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NOTICE OF WORK SESSION¹

Investigation of Resource Adequacy Alternatives

Docket No. EO20030203

Pursuant to the "Open Public Meetings Act," N.J.S.A. 10:4-6, et seq., the New Jersey Board of Public Utilities ("NJBPU" or "Board") hereby gives notice of the second in a series of Work Sessions in the Board's ongoing [Investigation of Resource Adequacy Alternatives](#) designed to examine how New Jersey can best achieve its long-term clean energy and environmental objectives under the current resource adequacy paradigm. Each Work Session is designed to discuss a specific facet of the resource adequacy challenges facing New Jersey, as initially set forth in the Resource Adequacy Order and further discussed in NJBPU's September 18, 2020 Technical Conference.

This second Work Session will explore alternative ways to integrate New Jersey's clean energy goals into its resource adequacy structure, and whether such a structure could lower the cost of achieving New Jersey's clean energy goals or accelerate the timeline for meeting those goals, while also ensuring sufficient generation resources to meet customer demand.

The Second Work Session will be conducted virtually on **February 19, 2021 at 10 a.m. ET.**

Interested parties may register at:

<https://attendee.gotowebinar.com/register/8220545276657392140>

NJBPU Staff anticipates holding a third Work Session in early March 2021 to discuss the financial implications of the Minimum Offer Price Rule ("MOPR") and how various resource adequacy options are likely to affect total consumer costs. The items discussed in each Work Session will, in part, form the basis of Staff's report to the Board on resource adequacy options.

To facilitate the second Work Session, NJBPU's consultant, The Brattle Group, will present a draft framework for incorporating New Jersey's clean energy goals into a resource adequacy solution,

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known as the Integrated Clean Capacity Market (“ICCM”). The ICCM concept is described in more detail in Attachment A to this Notice.

Summary of the Integrated Clean Capacity Market

The ICCM proposal is designed to put State clean energy goals at the center of a revised resource adequacy market, while also charting a potential path for modernizing resource adequacy throughout the region operated by PJM Interconnection, LLC (“PJM”).

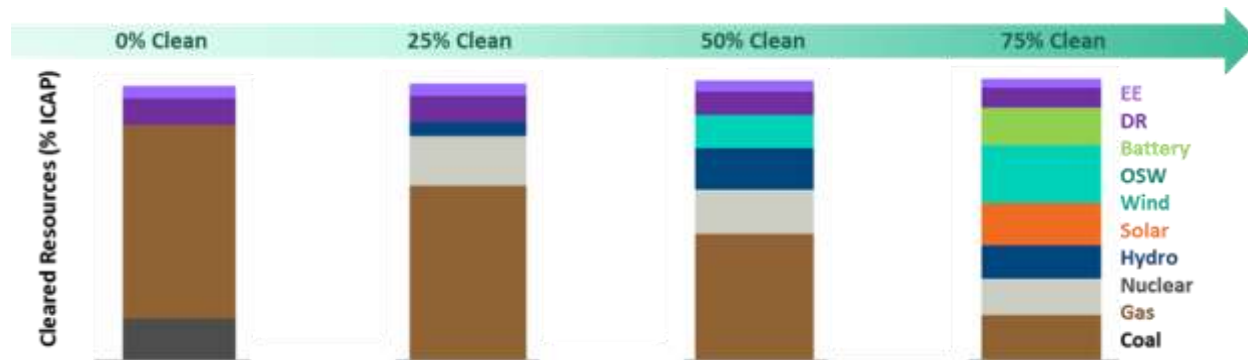
- Under the ICCM, New Jersey and other participating states would each identify the total percentage of load they seek to procure from non-carbon emitting resources,² as well as specify the maximum amount of fossil fuel generation that the state is willing to rely on for capacity.
- The ICCM would then use competitive market principles to select the lowest-cost suite of clean energy and conventional resources that meet each participating state’s requirements.
- Because the ICCM is a locational market (i.e., prices are higher in electrically constrained areas and lower in unconstrained areas), it ensures that the reliability metrics established by PJM continue to be met and encourages clean energy development where it is needed.
- Clean energy resources needed to meet state targets or to ensure reliability may “lock in” a portion of their revenues for a period of years, allowing for accelerated financing of clean energy infrastructure.
- Voluntary participation allows corporate sustainability buyers, retailers, cities, and others to place voluntary clean energy demand bids, providing easy access to the competitive marketplace and affordable prices, while promoting overachievement of state clean energy goals.

As set forth in the enclosed paper, the ICCM could serve to replace PJM’s existing capacity market. Generation resources would continue to participate in today’s existing wholesale energy markets. Clean energy resources would offer to sell both capacity and clean energy attributes. Emitting resources would offer to sell capacity, similar to today’s capacity market. Because sellers identify the amount of capacity and clean energy they have to sell separately, clean energy resources benefit from having two sources of revenue that adjust to the efficient level as part of the simultaneous clearing process.

The following chart shows how (based on a simplified model) selecting the lowest-cost resource mix might change as the amount of clean energy required increases, even with the same supply resources and offers.

² For New Jersey, that could include all program targets for Class I Renewable Portfolio Standard, solar, offshore wind, Zero Emission Certificates, and other programs that may be developed in the future.

FIGURE 1. ILLUSTRATION OF THE CLEAN ENERGY TRANSITION ENABLED BY THE ICCM



Notes: Simplified simulation illustrating ICCM procurement outcomes with the same hypothetical supply curve under a range of clean energy demand scenarios in the clean energy transition.

Mechanically, the ICCM auction would produce two simultaneous “clearing prices,” one for Clean Energy Attribute Credits, or “CEACs” (priced in \$/CEAC), and one for traditional capacity service (priced in \$/MW-day). Clean energy resources compete to receive *both* capacity revenues and CEAC revenues. Conventional resources compete solely for capacity revenues. By co-optimizing the two products into a single auction, consumers would benefit from having identified the lowest-cost, fully reliable system that meets the share of clean energy required by state policies.

Additional flexibility allows states to procure a share of the clean energy through carve outs for specific technology types or resources serving specific communities (e.g., the Community Solar program, which serves low-income customers).

The ICCM structure is specifically designed to be scalable, allowing for potential implementation by New Jersey alone, in concert with multiple states, or by implementing the design at the PJM-level, with increasing economies of scale as the market expands. Because the ICCM would potentially replace the existing capacity market structure with a durable, highly competitive market structure, there would no longer be a need to subject clean energy resources to the Minimum Offer Price Rule, which needlessly increases the costs of clean energy deployment.

INVESTIGATION OF RESOURCE ADEQUACY ALTERNATIVES SECOND WORK SESSION AGENDA

10 a.m. – 10:10 a.m.

Opening Remarks from NJBPU Staff

10:10 a.m. – 11:15 a.m.

Presentation from The Brattle Group on the ICCM Framework

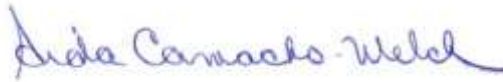
11:15 a.m. – 1:00 p.m.

