## UNITED STATES OF AMERICA BEFORE THE FEDERAL ENERGY REGULATORY COMMISSION

PJM Interconnection, L.L.C.	) )
PJM Interconnection, L.L.C.	) )
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Docket No. ER21-278-000 Docket No. EL19-100-000

(not consolidated)

#### COMMENTS AND MOTIONS OF THE INDEPENDENT MARKET MONITOR FOR PJM

Pursuant to Rule 211 of the Commission's Rules and Regulations,<sup>1</sup> Monitoring Analytics, LLC, acting in its capacity as the Independent Market Monitor ("Market Monitor") for PJM Interconnection, L.L.C. ("PJM"),<sup>2</sup> submits these comments responding to the filing submitted by PJM Interconnection, L.L.C. ("PJM") on October 30, 2020 ("October 30<sup>th</sup> Filing"). The October 30<sup>th</sup> Filing proposes revisions to the PJM market rules to apply an Effective Load Carrying Capability ("ELCC") approach for determining the amount of capacity that variable (intermittent), limited duration (storage), and combination (hybrid) resources may provide. The October 30<sup>th</sup> Filing is intended in part to establish a different participation model for electric storage.<sup>3</sup> After consolidation with the RAA revisions

<sup>&</sup>lt;sup>1</sup> 18 CFR § 385.211 (2019).

<sup>&</sup>lt;sup>2</sup> Capitalized terms used herein and not otherwise defined have the meaning used in the PJM Open Access Transmission Tariff ("OATT"), the PJM Operating Agreement ("OA") or the PJM Reliability Assurance Agreement ("RAA").

<sup>&</sup>lt;sup>3</sup> This filing is intended to establish PJM market rules that comply with Order No. 841, which provides in the relevant part: "RTO/ISO market rules that limit the services that electric storage

proposed in Docket No. ER20-584, the scope of the proceeding has expanded to consider the basis of capacity MW determinations of additional resource types.

The ELCC approach proposed in the October 30<sup>th</sup> Filing is flawed and should be rejected. The flawed design reflects, in part, the haste with which it was created. The flaws include strong constraints on PJM's ability to take corrective actions in the future. The ELCC as proposed will be difficult to unwind and will lock PJM customers into overpaying for ELCC resources and lock out new and innovative technologies for as long as 19 years.<sup>4</sup> The proposal includes "the general principle that the floor values already issued for a specific resource generally would not be changed."<sup>5</sup> This period is effectively forever in the life of the PJM capacity market.<sup>6</sup>

Careful evaluation, well beyond what has been done to date, is required before it can be concluded that an ELCC approach would be a better way to define the reliability contributions of intermittent and storage resources. Any ELCC design must be built on

resources are technically capable of providing may create barriers to the participation of electric storage resources in the RTO/ISO markets." *Electric Storage Participation in Markets Operated by Regional Transmission Organizations and Independent System Operators*, Order No. 841, 162 FERC ¶ 61,127 at P 19 (2018), *order on reh'g*, Order No. 841-A, 167 FERC ¶ 61,154 (2019), *aff'd sub nom*. Nat'l Ass'n of Regul. Util. Comm'rs v. FERC, 964 F.3d 1177 (D.C. Cir. 2020) ("Order No. 841"). In the course of PJM compliance proceedings on Order No. 841, the Commission initiated an investigation of "the justness and reasonableness of PJM's methodologies to determine the capability of all types of Generation Capacity Resources." *PJM Interconnection, L.L.C.*, 171 FERC ¶ 61,015 (2020) ("April 10<sup>th</sup> Order"). The compliance proceedings concerning Order No. 841 were held in abeyance in order to provide PJM and stakeholders time to develop and implement proposed ELCC rules. April 10<sup>th</sup> Order at PP 34–35. The investigation continues in abeyance pending the outcome of this proceeding.

<sup>&</sup>lt;sup>4</sup> The RAA revisions call for a review of the ELCC floor rules by the end of 2026. By that point the 2029/2030 RPM BRA will be complete. Capacity values for new resources that cleared in the 2029/2030 RPM BRA will be subject to ELCC floors through the 2041/2042 Delivery Year.

<sup>&</sup>lt;sup>5</sup> October 30<sup>th</sup> Filing, Attachment (Redlines), proposed RAA Schedule 9.1 Sect. J(3)(f).

<sup>&</sup>lt;sup>6</sup> Language apparently intended to limit the absolute right to ELCC floors is also included but there is no question about whether ELCC values are locked in for a significant period. *See id.* 

basic economic principles including recognizing the role of marginal concepts, dynamic interaction effects among resource types and the way in which a capacity market would actually clear. In addition, a reasonable ELCC design would not shift risks to new entrants and customers from incumbents. Such risk shifting is inconsistent with equity, efficient markets and efficient incentives for technological innovation. For example, what would happen to the proposed ELCC paradigm if hydrogen storage becomes economic and the fixed ELCC values are dramatically inconsistent with economic reality?

PJM should implement the current rule that determines the potential capacity value of Electric Storage Resources ("ESR") based on the maximum output sustainable over a 10 hour continuous period. Such a requirement is consistent with the requirements of Order No. 841. There is no reason for further delay of the paper hearing established in Docket No. EL19-100 or for taking action on the RAA revisions proposed in Docket No. ER20-584.

The fundamental issue in the PJM market is how best to integrate intermittent renewable resources and storage resources and various combinations thereof in the capacity market and in particular how to evaluate the reliability contribution of such resources so that they can be compared to existing resources in a market for a defined and homogeneous capacity product. There are a variety of ways to do that. Currently, PJM discounts the capacity contribution of renewable resources based on analysis of the periods such resources do and do not generate power. PJM also proposed to use the maximum output that an energy storage resource could sustain over a 10 hour discharge period for determining the potential capacity of a storage resource in PJM's Capacity Market. ELCC is an approach, developed as a tool for resource planning by vertically integrated utilities in the 1960s, that could also be used.<sup>7</sup> But there is significant debate, even among proponents of ELCC, about what applying ELCC correctly actually means. For example, does it mean

<sup>&</sup>lt;sup>7</sup> Garver, L. L., "Effective Load Carrying Capability of Generating Units," IEEE Transactions on Power Apparatus and Systems, (Aug 1966).

that ELCC should be applied to all resources rather than just intermittent resources? It is clear that the discussion about what ELCC really means and how it should be done correctly never occurred fully in the PJM process. That is required. After that phase of analysis, which would require significant work, there are further and more detailed questions about what applying ELCC correctly means. If PJM prefers an ELCC approach, PJM should start a process to fairly and analytically address each part of the ELCC approach rather than rushing to implement an incomplete approach based on inadequate development and data.

It is clearly a difficult and complex task to implement ELCC correctly. It is easy to make fundamental mistakes. Implementing ELCC incorrectly will create significant issues and, based on PJM's plan to lock in the results of its early mistakes, will create errors that will significantly distort markets and impose costs and risks on new entrants and customers for a very long time.

The PJM approach is designed explicitly to shift risks from incumbent investors to new entrants. The PJM approach also shifts risks to customers. This is incompatible with the market paradigm under which the Commission regulates wholesale power markets. Intermittent and storage technologies are competitive and will continue to evolve in innovative and unexpected ways to become even more competitive. Creating a bias against new technologies is inconsistent with the stated goals of the Commission as well as rational market policy. The purpose of Order No. 841 is to eliminate such biases. The goal should be to ensure that intermittent and storage resources have full opportunities to participate in PJM markets. In the name of reducing risk to investors in existing technologies, the October 30<sup>th</sup> Filing fails to provide such opportunities to the new and innovative technologies that are already under development and those that we cannot yet imagine.

The process for rule development already favors incumbents over new entrants who do not participate in the arcane rituals of the stakeholder process. The October 30<sup>th</sup> Filing proposes to create an inefficient market design supported by incumbents who will benefit. The proposed design should be rejected and the current rules should be implemented. If PJM prefers to pursue an ELCC approach, PJM should be directed to develop an approach that provides incentives to innovation and that continues to place risk and reward on investors who are best equipped to bear it, rather than on customers.

#### I. BACKGROUND

Under the Commission's Rules, PJM "must have tariff provisions providing a participation model for electric storage resources."<sup>8</sup> Under the Commission rules, PJM should allow resources of all types to provide the energy and capacity that they are "technically capable of providing," participate in competitive price formation and operate in accordance with bidding parameters that reflect their operational characteristics. Order No. 841 required the proper integration of electric storage into the competitive markets. It did not require distortions of the competitive market design or the creation of discriminatory preferences, which would not have been consistent with regulation through competition under the Federal Power Act.

On December 3, 2018, PJM submitted two filings in compliance with Order No. 841, in Docket Nos. ER19-462-000 and ER19-469-000.

In the compliance filing in Docket No. ER19-462, PJM proposed changes.<sup>9</sup> By letter order issued February 1, 2019, the Commission approved the changes.

In the compliance filing in Docket No. ER19-469, PJM explained, with the implementation of certain changes to the PJM manuals and tariff revisions, its rules would provide and fully support an acceptable participation model.<sup>10</sup>

By order issued October 17, 2019 ("October 17<sup>th</sup> Order), the Commission largely accepted PJM's representations and proposed revisions in Docket No. ER19-469.<sup>11</sup> The

<sup>&</sup>lt;sup>8</sup> 18 CFR § 35.28(g)(9)(i).

<sup>&</sup>lt;sup>9</sup> See PJM Compliance Filing, ER20-462-000 at 2.

<sup>&</sup>lt;sup>10</sup> See PJM Compliance Fling, ER20-469-000.

October 17<sup>th</sup> Order found (at P 174) that the PJM rules did not appropriately account for an Energy Storage Resource's State of Charge, Maximum State of Charge, and Minimum State of Charge through bidding parameters or other means in both its day-ahead and real-time market dispatch, as required by Order No. 841. The October 17<sup>th</sup> Order further found (at P 220) that PJM did not adequately describe the services that constitute Dispatched Charging Energy. The October 17<sup>th</sup> Order required an additional compliance filing in Docket No. ER19-469, which PJM filed December 16, 2019. The Commission approved, in part, the additional compliance filing.<sup>12</sup> PJM filed an additional compliance filing in Docket No. ER20-469-000 on October 13, 2020, which is now pending.<sup>13</sup>

In the October 17<sup>th</sup> Order, the Commission also initiated an investigation of whether, under Section 206 of the Federal Power Act, PJM's minimum run time rules and procedures are just and reasonable. As a preliminary matter, the October 17<sup>th</sup> Order directed PJM (at PP 140, 143) to "submit Tariff provisions reflecting the minimum run-time rules and procedures currently specified in its Manual for every resource." The Commission directed that PJM and other interested parties may file briefs in the new docket defined by the investigation, EL19-100, addressing PJM's application of the minimum run time rules and procedures to Capacity Storage Resources.<sup>14</sup>

PJM Interconnection, L.L.C., 169 FERC ¶ 61,049 ("October 17<sup>th</sup> Order"). The October 17<sup>th</sup> Order found (at P 138): "PJM's Tariff satisfies Order No. 841's general directive with respect to allowing electric storage resources to de-rate their capacity to meet minimum run-time requirements."

<sup>&</sup>lt;sup>12</sup> See PJM Interconnection, L.L.C., 172 FERC ¶ 61,029.

<sup>&</sup>lt;sup>13</sup> The compliance filing included revisions to OA Schedule 1 § 1.4A.1(g) in order to eliminate "any ambiguity regarding the prohibition on any distribution-connected ESR paying twice for the same charging energy." *See* Compliance Filing, Docket No. ER20-469 at 5.

<sup>&</sup>lt;sup>14</sup> The October 17<sup>th</sup> Order noted (at P 141): "[C]ommenters argue that: (1) it is unduly discriminatory to apply a 10-hour minimum run-time requirement to Capacity Storage Resources, while only applying a 4-hour minimum run-time requirement to intermittent resources; (2) PJM's 10-hour

In Docket No. ER20-584, on December 12, 2019, PJM filed revisions to the RAA "to incorporate rules pertaining to qualifications for all Capacity Resources." The filed revisions are the current PJM rules, incorporated into the RAA per the Commission's directive.

By order issued April 10, 2020 ("April 10<sup>th</sup> Order'),<sup>15</sup> the Commission granted (at P 33) a motion of NextEra to consolidate its investigation in Docket No. EL19-100 with Docket No. ER20-584, finding that "there are common issues of law and fact regarding PJM's methodologies to determine the capability of Capacity Storage Resources and of all other resource types," and (at PP 142–143) set the matter for paper hearing.

