy resources. That will enable the capacity market to continue offering competitive benefits by producing accurate price signals that align with market fundamentals and attract investment when needed.

Applying MOPR to Policy Resources Imposes Uneconomic Excess Costs on Customers and on Society as a Whole

The MOPR requires policy resources to offer into the capacity market at a higher price than they otherwise would, which can prevent these policy resources from clearing the market even if they will be built anyway and contribute to resource adequacy. Excluding them causes the capacity auction to perceive a supply "gap" that it will seek to fill by clearing other, higher-cost capacity resources while setting a higher clearing price. MOPR-Ex therefore causes the auction to retain more existing capacity resources (such as coal plants that would otherwise retire) and/or attract new investments (such as new gas combined cycle plants that would not otherwise be built). The total amount of capacity available and operating would exceed the amount needed to meet the reliability objectives that the capacity market was designed to meet.

To evaluate the impacts of applying MOPR to policy resources, we conducted a simulation analysis of the PJM capacity market in scenarios with: (a) the status quo of MOPR-Ex as applied to policy resources, and (b) no MOPR applied to policy resources such as under PJM's focused proposal.[12] As

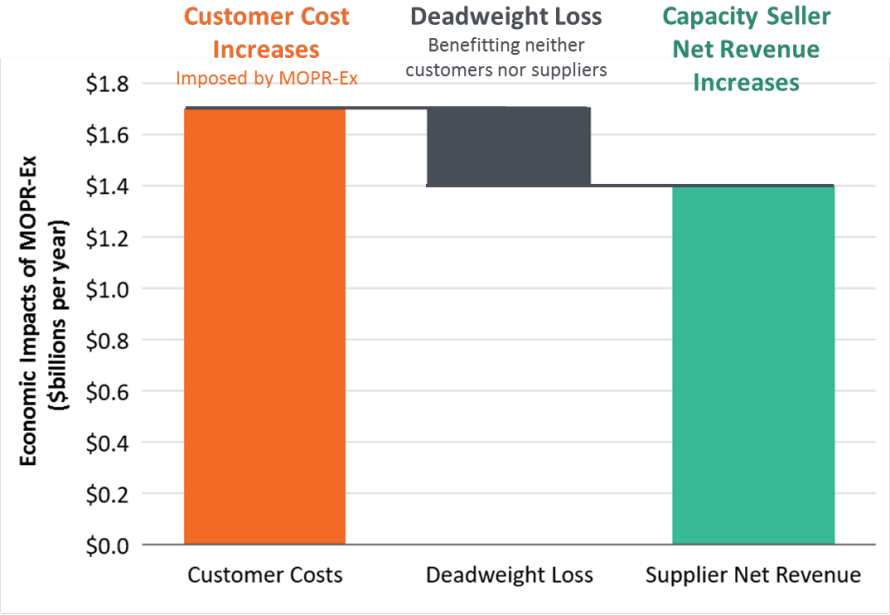
[12] We conducted this analysis on behalf of the New Jersey Board of Public Utilities (BPU) as an input to their assessment of alternative resource adequacy structures. See New Jersey Board of Public Utilities, Alternative Resource Adequacy Structures for New Jersey Staff Report on the Investigation of Resource Adequacy Alternatives, Docket #EO20030203, June 2021. The full report is included as Attachment A to this testimony.

summarized in Figure 1, we estimate that if MOPR-Ex is maintained in its present form, by 2030 it would:

- Prevent the capacity market from clearing approximately 6,800 MW of unforced capacity (UCAP) from state policy resources;
- Impose approximately $1.7 billion per year in excess costs on consumers in two ways: first, by causing them to pay higher capacity prices than is economically efficient (a cost that is borne by all customers, even those in states that have not supported any policy resources); and, second, by requiring customers in states with the affected policy resources to "pay twice" for capacity (once for policy resources that cannot clear, and a second time for duplicate capacity that does clear);
- Of the $1.7 billion in excess payments to capacity sellers, approximately $0.3 billion would be wastefully deployed toward the uneconomic retention of excess capacity resources beyond what is needed for reliability. This $0.3 billion in excess spending is economic deadweight loss that benefits neither customers nor suppliers; and
- The remainder of the excess capacity payments are a wealth transfer of approximately $1.4 billion per year from customers (who must pay a higher capacity price) to suppliers of capacity that would be there with or without MOPR (and who will earn the higher capacity price).

PJM's proposal for a focused MOPR would eliminate these adverse impacts caused by the expansive MOPR. This will restore the capacity market to its role in producing accurate prices and guiding market participants to pursue cost-effective entry and exit decisions.

FIGURE 1: IMPACTS ON PJM CUSTOMER COSTS AND CAPACITY SELLERS' NET REVENUES FROM IMPOSING MOPR ON POLICY RESOURCES BY 2030



Sources and Notes: See comprehensive modeling approach description in Attachment A, Section II.C, Appendix A, and Figure 20.

PJM's expert witness, Professor Peter Cramton, provides an assessment of the impacts of MOPR-Ex that largely aligns with our own. Professor Cramton similarly finds that MOPR-Ex induces systematic

over-procurement, is not needed for reliability, and imposes excess costs on customers.[13] Our analysis does differ from Professor Cramton's in some respects, due to differences in modeling frameworks and assumptions. The primary difference is that we anticipate a larger volume of resources would be affected by MOPR than is assumed in Professor Cramton's analysis. We developed our bottom-up, state-by-state estimate of the volume of policy resources that would be affected by MOPR after projecting the outlook of new resources needed to fulfill these policies over time. Professor Cramton has adopted a smaller number, an input assumption provided by PJM at the time. We believe that an updated estimate would be closer to ours, considering the larger volume of resources that PJM has projected in its more recent planning outlooks.[14] Due to this difference, we have estimated larger impacts on customer cost and larger excess procurement volumes from continuing MOPR-Ex.

Another difference is that we estimate approximately $26/MW-day and $25/MW-day increases in capacity price could be caused by MOPR-Ex in both 2025 and 2030 respectively. Our estimate of these MOPR-Ex price impacts are relatively similar in both years because there is a higher volume of capacity supply excluded by MOPR in 2030, but this is offset by the moderating effect of long-term entry and exit. Our approach utilizes an upward-sloping supply curve based on actual PJM capacity auction offer data (for 2025) and a more moderate but still upward-sloping longer-term supply curve (for 2030). Professor Cramton's model focuses on an even longer multi-decade timeframe over which the capacity supply curve becomes even more moderated (close to flat in the very long term relevant for his study), which explains his finding that prices are similar with or without MOPR-Ex.

The two approaches are complementary: our analysis provides the most robust estimate of near- and medium- term magnitudes of MOPR-Ex price, cost, and quantity impacts; Professor Cramton's modeling provides an assessment of the long-run outcomes that should be expected (though we expect that the magnitude of impacts he estimates would be larger with an updated estimate of the quantity of affected resources). We use alternative and complementary approaches to arrive at the same conclusions that MOPR-Ex will induce excess capacity to be developed, impose excess costs on customers, and is not needed for reliability.

Competitive Markets Must Acknowledge Policy Goals In Order to Enable the Greatest Benefits from Trade

Far from protecting the capacity market, applying the MOPR to policy resources will erode and eventually eliminate the benefits of the competitive capacity market. With MOPR-Ex the disconnect between market fundamentals and clearing prices will grow as greater quantities of policy-supported resources come online over the coming years. The consequential growth in excess customer costs,

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[13] See Affidavit of Peter Cramton on behalf of PJM Interconnection, L.L.C, p. 12, Attachment C of Letter to Kimberly D. Bose from Craig Glazer, Chenchao Lu (PJM); Paul M. Flynn, Ryan J. Collins, Elizabeth P. Trinkle (Wright & Talisman), Re: PJM Interconnection L.L.C., Docket No. ER21-2582-000 Revisions to Application of Minimum Offer Price Rule July30, 2021 with attachments A–G and the more detailed paper describing the modeling approach: Peter Cramton, Emmanuele Bobbio, David Malec, and Pacharasut Sujarittanonta, *Electricity Markets in Transition: A multi-decade micro-model of entry and exit in advanced wholesale markets*, July 2021.

[14] For example, in a recent planning outlook, PJM has projected approximately 82,961 ICAP MW of offshore wind, onshore wind, solar, and storage will be needed to meet policy targets by 2035 (a projection that is similar to our own). However, to compare this number meaningfully to our own estimate of resources affected by MOPR-Ex, PJM's projected volume of policy resources would need to be converted to a UCAP basis and deduct resources not subject to MOPR such as existing resources and distributed solar as we have done. See p. 21 of "Offshore Transmission Study Group Phase 1 Results," August 10, 2021.

societal costs, and wealth transfers to incumbent capacity suppliers will rapidly become unsustainable from a policy and economic perspective.

The solution to this problem is simple: eliminate the application of MOPR to policy resources and allow prices to reflect the intersection of supply with demand; and let every resource count for its reliability contribution, so the market will attract investment when needed and not when not needed. PJM's proposal will have this effect.

The MOPR is a blunt instrument designed only for its narrow original purpose of addressing manipulative price suppression. MOPR-Ex cannot harmonize incentives across state policies and efficient wholesale markets. MOPR-Ex would not improve PJM's ability to operate reliably in a system that is increasingly dominated by clean and distributed resources. And MOPR-Ex would not preserve the merchant investment model. These are very real challenges that must be addressed through enhancements to wholesale markets and state policies alike. But MOPR cannot serve these ends because it was never designed to do so.

The RTO, stakeholders, and state policymakers in PJM and other market regions are already considering a range of opportunities to better align wholesale markets with states' environmental policies, including enhanced carbon pricing, enhanced energy and ancillary service market designs, improved reliability accounting, and regional clean attribute markets.[15] These reforms may take some time to fully materialize but will ultimately support the evolution toward a fit-for-purpose wholesale market that acknowledges the reality of state policies. These state policies will be among the many financial and non-financial influences affecting the type, quantity, and prices at which supply and demand may arrive in the wholesale market, as well as the reliability products that will be needed to manage the resulting system. From there, the benefits of an efficient market derive from providing pricing and clearing structures through which public and private actors alike can inform their decisions and best serve their own interests. An efficient market will not "pass judgement" on whether those interests are acceptable or limit access for those deemed unworthy. The most efficient wholesale market is the one that can match supply and demand in ways that maximize the benefits of trade, including by introducing new markets when there are substantial opportunities for mutually beneficial transactions that are net yet facilitated via wholesale markets.

[15] See for example, PJM, Capacity Market Reform: Phase 2, August 12, 2021.

A. Background

A.1. The PJM Capacity Market

The PJM capacity market, the Reliability Pricing Model (RPM), is a centralized competitive platform within which the market operator procures the quantity of resources needed to meet regional resource adequacy or reliability needs. PJM uses an administrative demand curve to procure at least the quantity of capacity that it estimates will be needed to ensure that bulk system supply shortages are infrequent, occurring no more often than once in ten years in expectations (the "1-in-10" reliability standard). Import-constrained locations such as the Mid-Atlantic Area Council (MAAC) are represented by separate demand curves establishing a minimum quantity of capacity that must be located in that subregion.