Questions and comments from interested stakeholders

Comments

Staff will accept post-Work Session comments on this matter through **March 5, 2021**. Commenters are encouraged to file comments electronically through the Board's External Access Portal upon obtaining a MyNewJersey Portal ID. Once you establish a MyNewJersey account, an authorization code is required which you can request by emailing the NJBPU's IT Helpdesk at BPUIHELPDESK@bpu.nj.gov. Detailed instructions for e-Filing can be found on the Board's website at <https://www.nj.gov/bpu/agenda/efiling>. Members of the public may file written comments regardless of whether they participate in the Work Session. Written comments may also be submitted electronically to Board.Secretary@bpu.nj.gov in PDF or Word format with specific reference to this docket.

Any questions regarding this Work Session should be directed to Joe DeLosa at Joseph.DeLosa@bpu.nj.gov.



Aida Camacho-Welch
Secretary of the Board

Dated: January 21, 2021

Persons interested in attending the above Meeting who require special accommodations because of disability should contact the Office of the Secretary of the Board at (609) 292-1554 at least one (1) day prior to the Meeting date so that appropriate arrangements can be made.

Integrated Clean Capacity Market

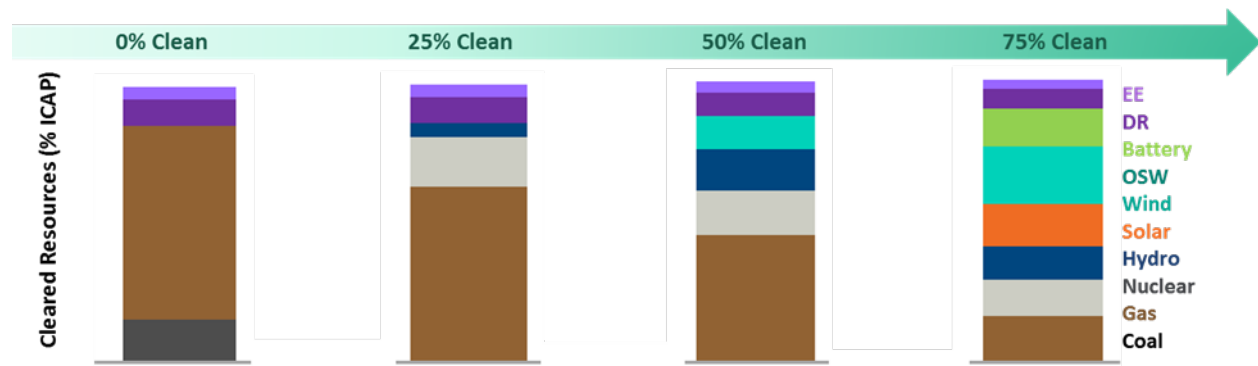
A Competitive Market for Powering the Clean Electricity Future

This whitepaper, prepared by the New Jersey Board of Public Utilities Staff (“Staff”) and consultants at The Brattle Group (“Brattle”), presents for public discussion a new resource adequacy concept centered on achievement of state clean energy requirements and locational reliability needs through a single integrated market, paving the way for a smooth, cost-effective transition to the clean energy grid of the future.

The Integrated Clean Capacity Market (“ICCM”) uses market principles to select a combination of clean and emitting resources based on participating states’ demand for zero-carbon generation that meets their policy needs while maintaining resource adequacy. The ICCM selects these resources at the lowest combined cost within a highly competitive forward framework.¹ The market design set forth for public discussion in this whitepaper could be adopted by a single state, a coalition of states, or could potentially serve as the basis for updating the existing PJM Interconnection, LLC (“PJM”) Reliability Pricing Model (“RPM”) construct. The ICCM is designed to replace PJM’s existing capacity market. Generation resources would continue to participate in existing wholesale energy markets as they do today.

The flexible framework of the ICCM accommodates both states with modest initial clean energy goals as well as those that seek to quickly ramp up clean energy procurement to meet large-scale policy goals. The ICCM accommodates existing state policies as well as serving as a robustly scalable option for least-cost achievement of future goals. States with aggressive decarbonization targets can use this market to move the grid forward, as illustrated in Figure 1, which simulates the clean energy pathway that could be achieved across the RTO by the ICCM. The clean energy goals of some states would be supported without imposing any costs on other states with differing policy priorities. The ICCM will position our market as the regional, national, and global leader on how to rapidly and reliably decarbonize the grid at the lowest possible cost.

FIGURE 1. ILLUSTRATION OF THE CLEAN ENERGY TRANSITION ENABLED BY THE ICCM



Notes: Simplified simulation illustrating ICCM procurement outcomes with the same hypothetical supply curve under a range of clean energy demand scenarios in the clean energy transition. Contact authors for the underlying model used to create this numerical example.

¹ In vertically integrated or other Fixed Resource Requirement states, the resource mix would be approved by the state.

What are the primary design features?

The ICCM design ensures the market is financeable, highly competitive, and harmonized with wholesale and retail markets. Some of its most important features are:

- The potential to scale from the state level to a **broad regional market** that will use competitive pricing to minimize cost of satisfying state policy requirements by coordinating clean electricity buyers and sellers across the PJM footprint to maintain reliability, onboard new clean energy, and phase out emitting plants through all stages of the clean energy transition, while ensuring that resources needed for reliability continue to receive adequate compensation.
- A **technology-inclusive approach** that is designed to encourage competition across all clean resources, attract innovative solutions, and drive down the cost of renewables, demand response, storage, and other clean energy technologies.
- **Elimination of the costly Minimum Offer Price Rule (“MOPR”)** provisions, achieving tremendous cost advantages on the path to deep decarbonization.
- A highly **competitive auction format** that ensures the very best price for consumers and offers all capacity resources access to compensatory prices in a **competitive and predictable market**.
- Financial incentives for clean energy resources that account for their **contribution to resource adequacy** as well as their production of megawatt-hours of clean energy.
- A **buyer-pays model** that allows individual states to determine their own pace of decarbonization and their willingness to pay for clean energy, allocating the incremental cost of the clean energy policies exclusively to the state that sets the policy goals.
- Voluntary participation in which states **have no obligation to purchase clean energy** in the ICCM. States may opt out of ICCM-based clean energy procurement because they are fully integrated, because they do not have clean electricity mandates, or because they meet their policy goals outside of the ICCM framework (i.e. through existing state-level clean energy procurements).
- Price-stabilizing mechanisms, including a multi-year price commitment for new clean energy supply to **ensure that investors can access low-cost financing**.
- **Demand curves for capacity, clean energy, and technology-specific carve outs** that will offer enhanced price stability and financeability for sellers and empower states to impose appropriate budget controls by including a price cap on payments for capacity and clean electricity.
- Opportunities for each state to adopt a sloped clean energy **“demand curve” that could accelerate decarbonization** relative to their procurement goal if prices are low. For example, suppose the expected clean energy price is \$20/MWh, with a clean energy target of 70% by 2025. If innovation and competition in the market lower clean energy prices to \$10/MWh, the auction will immediately accelerate decarbonization to 85% total clean energy by 2025, and at a lower total program budget.
- Voluntary participation allowing **corporate sustainability buyers, retailers, cities, and others to place voluntary clean energy demand bids**, providing easy access to the competitive marketplace and affordable prices, while **promoting overachievement of state clean energy goals**.