In the April 10<sup>th</sup> Order, the Commission also granted PJM's request that the paper hearing and its proposed RAA revisions be held in abeyance, based on PJM's intention "to pursue an Effective Load Carrying Capability ("ELCC") approach with PJM stakeholders for calculating the capability of resources (such as Energy Storage Resources[footnote omitted]) in the PJM Reliability Pricing Model ("RPM")."<sup>16</sup> PJM claimed such an ELCC approach "could potentially address the issues identified by the Commission in the October 17 Order initiating these proceedings." The Commission determined that PJM must file the ELCC revisions or submit its initial brief by October 30, 2020. The Commission explained: "[granting a period of abeyance] will permit PJM and the PJM stakeholders' time to consider a methodology or methodologies to apply to all resource types while also allowing for such rules to become effective in advance of the next capacity auction. … If PJM makes an FPA section 205 filing on or before October 30, 2020 with a proposed methodology or

<sup>15</sup> *PJM Interconnection, L.L.C.,* 171 FERC ¶ 61,015 ("April 10<sup>th</sup> Order").

minimum run-time requirement is not based on a sound consideration of physical and operational characteristics of Capacity Storage Resources; and (3) multiple PJM Tariff provisions differ in the treatment of Capacity Storage Resources and Generation Capacity Resources, even though PJM contends in its Data Request Response that Capacity Storage Resources are Generation Capacity Resources.

<sup>&</sup>lt;sup>16</sup> *Id.* at PP 34–35.

methodologies to determine the capability of all resource types for Capacity Resource qualification purposes, the instant consolidated proceedings will be held in further abeyance until Commission action on that filing."<sup>17</sup> PJM submitted the October 30<sup>th</sup> Filing, extending the period of abeyance of the investigation and paper hearing.

#### **II. COMMENTS**

There was and is no reason for PJM to rush to complete and implement an inadequate and flawed ELCC filing. The rush is a direct result of actions taken by PJM.

#### A. Issues

There are three basic issues with PJM's proposed approach to implementing an ELCC method.

The actual ELCC values are not adequately grounded on actual data. Even more importantly, PJM's approach fails to recognize the interdependence of ELCC values in a market. ELCC values are a complex function and depend on the interaction of all resource offers in an actual capacity market.

PJM proposes to lock in or guarantee ELCC levels for resource classes rather than letting the market determine the ELCC values. Such a lock in approach is specifically designed to shift risks from investors to customers, and shifts risks from incumbents to new, more technologically advanced entrants. This is inefficient and contravenes basic market principles.<sup>18</sup>

PJM fails to define the capacity market clearing so that the optimal value and mix of resources can be defined by the market. PJM imposes static, predefined values instead.

<sup>&</sup>lt;sup>17</sup> Id.

PJM introduces a new terms, ELCC resource and accredited UCAP. An ELCC resource is a resource for which the new rules apply and the accredited UCAP is the maximum amount an ELCC resource can offer into a RPM auction or assume through a replacement transaction.

These values will be wrong, by definition and inconsistent with an efficient competitive market outcome.

#### **B.** Definition

ELCC means effective load carrying capability. That means contribution to reliability. That means contribution to capacity. That means the degree to which a resource can substitute for any other resource in the PJM Capacity Market.

ELCC is a number, between zero and one, which when multiplied by the installed capacity of a resource results in the amount of capacity that can be sold in the PJM Capacity Market and can therefore substitute for, or replace, any other MW of capacity in that market.

PJM proposes to use its ELCC method only for specific, defined resource classes. But there is no reason that a properly designed ELCC method should not be applied to all resources in the PJM capacity mix.

PJM proposes to, in its aggregate model without transmission constraints, start with all expected thermal and ELCC resources, calculate the LOLE and increase the load until the LOLE is increased to the reliability target of 1 in 10. PJM then replaces all the ELCC resources with the level of "perfect generation" resources required to meet the same target LOLE. The ratio of the MW of perfect generation resources to the MW of ELCC resources is the ELCC.<sup>19</sup>

But this ELCC value is a single aggregate ELCC value for the diverse group of ELCC resources which includes solar generators, wind generators, storage resources and combination resources. PJM recognizes that the ELCC method does not calculate ELCC for the distinct resources classes or for the individual resources.<sup>20</sup> <sup>21</sup>

<sup>&</sup>lt;sup>19</sup> Attachment C Affidavit of Dr. Patricio Rocha Garrido, October 30th Filing at 22. Perfect generation is available 8,760 hours per year.

<sup>&</sup>lt;sup>20</sup> *Id.* at 24.

To allocate the ELCC to the separate ELCC resource classes, PJM does two more ELCC calculations for each class of resources. One calculation defines an ELCC for the resource class with the assumption that there are no other ELCC resource classes in the system, and a second calculation that includes the other ELCC classes in the baseline while changing only one ELCC class.<sup>22</sup> Based on these two ELCC values for each resource class, PJM will allocate the original ELCC to the resource classes such that the sum of the individual class ELCC values sums up to the originally determined ELCC value.

The models used in this exercise by PJM are still in the relatively early stages of development. They will continue to evolve and become more accurate and sophisticated. The models ignore transmission constraints. The models rely on assumptions about expected levels of generation investment and retirements. For example, PJM did not test the model for the impacts of significant coal or nuclear retirements, both of which would have significant impacts on ELCC values.

The models also rely on performance data for individual resources and for resource classes. None of the modeling means anything if the input data is not highly accurate. But PJM does not have good input data. PJM, tellingly, refers to its data on the performance of the ELCC technologies as "putative data."<sup>23</sup> Putative means, inter alia: imagined; postulated; hypothetical.<sup>24</sup> Presumably PJM uses the more arcane term putative rather than directly stating that the data is imaginary because this approach is unsupportable as the basis for establishing long lived ELCC values.

<sup>&</sup>lt;sup>21</sup> This is an accurate statement but is a byproduct of PJM's exogenous ELCC method. An ELCC method that simultaneously clears the capacity market and determines the ELCC does not have this limitation.

<sup>&</sup>lt;sup>22</sup> *Id.* at 25.

<sup>&</sup>lt;sup>23</sup> October 30<sup>th</sup> Filing, Attachment A (Redlines), proposed RAA Schedule 9.1 Sects. A–G.

<sup>&</sup>lt;sup>24</sup> Oxford English Dictionary *<https://www.oed.com/>* Accessed Nov. 19, 2020.

This absence of accurate data alone should disqualify the proposed method for use in calculating capacity values for intermittent and storage resources, especially when the values will persist for 10 years. At the very least, PJM should run this method in parallel for the next few capacity auctions.

PJM's approach will define ELCC values ex ante on a resource class basis. The assumed ex ante resource mix is not a function of how the capacity market clears. There is no interaction among offers or resource types and no simultaneous determination of ELCC values.

The ex ante ELCC values will always be wrong. Accurate predictions about the level of resources are not possible and the market clearing interaction effects are ignored. If an ELCC approach is to be explored, it should do so reflecting the actual, dynamic interactive effects among resource classes in the capacity market and use actual performance data.

#### C. Issue: ELCC Values

PJM's proposed ELCC method will apply only to intermittent resources, storage resources that cannot operate on a continuous basis for a 24 hour period, and combination or hybrid resources, collectively termed ELCC resources. The October 30<sup>th</sup> Filing defines these as: variable resource; limited duration resource; and combination resource. PJM defines thermal resources that can operate continuously at maximum capability for a 24 hour period as unlimited resources.<sup>25</sup> Table 1 shows ELCC values that PJM has calculated and posted for stakeholder meetings and Table 2 includes the assumed capacity levels used in the ELCC calculations.

PJM's results illustrate the issues with its approach. PJM's calculated ELCC of 1.0 for an eight hour battery is simply implausible, as are the other storage results. These ELCC values mean that, per PJM's calculations, a four hour battery is the approximate equivalent

<sup>&</sup>lt;sup>25</sup> See October 30<sup>th</sup> Filing, Attachment A (Redlines), proposed RAA Art. 1.

of a new, efficient gas fired combined cycle plant in its contribution to meeting load. The same conclusion is reached for an eight hour battery.

			Storage	Storage	Solar + Storage Hybrid (open	Solar + Storage Hybrid (Closed	Hydro w/o	Landfill	Hydro w/
Scenario	Wind	Solar	(4 Hour)	(8 hour)	Loop)	Loop)	Storage	Gas	Storage
1	10%	65%	92%	100%	97%	97%	49%	58%	100%
2	9%	59%	86%	98%	96%	96%	48%	5 <b>9</b> %	97%
3	9%	49%	74%	<b>9</b> 5%	86%	86%	51%	63%	97%
4	9%	40%	75%	93%	85%	85%	51%	62%	94%
5	9%	33%	81%	94%	74%	73%	51%	61%	92%
6	9%	27%	79%	94%	71%	71%	51%	5 <b>9</b> %	94%

# Table 1 PJM ELCC<sup>26</sup>

# Table 2 Assumed capacity levels (GW) for PJM ELCC calculations<sup>27</sup>

Scenario	Wind	Solar	Storage (4, 6, or 10 Hour)	Storage (8 hour)	Solar + Storage Hybrid (open Loop)	Solar + Storage Hybrid (Closed Loop)	Hydro w/o I Storage	Landfill Gas	Hydro w/ Storage
1	12.0	7.0	0.4	5.0	0.3	0.3	0.7	0.3	2.0
2	15.0	11.0	0.9	5.0	0.5	0.5	0.7	0.3	2.0
3	19.0	16.0	1.5	5.0	0.8	0.8	0.7	0.3	2.0
4	22.0	22.0	2.0	5.0	1.0	1.0	0.7	0.3	2.0
5	23.0	31.0	3.0	5.0	2.0	2.0	0.7	0.3	2.0
6	25.0	40.0	5.0	5.0	2.0	2.0	0.7	0.3	2.0

The October 30<sup>th</sup> Filing indicates that fixed ELCC capacity values will be defined by PJM and available to Capacity Market Sellers 150 days, or approximately five months, prior to an RPM auction, which would require data to be available and analysis to begin six to seven months prior an RPM auction.<sup>28</sup>

The October 30<sup>th</sup> Filing does not explain how the capacity mix will be determined prior to the ELCC analysis. The exact basis for the capacity mix assumptions should be made explicit.

<sup>&</sup>lt;sup>26</sup> "Capacity Capability Senior Task Force Presentation," at 15, Melissa Pilong, PJM, (September 17, 2020) <<u>https://pim.com/-/media/committees-groups/committees/mrc/2020/20200917/20200917-item-04-1-ccstf-presentation.ashx</u>>.

<sup>&</sup>lt;sup>27</sup> *Id.* at 14.

<sup>&</sup>lt;sup>28</sup> October 30<sup>th</sup> Filing at 62.

The October 30<sup>th</sup> Filing does not provide details on how the ICAP levels of the ELCC resources will be established. If PJM assumes 10 GW of wind for the ELCC analysis and 15 GW clear in the RPM Base Residual Auction the ELCC capacity value will not be correct. If PJM assumes 10 GW of wind for the ELCC analysis and 5 GW clear in the RPM Base Residual Auction, the capacity value will not be correct. The result could understate or overstate the ELCC value for wind or other resource types.

Regardless, this ex ante determination of the resource mix cannot be correct for the next auction because the actual mix that results from the auction is a function of the market clearing process. The ELCC values will be guaranteed for 10 years. The ex ante determination prior to year one of the resource mix cannot be correct for the next 10 years.

The ELCC analysis includes too many MW of unlimited resources. PJM includes MW of unlimited resources that did not clear in the capacity market and that should not have been included in the ELCC analysis because they were not part of the market solution to which the ELCC is being added. In addition, a significant level of the uncleared MW are at risk and should not be assumed to remain in service, regardless. As an example, the 2021/2022 RPM Base Residual Auction committed for RPM and FRR 160.9 GW ICAP of capacity from unlimited resources from the 183.3 GW of available capacity from unlimited resources.<sup>29</sup> PJM appears to include the full 183.3 GW in its ELCC analysis. PJM must explain why this is consistent with the ELCC approach and provide details on how they would choose the size and make up of the unlimited resource fleet.

# 1. PJM's Data and Modeling Are Not Sufficient to Determine ELCC Values

PJM's analysis and resulting ELCC values are not adequately based on actual data for actual resource behavior. Details like the effect of adding resources in specific locations

<sup>&</sup>lt;sup>29</sup> "Analysis of the 2021/2020 RPM Base Residual Auction: Revised," Tables 9, 21 and 22, <<u>http://www.monitoringanalytics.com/reports/Reports/2018/IMM Analysis of the 20212022 RPM BRA</u> <u>Revised 20180824.pdf</u>>.

are ignored, as are any of the potential interactions among resources based on network location. PJM's ELCC method does not model transmission limits and assumes away all transmission related reliability issues within the PJM footprint. This means that the model assumes, and the resulting ELCC values are the result of, a uniform distribution of all resource additions across the system.

Where historical output/behavioral data on specific resource types are missing, it is backcasted.<sup>30</sup> Backcasted means to assume historical behavior based on a combination of current information and historical weather data.<sup>31</sup> PJM states (at 25) that it will use actual values for load and actual and putative values for variable resource output from June 1, 2012, through the most recent delivery year for which data exists. However, data essential to the ELCC analysis and to the participation of specific new types of resources with little, if any operational history, such as limited use storage or hybrid (combined) resources, will be putative.<sup>32</sup> The ELCC analysis and results are heavily dependent on hypothetical data rather than actual data.

PJM does not have four hour limited use storage resources on its system participating in its reserve or energy markets. The limited use storage resources currently on PJM's system (less than 10 hour limited use) are participating in PJM's Regulation Market. There are no combined (hybrid) resources. While PJM's dependence on hypothetical data is unavoidable, PJM's uses of that data to create very long lived commitments is avoidable and should be avoided.