Capacity sellers offer their resources into the market at the minimum price they are willing to accept to come online or stay in the market. For any given resource, the minimum price they are willing to accept is driven by a number of factors, including primarily: costs associated with bringing new supply into the market or maintaining an existing facility that needs re-investment; minus any anticipated net revenues that could be earned from energy markets, ancillary service markets, or other revenue sources (such as sales of renewable energy credits (RECs), steam, or gypsum). Sellers also adjust their capacity offer price based on any bilateral sales agreements for capacity, any co-products they may produce, and their long-term view of future energy and capacity prices. Sellers that are able to pre-sell most of their capacity or energy through bilateral contracts would typically offer into RPM at a zero price, as would most sellers that have already come online or require minimal going-forward capital investments.

Capacity prices for all resources are set at the intersection of sellers' capacity market supply offers and the administrative demand curve in each location and system-wide. Under this framework, the capacity market produces prices consistent with supply-demand conditions. The market produces low prices when the region has more than enough supply to meet resource adequacy needs; it produces high prices when capacity supply is scarce. Since PJM's capacity market was implemented for the 2007/08 planning year, it has produced competitive prices signaling the relative need for capacity (or lack thereof); attracted new entry from generation, imports, and demand response when needed; and allowed for the orderly retirement or net exports of higher-cost resources when supply was long.[16]

A.2. MOPR and its Expansion in PJM

One of the design elements of the capacity market is a comprehensive framework for mitigating the potential for both supply-side and demand-side market power abuses, consisting of several interrelated design elements. Chiefly, the monitoring and mitigation framework includes: (a) *sell-side mitigation* provisions that impose capacity price offer caps and must-offer requirements that are intended to limit the ability of large net sellers from manipulative economic or physical withholding that could inflate market prices; (b) *buy-side mitigation* provisions that impose offer floors to prevent manipulative suppression of market prices (though the application of offer floors was expanded beyond this purpose in MOPR-Ex, as discussed below); and (c) *independent monitoring and mitigation* activities to regularly review market efficiency and competitiveness. Together, these comprehensive monitoring

[16] See, for example, Monitoring Analytics, 2020 State of the Market Report for PJM: Section 5 – Capacity Market, March 11, 2021.

and mitigation rules support price formation that market participants can anticipate will largely reflect economic fundamentals and supply-demand conditions, without being driven by the private interests of a player with large buy- or sell-side market share.

A robust monitoring and mitigation framework must be crafted in a targeted fashion in order to minimize the risk of applying buy or sell-side mitigation mechanisms to entities that do not have the incentive or ability to exercise market power. These entities cannot privately benefit from exercising market power, so mitigating their chosen offer prices serves no purpose to the broader market. If an offer price cap (or floor) is imposed on such a competitive offer price, this inflates the risk that a seller may incur unrecovered costs, introduces deviations away from the competitive price level, and induces economic inefficiencies. Though no market should guarantee that sellers are always able to recover their costs, it should guarantee that sellers can accurately reflect their costs in their offer prices so that they have a reasonable opportunity to recover costs through competitively-set prices.

The purpose of the original targeted MOPR in the context of the overall market monitoring and mitigation framework was to prevent manipulative price suppression. The rules were intended to prevent entities with a large net buyer position from exercising buy-side market power. Without such a rule, a large net buyer could be in a position to game the capacity markets by bringing a small quantity of incremental capacity supply into the market, offering the supply at a zero price, and producing a low capacity price. In some cases, a large buyer supporting new entry would not be a problem. For example, if the incremental supply is relatively low cost and thus a better deal than purchasing generalized capacity from the market. However, the purchase can be viewed as manipulative price suppression if the incremental supply is very high cost, higher than the but-for capacity price that would otherwise have materialized. In that circumstance, the buyer would develop uneconomic supply (taking a financial loss on a small quantity of high-cost capacity supply) in order to achieve a lower capacity price (thus benefitting the much larger net buy position). This behavior is, by definition, manipulative because the uneconomic incremental supply resource is not a rational resource to develop when viewed in isolation. The incremental supply is pursued only for the purpose of suppressing market prices below the competitive levels that would prevail from individually rational entry and exit.

To prevent this manipulative price suppression, a targeted MOPR would restate the offer price from zero to a higher level based on estimated net resource costs. The higher MOPR price prevents this scheme from producing price suppression and makes it less likely that the resource in question would clear the capacity market. When applied to large net buyers and their supported resources, the targeted MOPR can privatize the cost of any potentially uneconomic investments, while holding other parties in the market harmless. More importantly, the existence of the rule is intended to disincentivize the manipulative behavior and associated economic waste from taking place at all. Over the years, PJM's MOPR provisions have been updated several times, but have, for the most part, been updated so as to align with the original purpose of preventing manipulative price suppression.

With the Federal Energy Regulatory Commission's (FERC's) December 2019 Order and PJM's subsequent compliance filings, the current Expanded MOPR (MOPR-Ex) is now more broadly applied to new and existing resources that earn state policy payments.[17] The large majority of these resources in PJM and other regions are awarded policy payments in recognition of their contribution toward achieving states' environmental policies, though many of these resources also advance economic, employment, or other policy objectives as well. MOPR-Ex imposes an offer price floor on a wide array of state-supported policy resources including: (a) new renewable resources developed to meet state

[17] 169 FERC ¶ 61,239.

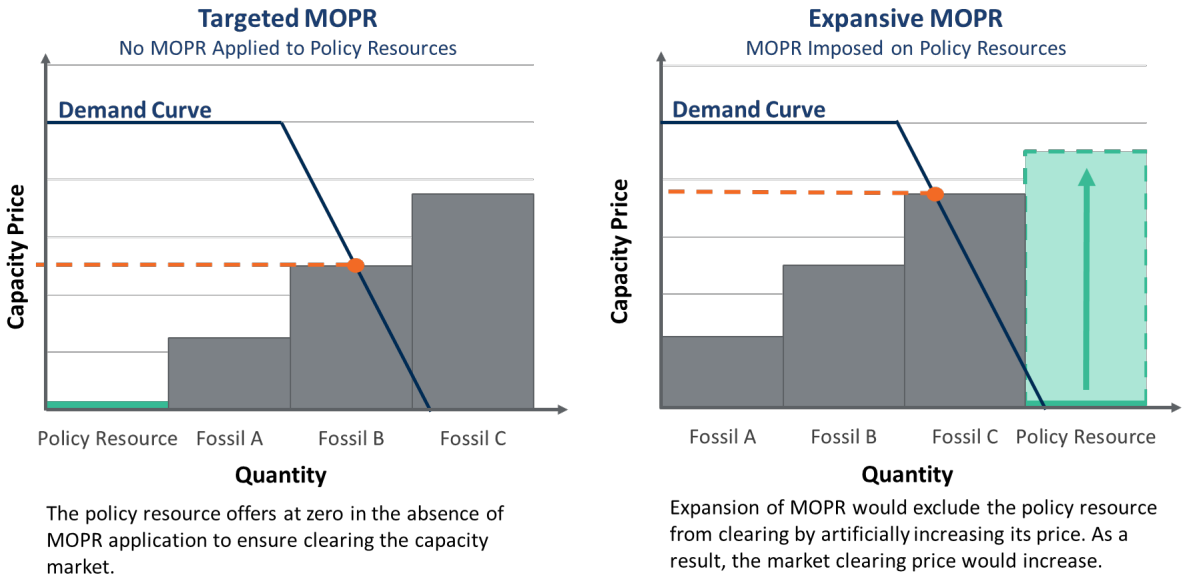
environmental targets and renewable portfolio standards (RPS); (b) new demand response, energy efficiency, storage, and distributed energy resources developed under utility or state programs that would otherwise participate in the supply side of the capacity market; (c) nuclear power plants earning zero emission credit (ZEC) or other state policy payments; and (d) all new (and many existing) capacity resources that states may wish to support in service of other environmental, economic, employment, health, safety, technology development, equity, education/training, or other state policy goals.[18] Overall these changes have substantially expanded the scope of capacity resources affected by MOPR such that it no longer has any relationship to the original purpose of mitigating the exercise of buy-side market power.

The mechanics of MOPR-Ex as applied to policy resources are illustrated in Figure 2. The left panel illustrates clearing outcomes if all capacity resources are allowed to offer at their preferred offer price. Many policy resources will offer at a zero price. For example, renewable resources earn the (large) majority of their revenues through energy market and REC payments reflecting their environmental value; a smaller share of their total revenues are earned via the capacity market. Thus, a renewable developer will often make a decision to build based primarily on expected and contracted energy plus REC revenues. Such a resource would be developed and online regardless of capacity price and so would typically offer at zero in the capacity market to ensure they earn capacity revenues. Fossil plants and other capacity resources use a similar logic when developing their capacity offer prices. A rational seller without market power would offer at the minimum capacity price needed to earn a return on going-forward investments. Immediately before a power plant is developed or immediately prior to a major retrofit decision, the owner is likely to offer into the capacity market at a medium-to-high price consistent with what is needed to justify a major investment. Once the investment is made, however, power plants tend to have low or zero net going forward costs, will continue to operate regardless of a single year's capacity price, and so offer at low or zero prices in the capacity market. Together, the aggregation of all offers from capacity resources makes up the market supply curve. Clearing prices are set at the intersection of supply and demand.

When MOPR-Ex is applied to a policy resource, its offer price is increased from zero to a higher level for the purposes of auction clearing. As illustrated in the right panel of Figure 2, the higher MOPR-based price will re-order the capacity market offer supply curve, make it less likely for the policy resource to clear the market, and cause higher clearing prices.

[18] Specifically, MOPR-Ex applies to resources earning revenue from actionable state policy support, including extensive rules designating which types of policies are considered "actionable". Exceptions to MOPR-Ex are made for some (but not all) existing capacity resources. PJM, Manual 18: PJM Capacity Market, August 1, 2021; and PJM, Open Access Transmission Tariff, Attachment DD Section 5.14(h-1), August 1, 2021.

FIGURE 2: EXPANSION OF MOPR INCREASES THE CAPACITY CLEARING PRICE



When applied to policy resources, the mechanics of the MOPR are identical as compared to the application in the context of manipulative price suppression. However, the economic purpose and impact are entirely different. Unlike in the context of manipulative price suppression, MOPR-Ex, when applied to policy resources, is not intended to prevent the investments from taking place. The policy investments will proceed regardless of MOPR because they are developed as a means to advance policy objectives such as environmental or economic goals. Thus the exclusion of these resources from clearing the market will not prevent such investments from taking place. As a result, the total quantity of installed capacity is all resources that have cleared the capacity auction (Fossil A-C) *plus* the Policy Resource that did not clear. This total quantity of capacity exceeds what is needed to meet reliability needs as represented by the sloping demand curve, causing excess investment and excess societal cost.