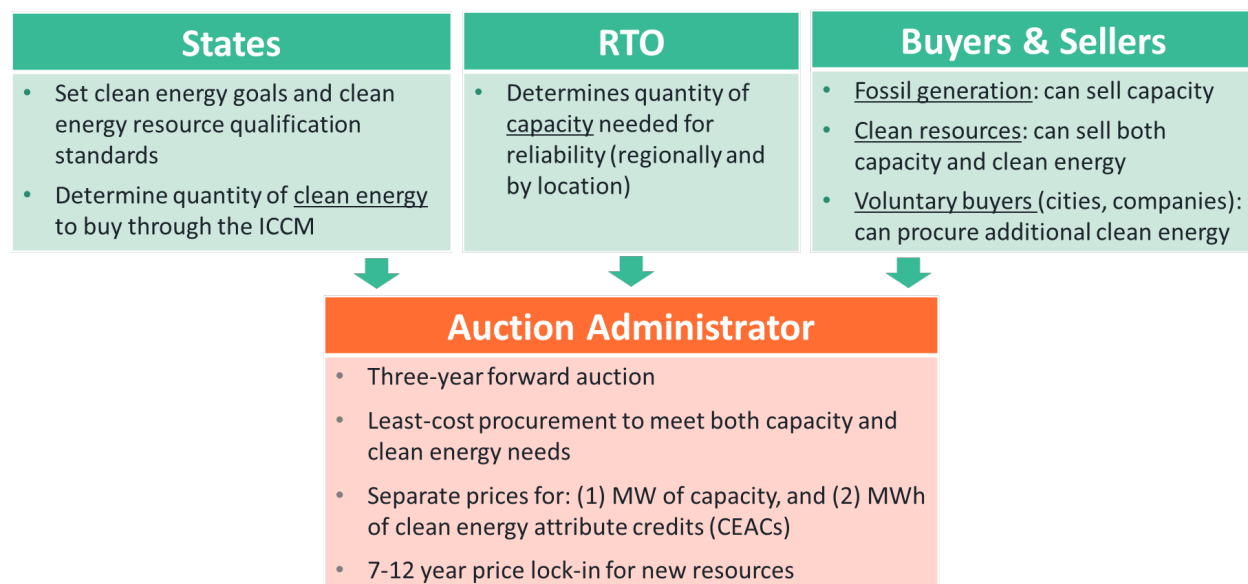
The ICCM would place states and customers in control of driving the clean energy future while unlocking the private sector’s potential to invest at large scale in decarbonizing the grid through a reliable and orderly transition. The diversity of state clean energy policies, integrated planning activities, and bilateral

arrangements would be fully accommodated within the ICCM, offering states and companies the opportunity to utilize market-based purchases of incremental clean energy to accelerate decarbonization.

How would the market work?

The ICCM is a market for capacity and clean energy built on two simple premises. *First*, a successful resource adequacy construct should produce a resource mix that ensures system reliability and meets state goals in both vertically integrated and restructured states. *Second*, a highly competitive, technology-inclusive clean energy market that incorporates locational reliability constraints will provide the most efficient path to guide the resource mix toward 100% clean energy. The ICCM is built upon a centralized, three-year forward auction to meet regional capacity and clean energy needs, as summarized in Figure 2.

FIGURE 2. THREE-YEAR FORWARD ICCM AUCTION FOR CAPACITY AND CLEAN ENERGY NEEDS



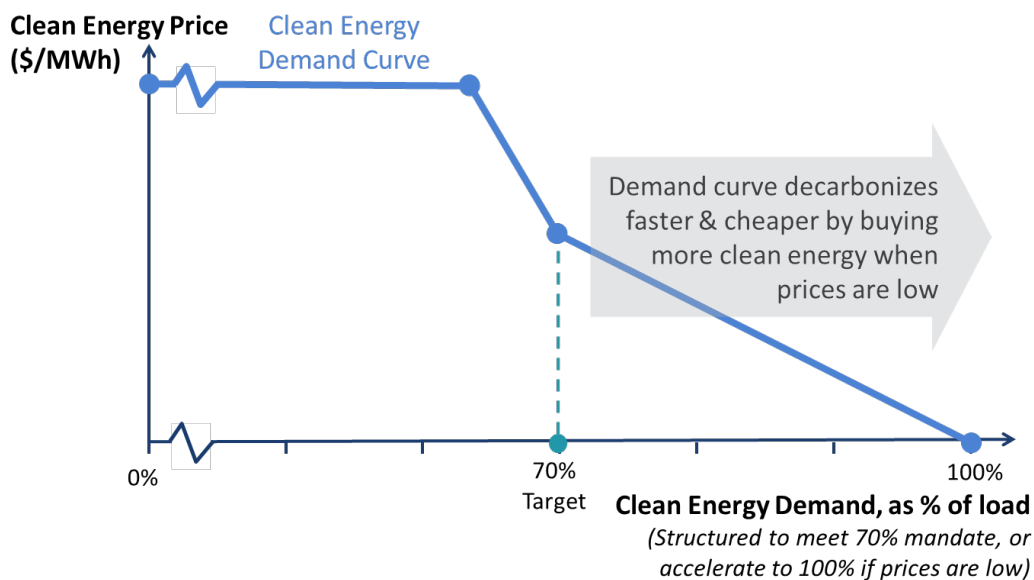
State Participation as Clean Energy Buyers: A central tenet of the ICCM is that states will set their own policy goals. Each state will determine whether to adopt clean energy mandates, the scale of these mandates, which resources are eligible, applicable budget caps, and whether to procure clean energy via the ICCM or via other mechanisms. The ICCM will be tailored to each state’s unique policies, while enabling participating states to tap into the competitive benefits of a broad regional marketplace for clean energy. States participating in the ICCM would specify:

- Clean Energy Procurement Volume: The state (via a state agency or the auction administrator) will translate their clean energy mandates into a volume of total clean energy to be achieved. States will have flexibility to procure a small or large portion of their clean energy needs through the ICCM.
- Eligibility and Product Definition: The state will specify supply eligibility. States that wish to align strictly to existing statutes and state programs will maintain current eligibility standards under their own state-defined renewable energy credit (“REC”) or zero-emission credit (“ZEC”) qualification rules, including maintaining distinctions among multiple classes of RECs. States with the most technology-inclusive approach can purchase clean energy via a newly-defined product the clean energy attribute credit (“CEAC”) that all clean energy resources in the PJM footprint would be

eligible to produce.² In all cases, buyers in the ICCM structure purchase the unbundled clean energy attribute. One REC, ZEC, or CEAC represents one MWh of electricity production from a non-carbon-emitting resource. A more advanced version of the ICCM may scale the value of each CEAC based on the level of carbon reduction achieved by each resource.