<sup>&</sup>lt;sup>30</sup> See PJM at 25–28.

<sup>&</sup>lt;sup>31</sup> Given that weather is local and PJM is assuming no transmission constraints and therefore no locational differences, the basis for the weather assumptions is not clear.

<sup>&</sup>lt;sup>32</sup> See PJM at 25–28.

#### D. Issue: Locked in ELCC Values

The October 30<sup>th</sup> Filing proposes that PJM calculate floor values for each ELCC class. The floor values, described euphemistically as a transition mechanism, will serve as a lower bound on the ELCC class ratings. Each specific resource class that clears in a given year will be guaranteed that its ELCC value will never be reduced until after the 13th auction, regardless of whether the actual ELCC value declines.

Each combination of delivery year and ELCC class will be associated with a unique 13 year schedule of ELCC floor values. The first 10 years of a particular ELCC floor schedule are established in the five month period prior to the start of the delivery year. Then in each of the next three years, an additional ELCC floor is added to the schedule filling in the remaining three years of the schedule. Each ELCC resource will be associated with the ELCC floor schedule corresponding to the resource's ELCC class and first delivery year for which the resource satisfies certain milestones in the New Services Queue.<sup>33</sup> One point of confusion regarding the applicable floor schedule is that a new resource could clear for a delivery year in an auction somewhere between two and three years prior to the ELCC class floor being established for the delivery year.

PJM's ELCC floor calculations are based on a forecast of ELCC resource type MW in 10 years. The ELCC class floors in each year are based on ELCC class MW interpolated between the current year and year 10. The ELCC floor analysis will use the year one capacity forecast and two times the year 10 capacity forecast. For years two through nine, the ELCC floor forecast will use the capacity amount corresponding to an exponential function defined by the year one and year 10 assumed values.<sup>34</sup>

<sup>&</sup>lt;sup>33</sup> October 30<sup>th</sup> Filing, Attachment A (Redlines), proposed RAA Schedule 9.1 Sect. J(1).

The assumed capacity values used by PJM for the ELCC floor analysis are given by the following formula:  $C_i = F_1 \left(\frac{2 \cdot F_{10}}{F_1}\right)^{(i-1)/9}$  for i = 1, ..., 10, where  $F_1$  is the year 1 forecast capacity value and  $F_{10}$  is the year 10 forecast capacity value.

#### 1. ELCC Floors Are Not Consistent with Competitive Market Principles

The ELCC class rating floors are explicitly designed to shift market risk away from developers and owners of existing ELCC resources. Developers and owners of ELCC resources should bear the risk of a potentially decreasing capacity value. Developers and owners must react to changing market conditions. Resources employing new technology will be at a disadvantage relative to old resources due to the ELCC floors. Customers will pay more for inefficient, old technology and be denied the benefits of innovation.

#### 2. Floors Will Make the System Less Reliable and Are Not Sustainable

An ELCC floor will be binding if a current year ELCC class rating is below the corresponding ELCC class floor. For example, suppose as part of the 2023/2024 ELCC analysis which PJM estimates will be performed in 2021, the 2026/2027 ELCC floor for solar resources is calculated to be 45 percent. Then in late 2025, the ELCC analysis for the upcoming 2026/2027 Delivery Year finds an ELCC solar class rating of 40 percent. Then for all solar capacity that is locked in at 45 percent, an ELCC class rating of 45 percent rather than 40 percent will be used in the accredited UCAP calculation. This simple example shows that a binding ELCC floor means a group of resource will be credited with a capacity level that exceeds the true capability of the resources. To balance this out PJM will take capacity away from a different group of resource that have an ELCC class rating that exceeds the ELCC floor. Table 1 shows an example in which 20 GW of solar capacity is eligible to offer into the RPM auction for delivery year X. The solar resources are grouped together according to the ELCC floors. Group A includes the oldest resources and has the highest floor value, Group C includes the newest resources and has the lowest floor value, and Group B consists of resources that came online somewhere in the middle. In Table 1, the ELCC analysis for delivery year X returns an ELCC class rating of 50.0 percent, which means in total the solar generators have a capacity value of 10 GW. To honor the Group A floor of 60 percent, 500 MW in excess of the true carrying capability of the Group A resources is assigned to Group A. To even things out, Group C is credited with 3,500 MW of ELCC capacity which is 500 MW less than the true carrying capability of the Group C resources.

In the example in Table 2, the Group C floor is 45 percent. The Group A resources still require an extra 500 MW but there are only 400 MW in excess of the amount that must be credited to Group C. Solar capacity is not able to cover the capacity guaranteed by the ELCC floors. Under the PJM ELCC rules, another class of resources would be required to cover the missing solar capacity by having their ELCC reduced.

## Table 3 ELCC Floor Example 1

	Group A	Group B	Group C
Solar Nameplate Capacity (MW) for Delivery Year X	5,000	7,000	8,000
ELCC Floor Established in Prior Years for Delivery Year X	60.0%	50.0%	40.0%
Realized ELCC rating for Solar for Delivery Year X		50.0%	
Realized ELCC Solar Capacity (MW) for Delivery Year X		10,000	
Accredited UCAP (MW) for Delivery Year X	3,000	3,500	3,500
Realized ELCC rating by Group for Delivery Year X	60.0%	50.0%	43.8%

## Table 4 ELCC Floor Example 2

	Group A	Group B	Group C
Solar Nameplate Capacity (MW) for Delivery Year X	5,000	7,000	8,000
ELCC Floor Established in Prior Years for Delivery Year X	60.0%	50.0%	45.0%
Realized ELCC rating for Solar for Delivery Year X		50.0%	
Realized ELCC Solar Capacity (MW) for Delivery Year X		10,000	
Accredited UCAP (MW) for Delivery Year X	3,000	3,500	3,600
Realized ELCC rating by Group for Delivery Year X	60.0%	50.0%	45.0%

It is likely that, within the duration of the floors, a large number of ELCC resources are credited with capacity values in excess of the true carrying capability, and there are not enough ELCC resources with nonbinding ELCC floors to make up the difference. A resolution to this potential outcome is not included in the proposed RAA revisions. The solution would be to require the procurement of additional capacity from unlimited resources which would be paid for by customers.

#### 3. ELCC Floor Calculations Are Not Just and Reasonable

The assumed capacity levels in PJM's ELCC analysis should reflect expectations of capacity for which there will be a PJM capacity obligation. PJM does not address the forecast of the unlimited resource fleet for the floor calculations which will necessarily require forecasting new resource and retirements over a 10 year period. PJM cannot accurately forecast the necessary inputs for the floor calculations. Given the level of uncertainty regarding the inputs to the floor calculations, the Commission should have no confidence that the resulting ELCC floor values will be just and reasonable. Amplifying the risk of the ELCC floor provisions are the revisions to the RAA which make it clear that the floors, once established, are binding and will not be changed for the 13 year duration except in an extraordinary circumstance of PJM discontinuing the use of the ELCC method or that PJM ceases to assign unforced capacity values to ELCC resources.<sup>35</sup>

## E. Issue: ELCC in the Capacity Market

## 1. Average ELCC versus Marginal ELCC

PJM's proposal incorrectly uses average ELCC rather than marginal ELCC values for determining unit specific contributions to total contributed capacity by class, for determining what resources will offer into the PJM Capacity Market, for determining UCAP obligations of cleared resources, for determining market clearing prices for ELCC affected resources and for determining potential performance penalties for ELCC affected resources. While PJM recognizes that marginal ELCC values are essential to develop an economically efficient signal to the market for entry and exit of capacity resources (PJM at 22), PJM erroneously concluded (PJM at 22) that "the use of marginal ELCC values does not generally credit a portfolio of resources for its total contribution to resource adequacy."

<sup>&</sup>lt;sup>35</sup> October 30<sup>th</sup> Filing, Attachment A (Redlines), proposed RAA Schedule 9.1 Sect. J(3)(f).

The theory behind ELCC analysis, requires the use of marginal, rather than average, ELCC values for determining unit specific contributions to total contributed capacity by class, for determining UCAP obligations of cleared resources, for determining market clearing prices for ELCC affected resources and for determining potential performance penalties for ELCC affected resources. It is generally recognized that marginal ELCC values will decline as additional ELCC resources are added. PJM's failure to use marginal rather than average ELCC values in its market evaluations of resources in the capacity market will cause the market to overvalue, over compensate and over procure that resource type in question. The use of average rather than marginal ELCC values will cause PJM's capacity market results to be incorrect and inefficient, at the expense of the PJM customers and non-ELCC resources competing with ELCC resources.

The ELCC analysis, properly done, would provide an ELCC function that determines the total amount of capacity being provided by an evaluated resource for a specific amount of that resource given the interactions with all other resources levels assumed to exists concurrently. The resulting ELCC function for any resource type with an output limitation would show decreasing returns to adding capacity from that resource type, holding all other resource levels constant. An ELCC function that provides decreasing returns for additions of the resource type indicates declining marginal ELCC value for that resource type, and function for which the average ELCC values of the resource type will be higher than the marginal ELCC values. This observation does not justify using average ELCC values rather than marginal ELCC values.

Properly functioning and efficient markets clear on the basis of marginal values, with marginal costs (prices) equaling marginal value, not average prices equaling average values. In a properly functioning capacity market that includes ELCC the market would set prices, compensation and MW obligations based on marginal ELCC, not average ELCC, values.

Using the marginal rather than average ELCC value in market clearing results in every resource receiving the same price per MW of provided equivalent load carrying capacity, the correct assignment of capacity obligations per MW of cleared of a ELCC adjusted resource and the correct allocation of any penalties for non performance.

Under this approach, the total amount of ELCC adjusted MW provided by a resource class would be based on the ELCC function or the area under the marginal ELCC curve, which is the derivative of the ELCC function relative to the limited resource being evaluated. The area under the marginal ELCC curve for a given MW amount is the total amount of capacity provided by that MW amount. It is the total effective capacity provided by that amount of MW. This is the same value that PJM erroneously asserts (PJM at 22) can be found only by using the average ELCC valuation of resources. Contrary to PJM's assertions (PJM at 22), the marginal ELCC framework credits a portfolio of resources for its total contribution to resource adequacy and does so in a way that is consistent with efficient market clearing, efficient market signals and the efficient allocation of resource obligations.

#### 2. ELCC Analysis Is Not Applicable to Storage Resources

ELCC analysis is dependent on assumptions about the behavior/output of the resources.

It is logically possible to use ELCC analysis for calculating the load carrying capability of non dispatchable intermittent resources because the output of these resources is caused by predictable factors exogenous to decisions by the unit's owners. For fully dispatchable units, such as thermal units, resource output is assumed to be available (subject to modeled outages) whenever needed.

But ELCC analysis is not applicable to limited duration storage resources as proposed by PJM. PJM's ELCC valuation limited duration storage is dependent on very strong behavioral assumptions about these resources and when they will use their limited capacity to inject power into the grid. PJM assumes that individual battery owners, each with their own incentives, will collectively behave perfectly. PJM's calculated ELCC values for storage depend entirely on this unsupported and unsupportable assumption. Under PJM's modeling assumptions, the output of limited duration storage (batteries) is only used "in hours in which all output from Unlimited Resources and available output from Variable Resources is insufficient to meet load."<sup>36</sup>

PJM claims (at 3) that this assumption "conservatively simulates the behavior of limited duration resources and combined resources." PJM notes (at 30) in the same discussion, the resulting analysis is intended to maximize the apparent reliability benefit, and resulting ELCC values, of limited duration storage resources.

The assumption is not conservative. The assumption is extreme. There is no basis for this assumption that limited duration storage resources will reserve their output for those hours when output from Unlimited Resources and available output from Variable Resources is insufficient to meet load. Rather than assuming standard profit maximizing behavior from limited duration resources, PJM assumes that storage will have, from a system reliability perspective, perfect behavior under all market conditions.

#### 3. ELCC Calculations in the Capacity Market

An efficient implementation of the ELCC method requires that resource specific ELCC values be determined simultaneously with the clearing of the RPM auction.<sup>37 38</sup> This approach requires the construction of a multivariable ELCC function or ELCC surface, constructed prior to an RPM auction and then used as an input into the auction. The capacity market can then be cleared efficiently and the cleared quantities and prices will reflect a marginal ELCC approach.

<sup>&</sup>lt;sup>36</sup> See PJM at 30.

<sup>&</sup>lt;sup>37</sup> "ELCC – IMM Proposal, Capacity Capability Senior Task Force," Independent Market Monitor for PJM Interconnection, L.L.C. (August 12, 2020), <<u>http://www.monitoringanalytics.com/</u> <u>reports/Presentations/2020/IMM CCSTF ELCC IMM Proposal 20200812.pdf</u>>.

<sup>&</sup>lt;sup>38</sup> "ELCC Comments – IMM, Markets and Reliability Committee," Independent Market Monitor for PJM Interconnection, L.L.C. (September 19, 2020), <<u>http://www.monitoringanalytics.com/</u> <u>reports/Presentations/2020/IMM MRC ELCC IMM Comments 20200919.pdf</u>>.