Another difference between the contexts of manipulative price suppression and policy resources is the scope and scale of the affected resources. In the context of manipulative price suppression, the typical behavior would be that the buyer would endure a small economic loss from developing a small quantity of uneconomic capacity resources, with that small loss more than offset by the gains to the much larger buy-side position. The scope of a targeted MOPR therefore tends to cover a small volume of supply that could be excluded from auction clearing (and likely no resources would even be subject to MOPR given that the mere existence of the targeted MOPR would be likely to prevent any would-be schemers from attempting to exercise buy-side market power).

In the context of policy resources, there is no expectation that the quantities of excluded resources will remain small. In fact, given the mandated climate and environmental policies of the majority of PJM states, the volume of policy resources across the region should be expected to become the majority of the regional marketplace as each state proceeds toward their respective policy goals. Policy-supported resources will need to be sufficient to fulfill ambitious goals, including Washington DC at 100% renewable by 2032, Virginia at 100% renewable by 2045/2050, New Jersey at 100% economy-wide clean energy by 2050, Delaware at 40% renewable by 2035, Maryland at 50% renewable by 2030, and

Illinois considering 100% clean energy as early as 2030.[19] Across the PJM footprint, 92% of customer demand is within states that have adopted renewable portfolio standard (RPS) or other clean energy requirements whose resources could be excluded by MOPR-Ex.[20]

B. PJM's Focused MOPR Proposal will Eliminate the Economic Inefficiencies Caused by the Current Expansive MOPR

PJM's filing in this docket proposes to replace MOPR-Ex with a much more focused MOPR.[21] The mechanics of MOPR when it is applied will be the same as described above. However, the focused MOPR will apply only under narrower circumstances:

- The focused MOPR can only apply to *generation resources*, not to demand response or energy efficiency.
- For non-policy resources, the focused MOPR can apply only in circumstances when the resource has a documented *relationship with a large net buyer that has both the incentive and ability to benefit from manipulative price suppression*. This application is further clarified to ensure that it will not apply to common and accepted business activities including merchant generation investments, competitive procurements open to both new and existing resources, and the self-supply business model of regulated utilities and many public power entities.
- For policy resources, the focused MOPR can only apply to *resources earning "Conditioned State Support,"* whereby they would earn the policy payments only subject to conditions placed on their capacity market offer price and clearing status. Conditioned State Support is furthered narrowed to explicitly exclude the vast majority of state policy support in common use across the PJM region including all existing state policies already in place, as well as future environmental policies, tax incentives, default service auctions, fuel incentives, and state-administered federal policies.

Every one of the changes proposed by PJM will increase the economic efficiency of the PJM capacity market; in its totality the new focused MOPR will eliminate most or all of the inefficiencies caused by the current MOPR-Ex. The central and fundamental improvement is that the proposed MOPR will apply only narrowly.

As applied to non-policy resources, the new MOPR will be restored to its original intent; it will aim to prevent and mitigate market power abuses that could be pursued by large net buyers. In this respect, the PJM's proposal for a focused MOPR is a marked improvement upon all prior versions because it includes a mechanism for PJM and its Independent Market Monitor (IMM) to assess the incentive and

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[19] *See* PJM-EIS, "Comparison of Renewable Portfolio Standards (RPS) Programs in PJM States," and "What is the Clean Energy Jobs Act," Illinois Citizens Utility Board. For an indication of the large scale of policy resources that PJM anticipates will be needed, see PJM Interconnection, "Offshore Transmission Study Group Phase 1 Results" August 10, 2021.

[20] Eleven of the 14 PJM states and the District of Columbia have RPS requirements; Kentucky, Tennessee, and West Virginia do not. Calculated from Monitoring Analytics, Data, Percentage of PJM Load by State, 2021

[21] Letter to Kimberly D. Bose from Craig Glazer, Chenchao Lu (PJM); Paul M. Flynn, Ryan J. Collins, Elizabeth P. Trinkle (Wright & Talisman), Re: PJM Interconnection L.L.C., Docket No. ER21-2582-000 Revisions to Application of Minimum Offer Price Rule July30, 2021 with attachments A–G.

ability to exercise buy-side market power, and makes plain that non-manipulative business activities will not be subject to the MOPR.

As applied to policy resources, the proposed rule is a vast improvement because it removes the application of MOPR from policy resources for most or all practical purposes. As we discuss at length throughout this testimony, the broad application of MOPR-Ex to large numbers of policy resources across the PJM footprint is based on flawed economic logic, would induce large inefficiencies, impose excess customer costs, and would discourage states from continuing to participate in the capacity market. The PJM proposal will eliminate these problems for all practical purposes.

C. The Application of MOPR to Policy Resources is Based on Flawed Economic Reasoning

In its filing, PJM explains why the current MOPR-Ex is unnecessary and will substantially erode the efficacy and efficiency of its capacity market. We agree with PJM's analysis of these flaws.

However, PJM's filing has not yet provided a complete analysis of each of the arguments and concerns that the Commission previously considered in approving the expansion of MOPR to policy resources in December 2019.[22] The stated concerns were as follows. States across the PJM region are attracting large quantities of new resources to meet clean energy and other policy goals, through a variety of programs and contract solicitations that MOPR-Ex advocates consider to be "subsidies."[23] Because these activities could reduce near-term capacity market prices and/or displace "non-subsidized" resources, MOPR-Ex advocates argued that it was necessary to "protect" wholesale capacity markets from the price-suppressive impacts of state policies. They argued that without intervention, market prices would be inappropriately low, merchant capacity suppliers would not earn adequate returns on investment, thus discouraging new capacity from entering the market and threatening future reliability. Their proposed remedy was to impose MOPR on policy resources to restore capacity prices to the "correct" level*, i.e.*, the price that would have prevailed in the absence of the state policies.

The rationale for applying MOPR to policy resources was based on incomplete and flawed economic logic. A corrected economic analysis reveals a simpler truth: that the "correct" capacity price is the one that accurately reflects underlying fundamentals of supply and demand. This is the accurate price that should signal when and where capacity investments are needed (and when high-cost resources can retire). The logical conclusion under this corrected economic analysis is that MOPR should be eliminated from application to policy resources so that capacity prices can be utilized to rationalize supply with demand.

C.1. State Policies Address Market Failures Such as Environmental Externalities

States across the PJM footprint have many reasons for supporting resources. However, by far the most common reason that PJM states support policy resources is to address the environmental and public

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22 163 FERC ¶ 61,236 and 169 FERC ¶ 61,239.

23 We do not subscribe to the view that such state programs and/or solicitations should be considered "subsidies" in the traditional sense, nor that subsidies are inappropriate or inherently problematic if they are pursued in light of policy goals. Instead, we see the introduction of clean energy policies as generally providing compensation for environmental externalities not otherwise provided for by the market itself.

health impacts caused by emissions from fossil fuel plants.[24] Translated to economic terms, these environmental and health impacts are "negative externalities" that are not automatically incorporated into market prices. The outcome of market forces alone is to produce inefficient, excess quantities of such externalities, unless governments take corrective action.

A negative externality is a negative side effect of an economic activity that adversely affects a party not involved in the transaction. The adversely affected third party has no influence over whether the transaction takes place, but is nevertheless harmed. Environmental externalities such as those caused by greenhouse gas and air quality emissions from fossil power plants are the classic textbook example of externalities.[25] Once emitted into the air, greenhouse gases cause a number of adverse effects on residents, businesses, and the environment across PJM, nationally, and globally in the present day and will continue to do so for hundreds of years in the future.[26] Other pollutants such as NO_X, SO_X, and particulates cause more immediate health impacts such as asthma and early death.[27] Absent policies to address these externalities, neither the purchaser of the power (PJM in this case) nor the producer of the emissions (the power plant owner) pays the full cost associated with these negative externalities.[28] Such unpriced or underpriced externalities will tend to be produced at a quantity that exceeds the economically efficient level from a societal perspective. The consequence of ignoring these environmental externalities is that market pricing alone would drive resource investments and operations toward an inefficiently large quantity of fossil fuel-fired power plants, imposing inefficiently large externality costs.

Externalities are by definition not "market forces," but rather market failures. Under their existence markets fail to allocate resources efficiently and the current market price would not be the "correct" one. As a general matter, public policies can address externalities and market failures in one of two ways: one is *command-and-control* policies that regulate behavior directly; the other is to develop market-based policies that align private incentives with social efficiency.[29]

Environmental externalities can be incorporated into electricity markets through policy mechanisms, whether through emissions pricing mechanisms (*e.g.,* carbon pricing) that charge emitters and indirectly reward non-emitters and/or through clean energy attribute payments that reward non-emitters directly. Carbon pricing can take many forms, from a tax or charge approach that sets a price per ton

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[24] Even though environmental goals are the most prominent and common policy goals amongst PJM states, most state policies are designed at least in part to consider a range of other objectives as well, such as affordability, equity, local economic effects, and employment.

[25] N. Gregory Mankiw, *Principles of Microeconomics*, 5th ed. Mason, (OH: South-Western Cengage Learning, 2009), p. 204.

[26] United States Environmental Protection Agency, "Climate Change Indicators: Greenhouse Gases," accessed on November 16, 2020.

[27] Michael Guarnieri, John R Balmes, "Outdoor Pollution and Asthma," *The Lancet* 383 (9928): 1581–1592. doi:10.1016/s0140-6736(14)60617-6 (2014).

[28] The Regional Greenhouse Gas Initiative (RGGI) has imposed some costs on emitters within a subset of PJM states, but the program does not currently have a mechanism for pricing emissions of imports into RGGI states and has produced prices in the range of $5-8/short ton, which is far the approximate $51/ton social cost of carbon estimated by the United States Government Interagency Working Group on Social Cost of Greenhouse Gases. See Interagency Working Group on Social Cost of Greenhouse Gases, United States Government, Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990, February 2021., and RGGI, Inc., Regional Greenhouse Gas Initiative, Allowances, Prices, and Volumes, 2021.

[29] N. Gregory Mankiw, *Principles of Microeconomics*, 5th ed. Mason, (OH: South-Western Cengage Learning, 2009), p. 154–210.

emitted; to a cap-and-trade approach that sets a cap on emissions and lets the market determine the price of allowances; to a hybrid, such as the Regional Greenhouse Gas Initiative (RGGI) that is nominally "cap-and-trade" but that includes adjustable caps to serve as price collars. In all of these cases, carbon pricing raises the cost for emitters to produce, making them less competitive and raising market clearing prices for energy; non-emitters earn the higher prices without being charged. Clean energy attribute payments work more directly by paying non-emitters to produce carbon-free energy. Such payments can be provided through long-term contracts, attribute markets, and other policy incentives, as demonstrated through a wide range of ZEC, REC, and other programs in use throughout the PJM footprint. The mechanisms used to support clean energy resources will continue to evolve as states, PJM, and stakeholders continue to assess the most effective and efficient opportunities to support the clean energy transition, as discussed in Section E below.