- **Clean Energy Demand Curve Parameters:** Each state will dictate the percentage of its load that it wishes to purchase from clean resources. Additionally, the market allows states to voluntarily purchase more than its minimum clean energy targets if prices are advantageous. As illustrated in Figure 3, the ICCM incorporates a downward-sloping demand curve that would procure larger volumes of clean energy if prices are low, while ensuring that total procurement costs are below any applicable budget caps. States will have the option to submit their own state-developed demand curve or to have the auction administrator translate existing policy goals into a demand curve on the state’s behalf.³
- **Carve Outs:** If a state wishes to use the ICCM to meet a technology-specific RPS carve out, such as for in-state solar, the ICCM can be used to procure a minimum volume of clean energy through a separate class of state-defined RECs.
- **Procurements Outside of ICCM:** States may elect to procure clean energy outside the ICCM to offset their ICCM-based clean energy purchases on a MWh-for-MWh basis. For example, if a state had an existing contract or procurement program, those resources would be fully credited toward the state’s demand for clean energy (as well as toward its capacity needs).

FIGURE 3. STATE “DEMAND CURVE” FOR CLEAN ENERGY



Voluntary Buyers of Clean Energy: In addition to state demand for clean energy, there are many other entities that may wish to participate within the ICCM as voluntary buyers of clean energy. Such entities could include cities, competitive retailers, corporate sustainability buyers, public power entities, or integrated utilities. Such voluntary buyers may operate within states with no clean energy mandates, or

² Most renewable energy resources such as wind and solar will qualify to serve all states’ clean energy goals, spurring the competitive benefits of a broad regional marketplace for these clean energy resources. Some resource types such as particular nuclear plants may be eligible to sell their clean attributes to only their home state.

³ States would have a choice to determine whether the qualification criteria of CEAC-qualified resources is sufficient to meet existing state standards, or whether they will procure RECs as defined and qualified under current state programs.

may wish to exceed any applicable state mandates. These buyers would be able to submit voluntary demand bids for clean energy attribute (and specify a maximum price they are willing to pay).

Role of the RTO: As the RTO, PJM would continue to establish the quantity of capacity needed regionally and by location to maintain system reliability consistent with the 1-event-in-10-years (“1-in-10”) reliability standard.

Seller Participation: Qualified resources, both clean and emitting, identify a total revenue requirement associated with providing capacity and/or clean energy in the relevant delivery year. The maximum allowable offer quantity of both capacity and clean energy for any given resource is determined ahead of the auction.

- *Clean resources* are eligible to sell both capacity and clean energy.⁴ These resources will offer one price and two quantities (i.e. they will specify a total payment they need to earn in order to deliver their total qualified volumes of capacity and clean energy).
- *Emitting resources* are only eligible to sell capacity.

Role of the Auction Administrator: The auction administrator will conduct a three-year forward auction to determine the lowest-cost mix of clean and emitting resources necessary to meet: (i) the clean energy requirements expressed by each state; and (ii) the capacity needed to meet regional and locational reliability needs.

- The auction administrator will utilize a co-optimized single auction to meet all capacity and clean energy needs at the lowest combined procurement cost. The auction will continuously adjust the selection of cleared resources until the most advantageous portfolio of resources in the system is identified (see appendix for more detail). The auction will produce two simultaneous “clearing prices,” one for clean energy (priced in \$/CEAC, \$/REC, or \$/ZEC as applicable for a given state) and one for traditional capacity service (priced in \$/MW-day as applicable for each location).
- By co-optimizing the two products within a single auction, consumers would benefit from identifying the lowest-cost, fully reliable system that meets the share of clean energy required by state policies while having the necessary resources to contribute to capacity needs.
- Because sellers identify the amount of capacity and clean energy they have to sell separately, clean resources benefit from having two sources of revenue that adjust to the efficient level as part of the simultaneous clearing process.
- The price signals that result from the single auction will demonstrate the need for reliable, clean energy, by location, depending on the appetite of a state or buyer for clean energy.

Who would run the market?

The new ICCM would be implemented under a new governance model that maintains appropriate state authority to establish clean energy policy for their own constituents. The ICCM could be administered by PJM under a reformed governance structure or by a separately established auction administrator. Rulemaking processes under the ICCM must offer greater voice to states, customers, clean energy companies, and disruptive new entrants.

⁴ Rules governing emitting resources using carbon capture and sequestration will have to be developed if the technology becomes commercially available in the PJM regions. Further discussion would be required to establish eligibility rules that might award clean energy credits in proportion to the emissions sequestered.

To achieve this outcome, interested PJM states could proceed with a collaborative engagement to design and implement the ICCM within a timeframe of approximately three years. Federal-state jurisdictional issues could be resolved in one of several ways. The ICCM governance structure could be entirely separate from the current PJM markets or could work within the PJM system, so long as it maintains an appropriate state role over critical ICCM design components and supports ongoing design evolution under a balanced governance model.⁵ For example, PJM could adopt the ICCM reforms into its Tariff in a way that ensures an appropriate state role. Alternatively, one or more interested states could elect a Fixed Resource Requirement and utilize the ICCM to select their resource mix, consistent with FERC and PJM rules. Such a process would require an auction administrator for the ICCM. PJM itself could potentially serve as this auction administrator, creating a new corporate entity that could implement and administer the ICCM under the necessary governing documents and market rules. If interested states determine that PJM is unable or unwilling to administer this type of program, this proposal envisions that states will identify or create a third-party entity to implement the ICCM.

What are the benefits?

Implementing the ICCM would position the PJM region as the national and global leader in adopting a market-based approach for accelerating decarbonization while maintaining reliability and affordability. Key benefits of the ICCM include that it would:

- Provide future commitments and price certainty that can attract the scale of capital investments required to achieve states' clean energy policy goals;
- Reduce costs to consumers by eliminating the MOPR, facilitating the orderly retirement of fossil resources, and harnessing competition across all carbon-free energy resources and technologies;
- Incentivize developers to site clean energy where it can provide maximum reliability benefit.
- As clean energy goals increase, provide price signals (that do not exist today) illustrating the demand for resources that can provide both clean energy and reliability.
- Offer a broad, regional scope for sourcing the least-cost capacity and clean energy resources;
- Drive accelerated decarbonization when costs are low;
- Maintain reliability at all stages of decarbonization, reducing the reliance on fossil plants and increasing reliance on clean resources over time; and
- Promote technological advances by rewarding suppliers that offer innovative, low-cost solutions.

The ICCM will enable states, customers, and clean energy companies across the PJM region to accelerate the transition to a reliable, affordable, and carbon-free electricity grid.

⁵ The current PJM markets do not offer states meaningful opportunities to support and advance their decarbonization policies. Market evolution has lagged state policy and in some cases actively interfered with states' ability to drive the clean energy transition. These shortcomings are in part an artifact of the flawed PJM governance structure that offers inappropriately large opportunities for incumbent generators and their transmission owner affiliates to influence market rules.

Appendix: Straw Proposal Design Detail

The ICCM is a state or regional market design for attracting and retaining the least-cost set of resources for maintaining grid reliability, achieving state electricity goals, accelerating clean energy adoption, empowering customers, and unlocking innovative new technologies. The ICCM builds on best practice by using a centralized competitive auction to meet capacity and clean energy needs through competitive merchant investments.⁶ Supply resources continue to participate in the energy markets and earn energy market revenues as they do today. This ensures that the resource adequacy market achieves a resource mix that is both reliable and consistent with participating states' decarbonization goals and public policies.