An ELCC surface can be constructed by applying the ELCC analysis to a range of possible values for each resource type. For example, if there were just two ELCC classes, say solar and wind, then the ELCC surface could be defined as

## ELCC = f(X, W, S)

where X represents the installed capacity of unlimited resources, W represents the installed capacity of the wind resources and S represents the installed capacity of the solar resources. An approximation to the ELCC surface could be obtained by the running the ELCC analysis for various combinations of X, W and S, and then employing an interpolation algorithm to complete the approximation.<sup>39</sup>

The surface reflects the fact that ELCC values are a function of the offers from other limited and unlimited resources. When the market clears, it accounts for these interactions and reaches an optimal solution based on the information that defines in the surface.

Capacity offers from ELCC resources would vary according to the ELCC value. Continuing with the example, consider a 100 MW (nameplate) wind resource that offers into the capacity market at \$20 per MW-day. If the resource clears the market, the resource must clear at a price no lower than its offer. If the market clears at a marginal ELCC of 12 percent, then the resource must be paid at least an amount corresponding to its effective offer at a 12 percent ELCC. The resource's effective offer at a 12 percent marginal ELCC is \$166.67 per MW-day.<sup>40</sup>

## F. PJM Should Implement an Acceptable Participation Model Now.

PJM has had an acceptable participation model for ESR and other resources. The filings in this proceeding have improved and clarified certain aspects of PJM's rules and

<sup>&</sup>lt;sup>39</sup> By assuming a smooth ELCC surface, an approximation method could be designed to achieve a high level of accuracy.

<sup>&</sup>lt;sup>40</sup> An offer of \$20 per MW-day for 100 MW (nameplate) or \$2000 per day is equivalent to an offer of \$166.67 per MW for 12 MW (UCAP) where 12.0 percent is the marginal ELCC rate.

would, if accepted, incorporate those rules into the tariff. The October 30<sup>th</sup> Filing is flawed and should not be approved. The October 30<sup>th</sup> Filing was proposed as an alternative to continued compliance filings following the issuance of Order No. 841. The October 30<sup>th</sup> Filing presents an unacceptable alternative. ELCC, as defined in the October 30<sup>th</sup> Filing, does not constitute an acceptable participation model and cannot be, without substantial additional effort in the stakeholder process. There is no reason to defer moving forward immediately with implementation of the PJM's filings in Docket Nos. ER19-469 and ER20-584 and conclude the paper hearing in Docket No. EL19-100.

#### **III. CONCLUSION**

The Market Monitor respectfully requests that the Commission afford due consideration to these comments as it resolves the issues raised in this proceeding.

Respectfully submitted,

officer Marger

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Dated: November 20, 2020

#### **CERTIFICATE OF SERVICE**

I hereby certify that I have this day served the foregoing document upon each person designated on the official service list compiled by the Secretary in this proceeding.

Dated at Eagleville, Pennsylvania, this 20<sup>th</sup> day of November, 2020.

Abrey Marger

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# Attachment A

# Revisions to the PJM Open Access Transmission Tariff and PJM Reliability Assurance Agreement

(Marked / Redline Format)

# Section(s) of the PJM Open Access Transmission Tariff

(Marked / Redline Format)

# ATTACHMENT DD

# **Reliability Pricing Model**

References to section numbers in this Attachment DD refer to sections of this Attachment DD, unless otherwise specified.

## 5.6 Sell Offers

Sell Offers shall be submitted or withdrawn via the internet site designated by the Office of the Interconnection, under the procedures and time schedule set forth in the PJM Manuals.

## 5.6.1 Specifications

A Sell Offer shall state quantities in increments of 0.1 megawatts and shall specify, as appropriate:

a) Identification of the Generation Capacity Resource, Demand Resource, Capacity Storage Resource or Energy Efficiency Resource on which such Sell Offer is based;

b) Minimum and maximum megawatt quantity of installed capacity that the Capacity Market Seller is willing to offer (notwithstanding such specification, the product offered shall be Unforced Capacity), or designate as Self-Supply, from a Generation Capacity Resource;

i) Price, in dollars and cents per megawatt-day, that will be accepted by the Capacity Market Seller for the megawatt quantity of Unforced Capacity offered from such Generation Capacity Resource.

ii) The Sell Offer may take the form of offer segments with varying pricequantity pairs for varying output levels from the underlying resource, but may not take the form of an offer curve with nonzero slope.

c) EFORd of each Generation Capacity Resource offered.

i) If a Capacity Market Seller is offering such resource in a Base Residual Auction, First Incremental Auction, Second Incremental Auction, or Conditional Incremental Auction occurring before the Third Incremental Auction, the Capacity Market Seller shall specify the EFORd to apply to the offer.

ii) If a Capacity Market Seller is committing the resource as Self-Supply, the Capacity Market Seller shall specify the EFORd to apply to the commitment.

iii) The EFORd applied to the Third Incremental Auction will be the final EFORd established by the Office of the Interconnection six (6) months prior to the Delivery Year, based on the actual EFORd in the PJM Region during the 12-month period ending September 30 that last precedes such Delivery Year.

d) The Nominated Demand Resource Value for each Demand Resource offered and the Nominated Energy Efficiency Value for each Energy Efficiency Resource offered. The Office of the Interconnection shall, in both cases, convert such value to an Unforced Capacity basis by multiplying such value by the DR Factor (for Delivery Years through May 31, 2018) times the Forecast Pool Requirement. Demand Resources shall specify the LDA in which the Demand Resource is located, including the location of such resource within any Zone that includes more than one LDA as identified on RAA, Schedule 10.1. e) For Delivery Years through May 31, 2018, a Demand Resource with the potential to qualify as two or more of a Limited Demand Resource, Extended Summer Demand Resource or Annual Demand Resource may submit separate but coupled Sell Offers for each Demand Resource type for which it qualifies at different prices and the auction clearing algorithm will select the Sell Offer that yields the least-cost solution. For such coupled Demand Resource offers, the offer price of an Annual Demand Resource offer must be at least \$.01 per MW-day greater than the offer price of a coupled Extended Summer Demand Resource offer and the offer price of a Extended Summer Demand Resource offer must be at least \$.01 per MW-day greater than the offer price of a coupled Limited Demand Resource offer.

f) For a Qualifying Transmission Upgrade, the Sell Offer shall identify such upgrade, and the Office of the Interconnection shall determine and certify the increase in CETL provided by such upgrade. The Capacity Market Seller may offer the upgrade with an associated increase in CETL to an LDA in accordance with such certification, including an offer price that will be accepted by the Capacity Market Seller, stated in dollars and cents per megawatt-day as a price difference between a Capacity Resource located outside such an LDA and a Capacity Resource located inside such LDA; and the increase in CETL into such LDA to be provided by such Qualifying Transmission Upgrade, as certified by the Office of the Interconnection.

g) For the 2018/2019 and 2019/2020 Delivery Years, each Capacity Market Seller owning or controlling a resource that qualifies as both a Base Capacity Resource and a Capacity Performance Resource may submit separate but coupled Sell Offers for such resource as a Base Capacity Resource and as a Capacity Performance Resource, at different prices, and the auction clearing algorithm will select the Sell Offer that yields the least-cost solution. Submission of a coupled Base Capacity Resource Sell Offer shall be mandatory for any Capacity Performance Resource Sell Offer that exceeds a Sell Offer Price equal to the applicable Net Cost of New Entry times the Balancing Ratio as provided for in Tariff, Attachment DD, section 6.4. For such coupled Sell Offers, the offer price of a Capacity Performance Resource offer must be at least \$.01 per MW-day greater than the offer price of a coupled Base Capacity Resource offer.

For the 2018/2019 Delivery Year and subsequent Delivery Years, a A Capacity (h) Market Seller that owns or controls one or more Capacity Storage Resources, Intermittent Resources, Demand Resources, or Energy Efficiency Resources may submit a Sell Offer as a Capacity Performance Resource in a MW quantity consistent with their average expected output during peak-hour periods but for ELCC Resources, for the 2023/2024 Delivery Year and subsequent Delivery Years, such MW quantity shall not to exceed the Accredited UCAP of the resource. Alternatively, for the 2018/2019 Delivery Year and subsequent Delivery Years, a Capacity Market Seller that owns or controls one or more Capacity Storage Resources, Intermittent Resources, Demand Resources, Energy Efficiency Resources, or Environmentally-Limited Resources may submit a Sell Offer which represents the aggregated Unforced Capacity value of such resources, where such Sell Offer shall be considered to be located in the smallest modeled LDA common to the aggregated resources. Such aggregated resources shall be owned by or under contract to the Capacity Market Seller, including all such resources obtained through bilateral contract and reported to the Office of the Interconnection in accordance with the Office of the Interconnection's rules related to its Capacity Exchange tools. If any of the commercially aggregated resources in such Sell Offer are subject to the Minimum Floor Offer Price pursuant

to Tariff, Attachment DD, sections 5.14(h) and 5.14(h-1), the Capacity Market Seller that owns or controls such resources may submit a Sell Offer with a Minimum Floor Offer Price of no lower than the time and MW-weighted average of the applicable MOPR Floor Offer Prices (zero if not applicable) of the aggregated resources in such Sell Offer.

For the 2020/2021 Delivery Year and subsequent Delivery Years, a Capacity (i) Market Seller that owns or controls a resource that qualifies as a Summer-Period Capacity Performance Resource may submit a Sell Offer as a Capacity Performance Resource in a MW quantity consistent with the average expected output of such resource during peak-hour periods, and may submit a separate Sell Offer as a Summer-Period Capacity Performance Resource in a MW quantity consistent with the average expected output of such resource during summer peakhour periods, provided the total Sell Offer MW quantity submitted as both a Capacity Performance Resource and a Summer-Period Capacity Performance Resource does not exceed the Unforced Capacity value of the resource. For the 2020/2021 Delivery Year and subsequent Delivery Years, a Capacity Market Seller that owns or controls a resource that qualifies as a Winter-Period Capacity Performance Resource may submit a Sell Offer as a Capacity Performance Resource in a MW quantity consistent with the average expected output of such resource during peak-hour periods, and may submit a separate Sell Offer as a Winter-Period Capacity Performance Resource in a MW quantity consistent with the average expected output of such resource during winter peak-hour periods, provided the total Sell Offer MW quantity submitted as both a Capacity Performance Resource and a Winter-Period Capacity Performance Resource does not exceed the Unforced Capacity value of the resource. Each segment of a Seasonal Capacity Performance Resource Sell Offer must be submitted as a flexible Sell Offer segment with the minimum MW quantity offered set to zero.

# 5.6.2 Compliance with PJM Credit Policy

Capacity Market Sellers shall comply with the provisions of the PJM Credit Policy as set forth in Tariff, Attachment Q, including the provisions specific to the Reliability Pricing Model, prior to submission of Sell Offers in any Reliability Pricing Model Auction. A Capacity Market Seller desiring to submit a Credit-Limited Offer shall specify in its Sell Offer the maximum auction credit requirement, in dollars, and the maximum amount of Unforced Capacity, in megawatts, applicable to its Sell Offer.

# 5.6.3 [reserved]

# 5.6.4 Qualifying Transmission Upgrades

A Qualifying Transmission Upgrade may not be the subject of any Sell Offer in a Base Residual Auction unless it has been approved by the Office of the Interconnection, including certification of the increase in Import Capability to be provided by such Qualifying Transmission Upgrade, no later than 45 days prior to such Base Residual Auction. No such approval shall be granted unless, at a minimum, a Facilities Study Agreement has been executed with respect to such upgrade, and such upgrade conforms to all applicable standards of the Regional Transmission Expansion Plan process.

# 5.6.5 Market-based Sell Offers

Subject to section 6, a Market Seller authorized by FERC to sell electric generating capacity at market-based prices, or that is not required to have such authorization, may submit Sell Offers that specify market-based prices in any Base Residual Auction or Incremental Auction.

#### 5.6.6 Availability of Capacity Resources for Sale

(a) The Office of the Interconnection shall determine the quantity of megawatts of available installed capacity that each Capacity Market Seller must offer in any RPM Auction pursuant to Tariff, Attachment DD, section 6.6, through verification of the availability of megawatts of installed capacity from: (i) all Generation Capacity Resources owned by or under contract to the Capacity Market Seller, including all Generation Capacity Resources obtained through bilateral contract; (ii) the results of prior Reliability Pricing Model Auctions, if any, for such Delivery Year (including consideration of any restriction imposed as a consequence of a prior failure to offer); and (iii) such other information as may be available to the Office of the Interconnection. The Office of the Interconnection shall reject Sell Offers or portions of Sell Offers for Capacity Resources in excess of the quantity of installed capacity from such Capacity Market Seller's Capacity Resource that it determines to be available for sale.