Many economists (and some pro-MOPR-Ex advocates) argue that a carbon pricing mechanism would be a better way to address these environmental externalities and enable all resources to compete based on market prices for energy (that account for carbon-related externalities), capacity, and ancillary services. We agree with many of the arguments in favor of carbon pricing but caution that electricity sector carbon pricing alone may be an incomplete solution in the context of the wide diversity of state environmental mandates (and lack thereof) across the PJM region.

We too believe that carbon pricing would help support the states' environmental objectives cost-effectively, through resource-neutral competition that accurately signals where and when clean energy production displaces the most carbon emissions, while also appropriately rewarding storage and higher-efficiency gas-fired generation that partially reduce emissions. The ideal is for a carbon pricing regime to apply uniformly and comprehensively in its geographic scope (across state and national borders) and in its coverage of all economic sectors. However, without this comprehensive scope, carbon pricing could induce unintended effects such as leakage or disincentives to electrify heating and transportation demand. Within the PJM Carbon Pricing Senior Task Force, many stakeholders as well as PJM staff have been working to identify solutions such as border adjustments, allocating carbon revenues to customers, and improving coordination with RGGI as opportunities to address these challenges.[30] Implementing such solutions could be technically and politically challenging, but carbon pricing should continue to be pursued, especially at a national and economy-wide level in order to achieve carbon abatement in the most cost-effective fashion.

However carbon pricing should not be presented as the only "legitimate" or "efficient" policy option for reflecting state policy priorities into electricity markets. Even if carbon pricing is pursued, the practical reality is that carbon prices alone may not be set high enough to support sufficient investment to meet mandated clean energy targets in the timeframe required by PJM states' laws. Clean energy attribute payments, competitive clean energy solicitations, and customer-backed contracts for clean energy resources are all alternative approaches that can be pursued for addressing environmental externalities, each with advantages and disadvantages relative to carbon pricing in terms of timing, economic efficiency, risk allocation, and implementation feasibility. Further, different communities, customers, and state governments across the region will place different values on their deemed cost of carbon emissions and so will not be able to establish a single market-wide carbon price that reflects all of the region's policy requirements. Overall, we anticipate that a combination of carbon pricing, clean energy attribute payments, and other policy structures will be needed to meet states' respective mandates.

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[30] PJM, Committees and Groups, Carbon Pricing Senior Task Force.

Unless and until a single policy approach to addressing externalities would be agreed upon across the PJM region, the marketplace can acknowledge that states, communities, and customers will use a range of market-based and non-market-based mechanisms to pursue their legitimate interest in addressing environmental externalities. As the demand side of wholesale electricity markets, customers and their elected representatives have the proper role of establishing how much they are willing to pay to address environmental externalities and what combination of contracts and policies they wish to use to express that value. An efficient marketplace should aim to assist states and customers by providing options for achieving their environmental goals at the lowest possible cost.

C.2. The "Correct" Capacity Price Is the One that Aligns Supply with Demand (Not the Price that Would Prevail in the Absence of State Policies)

The efficient outcome in a market, or set of interconnected markets, is that which maximizes social welfare: the sum of consumer and producer surplus. Absent environmental externalities and with market participants acting competitively, this outcome would result at the price where the marginal cost of supply (to producers) is equal to the marginal value of additional consumption (to consumers). However, when environmental externalities are introduced, the intersection of (private) supply and demand *will not represent the efficient outcome.* This inefficient outcome is the one that MOPR-Ex would seek to re-establish. Instead, the correct capacity price is that which aligns supply and demand, given other policies and/or markets that policymakers have identified as necessary to address externalities and other policy priorities.

Compensating capacity resources for their environmental and other policy value lowers their net cost of providing capacity (regardless of whether that compensation is achieved through carbon pricing, clean energy payments, or some other mechanism). Clean energy resources correctly appear more competitive as capacity providers, just like resources with high energy and ancillary services value, and they should be allowed to clear the capacity market and be recognized for the resource adequacy value they contribute to the system.

If the capacity market consequently produces low prices, this is correctly signaling an oversupply of capacity, that no more investments are needed for resource adequacy, and that the least valuable resources should retire. Reliability will not be threatened by replacing traditional power plants with non-emitting resources, as clean resources will be assigned capacity ratings reflecting only the reliability value they actually provide. In fact, under PJM's new effective load carrying capability (ELCC) approach recently approved by the FERC, capacity accreditation for intermittent and storage resources is already a fraction of their nameplate capacity and will be continuously updated to reflect their capacity value market share increases.[31] Thus, as the clean energy transition proceeds it will take greater quantities of wind, solar, and battery supplies to replace a single retiring gas or coal plant. Through this continuously-adjusted displacement rate, reliability will be maintained. PJM's methods for accurately assessing capacity needs and resources' reliability contributions will need to continue to be refined throughout the upcoming fleet transition (just as they have been continuously refined since the advent of the RPM).[32] The combination of accurate, ELCC-based capacity ratings and a graduated sloping demand curve will allow for an orderly pace of retirements that largely proceeds on the same

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[31] See, for example, PJM's preliminary analysis illustrating how different intermittent and storage resources' capacity ratings may change over the coming decade. See PJM Interconnection, Preliminary ELCC Results, February 18, 2021.

[32] PJM's board and management have identified enhancements to reliability accounting on the supply and demand side of the capacity market as a priority focus area over the coming years. See PJM Interconnection, "Capacity Market Reform: Phase 2," August 12, 2021.

pace that new resources are developed. For the same reasons, the market (absent any MOPR application to policy resources) can provide the right price signals and result in efficient outcomes with the least-cost set of economic retirements, entry, and retention of resources needed to maintain resource adequacy. This all works if every resource is accurately counted and compensated according to its contribution to resource adequacy (as they will be if PJM's focused MOPR proposal is implemented).

Yet, forcing policy resource offers upward via MOPR can prevent them from clearing the market. It results in an artificially high capacity clearing price and induces inefficient behaviors and uneconomic incentives: it can retain costly existing supply that would otherwise retire, attract costly new supply that is not needed, and disincentivize customers from utilizing more electricity given inflated prices that signal a false scarcity of capacity supply. Thus, the application of MOPR to policy resources causes the capacity market to depart from supply-demand fundamentals.

The inefficiency of the outcome is especially apparent considering that policy resources will be developed and operated regardless of whether or not they clear the capacity market. Thus the MOPR distorts the capacity market by requiring the mandatory procurement of additional capacity on behalf of customers, beyond what is needed to meet the reliability standard. Under MOPR-Ex, the capacity market simulates a fictional reality as if the policy resources that help meet demand did not exist. Under that fictional scenario, the reliability value of the policy resource in question is ignored, the capacity market price reflects a fictional "need" for capacity, causing consumers to pay real money for real capacity resources to fill that fictional need. This scenario is inefficient when it excludes even one policy resource from clearing the market. It becomes entirely nonsensical when applied to states with high 50−100% clean electricity mandates. Many (and for some states, literally all) policy-supported resources that physically supply resource adequacy could be excluded from being counted in the capacity market, while the capacity market would remain a multi-billion-dollar-per-year parallel "shadow market" that exists primarily as a means for customers to make duplicative payments to resources that are not needed for resource adequacy.

Thus the MOPR-Ex offers a costly solution to a non-problem. The grievance from the standpoint of incumbent fossil generators is that they cannot compete and win against the clean resources that states and consumers prefer. As a consequence, fossil generation owners will earn lower revenues than they would in a world where emissions do not matter or where state policies favored their resources. Failing to earn a return on investment may be problematic for the owners of such assets, but this is not a problem that the wholesale markets can or should fix. The fix occurs when generators shift their investment portfolios toward the types of electricity resources that customers and states want to buy.

Capacity prices will be lower under PJM's focused MOPR approach than they would be if MOPR-Ex were maintained. These lower capacity prices are not a problem from a market design, reliability, or economic perspective. Low prices would be produced only when supply is long, new entry is not needed, and retirements can be accommodated. Applying MOPR to policy resources creates a fundamental disconnect between market pricing outcomes that deviate from the underlying fundamentals of supply (including that associated with state policy resources) and demand (as expressed through resource adequacy requirements).

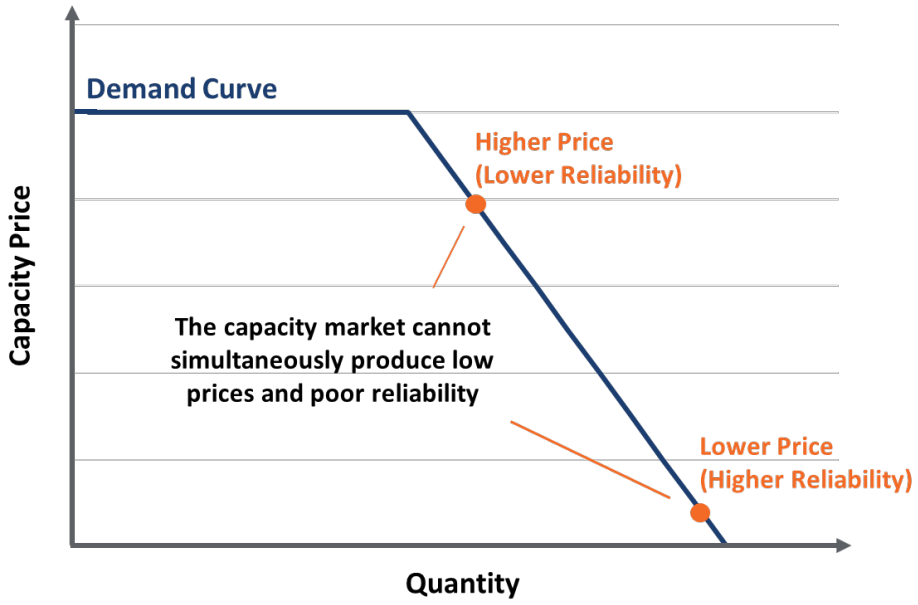
C.3. Capacity Markets with Sloping Demand Curves Cannot Simultaneously Produce Low Prices and Poor Resource Adequacy

MOPR-Ex advocates have expressed a misguided concern that the low prices that may prevail due to growth in policy resources will threaten reliability by discouraging investment.

As shown in Figure 3, this concern is illogical in the context of a capacity market with a downward-sloping demand curve that reflects the required reserve margin and the incremental value of additional supply beyond that reserve margin. By its nature, the downward sloping demand curve simply cannot produce market outcomes with low prices and low reliability at the same time. If prices are low due to the entry of policy resources, this means that there is ample supply of capacity on the system. In this long market condition, the low capacity prices signal that high-cost resources should retire and new entry is not needed. If the supply-demand balance tightens, prices will rise and signal the need to attract and retain scarce capacity. Thus, the concern that low prices will produce low reliability is unfounded (and a mathematical impossibility).