The ICCM clearing engine starts with the assumption that the market will procure enough clean energy (denominated as regionally-defined CEACs, state-defined RECs, or state-defined ZECs) to meet each participating state's clean energy requirements. The total clean energy accounted for will include resources selected through the ICCM as well as those procured outside the ICCM and offsetting each state's clean energy requirements.⁷ Because the ICCM procures the specified percentage of clean energy in a competitive fashion, there is no longer any need for a MOPR; all clean energy resources are eligible to clear the ICCM auction without mitigation. The ICCM auction clearing engine determines the lowest-cost suite of clean and emitting generation resources to procure the specified volume of clean energy, account for state policy procurements outside of ICCM, *and* commit enough capacity to satisfy all regional and local reliability constraints. The ICCM thus simultaneously procures two distinct products (capacity and clean energy) at the lowest combined cost, while accommodating state policy.

Resources will offer qualified quantities of both capacity MW and clean energy MWhs, up to a maximum determined under eligibility rules. Capacity and clean energy will clear at two different prices (denominated in \$/MW-day of unforced capacity ("UCAP") for capacity and in \$/CEAC, \$/REC, or \$/ZEC for each MWh of clean energy). Cleared capacity and clean energy products will be committed for delivery in the specified ICCM delivery year, which is three years after the auction is conducted. ***Because the ICCM integrates clean energy and locational capacity requirements into a single auction, it could entirely replace the existing RPM structure, while also advancing decarbonization at a regional scale.***

AUCTION FORMAT, RESOURCE CLEARING, AND PRICE SETTING

The ICCM auction format and clearing procedures derive from best practices in resource adequacy market design while incorporating certain new design concepts to ensure that clean energy needs are procured alongside capacity. The approach used to procure this least-cost, clean resource mix includes:

- **Three-Year Forward Auction:** The auction administrator would conduct an auction for each year to procure enough capacity and clean energy to meet system needs three years later. For example, the auction conducted in 2025 would procure capacity and clean energy for delivery in 2028.

⁶ Many design details of the resource adequacy market will be derived from the current practice of PJM RPM capacity market; many design details of the clean energy product procurement will be derived from the Forward Clean Energy Market ("FCEM") design proposal described in the appendix of: Spees, *et al.*, [How States, Cities, and Customers Can Harness Competitive Markets to Meet Ambitious Carbon Goals: Through a Forward Market for Clean Energy Attributes](#), September 2019.

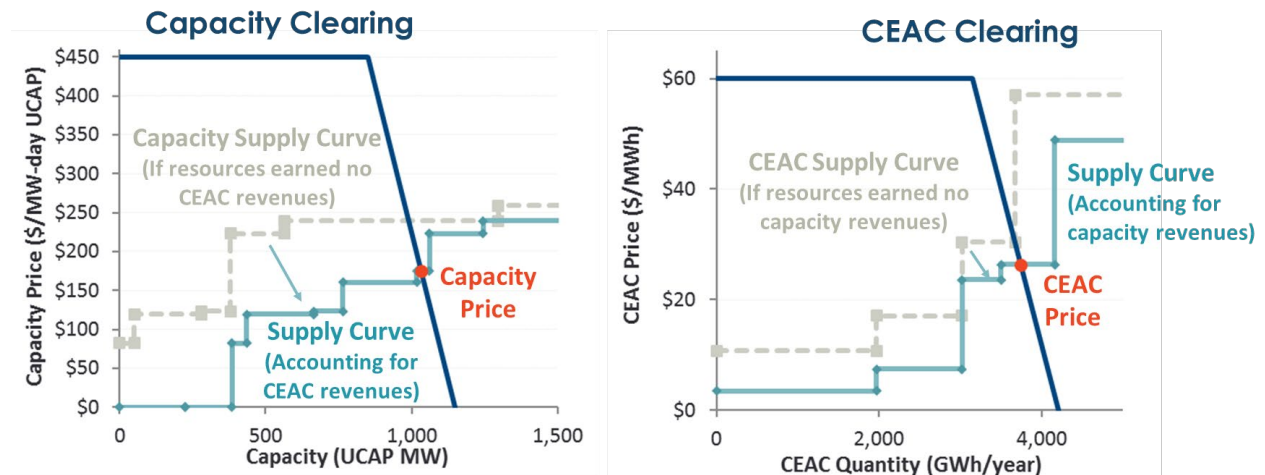
⁷ Resources procured outside of ICCM could include (but is not limited to): resources procured under state solicitations, resources approved under state planning, or resources developed under incentives programs that the state wishes to maintain outside the ICCM construct. States could choose to maintain any and all such existing programs (which would reduce the volumes procured via ICCM), or could utilize the ICCM to meet their entire clean energy demand.

- **Single-Round, Uniform Price:** The auction format would be a single-round auction that would produce a separate, uniform clearing price for each clean energy and capacity products (i.e., single clearing price for each distinct product).
- **Optimized Clearing:** The auction would clear using a surplus-maximizing optimization formulation. This would maximize the value of cleared capacity and clean energy to states and customers, minus the cost of procured resources. This optimal resource mix is identified by continuously adjusting the set of cleared resources; determining the relevant clearing price for each product as consistent with the total volume cleared on the capacity and clean energy demand curves; assessing which resources would wish to clear (or not to clear) consistent with those prices; and then readjusting the selection of cleared resources. This is comparable to today’s capacity market design.
- **Price-Setting Based on Marginal Value:** Prices for each product would be set based on marginal value (i.e., at the intersection of supply and demand). To the extent that locational transmission constraints apply, capacity prices may differ by locational deliverability area (“LDA”), just as in today’s capacity market. If a state wishes to meet a technology-specific carve out, such as for in-state solar, the ICCM will also support this through a separate class of RECs for the targeted resource type. The auction will include a constraint requiring the minimum share of RECs be procured from resources eligible to meet the technology-specific carve out. Any such state carve-out REC product may clear at higher prices than the more broadly-defined CEAC product. If states impose a separate (smaller) cap on ZEC volumes or program costs, this could produce a lower clearing price for ZECs delivered to their state.

Viewed from the customer’s perspective, this auction format seeks to identify the lowest-cost portfolio of resources to meet capacity and clean energy needs by continuously adjusting resource selection until the lowest possible total procurement cost is achieved. Viewed from the seller’s perspective, the same auction format seeks to clear any resource that can earn its total revenue requirement from some combination of clean energy and capacity payments; the auction would exclude any resource that cannot earn sufficient revenue to cover its offer price. Overall, the outcome from the auction maximizes social value by identifying the least-cost solution for customers and ensuring that sellers’ private incentives align with auction outcomes (i.e., profitable projects clear while unprofitable projects do not).

Figure 4 illustrates auction clearing and price setting in a simplified example. The curves illustrate the capacity demand curve developed by the auction administrator (on the left) and the clean energy demand curve developed by each state or voluntary commercial buyer, as described further below (on the right). Sellers offer their resources at their minimum revenue requirement. The gray dashed supply curves are drawn as if the seller would need to earn the entire revenue requirement from just one product. The lower aqua supply curves account for clean energy revenues driving a lower capacity supply curve (and vice versa, with capacity revenues driving a lower clean energy supply curve).