(b) The Office of the Interconnection shall determine the quantity of installed capacity available for sale in a Base Residual Auction or Incremental Auction as of the beginning of the period during which Buy Bids and Sell Offers are accepted for such auction, as applicable, in accordance with the time schedule set forth in the PJM Manuals. Removal of a resource from Capacity Resource status shall not be reflected in the determination of available installed capacity unless the associated unit-specific bilateral transaction is approved, the designation of such resource (or portion thereof) as a network resource for the external load is demonstrated to the Office of the Interconnection, or equivalent evidence of a firm external sale is provided prior to the deadline established therefor. The determination of available installed capacity shall also take into account, as they apply in proportion to the share of each resource owned or controlled by a Capacity Market Seller, any approved capacity modifications, and existing capacity commitments established in a prior RPM Auction, an FRR Capacity Plan, Locational UCAP transactions and/or replacement capacity transactions under this Tariff, Attachment DD. To enable the Office of the Interconnection to make this determination, no bilateral transactions for Capacity Resources applicable to the period covered by an auction will be processed from the beginning of the period for submission of Sell Offers and Buy Bids, as appropriate, for that auction until completion of the clearing determination for such auction. Processing of such bilateral transactions will reconvene once clearing for that auction is completed. A Generation Capacity Resource located in the PJM Region shall not be removed from Capacity Resource status to the extent the resource is committed to service of PJM loads as a result of an RPM Auction, FRR Capacity Plan, Locational UCAP transaction and/or by designation as a replacement resource under this Tariff, Attachment DD.

(c) In order for a bilateral transaction for the purchase and sale of a Capacity Resource to be processed by the Office of the Interconnection, both parties to the transaction must notify the Office of the Interconnection of the transfer of the Capacity Resource from the seller to the buyer in accordance with procedures established by the Office of the Interconnection and set forth in the PJM Manuals. If a material change with respect to any of the prerequisites for the application of Tariff, Attachment DD, section 5.6.6 to the Generation Capacity Resource occurs, the Capacity Resource Owner shall immediately notify the Market Monitoring Unit and the Office of the Interconnection.

# 5.10 Auction Clearing Requirements

The Office of the Interconnection shall clear each Base Residual Auction and Incremental Auction for a Delivery Year in accordance with the following:

a) Variable Resource Requirement Curve

The Office of the Interconnection shall determine Variable Resource Requirement Curves for the PJM Region and for such Locational Deliverability Areas as determined appropriate in accordance with subsection (a)(iii) for such Delivery Year to establish the level of Capacity Resources that will provide an acceptable level of reliability consistent with the Reliability Principles and Standards. It is recognized that the variable resource requirement reflected in the Variable Resource Requirement Curve can result in an optimized auction clearing in which the level of Capacity Resources committed for a Delivery Year exceeds the PJM Region Reliability Requirement (for Delivery Years through May 31, 2018, less the Short-Term Resource Procurement Target) or Locational Deliverability Area Reliability Requirement (for Delivery Year through May 31, 2018, less the Short-Term Resource Procurement Target for the Zones associated with such LDA) for such Delivery Year. For any auction, the Updated Forecast Peak Load, and Short-Term Resource Procurement Target applicable to such auction, shall be used, and Price Responsive Demand from any applicable approved PRD Plan, including any associated PRD Reservation Prices, shall be reflected in the derivation of the Variable Resource Requirement Curves, in accordance with the methodology specified in the PJM Manuals.

i) Methodology to Establish the Variable Resource Requirement Curve

Prior to the Base Residual Auction, in accordance with the schedule in the PJM Manuals, the Office of the Interconnection shall establish the Variable Resource Requirement Curve for the PJM Region as follows:

- Each Variable Resource Requirement Curve shall be plotted on a graph on which Unforced Capacity is on the x-axis and price is on the y-axis;
- For the 2015/2016, 2016/2017, and 2017/2018 Delivery Years, the Variable Resource Requirement Curve for the PJM Region shall be plotted by combining (i) a horizontal line from the y-axis to point (1), (ii) a straight line connecting points (1) and (2), (iii) a straight line connecting points (2) and (3), and (iv) a vertical line from point (3) to the x-axis, where:
  - For point (1), price equals: {the greater of [the Cost of New Entry] or [1.5 times (the Cost of New Entry minus the Net Energy and Ancillary Service Revenue Offset)]} divided by (one minus the pool-wide average EFORd) and Unforced Capacity equals: [the PJM Region Reliability Requirement multiplied by (100% plus the approved PJM Region Installed Reserve Margin ("IRM")% minus 3%) divided by (100% plus IRM%)], and for Delivery Years

through May 31, 2018, minus the Short-Term Resource Procurement Target;

- For point (2), price equals: (the Cost of New Entry minus the Net Energy and Ancillary Service Revenue Offset) divided by (one minus the pool-wide average EFORd) and Unforced Capacity equals: [the PJM Region Reliability Requirement multiplied by (100% plus IRM% plus 1%) divided by (100% plus IRM%)], and for Delivery Years through May 31, 2018, minus the Short-Term Resource Procurement Target; and
- For point (3), price equals [0.2 times (the Cost of New Entry minus the Net Energy and Ancillary Service Revenue Offset)] divided by (one minus the pool-wide average EFORd) and Unforced Capacity equals: [the PJM Region Reliability Requirement multiplied by (100% plus IRM% plus 5%) divided by (100% plus IRM%)], and for Delivery Years through May 31, 2018, minus the Short-Term Resource Procurement Target;
- For the 2018/2019 Delivery Year and subsequent Delivery Years through and including the Delivery Year commencing June 1, 2021, the Variable Resource Requirement Curve for the PJM Region shall be plotted by combining (i) a horizontal line from the y-axis to point (1), (ii) a straight line connecting points (1) and (2), and (iii) a straight line connecting points (2) and (3), where:
  - For point (1), price equals: {the greater of [the Cost of New Entry] or [1.5 times (the Cost of New Entry minus the Net Energy and Ancillary Service Revenue Offset)]} divided by (one minus the pool-wide average EFORd) and Unforced Capacity equals: [the PJM Region Reliability Requirement multiplied by (100% plus the approved PJM Region Installed Reserve Margin ("IRM")% minus 0.2%) divided by (100% plus IRM%)];
  - For point (2), price equals: [0.75 times (the Cost of New Entry minus the Net Energy and Ancillary Service Revenue Offset)] divided by (one minus the pool-wide average EFORd) and Unforced Capacity equals: [the PJM Region Reliability Requirement multiplied by (100% plus IRM% plus 2.9%) divided by (100% plus IRM%)]; and
  - For point (3), price equals zero and Unforced Capacity equals: [the PJM Region Reliability Requirement multiplied by (100% plus IRM% plus 8.8%) divided by (100% plus IRM%)].
  - For the 2022/2023 Delivery Year and subsequent Delivery Years, the Variable Resource Requirement Curve for the PJM Region shall be plotted

by combining (i) a horizontal line from the y-axis to point (1), (ii) a straight line connecting points (1) and (2), and (iii) a straight line connecting points (2) and (3), where:

- For point (1), price equals: {the greater of [the Cost of New Entry] or [1.5 times (the Cost of New Entry minus the Net Energy and Ancillary Service Revenue Offset)]} divided by (one minus the pool-wide average EFORd) and Unforced Capacity equals: [the PJM Region Reliability Requirement multiplied by (100% plus the approved PJM Region Installed Reserve Margin ("IRM")% minus 1.2%) divided by (100% plus IRM%)];
- For point (2), price equals: [0.75 times (the Cost of New Entry minus the Net Energy and Ancillary Service Revenue Offset)] divided by (one minus the pool-wide average EFORd) and Unforced Capacity equals: [the PJM Region Reliability Requirement multiplied by (100% plus IRM% plus 1.9%) divided by (100% plus IRM%)]; and
- For point (3), price equals zero and Unforced Capacity equals: [the PJM Region Reliability Requirement multiplied by (100% plus IRM% plus 7.8%) divided by (100% plus IRM%)].

ii) For any Delivery Year, the Office of the Interconnection shall establish a separate Variable Resource Requirement Curve for each LDA for which:

- A. the Capacity Emergency Transfer Limit is less than 1.15 times the Capacity Emergency Transfer Objective, as determined by the Office of the Interconnection in accordance with NERC and Applicable Regional Entity guidelines; or
- B. such LDA had a Locational Price Adder in any one or more of the three immediately preceding Base Residual Auctions; or
- C. such LDA is determined in a preliminary analysis by the Office of the Interconnection to be likely to have a Locational Price Adder, based on historic offer price levels; provided however that for the Base Residual Auction conducted for the Delivery Year commencing on June 1, 2012, the Eastern Mid-Atlantic Region ("EMAR"), Southwest Mid-Atlantic Region ("SWMAR"), and Mid-Atlantic Region ("MAR") LDAs shall employ separate Variable Resource Requirement Curves regardless of the outcome of the above three tests; and provided further that the Office of the Interconnection may establish a separate Variable Resource Requirement Curve for an LDA not otherwise qualifying under the above three tests if it finds that such is required to achieve an acceptable level of reliability consistent with the Reliability

Principles and Standards, in which case the Office of the Interconnection shall post such finding, such LDA, and such Variable Resource Requirement Curve on its internet site no later than the March 31 last preceding the Base Residual Auction for such Delivery Year. The same process as set forth in subsection (a)(i) shall be used to establish the Variable Resource Requirement Curve for any such LDA, except that the Locational Deliverability Area Reliability Requirement for such LDA shall be substituted for the PJM Region Reliability Requirement and, for Delivery Years through May 31, 2018, the LDA Short-Term Resource Procurement Target shall be substituted for the PJM Region Short-Term Resource Procurement Target. For purposes of calculating the Capacity Emergency Transfer Limit under this section, all generation resources located in the PJM Region that are, or that qualify to become, Capacity Resources, shall be modeled at their full capacity rating, regardless of the amount of capacity cleared from such resource for the immediately preceding Delivery Year.

For each such LDA, for the 2018/2019 Delivery Year and subsequent Delivery Years, the Office of the Interconnection shall (a) determine the Net Cost of New Entry for each Zone in such LDA, with such Net Cost of New Entry equal to the applicable Cost of New Entry value for such Zone minus the Net Energy and Ancillary Services Revenue Offset value for such Zone, and (b) compute the average of the Net Cost of New Entry values of all such Zones to determine the Net Cost of New Entry for such LDA. The Net Cost of New Entry for use in an LDA in any Incremental Auction for the 2015/2016, 2016/2017, and 2017/2018 Delivery Years shall be the Net Cost of New Entry used for such LDA in the Base Residual Auction for such Delivery Year.

iii) Procedure for ongoing review of Variable Resource Requirement Curve

shape.

Beginning with the Delivery Year that commences June 1, 2018, and continuing no later than for every fourth Delivery Year thereafter, the Office of the Interconnection shall perform a review of the shape of the Variable Resource Requirement Curve, as established by the requirements of the foregoing subsection. Such analysis shall be based on simulation of market conditions to quantify the ability of the market to invest in new Capacity Resources and to meet the applicable reliability requirements on a probabilistic basis. Based on the results of such review, PJM shall prepare a recommendation to either modify or retain the existing Variable Resource Requirement Curve shape. The Office of the Interconnection shall post the recommendation and shall review the recommendation through the stakeholder process to solicit stakeholder input. If a modification of the Variable Resource Requirement Curve shape is recommended, the following process shall be followed:

> A) If the Office of the Interconnection determines that the Variable Resource Requirement Curve shape should be modified, Staff of
the Office of the Interconnection shall propose a new Variable Resource Requirement Curve shape on or before May 15, prior to the conduct of the Base Residual Auction for the first Delivery Year in which the new values would be applied.

- B) The PJM Members shall review the proposed modification to the Variable Resource Requirement Curve shape.
- C) The PJM Members shall either vote to (i) endorse the proposed modification, (ii) propose alternate modifications or (iii) recommend no modification, by August 31, prior to the conduct of the Base Residual Auction for the first Delivery Year in which the new values would be applied.
- D) The PJM Board of Managers shall consider a proposed modification to the Variable Resource Requirement Curve shape, and the Office of the Interconnection shall file any approved modified Variable Resource Requirement Curve shape with the FERC by October 1, prior to the conduct of the Base Residual Auction for the first Delivery Year in which the new values would be applied.
- iv) Cost of New Entry
  - A) For the Incremental Auctions for the 2019/2020, 2020/2021, and 2021/2022 Delivery Years, the Cost of New Entry for the PJM Region and for each LDA shall be the respective value used in the Base Residual Auction for such Delivery Year and LDA. For the Delivery Year commencing on June 1, 2022, and continuing thereafter unless and until changed pursuant to subsection (B) below, the Cost of New Entry for the PJM Region shall be the average of the Cost of New Entry for each CONE Area listed in this section as adjusted pursuant to subsection (a)(iv)(B).

Geographic Location Within the	Cost of New Entry
PJM Region Encompassing These	in \$/MW-Year
Zones	
PS, JCP&L, AE, PECO, DPL, RECO	108,000
("CONE Area 1")	
BGE, PEPCO ("CONE Area 2")	109,700
AEP, Dayton, ComEd, APS, DQL,	105,500
ATSI, DEOK, EKPC, Dominion,	
OVEC ("CONE Area 3")	
PPL, MetEd, Penelec ("CONE Area	105,500
4")	

B) Beginning with the 2023/2024 Delivery Year, the CONE for each CONE Area shall be adjusted to reflect changes in generating plant construction costs based on changes in the Applicable United States Bureau of Labor Statistics ("BLS") Composite Index, and then adjusted further by a factor of 1.022 to reflect the annual decline in bonus depreciation scheduled under federal corporate tax law, in accordance with the following:

(1) The Applicable BLS Composite Index for any Delivery Year and CONE Area shall be the most recently published twelve-month change, at the time CONE values are required to be posted for the Base Residual Auction for such Delivery Year, in a composite of the BLS Quarterly Census of Employment and Wages for Utility System Construction (weighted 20%), the BLS Producer Price Index for Construction Materials and Components (weighted 55%), and the BLS Producer Price Index Turbines and Turbine Generator Sets (weighted 25%), as each such index is further specified for each CONE Area in the PJM Manuals.