This is not to say that reliability is not a concern in the clean energy transition. As noted above, intermittent resources whose unavailability may be correlated across the fleet (*e.g.,* low wind days, or low solar insolation periods such as nighttime) provide less and less incremental resource adequacy value as their penetration increases. Capacity markets must recognize that fact through resource accreditation that accurately reflects resources' contribution to system reliability. Beyond the context of capacity markets discussed in this testimony, other aspects of the wholesale electricity markets including energy, ancillary service, and transmission planning rules will need to be enhanced to ensure robust pricing and operations in the context of different resource patterns and capabilities throughout clean energy transition. In all cases, across all electricity products, the system will need to be refined to accurately reflect reliability needs, enable all resources to support those needs (subject to their technical capabilities), and use principles of supply and demand to establish efficient pricing to meet those needs.

FIGURE 3: CAPACITY MARKETS WITH DOWNWARD-SLOPING DEMAND CURVES CANNOT SIMULTANEOUSLY PRODUCE LOW PRICES AND POOR RESOURCE ADEQUACY



C.4. Merchant Investors Operate Amidst Wide-Ranging Energy and Environmental Policies from which They Never Should Have Expected to be Indemnified

Some MOPR-Ex advocates express concern that their merchant investments are not earning the return on investment that they anticipated. They assert that "state subsidy issues" are producing prices that are too low to provide a sufficient return on merchant power plant investments.

While poor investment returns are a concern for the affected asset owners, this is not necessarily a concern from a market design perspective. Merchant generation investors operate in a market and regulatory context that has always included environmental regulations from which they should not expect to be indemnified any more than they should be charged when regulations work in their favor. The Mercury and Air Toxic Standard (MATS), other environmental regulations, and general market conditions, for example, contributed to the retirement of some 37,000 MW of installed capacity (ICAP) from aging coal, oil and gas plants over 2012–2020. These retirements created opportunities for approximately 35,000 ICAP MW of new gas-fired power plant investments even though peak demand has remained relatively flat.[33] Natural gas-fired generators also benefit from various tax policies and ratepayer-funded gas transportation infrastructure that have lowered the delivered costs of their fuels.[34] In the future, merchant capacity suppliers may enjoy upward price pressure that may be caused by policy-driven electrification of vehicle and transportation sectors.

The majority of states' policies across the PJM region will not enhance returns to the fossil-fired plants that are major emitters of carbon dioxide. But this should not have surprised generation owners, as states across the PJM region have long discussed and expressed their environmental policies, including the need to limit carbon emissions to address climate change. Investors in new power plants can review the outlook of state RPS mandates as an indicator of the minimum growth in renewable supply that should be expected (while considering that nearly all PJM states have increased their RPS mandates at several points as their programs have proven cost effective and as environmental commitments have strengthened).[35] No responsible investor in any power plant entering the PJM capacity market can have made its investment and been unaware of the downside risks associated with states' environmental policies. Some investors may have miscalculated by underestimating the pace and magnitude of PJM states' environmental policies, but many other investors have had the foresight to adjust their business strategies to align with clean energy transition.

Reviewing recent capacity market outcomes further undermines the claims that policy resources are somehow driving "uncompetitive" low prices or making it impossible for merchant generators to compete. The real reason that capacity prices have been low is precisely because the market has driven competition, with most capacity market entry and exit decisions involving merchant generation resources (not policy resources). Using the last PJM capacity auction results as an example, when the system capacity price cleared at the surprisingly low price of $50/MW-day (compared to the much higher $260/MW-day estimate of the net cost of new entry (Net CONE) that was used to calculate the demand curve).[36] This low price was affected in some part by state policies; for example, 1,785 ICAP MW (about 500 UCAP MW) of new renewable resources cleared the auction.[37] But the much larger driver of low capacity prices was another large increase in the volume of new gas combined-cycle plants that cleared the market at 5,627 ICAP MW (approximately 4,300 UCAP MW).[38] In fact, since

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[33] Coal retirement data from PJM, Generation Deactivations. Gas-fired power plant additions from PJM, 2022/2023 RPM Base Residual Auction Results, June 2, 2021.

[34] For example, s*ee* Testimony of Doug Koplow on behalf of Sierra Club in Protest on Behalf of Clean Energy Advocates", in FERC Docket No. ER18-1314, May 7, 2018.

[35] See DSIRE, Database of State Incentives for Renewables & Efficiency.

[36] PJM, 2022/2023 RPM Base Residual Auction Results, June 2, 2021.

[37] PJM, 2022/2023 RPM Base Residual Auction Results, June 2, 2021.

[38] Both of these numbers are from the PJM auction results report and appear to indicate different levels of resource clearing (given that thermal plants typically have UCAP at 95% of ICAP); one possible reason for the difference could

2015/16 planning year, over 35,000 ICAP MW of gas plants have entered the PJM capacity market, demonstrating that the merchant investment model is alive and well.[39] If investors feel that they have earned too little in the capacity market, they can more accurately blame their merchant competitors for the low prices (rather than state policymakers).

Regardless of whether investors anticipate the full extent or particulars of any states' policy mandates, these policies are part of the broader market context in which all PJM capacity resources have chosen to invest. They chose to bear the risks and rewards associated with changing market conditions and regulations, and there is no reason to indemnify them through an expansive MOPR. Doing so distorts the market, as explained above, and imposes unnecessary costs on consumers.

C.5. Expanding MOPR Application to Policy Resources Amplifies (Rather than Mitigates) Regulatory Risks

MOPR-Ex advocates have argued that applying MOPR to policy resources is necessary to mitigate regulatory risk surrounding capacity investments. We acknowledge that capacity investments do face more regulatory risk in a world with environmental policies than one in which policies never change; and that imposition of increasingly-stringent policies will usually disadvantage higher-emitting resources and any other resources not favored by state policies. The application of MOPR-Ex to clean energy policy resources undoes some of that effect, by elevating capacity prices to the level that would prevail absent the policy resources. MOPR-Ex would also cause the market to attract and retain more merchant capacity than with a targeted MOPR. As long as MOPR-Ex is maintained, it will benefit incumbent capacity resources and may even attract more investment in new gas-fired resources (in both cases, securing more capacity than is needed for reliability).

However, elevated prices should not be conflated with less-risky prices. We do not believe the MOPR-Ex reduces regulatory risk or provides an efficient basis for attracting new investment. On the contrary, a market whose price is artificially inflated by a rule as controversial and economically inefficient as MOPR-Ex is unsustainable. Investors will not count on the price premiums produced by such a rule to persist over the long term. They would have to realize that, over time, the pressure to eliminate MOPR-Ex will only increase as mounting quantities of policy resources are excluded from the market and the MOPR-Ex-supported price and capacity deviate further from reflecting actual supply and demand conditions. Customers will ask why they are paying so much to support excess capacity. They will notice that the excess capacity they are supporting is primarily fossil fuel generation that contravenes state clean energy policy goals with wide popular support, and they will demand change. States and utilities will pursue the economic and environmental objectives of their constituents by exiting the capacity auction under the Fixed Resource Requirement (FRR) alternative, rather than continuing to bear these excess costs. For these reasons, capacity markets that fail to accommodate policies that states are committed to pursuing cannot form the basis for a sustainable market design that supports investment.

Capacity markets can better support merchant investment when needed, with lower regulatory risk, if they do not apply MOPR to policy resources. Such a market reflecting actual supply and demand conditions—counting each resource for its contribution to resource adequacy—will send just the right price signals to maintain resource adequacy at least cost. Merchant investors will still face market and

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be partial clearing of some resources. ICAP values are precise from Table 8, UCAP is cleared new units from Table 2A after subtracting renewable entry. See PJM, 2022/2023 RPM Base Residual Auction Results, June 2, 2021.

[39] PJM Interconnection, L.L.C., "2022/2023 RPM Base Residual Auction Results," Table 8.

regulatory risks, including risks from environmental policies changing in the future. States can mitigate these risks by setting environmental policies on a long-term stable basis, as many states have already done via multi-decade commitments that will not be fully realized until 2040 or 2050. Investors can then view these policies as part of the fundamentals against which they can plan their business strategies.

C.6. There Is No Economic Justification for Expanding MOPR to Policy Resources (Or Using It for Any Purpose Other than Mitigating the Market Power Abuses)

MOPR is an appropriate mechanism for its original purpose of preventing manipulative price suppression.[40] In that context MOPR has a valid economic rationale: to prevent net-short entities and their representatives from sponsoring uneconomic investments to suppress prices, benefit themselves in the short run (at the expense of other market participants), and induce economic deadweight losses.[41] Applied for that original purpose, MOPR can work together with other elements of a comprehensive monitoring and mitigation framework that assures market participants that market outcomes will be competitive, reflecting supply-demand fundamentals.[42]

This valid economic rationale for MOPR does not apply in the context of state policy resources:

- Policy resources across the PJM footprint are supported as a means to pursue environmental, public health, economic growth, or employment objectives. As long as they are not pursued as a means to profitably suppress capacity prices, they should not be subjected to the MOPR.
- State-supported capacity resources are not uneconomic just because they receive payments beyond what they would earn through wholesale electricity markets alone. In the case of environmental policies, incentives can correct for the market failure to reflect the costs of environmental externalities associated with climate change and public health.
- Applying MOPR to policy resources does not prevent uneconomic behavior (as it does when applied to mitigate manipulative price suppression schemes); rather, it actually *causes* uneconomic behavior by incentivizing the retention of uneconomic, unneeded resources.

States' energy policies will have a number of effects in the electricity sector and broader economy. Capacity markets, like all other markets, can be affected by these policies. The overall outcome of an effective policy to mitigate climate change will be to reduce the greenhouse gas emissions produced and to guide the resource mix away from fossil and toward a mix that meets energy and reliability needs with cleaner resources.

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40 *See:* FERC, Docket No. EL07-39-000, Order Conditionally Approving Proposal at PP 100–P100106, March 7, 2008.

41 This deadweight loss is the cost of the uneconomic resources in excess of the value they provide. The costs of the resources developed in order to suppress prices exceeds the cost of the resources displaced that would otherwise have cleared the market.

42 *See* Affidavit of Dr. Samuel A. Newell on Behalf of the Competitive Markets Coalition: FERC Docket No. ER13-535-000 (supporting PJM's proposed tariff revisions to change certain terms regarding the Minimum Offer Price Rule in the Reliability Pricing Model).

D. Applying Expanded MOPR to Policy Resources Imposes Uneconomic Excess Costs on Customers and on Society as a Whole

Applying MOPR to policy resources can prevent resources from clearing the capacity market, even though they will continue to operate in the energy market. Forcing policy resources to offer into the capacity market at a higher price will increase the capacity auction clearing price, and can prevent these policy resources from clearing the market. Excluding these policy resources then causes the capacity auction to perceive a supply "gap" that it will seek to fill by clearing other, higher-cost capacity resources. MOPR-Ex therefore causes the auction to retain more existing capacity resources (such as coal plants that would otherwise retire) and/or attract new investments (such as new gas combined cycle plants that would not otherwise be built). The total amount of capacity available and operating would exceed the amount needed to meet the reliability objectives that the capacity market was designed to meet.