FIGURE 4. CO-OPTIMIZED PRICE FORMATION REFLECTING THE MARGINAL COST OF EACH PRODUCT



Notes: Simplified simulation illustrating ICCM procurement outcomes in a simplified example, contact authors for the underlying model used to create this numerical example.

This simplified example illustrates that by optimizing the procurement across both products, prices and customer costs can be reduced. If the auction were designed to narrowly focus on capacity procurement (as the RPM market does today), it would likely procure capacity primarily from fossil plants and attract investments in new gas combined-cycle resources. This outcome runs counter to policy goals in many states by expanding the reliance on fossil resources even for states that wish to decarbonize. States would then need to conduct separate solicitations for clean energy resources, inducing an excess of total capacity in the market and leaving customers to pay for duplicate resources. This double-payment problem is amplified by the MOPR construct that will increasingly exclude clean energy resources from the capacity market, however some of the inefficiencies and customer costs associated with a sub-optimal resource mix would persist in the RPM even without MOPR.

A joint auction resolves these inconsistencies in ways that will drive the resource mix toward an efficient balance of firm capacity needed for reliability and bulk clean energy resources needed to decarbonize the grid. As illustrated in Figure 4 above, the price paid for capacity will go down as clean resources earn a portion of their revenue requirements from the CEAC product. CEAC payment prices will also go down as clean resources earn a portion of their revenues from selling capacity. These customer savings do not occur by accident, but rather by utilizing competitive forces to drive the right quantity and the right mix of supply to meet all system needs.

HOW STATES CAN PARTICIPATE IN THE ICCM

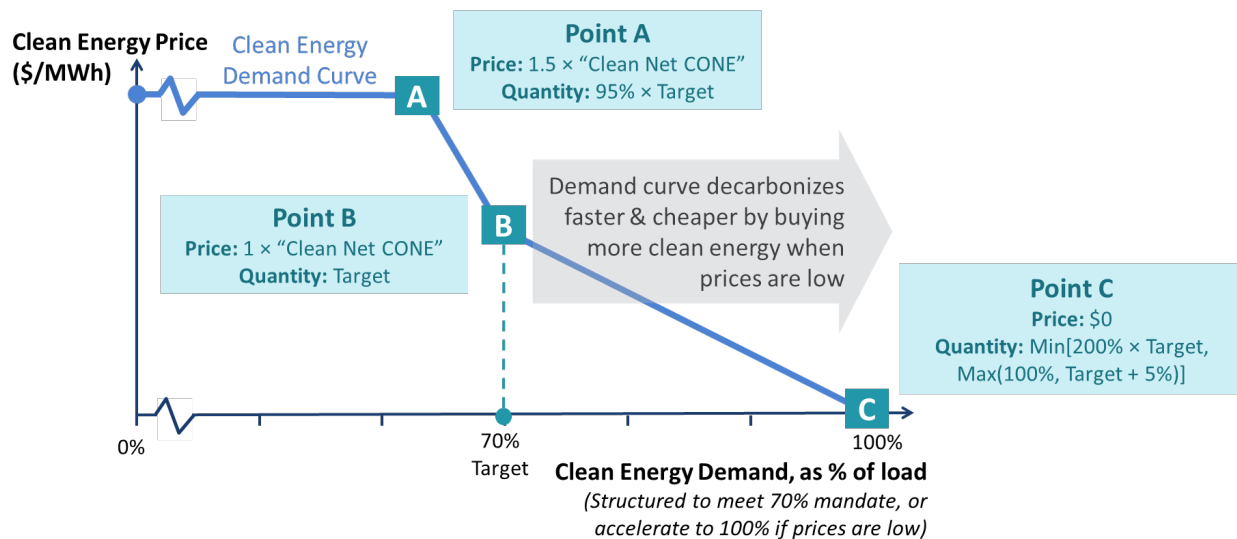
State participation in the ICCM is voluntary.⁸ States wishing to procure clean energy through the ICCM can determine the volume of clean energy they wish to procure and the prices they are willing to pay. In the alternative, a state may direct the auction administrator to translate existing state policy goals that the state wishes to procure competitively through the ICCM, into these price and quantity values consistent with state law. Each state would retain the flexibility to tailor the structure of their demand bids consistent with state policy objectives.

⁸ Corporate buyers seeking to acquire clean energy could also develop a demand curve to express their increased willingness to pay for clean energy, including selecting new resources or purchasing only from their preferred state-specified REC products. Other ways of enabling and supporting private demand for clean energy would be evaluated on an ongoing basis.

INTEGRATED CLEAN CAPACITY MARKET

States would have the option to use a downward-sloping demand curve to express their willingness to pay for clean energy, as illustrated in Figure 5.⁹ There are a number of benefits to using a sloped demand curve. A sloping curve mitigates year-to-year price volatility as market conditions fluctuate and mitigates potential exercise of market power. These beneficial price formation properties can stabilize pricing in a way that helps to support the financing of new resources when needed. A sloping curve can also help balance program costs against the pace of decarbonization to achieve faster carbon abatement if this can be done at reasonable costs to the consumer.

FIGURE 5. ILLUSTRATIVE DEMAND CURVE FOR A STATE WITH A 70% CLEAN ENERGY TARGET



For the purposes of this proposal, a draft state design curve could be defined by three price and quantity points that would be updated each year using a formula that reflects each state’s willingness to pay to achieve carbon abatement, as illustrated in Figure 5:

- **Point B:** The curve is anchored at “Point B,” which is the procurement target at a price equal to the Clean Resource Net Cost of New Entry (“Clean Net CONE”), calculated as the estimated CEAC price that would be needed to attract new clean energy resources into the PJM region (i.e., the net of anticipated energy, ancillary service, and capacity payments).¹⁰
- **Point C:** To the right of the anchor point, the demand curve slopes downward and reaches “Point C” at a price of zero at either (i) double the procurement target if clean energy targets are below 50% of electricity load; (ii) at 100% of forecasted electricity demand if the clean energy target is between 50 and 95%; or (iii) at the target plus 5% for clean energy targets exceeding 95%. This low-priced portion of the demand curve enables the state to pursue an accelerated pace of decarbonization if it is possible to do so at low cost.
- **Point A:** To the left of the anchor point, the curve slopes up to the price cap at “Point A”. The price is capped at 1.5 times Clean Net CONE, at a quantity 5% less than the target. States would have the flexibility to adjust the price and quantity at Point A in order to only procure CEACs below a threshold price cap or program budget cap. This higher-priced portion of the demand curve allows the pace of decarbonization to moderate slightly if CEACs are only available at high prices (e.g., in case there is a period with high commodity prices or tight financial market conditions). During such a time, a state may wish to take a somewhat moderated pace as a cost mitigation decision.