(2) The CONE in a CONE Area shall be adjusted prior to the Base Residual Auction for each Delivery Year by applying the Applicable BLS Composite Index for such CONE Area to the Benchmark CONE for such CONE Area, and then multiplying the result by 1.022.

(3) The Benchmark CONE for a CONE Area shall be the CONE used for such CONE Area in the Base Residual Auction for the prior Delivery Year (provided, however that the Gross CONE values stated in subsection (a)(iv)(A) above shall be the Benchmark CONE values for the 2022/2023 Delivery Year to which the Applicable BLS Composite Index shall be applied to determine the CONE for subsequent Delivery Years), and then multiplying the result by 1.022.

(4) Notwithstanding the foregoing, CONE values for any CONE Area for any Delivery Year shall be subject to amendment pursuant to appropriate filings with FERC under the Federal Power Act, including, without limitation, any filings resulting from the process described in section 5.10(a)(vi)(C) or any filing to establish new or revised CONE Areas.

- v) Net Energy and Ancillary Services Revenue Offset *up to the 2021/2022 Delivery Year:* 
  - A) The Office of the Interconnection shall determine the Net Energy and Ancillary Services Revenue Offset each year for the PJM Region as (A) the annual average of the revenues that would have been received by the Reference Resource from the PJM energy markets during a period of three consecutive calendar years preceding the time of the determination, based on (1) the heat rate and other characteristics of such Reference Resource; (2) fuel prices reported during such period at an appropriate pricing point

for the PJM Region with a fuel transmission adder appropriate for such region, as set forth in the PJM Manuals, assumed variable operation and maintenance expenses for such resource of \$6.93 per MWh, and actual PJM hourly average Locational Marginal Prices recorded in the PJM Region during such period; and (3) an assumption that the Reference Resource would be dispatched for both the Day-Ahead and Real-Time Energy Markets on a Peak-Hour Dispatch basis; plus (B) ancillary service revenues of \$2,199 per MW-year.

- B) The Office of the Interconnection also shall determine a Net Energy and Ancillary Service Revenue Offset each year for each Zone, using the same procedures and methods as set forth in the previous subsection; provided, however, that: (1) the average hourly LMPs for such Zone shall be used in place of the PJM Region average hourly LMPs; (2) if such Zone was not integrated into the PJM Region for the entire applicable period, then the offset shall be calculated using only those whole calendar years during which the Zone was integrated; and (3) a posted fuel pricing point in such Zone, if available, and (if such pricing point is not available in such Zone) a fuel transmission adder appropriate to such Zone from an appropriate PJM Region pricing point shall be used for each such Zone.
- *v-1)* Net Energy and Ancillary Services Revenue Offset for the 2022/2023 Delivery and subsequent Delivery Years:
  - A) The Office of the Interconnection shall determine the Net Energy and Ancillary Services Revenue Offset each year for the PJM *Region as (1) the average of the net energy and ancillary services* revenues that the Reference Resource is projected to receive from the PJM energy and ancillary service markets for the applicable Delivery Year from three separate simulations, with each such simulation using forward prices shaped using historical data from one of the three consecutive calendar years preceding the time of the determination for the RPM Auction to take account of year-toyear variability in such hourly shapes. Each net energy and ancillary services revenue simulation is based on (a) the heat rate and other characteristics of such Reference Resource such as assumed variable operation and maintenance expenses of \$1.95 per MWh and \$11,732/start, and emissions costs; (b) Forward Hourly LMPs for the PJM Region; (c) Forward Hourly Ancillary Services Prices, (d) Forward Daily Natural Gas Prices at an appropriate pricing point for the PJM Region with a fuel transmission adder appropriate for such region, as set forth in the *PJM Manuals; and (e) an assumption that the Reference Resource*

would be dispatched on a Projected EAS Dispatch basis; plus (2) reactive service revenues of \$2,199 per MW-year.

- B) The Office of the Interconnection also shall determine a Net Energy and Ancillary Service Revenue Offset each year for each Zone, using the same procedures and methods as set forth in the previous subsection; provided, however, that: (1) the Forward Hourly LMPs for such Zone shall be used in place of the Forward Hourly LMP for the PJM Region; (2) if such Zone was not integrated into the PJM Region for the entire three calendar years preceeding the time of the determination for the RPM Auction, then simulations shall rely on only those whole calendar years during which the Zone was integrated; and (3) Forward Daily Natural Gas Prices for the fuel pricing point mapped to such Zone.
- *C) "Forward Hourly LMPs" shall be determined as follows:* 
  - (1) Identify the liquid hub to which each Zone is mapped, as specified in the PJM Manuals.
  - (2) For each liquid hub, calculate the average day-ahead onpeak and day-ahead off-peak energy prices for each month during the Delivery Year over the most recent thirty trading days as of 180 days prior to the Base Residual Auction. For each of the remaining steps, the historical prices used herein shall be taken from the most recent three calendar years preceding the time of the determination for the RPM Auction:
  - (3)Determine and add monthly basis differentials between the hub and each of its mapped Zones to the forward monthly day-ahead on-peak and off-peak energy prices for the hub. This differential is developed using the prices for the Planning Period closest in time to the Delivery Year from the most recent long-term Financial Transmission Rights auction conducted prior to the Base Residual Auction. The difference between the annual long-term Financial Transmission Rights auction prices for the Zone and the hub are converted to monthly values by adding, for each month of the year, the difference between (a) the historical monthly average day-ahead congestion price differentials between the Zone and relevant hub and (b) the historical annual average day-ahead congestion price differentials between the Zone and hub. This step is only used when developing forward prices for locations other than the *liquid hubs;*

- (4) Determine and add marginal loss differentials to the forward monthly day-ahead on-peak and off-peak energy prices for the hub. For each month of the year, calculate the marginal loss differential, which is the average of the difference between the loss components of the historical on peak or off peak day-ahead LMPs for the Zone and relevant hub in that month across the three year period scaled by the ratio of (a) the forward monthly average on-peak or offpeak day-ahead LMP at such hub to (b) the average of the historical on-peak or off-peak day-ahead LMPs for such hub in that month across the three year period. This step is only used when developing forward prices for locations other than the liquid hubs;
- (5) Shape the forward monthly day-ahead on-peak and offpeak prices to (a) forward hourly day-ahead LMPs using historic hourly day-ahead LMP shapes for the Zone and (b) forward hourly real-time LMPs using historic hourly realtime LMP shapes for the Zone. The historic hourly shapes are based on the ratio of the historic day-ahead or realtime LMP for the Zone for each given hour in a monthly on-peak or off-peak period to the average of the historic day-ahead or real-time LMP for the Zone for all hours in such monthly on-peak or off-peak period. The historical prices used in this step shall be taken from one of each of the most recent three calendar years preceding the time of the determination for the RPM Auction;
- (6) For unit-specific energy and ancillary service offset calculations, determine and apply basis differentials from the Zone to the generation bus to the forward day-ahead and real-time hourly LMPs for the Zone. The differential for each hour of the year is developed using the difference between the historical DA or RT LMP for the generation bus and the historical DA or RT LMP for the Zone in which the generation bus is located for that same hour; and
- (7) Develop the Forward Hourly LMPs for the PJM Region pricing point. Calculate the load-weighted average of the monthly on-peak and off-peak Zonal LMPs developed in step (4) above, using the historical average load within each monthly on-peak or off-peak period. The loadweighted average monthly on-peak or off-peak Zonal LMPs are then shaped to forward hourly day-ahead and real-time LMPs using the same procedure as defined in step (5) above, except using historical LMPs for the PJM Region pricing point.

- D) Forward Hourly Ancillary Services Prices shall include prices for Synchronized Reserve, Non-Synchronized Reserve, Secondary Reserve and Regulation and shall be determined as follows. The historical prices used herein shall be taken from one of each of the most recent three calendar years preceding the time of the determination for the RPM Auction:
  - (1) For Synchronized Reserve, the forward day-ahead and real-time market clearing prices for the Reserve Zone for each hour of the Delivery Year shall be equal to the historical real-time Synchronized Reserve Market Clearing Price for the Reserve Zone for the corresponding hour of the year.
  - (2) For Non-Synchronized Reserve, the forward day-ahead and real-time market clearing prices for the Reserve Zone for each hour of the Delivery Year shall be equal to the historical real-time Non-Synchronized Reserve Market Clearing Price for the Reserve Zone for the corresponding hour of the year.
  - (3) For Secondary Reserve, the forward day-ahead and realtime Secondary Reserve market clearing price shall be \$0.00/MWh for all hours.
  - (4) For Regulation, the forward real-time Regulation market clearing price shall be calculated by multiplying the historical real-time hourly Regulation market clearing price for each hour of the Delivery Year by the ratio of the real-time Forward Hourly LMP at an appropriate pricing point, as defined in the PJM manuals, to the historic hourly real-time LMP at such pricing point for the corresponding hour of the year; and
- *E)* Forward Daily Natural Gas Prices shall be determined as follows:
  - (1) Map each Zone to the appropriate natural gas hub in the PJM Region, as listed in the PJM Manuals;
  - (2) Map each natural gas hub lacking sufficient liquidity to the liquid hub to which it has the highest historic price correlation;
  - (3) For each sufficiently liquid natural gas hub, calculate the simple average natural gas monthly settlement prices over

the most recent thirty trading days as of 180 days prior to the Base Residual Auction;

- (4) Calculate the forward monthly prices for each illiquid hub by scaling the forward monthly price of the mapped liquid hub by the average ratio of historical monthly prices at the insufficiently liquid hub to the historical monthly prices at the sufficiently liquid over the most recent three calendar years preceding the time of determination for the RPM Auction;
- (5) Shape the forward monthly prices for each hub to Forward Daily Natural Gas Prices using historic daily natural gas price shapes for the hub. The historic daily shapes are based on the ratio of the historic price for the hub for each given day in a month to the average of the historic prices for the hub for all days in such month. The daily prices are then assigned to each hour starting 10am Eastern Prevailing Time each day. The historical prices used in this step shall be taken from one of each of the most recent three calendar years preceding the time of the determination for the RPM Auction.
- vi) Process for Establishing Parameters of Variable Resource Requirement
  - A) The parameters of the Variable Resource Requirement Curve will be established prior to the conduct of the Base Residual Auction for a Delivery Year and will be used for such Base Residual Auction.
  - B) The Office of the Interconnection shall determine the PJM Region Reliability Requirement and the Locational Deliverability Area Reliability Requirement for each Locational Deliverability Area for which a Variable Resource Requirement Curve has been established for such Base Residual Auction on or before February 1, prior to the conduct of the Base Residual Auction for the first Delivery Year in which the new values will be applied, in accordance with the Reliability Assurance Agreement.
  - C) Beginning with the Delivery Year that commences June 1, 2018, and continuing no later than for every fourth Delivery Year thereafter, the Office of the Interconnection shall review the calculation of the Cost of New Entry for each CONE Area.
    - 1) If the Office of the Interconnection determines that the Cost of New Entry values should be modified, the Staff of the

Curve

Office of the Interconnection shall propose new Cost of New Entry values on or before May 15, prior to the conduct of the Base Residual Auction for the first Delivery Year in which the new values would be applied.

- 2) The PJM Members shall review the proposed values.
- 3) The PJM Members shall either vote to (i) endorse the proposed values, (ii) propose alternate values or (iii) recommend no modification, by August 31, prior to the conduct of the Base Residual Auction for the first Delivery Year in which the new values would be applied.
- 4) The PJM Board of Managers shall consider Cost of New Entry values, and the Office of the Interconnection shall file any approved modified Cost of New Entry values with the FERC by October 1, prior to the conduct of the Base Residual Auction for the first Delivery Year in which the new values would be applied.
- D) Beginning with the Delivery Year that commences June 1, 2018, and continuing no later than for every fourth Delivery Year thereafter, the Office of the Interconnection shall review the methodology set forth in this Attachment for determining the Net Energy and Ancillary Services Revenue Offset for the PJM Region and for each Zone.
  - If the Office of the Interconnection determines that the Net Energy and Ancillary Services Revenue Offset methodology should be modified, Staff of the Office of the Interconnection shall propose a new Net Energy and Ancillary Services Revenue Offset methodology on or before May 15, prior to the conduct of the Base Residual Auction for the first Delivery Year in which the new methodology would be applied.
  - 2) The PJM Members shall review the proposed methodology.
  - 3) The PJM Members shall either vote to (i) endorse the proposed methodology, (ii) propose an alternate methodology or (iii) recommend no modification, by August 31, prior to the conduct of the Base Residual Auction for the first Delivery Year in which the new methodology would be applied.
  - 4) The PJM Board of Managers shall consider the Net Revenue Offset methodology, and the Office of the

Interconnection shall file any approved modified Net Energy and Ancillary Services Revenue Offset values with the FERC by October 1, prior to the conduct of the Base Residual Auction for the first Delivery Year in which the new values would be applied.