To evaluate the impacts of applying MOPR to policy resources, we conducted a simulation analysis of the PJM capacity market in a 2025 and 2030 study years in scenarios with: (a) the status quo of MOPR-Ex as applied to policy resources, and (b) no MOPR applied to policy resources such as under PJM's focused proposal.[43]

Our analysis shows that applying MOPR to policy resources will introduce several adverse consequences:

- MOPR-Ex will prevent state policy resources from clearing the capacity market and induce the uneconomic retention of excess capacity resources;
- MOPR-Ex will impose costs on consumers in two ways: first by causing them to pay higher capacity prices than is economically efficient (a cost that is borne by all customers, even those in states that have not supported any policy resources); and second by requiring customers in states with policy resources to "pay twice" for capacity (once for policy resources that cannot clear, and a second time for duplicate capacity that does clear);
- Higher prices would effectuate a wealth transfer from customers to suppliers on the entire volume of capacity transacted in the market, not just the excess resources; and
- Supporting excess capacity results in excess societal costs or deadweight loss that benefits neither customers nor suppliers (who bear the costs of maintaining the uneconomic excess supply).

The scale of these problems would grow with the scope of MOPR application and will grow over time as PJM states proceeds toward fulfilling their various clean energy mandates.

D.1. Approximately 6,800 MW of Policy Resources Could be Excluded from Clearing the Capacity Market by 2030

To assess the volume of policy resources that may be affected by MOPR-Ex, we reviewed the RPS and nuclear support programs of every state in the PJM footprint with the results summarized in Figure 4.[44]

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[43] We conducted this analysis on behalf of the New Jersey Board of Public Utilities (BPU) as an input to their assessment of alternative resource adequacy structures. See Attachment A.

[44] Our analysis accounted for carve-outs for certain resource types such as offshore wind, solar, and storage; we also deducted quantities anticipated from distributed solar. This analysis likely under-reports the total quantity of policy

Based on this analysis, we estimate that the total quantity of resources subject to the expanded MOPR PJM-wide could be approximately 11,500 UCAP MW by 2030 (more if states continue to expand their policies).

Not all of these resources will be precluded from clearing the capacity market. The majority of these resources are multi-unit nuclear plants earning ZECs and able to offer at zero MOPR price and thus, unless the MOPR floor price increases, would be unaffected by the expanded MOPR. In our analysis we have assumed that all of these resources will clear the market in 2030, though we note that Exelon recently announced that MOPR has prevented its 1,403 ICAP MW Quad Cities nuclear plant from clearing the 2022/23 capacity auction.[45] If Quad Cities or other nuclear units would always or sometimes fail to clear the auction, then the true costs of MOPR-Ex would be higher than we estimate in this testimony.

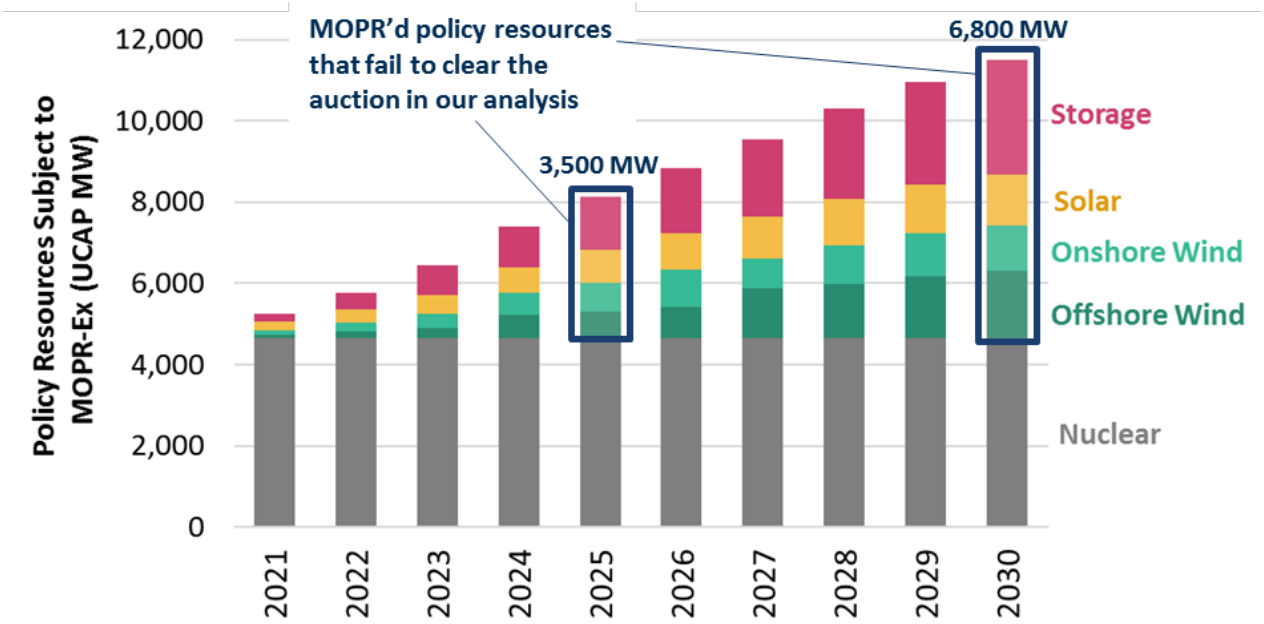
We also estimate that at default MOPR price levels (and after adjusting for projected resource cost declines), new onshore wind, offshore wind, solar, and storage resources are unlikely to clear the market. If some of these resources would be awarded a lower MOPR price that allows them to clear the auction, then the true costs of MOPR-Ex could be mitigated from our estimate. Overall, on a PJM-wide basis we estimate that approximately 3,500 UCAP MW of policy resources are at risk of not clearing by 2025, and up to 6,800 UCAP MW by 2030.[46]

resources that may be subject to MOPR-Ex given that we have focused on only a subset of states' policies. See additional discussion in Attachment A.

[45] Edgar Glimpses, "Exelon Corp Files (8-K) Disclosing Other Events, Financial Statements and Exhibits," *EnergyCentral*, June 3, 2021; and Michael Yoder and Rich Heidorn Jr, "Stakeholders Discuss PJM Capacity Auction Impacts" *RTO Insider, LLC*., June 3,2021.

[46] Outlook developed based on an analysis of individual states' policy goals, existing resource mix, resource ratings, current MOPR price levels, and the outlook for resource cost declines. "2022/2023 BRA Default MOPR Floor Offer Prices for New Entry Capacity Resources with State Subsidy," PJM Interconnection, L.L.C. and "2020 Annual Technology Baseline," National Renewable Energy Laboratory.

FIGURE 4: VOLUME OF POLICY RESOURCES SUBJECT TO MOPR-EX



Sources and Notes: Developed based on an analysis of nuclear and renewable support standards of all states in PJM, accounting for the scale of resources that will need to be added to meet renewable and clean energy standards, any applicable technology carve-outs, deductions associated with distributed solar, and effective load carrying capability (ELCC) ratings.

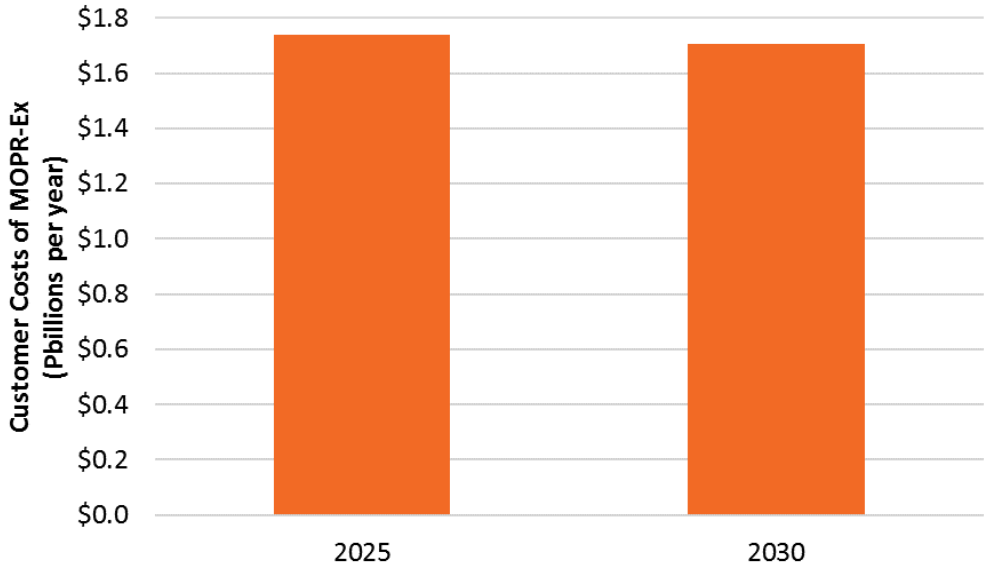
D.2. MOPR-Ex Could Impose Approximately $1.7 Billion per Year in Excess Costs on Customers by 2030

Our analysis indicates that continuing to apply MOPR to policy resources would impose a significant cost on customers across the PJM region, amounting to $1.74 billion per year by 2025 and $1.70 billion per year by 2030 as illustrated in Figure 5. The detailed assumptions and results from this analysis are included in Attachment A. These excess costs appear in two ways: (1) as an increase in capacity prices affecting all transactions; and (2) as an increase in contract payments to policy resources because they are deprived of capacity market revenues that go instead to unnecessary substitute resources.

Our 2025 and 2030 cost impact estimates are similar in magnitude even though the volume of resources subject to MOPR-Ex will grow. This is because our 2025 analysis is a "short-run" analysis that utilizes supply offer prices and quantities that match offers in recent PJM auctions, as adjusted only for known changes to supply and projected demand increases.[47] In the short run (as represented by realized capacity auction supply curve shapes), the price impacts of MOPR-Ex and other policies that affect similarly-sized quantities of supply and demand could have a large price impact. Over the longer term however, the market would tend to react to very high prices with offsetting adjustments to their entry and exit decisions (thus moderating price impacts over the long term). Our 2030 cost estimates account for the offsetting effects of supply elasticity that could moderate price impacts from MOPR-Ex over the long term.

[47] The capacity auction offer data used for that analysis were provided to us and the New Jersey BPU for the purpose of supporting their analysis of resource adequacy alternatives. See additional discussion of this modeling in Attachment A.

FIGURE 5: PJM-WIDE CUSTOMER COSTS IMPOSED BY MOPR-EX



Sources and Notes: See comprehensive modeling description and results in Attachment A, Section II.C, Appendix A, and Figure 20.

If more resources were subjected to MOPR-Ex and failed to clear the auction than we have assumed, the cost impacts would be higher. This could occur, for example, if states pursued additional policies beyond what we have accounted for or if nuclear resources were unable to clear the auction due to updates in the applicable MOPR-Ex price.