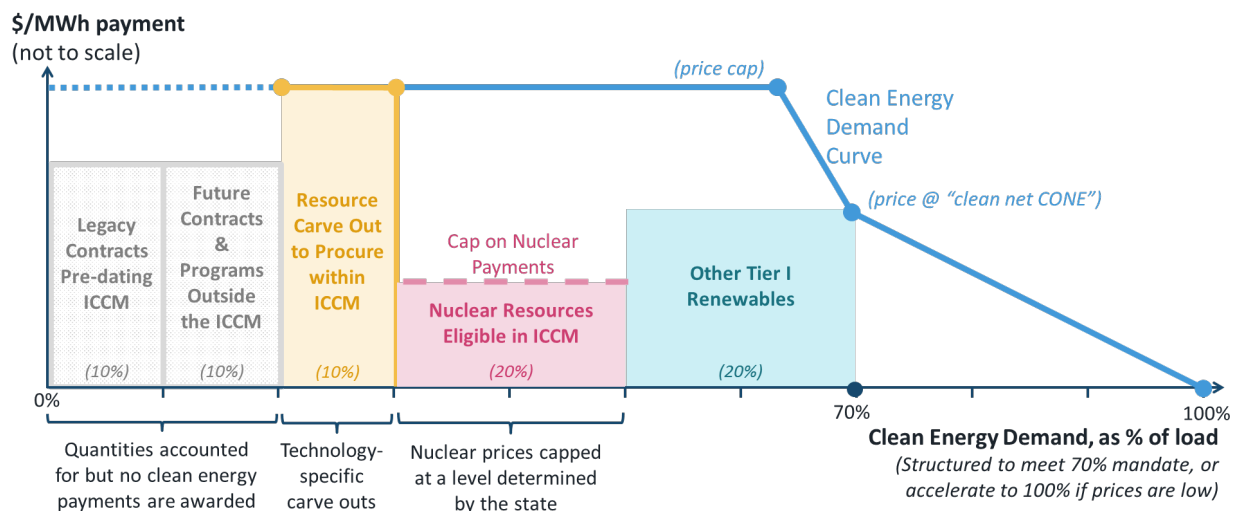
⁹ See additional discussion of concepts for developing a state demand curve for clean energy in Appendix B.1-B.2 [here](#).

¹⁰ This proposal envisions Clean Net CONE being determined through a periodic expert review in accordance with the ICCM governance structure.

These price and quantity points are a reasonable starting point for states that wish to use a demand curve approach, though the specific formula for each point should be adjusted to match the state’s policy priorities. If a state prioritizes to never fall short of the target, “Point A” should be right-shifted so that the sloping part of the demand curve can start at the target. If total cost is the main concern, the price at the cap can be lower than in the figure. If the state wishes to maximize the pace of decarbonization, the foot of the curve can extend to 105% of load even if the target begins at a low level. As long as the curve passes through the target quantity at a price near or above Clean Net CONE, the curve will help meet the clean energy objectives while appropriately balancing costs, mitigating price volatility, and supporting a sustainable marketplace.

Within the total clean energy procurement target, many states will also have a variety of state programs or procurements that need to be accommodated. These state programs would be reflected as a part of a state’s total demand for clean energy, but would not be competitively procured through ICCM. As an example, Figure 6 illustrates the demand of a “typical” state with multiple policies including ZEC payments for existing nuclear resources and a renewable portfolio standard with technology-specific goals. The ICCM can be used to meet the overall state policy goals while accounting for existing contracts and future clean energy procurements that may occur outside the ICCM.

FIGURE 6. CLEAN ENERGY DEMAND IN ICCM FOR A STATE WITH MULTIPLE CLEAN ENERGY POLICIES



To meet these particular goals, the state demand would be reflected as:

- **Overall Clean Energy Demand Curve** (blue line): The state would translate its total appetite for clean energy into a state-specific demand curve. In this example, the total state demand for clean energy is 50% renewables, plus 20% under the ZEC program (70% total clean energy mandate). This total demand for clean energy is expressed by the total state demand curve (blue line, identical to the demand curve illustrated in Figure 5 above). The specific price and quantity parameters of the curve could be pre-approved by each state’s policymakers and adjusted over time.
- **Legacy Contracts and Procurements Outside of ICCM** (gray boxes): States would maintain total flexibility to continue using existing or future programs other than the ICCM at their own discretion. In this example, the state anticipates meeting 10% of its clean energy mandate through legacy contracts. It further anticipates meeting an additional 10% of its clean energy needs through future programs or procurements outside the ICCM construct (for example, through a specific state-sponsored resource investment). The volumes of clean energy of any contracts signed outside of ICCM would be accounted for in auction clearing (but the resources would not earn any CEAC

payments). These clean energy resources would be fully enabled to sell capacity into the ICCM with no MOPR. After contract expiration, these resources would become eligible to participate in ICCM as existing resources eligible to earn both capacity and clean energy payments.

- **Technology-Specific Carve Outs within ICCM** (yellow box): Some states may have technology-specific mandates such as for in-state solar or offshore wind within their clean energy standards. The states may elect to achieve these minimum procurements within the ICCM by specifying a minimum share of the total demand that must be met by resources qualified under the particular technology type. The minimum demand curve for these technologies may have a different price cap and new resource lock-in period than the generalized clean energy demand curve and may produce higher (but not lower) clearing prices for these preferred technology types.¹¹
- **Nuclear Resources** (pink box): Each state would determine the extent to which nuclear resources would be eligible to contribute to their clean energy goals, including whether only in-state nuclear resources could qualify or whether out-of-state nuclear resources could also qualify. States can impose a \$/ZEC cap on payments awarded to nuclear supply and/or on volumes of nuclear supply eligible to serve their total clean energy demand. This structure introduces downside price competition for nuclear resources from other sources of clean energy supply, but can prevent payments in excess of nuclear program budgets.

Together, these structures will offer each participating state total flexibility to meet none, some, or all of their clean energy needs within the ICCM.¹² While procuring all of the state's clean energy objectives through the ICCM would result in the lowest-cost path to decarbonization, each state still maintains the ability to procure clean capacity outside the market or voluntarily pay a premium for resources that they see as necessary to achieve their public policies. To maximize the competitive benefits of the ICCM over time, participating states can collaborate on opportunities to increase the quantities procured, reduce the volume of resource carve outs, and increase alignment of resource qualification across states.

HOW RELIABILITY IS MAINTAINED WITHIN THE ICCM

PJM Interconnection will continue to set reliability standards both system-wide and by LDA. However, the auction administrator (whether PJM or another entity) would take on responsibility for ensuring that sufficient capacity is procured to meet these standards. PJM will have the following responsibilities associated with its mandate of maintaining the 1-in-10 reliability standard:

- Determining the Reliability Requirement or UCAP MW quantity of supply needed system-wide and within each LDA in order to maintain reliability;
- Determining the UCAP MW ratings of each eligible supply resource including both fossil and clean energy resources, developed in a technology-neutral fashion such that 1 UCAP MW of capacity has the same reliability value regardless of the underlying technology type;
- Determining which LDAs must be separately considered for reliability purposes and calculating the Capacity Emergency Transfer Limit ("CETL") of supply that could be imported into each LDA; and

¹¹ See Appendix H.3 [here](#) for additional discussion of auction clearing with technology-specific carve outs.

¹² As an additional element of flexibility to states concerned about the deliverability of clean energy within their subregion of the grid, the ICCM could be utilized to impose a maximum constraint on the quantity of capacity that could be procured from fossil resources. This constraint would ensure that the remainder of state system and local capacity needs will be supplied by clean energy resources, including non-CEAC-eligible resources such as demand response and storage.