- vii)In conjunction with a review of the Variable Resource Requirement Curve<br/>shape that commences no later than December 31, 2026, the Office of the<br/>Interconnection shall review the ELCC transition mechanism set forth in<br/>RAA, Schedule 9.1, section J. Based on the results of such review, PJM<br/>shall prepare a recommendation to either modify or retain the existing<br/>ELCC transition mechanism. The Office of the Interconnection shall post<br/>the recommendation and shall review the recommendation through the<br/>stakeholder process to solicit stakeholder input.
- b) Locational Requirements

The Office of Interconnection shall establish locational requirements prior to the Base Residual Auction to quantify the amount of Unforced Capacity that must be committed in each Locational Deliverability Area, in accordance with the Reliability Assurance Agreement.

c) Resource Requirements and Constraints

Prior to the Base Residual Auction and each Incremental Auction for the Delivery Years starting on June 1, 2014 and ending May 31, 2017, the Office of the Interconnection shall establish the Minimum Annual Resource Requirement and the Minimum Extended Summer Resource Requirement for the PJM Region and for each Locational Deliverability Area for which the Office of the Interconnection is required under section 5.10(a) above to establish a separate VRR Curve for such Delivery Year. Prior to the Base Residual Auction and Incremental Auctions for the 2017/2018 Delivery Year, the Office of the Interconnection shall establish the Limited Resource Constraints and the Sub-Annual Resource Constraints for the PJM Region and for each Locational Deliverability Area for which the Office of the Interconnection is required under section 5.10(a) above to establish a separate VRR Curve for such Delivery Year. Prior to the Base Residual Auction and Incremental Auctions for 2018/2019 and 2019/2020 Delivery Years, the Office of the Interconnection shall establish the Base Capacity Demand Resource Constraints and the Base Capacity Resource Constraints for the PJM Region and for each Locational Deliverability Area for which the Office of the Interconnection is required under section 5.10(a) above to establish a separate VRR Curve for such Delivery Year. Prior to the Base Residual Auction and Incremental Auctions for 2018/2019 and 2019/2020 Delivery Years, the Office of the Interconnection shall establish the Base Capacity Demand Resource Constraints and the Base Capacity Resource Constraints for the PJM Region and for each Locational Deliverability Area for which the Office of the Interconnection is required under section 5.10(a) above to establish a separate VRR Curve for such Delivery Year.

d) Preliminary PJM Region Peak Load Forecast for the Delivery Year

The Office of the Interconnection shall establish the Preliminary PJM Region Load Forecast for the Delivery Year in accordance with the PJM Manuals by February 1, prior to the conduct of the Base Residual Auction for such Delivery Year.

e) Updated PJM Region Peak Load Forecasts for Incremental Auctions

The Office of the Interconnection shall establish the updated PJM Region Peak Load Forecast for a Delivery Year in accordance with the PJM Manuals by February 1, prior to the conduct of the First, Second, and Third Incremental Auction for such Delivery Year.

## 5.14 Clearing Prices and Charges

## a) Capacity Resource Clearing Prices

For each Base Residual Auction and Incremental Auction, the Office of the Interconnection shall calculate a clearing price to be paid for each megawatt-day of Unforced Capacity that clears in such auction. The Capacity Resource Clearing Price for each LDA will be the marginal value of system capacity for the PJM Region, without considering locational constraints, adjusted as necessary by any applicable Locational Price Adders, Annual Resource Price Adders, Extended Summer Resource Price Adders, Limited Resource Price Decrements, Sub-Annual Resource Price Decrements, Base Capacity Demand Resource Price Decrements, and Base Capacity Resource Price Decrements, all as determined by the Office of the Interconnection based on the optimization algorithm. If a Capacity Resource is located in more than one Locational Deliverability Area, it shall be paid the highest Locational Price Adder in any applicable LDA in which the Sell Offer for such Capacity Resource cleared. The Annual Resource Price Adder is applicable for Annual Resources only. The Extended Summer Resource Price Adder is applicable for Annual Resources and Extended Summer Resources.

The Locational Price Adder applicable to each cleared Seasonal Capacity Performance Resource is determined during the post-processing of the RPM Auction results consistent with the manner in which the auction clearing algorithm recognizes the contribution of Seasonal Capacity Performance Resource Sell Offers in satisfying an LDA's reliability requirement. For each LDA with a positive Locational Price Adder with respect to the immediate higher level LDA, starting with the lowest level constrained LDAs and moving up, PJM determines the quantity of equally matched Summer-Period Capacity Performance Resources and Winter-Period Capacity Performance Resources and Winter-Period Capacity Performance Resources and Winter-Period Capacity Performance Resources with the lowest Sell Offer prices will be compensated using the highest Locational Price Adder applicable to such LDA; and any remaining Seasonal Capacity Performance Resources cleared within the LDA are effectively moved to the next higher level constrained LDA, where they are considered in a similar manner for compensation.

b) Resource Make-Whole Payments

If a Sell Offer specifies a minimum block, and only a portion of such block is needed to clear the market in a Base Residual or Incremental Auction, the MW portion of such Sell Offer needed to clear the market shall clear, and such Sell Offer shall set the marginal value of system capacity. In addition, the Capacity Market Seller shall receive a Resource Make-Whole Payment equal to the Capacity Resource Clearing Price in such auction times the difference between the Sell Offer's minimum block MW quantity and the Sell Offer's cleared MW quantity. If the Sell Offer price of a cleared Seasonal Capacity Performance Resource exceeds the applicable Capacity Resource Clearing Price, the Capacity Market Seller shall receive a Resource Make-Whole Payment equal to the difference between the Sell Offer price and Capacity Resource Clearing Price in such RPM Auction. The cost for any such Resource Make-Whole Payments required in a Base Residual Auction or Incremental Auction for adjustment of prior capacity commitments shall be collected pro rata from all LSEs in the LDA in which such payments were made, based on their Daily Unforced Capacity Obligations. The cost for any such Resource Make-Whole

Payments required in an Incremental Auction for capacity replacement shall be collected from all Capacity Market Buyers in the LDA in which such payments were made, on a pro-rata basis based on the MWs purchased in such auction.

c) New Entry Price Adjustment

A Capacity Market Seller that submits a Sell Offer based on a Planned Generation Capacity Resource that clears in the BRA for a Delivery Year may, at its election, submit Sell Offers with a New Entry Price Adjustment in the BRAs for the two immediately succeeding Delivery Years if:

1. Such Capacity Market Seller provides notice of such election at the time it submits its Sell Offer for such resource in the BRA for the first Delivery Year for which such resource is eligible to be considered a Planned Generation Capacity Resource. When the Capacity Market Seller provides notice of such election, it must specify whether its Sell Offer is contingent upon qualifying for the New Entry Price Adjustment. The Office of the Interconnection shall not clear such contingent Sell Offer if it does not qualify for the New Entry Price Adjustment.

2. All or any part of a Sell Offer from the Planned Generation Capacity Resource submitted in accordance with section 5.14(c)(1) is the marginal Sell Offer that sets the Capacity Resource Clearing Price for the LDA.

3. Acceptance of all or any part of a Sell Offer that meets the conditions in section 5.14(c)(1)-(2) in the BRA increases the total Unforced Capacity committed in the BRA (including any minimum block quantity) for the LDA in which such Resource will be located from a megawatt quantity below the LDA Reliability Requirement, minus the Short Term Resource Procurement Target, to a megawatt quantity at or above a megawatt quantity at the price-quantity point on the VRR Curve at which the price is 0.40 times the applicable Net CONE divided by (one minus the pool-wide average EFORd).

4. Such Capacity Market Seller submits Sell Offers in the BRA for the two immediately succeeding Delivery Years for the entire Unforced Capacity of such Generation Capacity Resource committed in the first BRA under section 5.14(c)(1)-(2) equal to the lesser of: A) the price in such seller's Sell Offer for the BRA in which such resource qualified as a Planned Generation Capacity Resource that satisfies the conditions in section 5.14(c)(1)-(3); or B) 0.90 times the Net CONE applicable in the first BRA in which such Planned Generation Capacity Resource meeting the conditions in section 5.14(c)(1)-(3) cleared, on an Unforced Capacity basis, for such LDA.

5. If the Sell Offer is submitted consistent with section 5.14(c)(1)-(4) the foregoing conditions, then:

(i) in the first Delivery Year, the Resource sets the Capacity Resource Clearing Price for the LDA and all cleared resources in the LDA receive the Capacity Resource Clearing Price set by the Sell Offer as the marginal offer, in accordance with Tariff, Attachment DD, section 5.12(a) and section 5.14(a) above.

- (ii) in either of the subsequent two BRAs, if any part of the Sell Offer from the Resource clears, it shall receive the Capacity Resource Clearing Price for such LDA for its cleared capacity and for any additional minimum block quantity pursuant to section 5.14(b) above; or
- (iii) if the Resource does not clear, it shall be deemed resubmitted at the highest price per MW-day at which the megawatt quantity of Unforced Capacity of such Resource that cleared the first-year BRA will clear the subsequent-year BRA pursuant to the optimization algorithm described in Tariff, Attachment DD, section 5.12(a), and
- (iv) the resource with its Sell Offer submitted shall clear and shall be committed to the PJM Region in the amount cleared, plus any additional minimum-block quantity from its Sell Offer for such Delivery Year, but such additional amount shall be no greater than the portion of a minimumblock quantity, if any, from its first-year Sell Offer satisfying section 5.14(c)(1)-(3) above that is entitled to compensation pursuant to section 5.14(b) above; and
- (v) the Capacity Resource Clearing Price, and the resources cleared, shall be re-determined to reflect the resubmitted Sell Offer. In such case, the Resource for which the Sell Offer is submitted pursuant to section 5.14(c)(1)-(4) above shall be paid for the entire committed quantity at the Sell Offer price that it initially submitted in such subsequent BRA. The difference between such Sell Offer price and the Capacity Resource Clearing Price (as well as any difference between the cleared quantity and the committed quantity), will be treated as a Resource Make-Whole Payment in accordance with section 5.14(b) above. Other capacity Resource Clearing Price as determined in such LDA receive the Capacity Resource Clearing Price as determined in section 5.14(a) above.

6. The failure to submit a Sell Offer consistent with section 5.14(c)(i)-(iii) above in the BRA for Delivery Year 3 shall not retroactively revoke the New Entry Price Adjustment for Delivery Year 2. However, the failure to submit a Sell Offer consistent with section 5.14(c)(4) above in the BRA for Delivery Year 2 shall make the resource ineligible for the New Entry Pricing Adjustment for Delivery Years 2 and 3.

7. For each Delivery Year that the foregoing conditions are satisfied, the Office of the Interconnection shall maintain and employ in the auction clearing for such LDA a separate VRR Curve, notwithstanding the outcome of the test referenced in Tariff, Attachment DD, section 5.10(a)(ii).

8. On or before August 1, 2012, PJM shall file with FERC under FPA section 205, as determined necessary by PJM following a stakeholder process, tariff changes to

establish a long-term auction process as a not unduly discriminatory means to provide adequate long-term revenue assurances to support new entry, as a supplement to or replacement of this New Entry Price Adjustment.

d) Qualifying Transmission Upgrade Payments

A Capacity Market Seller that submitted a Sell Offer based on a Qualifying Transmission Upgrade that clears in the Base Residual Auction shall receive a payment equal to the Capacity Resource Clearing Price, including any Locational Price Adder, of the LDA into which the Qualifying Transmission Upgrade is to increase Capacity Emergency Transfer Limit, less the Capacity Resource Clearing Price, including any Locational Price Adder, of the LDA from which the upgrade was to provide such increased CETL, multiplied by the megawatt quantity of increased CETL cleared from such Sell Offer. Such payments shall be reflected in the Locational Price Adder determined as part of the Final Zonal Capacity Price for the Zone associated with such LDAs, and shall be funded through a reduction in the Capacity Transfer Rights allocated to Load-Serving Entities under Tariff, Attachment DD, section 5.15, as set forth in that section. PJMSettlement shall be the Counterparty to any cleared capacity transaction resulting from a Sell Offer based on a Qualifying Transmission Upgrade.

e) Locational Reliability Charge

In accordance with the Reliability Assurance Agreement, each LSE shall incur a Locational Reliability Charge (subject to certain offsets and other adjustments as described in Tariff, Attachment DD, section 5.14B, Tariff, Attachment DD, section 5.14C, Tariff, Attachment DD, section 5.14D, Tariff, Attachment DD, section 5.14E and Tariff, Attachment DD, section 5.15) equal to such LSE's Daily Unforced Capacity Obligation in a Zone during such Delivery Year multiplied by the applicable Final Zonal Capacity Price in such Zone. PJMSettlement shall be the Counterparty to the LSEs' obligations to pay, and payments of, Locational Reliability Charges.

f) The Office of the Interconnection shall determine Zonal Capacity Prices in accordance with the following, based on the optimization algorithm:

i) The Office of the Interconnection shall calculate and post the Preliminary Zonal Capacity Prices for each Delivery Year following the Base Residual Auction for such Delivery Year. The Preliminary Zonal Capacity Price for each Zone shall be the sum of: 1) the marginal value of system capacity for the PJM Region, without considering locational constraints; 2) the Locational Price Adder, if any, for the LDA in which such Zone is located; provided however, that if the Zone contains multiple LDAs with different Capacity Resource Clearing Prices, the Zonal Capacity Price shall be a weighted average of the Capacity Resource Clearing Prices for such LDAs, weighted by the Unforced Capacity of Capacity Resources cleared in each such LDA; 3) an adjustment, if required, to account for adders paid to Annual Resources and Extended Summer Demand Resources in the LDA for which the zone is located; 4) an adjustment, if required, to account for Resource Make-Whole Payments; and (5) an adjustment, if required to provide sufficient revenue for payment of any PRD Credits, all as determined in accordance with the optimization algorithm.