Conversely, the customer costs imposed by MOPR-Ex would be lower if the volume of resources excluded from MOPR were lower than we have estimated. For example, this could occur if many resources demonstrated lower costs and therefore cleared under resource-specific offer prices. The possibility that some resources could be allowed a low offer price and clear the auction would somewhat mitigate the adverse impacts of MOPR-Ex, but is not a reason that the rule should be maintained. Even if some policy resources cleared the market, others could be excluded, still causing the kinds of adverse impacts we have described, albeit with a smaller magnitude. These are costs that offer no offsetting benefits to the market. The only way to fully eliminate these costs would be to entirely eliminate MOPR-Ex from application to policy resources.

D.3. MOPR-Ex Imposes Excess Costs on Consumers in all States, with and without Substantial Policy Mandates

Customers in every state across the PJM footprint would bear a portion of the costs caused by MOPR-Ex. The largest costs would be imposed on customers in states whose policies support the largest UCAP MW volume of resources excluded from clearing the auction. But even in states with no policy resources excluded, customers would face excess costs from MOPR-Ex.

To understand why MOPR-Ex would impose costs so broadly across all customers, consider the impacts on customers in differently-situated states:

- **Customers in States with Substantial Policy Mandates:** In these states, consumers will face excess costs for two reasons: (1) the MOPR-Ex "price effect" that causes them to buy capacity at a higher price than is needed to support reliability, and (2) the "double payment" effect through

which consumers must pay once for the capacity value of its policy resource (*e.g.*, through an all-in-bundled contract for offshore wind) and a second time for capacity through the capacity market (which must be procured only because MOPR-Ex has prevented the offshore wind from clearing). Of these two effects, the "price effect" is by far the larger contributor to customer costs at 88% of 2025 customer costs and 80% of 2030 customer costs. The price effect is large because the price increase is applied across the entire volume of the PJM market (the double-counting effect, while imposing a greater cost per MW excluded, applies to a smaller volume).

- **Customers in States with Few or No Policy Resources:** In these states, customers will face the price effect (but will not face a double-payment effect). Higher capacity prices caused by MOPR-Ex will be paid by all customers across the PJM footprint, regardless of which resources are excluded from clearing.
- **Customers in States that Utilize the Fixed Resource Requirement (FRR) Alternative:** Some states or utilities may exit the PJM capacity market under the FRR alternative as a means to utilize the capacity value of their policy resources. Under the FRR alternative, the state or utility can select its chosen policy resources and submit these resources as the FRR capacity plan to PJM to demonstrate that their customers' reliability requirements are fulfilled. For both Maryland and New Jersey, we have examined the options to mitigate MOPR-Ex cost impacts by pursuing such an FRR alternative. Across these separate studies, we estimated that a well-designed FRR mechanism could mitigate approximately 51-79% of the costs of MOPR-Ex depending on the approach.[48] In those cases, we found that there would be opportunities to avoid the costs of double-payment, but that they would be unable to avoid the price effect as long as they would seek to procure a portion of their capacity needs from resources that could sell into the RPM at a higher price.

The customer costs imposed by MOPR-Ex if maintained in its present form would thus be broadly felt by customers across the PJM footprint (though the exact share of these costs would differ amongst the states).

D.4. MOPR-Ex Could Induce Economic Inefficiencies of Approximately $0.3 Billion per Year by 2030

We estimate that approximately 6,800 UCAP MW of policy resources could be excluded from capacity auction clearing by 2030 (left side of Figure 6). Without these resources, the capacity auction will seek to fill a (fabricated) gap in supply needs. The "gap" will be filled by purchasing approximately 5,700 UCAP MW of higher-cost capacity that would not otherwise clear the market and that is not needed for reliability (right side of Figure 6).[49] Because the policy resources will be developed and operate in the energy market regardless of their capacity auction clearing status, the result that the total volume of resources exceeds what is needed for reliability (as represented by the capacity demand curve).

These excess capacity resources will be "marginal" resources that have offered at relatively high prices in the capacity market, at levels generally consistent with their net going-forward costs. For example,

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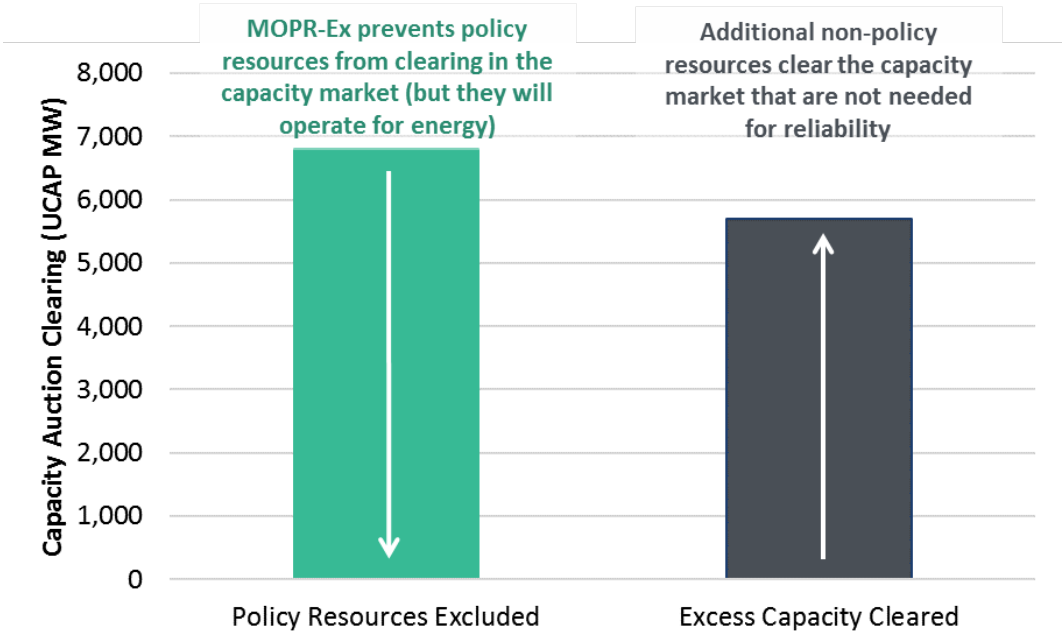
[48] See Attachment A and Kathleen Spees, Travis Carless, Walter Graf, Sam Newell, *et al.*, *Alternative Resource Adequacy Structures for Maryland: Review of the PJM Capacity Market and Options for Enhancing Alignment with Maryland's Clean Electricity Future*, prepared for Maryland Energy Administration, March 2021.

[49] The quantity of excess capacity procured via the capacity market is somewhat less than the quantity of policy resources excluded because at the higher capacity price caused by MOPR-Ex, the capacity demand curve procures a lower quantity of total supply.

these excess capacity resources could be high-cost aging fossil plants that require substantial re-investments to continue operating, or they could be new gas-fired power plants that require substantial new investments to be built. Regardless of what type of capacity is built to fill the phantom supply gap, every dollar spent to bring them online or keep them in service is a dollar of economic waste. Owners of these marginal resources are barely better off by clearing the market (as nearly every capacity dollar earned must be spent to maintain the high-cost resource); customers are far worse off because they must pay for excess capacity that has no reliability value.

We estimate that by 2030, MOPR-Ex will retain enough excess capacity to induce $0.3 billion per year in excess societal costs or deadweight loss that benefits neither customers nor suppliers.[50]

FIGURE 6: ESTIMATED CHANGES IN CAPACITY AUCTION CLEARING CAUSED BY MOPR-EX IN 2030



Sources and Notes: The quantity of excess capacity procured via the capacity market is somewhat less than the quantity of policy resources excluded because at the higher capacity price caused by MOPR-Ex, the capacity demand curve procures a lower quantity of total supply. See comprehensive modeling description and results in Attachment A, Section II.C, Appendix A, and Figure 20.

D.5. MOPR-Ex Could Induce a $1.4 Billion per Year Transfer Payment from Customers to Capacity Sellers by 2030 (But Harms to Customers Exceed Benefits to Sellers)

Incumbent capacity sellers are the primary beneficiaries of MOPR-Ex. However, the approximately $1.4 billion per year in net benefits that these incumbent players would enjoy by 2030 from maintaining MOPR-Ex are substantially below the $1.7 billion per year increases in costs imposed on customers as illustrated in Figure 7.

The reason for this discrepancy is associated with the economic waste induced by MOPR-Ex as illustrated in the figure. As discussed above, customer costs are increased according to the quantity effect (higher contract payments) and price effect (higher capacity market costs). The higher contract

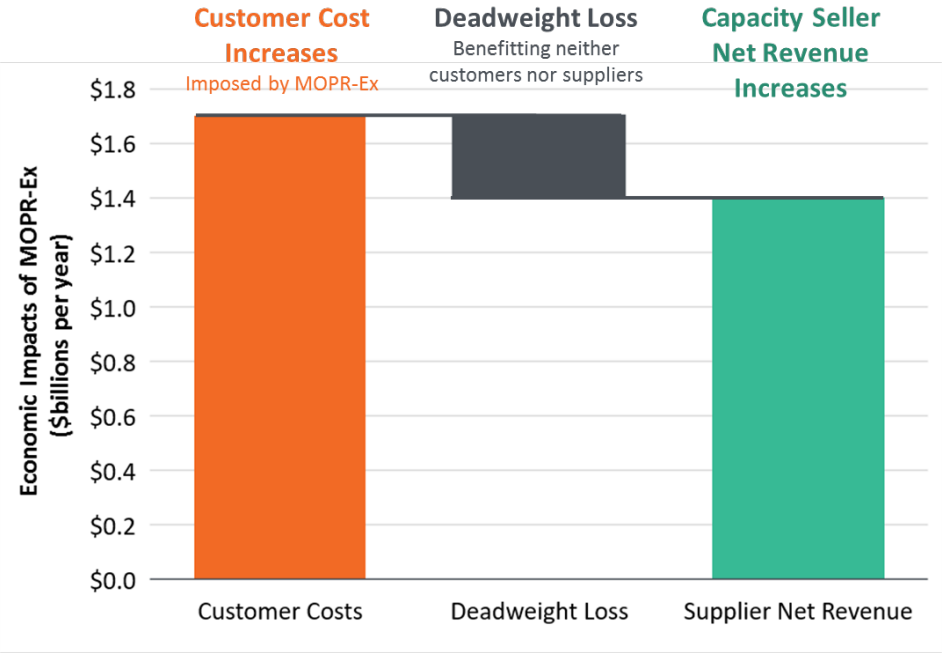
[50] Calculated as approximately 5,700 UCAP MW of excess capacity that is retained under MOPR-Ex, multiplied by approximately $145/MW-day in average resource costs of the excess capacity; prices and quantities derived from Attachment A, Section II.C and Figure 20.

payments are earned by policy resources, making up for lost revenues from the capacity market (resulting in overall no net cost or benefit to policy resources that are subject to MOPR under the assumed contract/policy structure).

Other incumbent capacity sellers enjoy significant increases in capacity revenue as driven by higher capacity prices and by gaining a greater market share. This produces approximately $1.7 billion per year in increased capacity revenues to incumbent capacity by 2030. This increase in revenues, however, is partly offset by $0.3 billion per year in increased costs that are incurred to keep uneconomic resources online. Thus, the net benefits to capacity sellers is the remaining $1.4 billion per year.