INTEGRATED CLEAN CAPACITY MARKET

- Enhancing current reliability accounting practices to align with the region’s clean energy transition, including considering: (a) more accurate accounting of resources’ reliability value and ensuring full participation of emerging clean energy technologies; (b) separate summer and winter reliability requirements; and (c) flexible capacity requirements.

The auction administrator will take these reliability parameters as inputs into the ICCM. The auction administrator will translate capacity needs into system-wide and locational demand curves for capacity, and will ensure that CETL and other reliability constraints are appropriately reflected within ICCM auction clearing. Based on this foundation of accurate supply and demand accounting, the ICCM will be able to ensure reliability by procuring sufficient UCAP MW to meet all system and locational reliability needs.

HOW SUPPLY RESOURCES PARTICIPATE IN THE ICCM

Participating resources, both clean and emitting, participate in the ICCM by identifying their annual revenue requirement (i.e., their offer prices) for delivering capacity and clean energy in the targeted delivery year (three years in the future). Offer prices for new resources will likely reflect total resource costs minus net energy and ancillary service market revenues. For traditional resources, the offer price is the total payment needed to deliver their qualified quantity of unforced capacity (in UCAP MW, comparable to today’s capacity market). In the case of clean resources, the sell offer will also include the number of clean energy MWh (denominated as CEACs, RECs, or ZECs) the clean resource is expected to produce during the delivery year. New clean suppliers would have the option of selecting a 7-12 year price lock-in on clean energy payments to promote efficient financing.¹³

A clean energy supply resource would be eligible to sell capacity, CEACs, or both products into the ICCM. Examples of bids would include:¹⁴

- **A new 100 MW (nameplate) onshore windfarm**, with a \$76/kW-year installed capacity (“ICAP”) revenue requirement and a 30% annual capacity factor would expect to produce 262,800 MWh of clean electricity and 13 MW of unforced capacity. It would be eligible to sell 262,800 CEACs and 13 MW UCAP of capacity.
- **A new 100 MW (nameplate) solar facility**, with a \$61/kW-year ICAP revenue requirement and a 15% annual capacity factor would expect to produce 131,400 MWh of clean electricity and 42 MW of unforced capacity. It would be eligible to sell 131,400 CEACs and 42 UCAP MW of capacity.
- **A new 100 MW (nameplate) gas-fired peaking resource**, with an \$82/kW-year ICAP revenue requirement, would expect to produce 0 MWh of clean electricity and 95 MW of unforced capacity. It would be eligible to sell 0 CEACs and 95 UCAP MW of capacity.

Each supply resource would select one of three different offer types, representing their offer of committed production in the delivery year, three years in the future:

- **Capacity-Only Offers** (in units of \$/MW-day UCAP) would be submitted by fossil plants or demand response that can sell capacity but that cannot sell CEACs;
- **Bundled Capacity + Clean Energy Offers** (in units of total \$/year revenue requirement to deliver the independently-specified volumes of capacity and clean energy), which would be offered by

¹³ Resources that acquire a price lock would have their clean energy contributions automatically credited for the duration of the price lock (i.e., have their supply offered at zero in subsequent auctions during the price lock period).

¹⁴ The majority of the numbers in these examples are derived from PJM’s August 19th filing before the Federal Energy Regulatory Commission regarding MOPR levels for new resources.

clean energy resources that seek to earn this total revenue requirement but that are indifferent as to whether the revenues are earned from capacity or clean energy payments; or

- **Clean-Energy-Only Offers** (in units of \$/MWh of CEACs, RECs, or ZECs) would be offered by sellers that wish to market their clean energy sales independent of any capacity obligation. This offer type might be primarily relevant for clean energy resources that have failed to qualify for capacity sales, or market participants that hold excess volumes of unbundled CEACs that were procured bilaterally.

Each resource would compete to sell capacity and clean energy up to their maximum offered quantity. The auction clearing would account for each resource's eligibility to serve each LDA demand curve and fulfill each state's demand curve (as well as to meet any state resource carve outs that it is eligible to serve). Resources would clear to sell the highest-value products for which they are eligible and would be guaranteed to earn payments equal to or exceeding their offer price.

Once cleared in the forward auction, each supply resource would take on an obligation to deliver the cleared volume in the specified delivery year. Resources that produce excess volumes of clean energy attributes within the delivery year would be able to sell these excess volumes bilaterally, in a spot auction, or possibly bank the excess credits. Resources that produce an insufficient volume of clean energy relative to their commitment would be required to fulfill the obligation either through a bilateral purchase or a procurement within the final spot auction.¹⁵

¹⁵ See additional discussion of arrangements for discussion of delivery obligations in Appendix D [here](#).

DETAILED DESIGN STRAW PROPOSAL SUMMARY

The ICCM would procure two products: (1) capacity and (2) clean energy. Table 1 provides design details describing how capacity and clean energy needs would be defined and procured.

TABLE 1. ICCM DESIGN PROPOSAL DETAILS FOR CAPACITY AND CLEAN ENERGY NEEDS

	Capacity <i>Denominated in \$/MW-day UCAP</i>	Clean Energy <i>Denominated in \$/ CEAC, \$/REC, or \$/ZEC</i>
Who Sets Demand?	<ul style="list-style-type: none"> • PJM 	<ul style="list-style-type: none"> • State policymakers (who may delegate demand curve development to the auction administrator) • Voluntary buyers (retailers, companies)
Product Definition	<ul style="list-style-type: none"> • Unforced capacity (UCAP MW) • Keep locational specificity (as today) • Accurate accounting of capacity needs and values of resource types 	<ul style="list-style-type: none"> • Unbundled clean energy attributes • States can buy regionally-defined CEACs, or state-defined REC or ZEC products • <i>Consider</i>: CEAC accreditation tied to carbon abatement value
Supply Eligibility	<ul style="list-style-type: none"> • All clean and fossil resources are eligible • Effective load carrying capability (ELCC) accounting used to develop resource-neutral capacity values (by location, season, and flexibility) 	<ul style="list-style-type: none"> • CEACs: clean energy resources across PJM • RECs: state-defined eligibility, including for technology-specific classes of RECs to fulfill carve-out requirements • ZECs: Each state determines whether in-state and out-of-state nuclear qualifies • Each state can specify eligible technologies (but aim to limit cross-state differences to maximize competition)
Quantity to Procure	<ul style="list-style-type: none"> • Quantity needed to support 1-in-10 reliability standards • Based on advanced reliability modeling that considers resource characteristics and flexibility needs in the clean grid • <i>Consider</i>: State option to impose a maximum on the share of capacity procured from fossil plants 	<ul style="list-style-type: none"> • States and customers set demand quantity • Pre-existing contracts are fully accounted for as self-supply • In vertically integrated or other Fixed Resource Requirement states, the resource mix is approved by the state and not subject to ICCM
Willingness to Pay for each Product	<ul style="list-style-type: none"> • Sloping demand curves for each system-wide and locational capacity requirement • <i>Consider</i>: Separate demand curves for summer/winter needs and “flexible” capacity needs 	<ul style="list-style-type: none"> • States submit sloping demand curves for total clean energy demand, and carve out requirements (if any) • Voluntary buyers can submit price-quantity pairs to exceed state mandates, for regional CEACs or state-defined RECs/ZECs