Overall, the net benefits to incumbent capacity sellers from MOPR-Ex are lower than the costs to customers. This is because a portion of the customer costs from MOPR-Ex fund a $1.4 billion per year wealth transfer from customers to capacity sellers (benefitting capacity sellers at the expense of customers), while the remainder of customer cost increases are used to fund uneconomic investments to maintain aging fossil plants that would otherwise retire (benefitting neither customers nor generators).

FIGURE 7: IMPACTS ON PJM CUSTOMER COSTS AND CAPACITY SELLERS' NET REVENUES FROM IMPOSING MOPR ON POLICY RESOURCES BY 2030



Sources and Notes: See comprehensive modeling approach description in Attachment A, Section II.C, Appendix A, and Figure 20.

D.6. Professor Cramton's Analysis Complements and Confirms Our Own, Despite Methodological Differences

PJM's expert witness, Professor Peter Cramton, provides an assessment of the impacts of MOPR-Ex that largely aligns with our own. Professor Cramton similarly finds that MOPR-Ex induces systematic

over-procurement, is not needed for reliability, and imposes excess costs on customers.[51] Our analysis does differ from Professor Cramton's in some respects, due to differences in modeling frameworks and assumptions. The primary differences are as follows:

- **Quantity of Resources Affected by MOPR-Ex:** We estimate that by 2030, MOPR-Ex will be applied to approximately 11,500 UCAP MW of policy resources (of which 6,800 UCAP MW would not clear the market). Our estimate of resources subject to MOPR-Ex is based on a detailed state-by-state analysis of existing supply (which is not subject to MOPR-Ex), growth in policy mandates, carve outs for specific technologies, deductions for distributed solar that are not affected by MOPR-Ex, and estimated ELCC ratings by resource type.[52] Professor Cramton adopts a lower assumption (as provided by PJM) that 3,417 MW of policy resources would be subject to MOPR-Ex by 2030.[53] Professor Cramton has not reported the details of how PJM developed this assumption, but we believe that an updated assessment of state policies would produce a higher number closer to our own considering the larger volume of policy resources that PJM has projected in its more recent planning outlooks.[54]
- **Quantity of Supply Excess:** Professor Cramton has estimated that MOPR-Ex would induce two percentage points more excess capacity than a focused MOPR, whereas we estimate a larger excess of approximately four percentage points. Again, this difference is caused by Professor Cramton's lower input assumption on the volume of policy resources subject to MOPR.
- **Impacts of MOPR-Ex on Prices:** Another difference is that Professor Cramton's simulations indicate that capacity prices are similar with or without MOPR-Ex, while we estimate that MOPR-Ex would cause approximately $26/MW-day and $25/MW-day increases in capacity prices in 2025 and 2030 respectively. This difference is explained by our different modeling approaches. Our approach utilizes an upward-sloping supply curve based on actual PJM capacity auction offer data (for 2025) and a more moderate but still upward-sloping longer-term supply curve (for 2030).[55] Because we have used detailed present market data to support this analysis,

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51 See Affidavit of Peter Cramton on behalf of PJM Interconnection, L.L.C, p. 12, Attachment C of Letter to Kimberly D. Bose from Craig Glazer, Chenchao Lu (PJM); Paul M. Flynn, Ryan J. Collins, Elizabeth P. Trinkle (Wright & Talisman), Re: PJM Interconnection L.L.C., Docket No. ER21-2582-000 Revisions to Application of Minimum Offer Price Rule July30, 2021 with attachments A–G and the more detailed paper describing the modeling approach: Peter Cramton, Emmanuele Bobbio, David Malec, and Pacharasut Sujarittanonta, *Electricity Markets in Transition: A multi-decade micro-model of entry and exit in advanced wholesale markets*, July 2021.

52 See additional detail in Attachment A, Appendix A.

53 In 2030, his reported number of resources subject to MOPR is 3,417 MW (not explicitly reported in either ICAP or UCAP terms). See Table 6.5 in Peter Cramton, Emmanuele Bobbio, David Malec, and Pacharasut Sujarittanonta, *Electricity Markets in Transition: A multi-decade micro-model of entry and exit in advanced wholesale markets*, July 2021.

54 For example, in a recent planning outlook, PJM has projected approximately 82,961 ICAP MW of offshore wind, onshore wind, solar, and storage will be needed to meet policy targets by 2035 (a projection that is similar to our own). However, to compare this number meaningfully to our own estimate of resources affected by MOPR-Ex, PJM's projected volume of policy resources would need to be converted to a UCAP basis and deduct resources not subject to MOPR such as existing resources and distributed solar as we have done. See p. 21 of "Offshore Transmission Study Group Phase 1 Results" August 10, 2021.

55 In our 2025 analysis, we used historical capacity auction offer data provided to the NJ BPU for the purposes of conducted this analysis; we updated these offer data to account for known entry and exit as well as the effects of MOPR-Ex. In our 2030 analysis, we accounted for long-term supply elasticity by adjusting existing generation resources' offer prices consistent with net going-forward fixed and operating costs, minus net energy and ancillary services revenues. This higher offer price accounts for the logic that an existing resource may remain in the market for

our approach provides the most robust estimate of near-term and medium-term MOPR-Ex cost impacts. By Comparison, Professor Cramton's model focuses on an even longer-term multi-decade timeframe over which the capacity supply curve becomes even more moderated (close to flat in the very long term relevant for his study), which explains is finding that prices are similar with or without MOPR-Ex.

- **Cost Impacts:** Regardless of any moderation in price impacts over a longer timeframes, we and Professor Cramton have similarly found that the MOPR-Ex would cause a perpetual and persistent over-procurement in capacity supply that is not needed for reliability. This excess supply induces both excess customer costs and economic waste.

Overall, our analysis and findings are consistent and complementary to those of Professor Cramton. Our analysis provides the most robust estimate of near- and medium- term magnitudes of MOPR-Ex price, cost, and quantity impacts, including accounting for a larger volume of resources that would be affected by the rule between now and 2030. Professor Cramton's modeling provides an assessment of the longer-term outcomes that could be expected (though an updated assessment of the volume of resources subject to MOPR-Ex would likely result in larger impacts). We use alternative and complementary approaches to arrive at the same conclusions that MOPR-Ex will induce excess capacity to be developed, impose excess costs on customers, and is not needed for reliability.

E. Competitive Markets must Acknowledge Policy Goals in Order to Enable the Greatest Benefits from Trade

Competitive wholesale electricity markets, including the PJM capacity market, have a long history of offering significant benefits to consumers by maintaining reliability at low costs. To continue offering these benefits in the future, the market will increasingly need to facilitate and accommodate states' clean energy mandates and other policy priorities.

E.1. The Capacity Market Must Recognize State Policies if it Is to Incentivize Private Actors to Make Cost-Effective Entry and Exit Decisions

State entities, like large buyers and resource owners, have many financial and non-financial reasons they may wish to develop capacity resources. This wide range of policy and business priorities will naturally affect supply resources' participation levels and offer prices within the PJM capacity market. Incorporating all offers into the regional market provides a common forum through which the wide variety of private and public interests come together through capacity auction clearing and price formation. Through this mechanism the common market informs public entities and private actors whether to proceed with their investments, which resources can be economically retired, and which types of policy resources offer the most capacity value (as measured in both reliability and economic terms). Public and private actors that utilize the regional capacity market to its fullest potential can substantially improve the cost-effectiveness of their policy and business decisions; actors that under-utilize the market will risk forgoing these benefits.

a few years (i.e., the "short term") at low capacity prices, but will eventually exit if they are unable to recover their costs for the foreseeable future (i.e., the "long term"). See additional detail in Attachment A, Appendix A.

E.2. MOPR-Ex Threatens to Undermine the Future of Competitive Capacity Markets

Far from "protecting" capacity markets from the threat of price suppression and policy resources, the application of MOPR to policy resources threatens to undermine the benefits and eventually the very existence of competitive capacity markets. Applying MOPR to state policy resources erodes the benefits that a competitive capacity market can offer. It imposes unnecessary excess costs on customers and society, interferes with the ability to achieve states' policy goals, and effectuates a wealth transfer from customers to incumbent capacity sellers. These adverse economic outcomes are amplified in any region with a significant environmental policy and will rise quickly as states across the PJM region proceed toward achieving their ambitious clean energy mandates.

Eventually, the scope and scale of an MOPR-Ex would become so great that it could exclude the large majority of all resources from participating, especially in states with the most ambitious climate goals. At the same time, the capacity market would continue to produce the high prices that would be necessary to retain excess capacity resources consistent with a fictional scenario as though the states' policies did not exist. This outcome is nonsensical and unsustainable. Rather than force customers to endure persistent, growing, and unnecessary excess costs, state policymakers would be forced to exit the capacity market entirely. In fact, state policymakers in New Jersey, Maryland, and Illinois have engaged in proceeding on the future of resource adequacy in the state for this very reason; and Dominion has already exited the market via the FRR alternative.

The solution to this problem is simple: eliminate the application of MOPR to policy resources, and allow prices to reflect the intersection of supply with demand.

E.3. Wholesale Electricity Markets Can Offer Greater Economic Benefits by Offering Competitive Solutions for Aligning with and Achieving Policy Goals

More generally, well-designed competitive markets will greatly aid the cost-effective, reliable transition to a clean electricity grid. To preserve and expand the role of competitive markets in offering broad consumer benefits, they will increasingly need to align with and support states' environmental and other policy goals. The FERC has acknowledged the benefits of supporting state goals through the reflection of enhanced carbon pricing within wholesale electricity markets.[56] PJM has similarly adopted a strategic priority to "facilitate pursuit of policy-maker and consumer decarbonization objectives by establishing ourselves as a trusted, unbiased policy adviser & driving consensus for at-scale, market-based solutions where possible."[57] States, Independent System Operators (ISOs), and stakeholders will increasingly identify opportunities to enhance the markets for a decarbonized grid, such as through enhanced carbon pricing, enhanced energy and ancillary service market designs, and solutions for aligning the capacity market with state policy.[58] These reforms may take some time but will ultimately support the evolution toward a fit-for-purpose wholesale market supporting efficient, reliable energy transition.

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[56] FERC, Docket No. AD20-14-000, "Carbon Pricing in Organized Wholesale Electricity Markets," October 15, 2020.

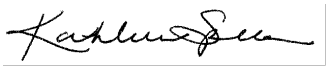
[57] See PJM Interconnection, *PJM Strategy – Powering Our Future*, p. 10.

[58] For example see the Integrated Clean Capacity Market concept described in Attachment A, Appendix B; and a range of solutions proposed within the PJM Carbon Pricing Senior Task Force.

F. Certification

We hereby certify that we have read the filing signed and know its contents are true as stated to the best of our knowledge and belief. We possess full power and authority to sign this filing.

Respectfully Submitted,



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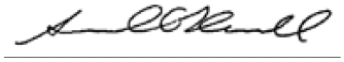

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