The Office of the Interconnection shall calculate and post the Adjusted ii) Zonal Capacity Price following each Incremental Auction. The Adjusted Zonal Capacity Price for each Zone shall equal the sum of: (1) the average marginal value of system capacity weighted by the Unforced Capacity cleared in all auctions previously conducted for such Delivery Year (excluding any Unforced Capacity cleared as replacement capacity); (2) the average Locational Price Adder weighted by the Unforced Capacity cleared in all auctions previously conducted for such Delivery Year (excluding any Unforced Capacity cleared as replacement capacity); (3) an adjustment, if required, to account for adders paid to Annual Resources and Extended Summer Demand Resources for all auctions previously conducted for such Delivery Year (excluding any Unforced Capacity cleared as replacement capacity); (4) an adjustment, if required, to account for Resource Make-Whole Payments for all actions previously conducted (excluding any Resource Make-Whole Payments to be charged to the buyers of replacement capacity); and (5) an adjustment, if required to provide sufficient revenue for payment of any PRD Credits. The Adjusted Zonal Capacity Price may decrease if Unforced Capacity is decommitted or the Resource Clearing Price decreases in an Incremental Auction.

iii) The Office of the Interconnection shall calculate and post the Final Zonal Capacity Price for each Delivery Year after the final auction is held for such Delivery Year, as set forth above. The Final Zonal Capacity Price for each Zone shall equal the Adjusted Zonal Capacity Price, as further adjusted to reflect any decreases in the Nominated Demand Resource Value of any existing Demand Resource cleared in the Base Residual Auction and Second Incremental Auction.

g) Resource Substitution Charge

Each Capacity Market Buyer in an Incremental Auction securing replacement capacity shall pay a Resource Substitution Charge equal to the Capacity Resource Clearing Price resulting from such auction multiplied by the megawatt quantity of Unforced Capacity purchased by such Market Buyer in such auction.

h) Minimum Offer Price Rule for Certain *New* Generation Capacity Resources *that are not Capacity Resources with State Subsidy* 

(1) For purposes of this section, the Net Asset Class Costs of New Entry shall be asset-class estimates of competitive, cost-based nominal levelized Cost of New Entry, net of energy and ancillary service revenues. Determination of the gross Cost of New Entry component of the Net Asset Class Cost of New Entry shall be consistent with the methodology used to determine the Cost of New Entry set forth in Tariff, Attachment DD, section 5.10(a)(iv)(A) of this Attachment. This section only applies to new Generation Capacity Resources that do not receive or are not entitled to receive a State Subsidy, meaning that such resources are not Capacity Resources with State Subsidy. To the extent a new Generation Capacity Resource is a Capacity Resource with State Subsidy, then the provisions in Tariff, Attachment DD, section 5.14(h-1) apply.

The gross Cost of New Entry component of Net Asset Class Cost of New Entry shall be, for purposes of the 2022/2023 Delivery Year and subsequent Delivery Years, the values indicated in the table below for each CONE Area for a combustion turbine generator ("CT"), and

a combined cycle generator ("CC") respectively, and shall be adjusted for subsequent Delivery Years in accordance with subsection (h)(2) below. For purposes of Incremental Auctions for the 2021/2022 Delivery Year, the MOPR Floor Offer Price shall be the same as that used in the Base Residual Auction for such Delivery Year. The estimated energy and ancillary service revenues for each type of plant shall be determined as described in subsection (h)(3) below. Notwithstanding the foregoing, the Net Asset Class Cost of New Entry shall be zero for: (i) Sell Offers based on nuclear, coal or Integrated Gasification Combined Cycle facilities; or (ii) Sell Offers based on hydroelectric, wind, or solar facilities.

	CONE Area 1	CONE Area 2	CONE Area 3	CONE Area 4
CT \$/MW-yr	108,000	109,700	105,500	105,500
CC \$/MW-yr	118,400	122,000	111,900	114,200

(2) Beginning with the Delivery Year that begins on June 1, 2019, the gross Cost of New Entry component of the Net Asset Class Cost of New Entry shall be adjusted to reflect changes in generating plant construction costs in the same manner as set forth for the cost of new entry in Tariff, Attachment DD, section 5.10(a)(iv)(B), provided, however, that the Applicable BLS Composite Index used for CC plants shall be calculated from the three indices referenced in that section but weighted 20% for the wages index, 55% for the construction materials index, and 25% for the turbines index, and provided further that nothing herein shall preclude the Office of the Interconnection from filing to change the Net Asset Class Cost of New Entry for any Delivery Year pursuant to appropriate filings with FERC under the Federal Power Act.

For the 2021/2022 Delivery Year, for purposes of this provision, (3) the net energy and ancillary services revenue estimate for a combustion turbine generator shall be that determined by Tariff, Attachment DD, section 5.10(a)(v)(A), provided that the energy revenue estimate for each CONE Area shall be based on the Zone within such CONE Area that has the highest energy revenue estimate calculated under the methodology in that subsection. The net energy and ancillary services revenue estimate for a combined cycle generator shall be determined in the same manner as that prescribed for a combustion turbine generator in the previous sentence, except that the heat rate assumed for the combined cycle resource shall be 6.553 MMbtu/Mwh, the variable operations and maintenance expenses for such resource shall be \$2.11 per MWh, the Peak-Hour Dispatch scenario for both the Day-Ahead and Real-Time Energy Markets shall be modified to dispatch the CC resource continuously during the full peakhour period, as described in Peak-Hour Dispatch, for each such period that the resource is economic (using the test set forth in such *definition*), rather than only during the four-hour blocks within such period that such resource is economic, and the ancillary service revenues shall be \$3350 per MW-year.

For the 2022/2023 Delivery Year and subsequent Delivery Years, for purposes of this provision, the net energy and ancillary services revenue estimate for a combustion turbine generator shall be that determined by Tariff, Attachment DD, section 5.10(a)(v-1)(A), provided that the energy and ancillary services revenue estimate for each CONE Area shall be based on the Zone within such CONE Area that has the highest energy revenue estimate calculated under the methodology in that subsection. The net energy and ancillary services revenue estimate for a combined cycle generator shall be determined in the same manner as that prescribed for a

combustion turbine generator in the previous sentence, except that the heat rate assumed for the combined cycle resource shall be 6.501 MMbtu/MWh, the variable operations and maintenance expenses for such resource shall be \$2.11 per MWh, a 10% adder will not be included in the energy offer, and the reactive service revenues shall be \$3,350 per MW-year.

(4) Any Sell Offer that is based on *either* (*i*) *or* (*ii*), *and* (*iii*):

i) a Generation Capacity Resource located in the PJM Region that is submitted in an RPM Auction for a Delivery Year unless a Sell Offer based on that resource has cleared an RPM Auction for that or any prior Delivery Year, or until a Sell Offer based on that resource clears an RPM auction for that or any subsequent Delivery Year; or

ii) a Generation Capacity Resource located outside the PJM Region (where such Sell Offer is based solely on such resource) that requires sufficient transmission investment for delivery to the PJM Region to indicate a long-term commitment to providing capacity to the PJM Region, unless a Sell Offer based on that resource has cleared an RPM Auction for that or any prior Delivery Year, or until a Sell offer based on that resource clears an RPM Auction for that or any subsequent Delivery Year;

in any LDA for which a separate VRR Curve is established for use iii) in the Base Residual Auction for the Delivery Year relevant to the RPM Auction in which such offer is submitted, and that is less than 90 percent of the applicable Net Asset Class Cost of New Entry or, if there is no applicable Net Asset Class Cost of New Entry, less than 70 percent of the Net Asset Class Cost of New Entry for a combustion turbine generator as provided in subsection (h)(1) above shall be set to equal 90 percent of the applicable Net Asset Class Cost of New Entry (or set equal to 70 percent of such cost for a combustion turbine, where there is no otherwise applicable net asset class figure), unless the Capacity Market Seller obtains the prior determination from the Office of the Interconnection described in subsection (5) hereof. This provision applies to Sell Offers submitted in Incremental Auctions conducted after December 19, 2011, provided that the Net Asset Class Cost of New Entry values for any such Incremental Auctions for the 2012-13 or 2013-14 Delivery Years shall be the Net Asset Class Cost of New Entry values posted by the Office of the Interconnection for the Base Residual Auction for the 2014-15 Delivery Year.

(5) Unit-Specific Exception. A Sell Offer meeting the criteria in subsection (4) shall be permitted and shall not be re-set to the price level specified in that subsection if the Capacity Market Seller obtains a determination from the Office of the Interconnection or the Commission, prior to the RPM Auction in which it seeks to submit the Sell Offer, that such Sell Offer is permissible because it is consistent with the competitive, cost-based, fixed, net cost of new entry were the resource to rely solely on revenues from PJM-administered markets. The following process and requirements shall apply to requests for such determinations:

i) The Capacity Market Seller may request such a determination by no later than one hundred twenty (120) days prior to the commencement of the offer period for the RPM Auction in which it seeks to submit its Sell Offer, by submitting simultaneously to the Office of the Interconnection and the Market Monitoring Unit a written request with all of the required documentation as described below and in the PJM Manuals. For such purpose, the Office of the Interconnection shall post, by no later than one hundred fifty (150) days prior to the commencement of the offer period for the relevant RPM Auction, a preliminary estimate for the relevant Delivery Year of the minimum offer level expected to be established under subsection (4). If the minimum offer level subsequently established for the relevant Delivery Year is less than the Sell Offer, the Sell Offer shall be permitted and no exception shall be required.

As more fully set forth in the PJM Manuals, the Capacity Market Seller ii) must include in its request for an exception under this subsection documentation to support the fixed development, construction, operation, and maintenance costs of the planned generation resource, as well as estimates of offsetting net revenues, or, sufficient data for the Office of the Interconnection and the Market Monitoring Unit to produce such an estimate. Estimates of costs or revenues shall be supported at a level of detail comparable to the cost and revenue estimates used to support the Net Asset Class Cost of New Entry established under this section 5.14(h). As more fully set forth in the PJM Manuals, supporting documentation for project costs may include, as applicable and available, a complete project description; environmental permits; vendor quotes for plant or equipment; evidence of actual costs of recent comparable projects; bases for electric and gas interconnection costs and any cost contingencies; bases and support for property taxes, insurance, operations and maintenance ("O&M") contractor costs, and other fixed O&M and administrative or general costs; financing documents for construction-period and permanent financing or evidence of recent debt costs of the seller for comparable investments; and the bases and support for the claimed capitalization ratio, rate of return, cost-recovery period, inflation rate, or other parameters used in financial modeling. Such documentation also shall identify and support any sunk costs that the Capacity Market Seller has reflected as a reduction to its Sell Offer. The request shall include a certification, signed by an officer of the Capacity Market Seller, that the claimed costs accurately reflect, in all material respects, the seller's reasonably expected costs of new entry and that the request satisfies all standards for an exception hereunder.

The request also shall identify all revenue sources relied upon in the Sell Offer to offset the claimed fixed costs, including, without limitation, long-term power supply contracts, tolling agreements, or tariffs on file with state regulatory agencies, and shall demonstrate that such offsetting revenues are consistent, over a reasonable time period identified by the Capacity Market Seller, with the standard prescribed above.

*For the 2021/2022 Delivery Year, in* making such demonstration, the Capacity Market Seller may rely upon forecasts of competitive electricity prices in the PJM Region based on well defined models that include fully documented estimates of future fuel prices, variable operation and maintenance expenses, energy demand, emissions allowance prices, and expected environmental or energy policies that affect the seller's forecast of electricity prices in such region, employing input data from sources readily available to the public. Documentation for net revenues also may include, as available and applicable, plant performance and capability information, including heat rate, start-up times and costs, forced outage rates, planned outage schedules, maintenance cycle, fuel costs and other variable operations and maintenance expenses, and ancillary service capabilities. In addition to the documentation identified herein and in the PJM Manuals, the Capacity Market Seller shall provide any additional supporting information reasonably requested by the Office of the Interconnection or the Market Monitoring Unit to evaluate the Sell Offer. Requests for additional documentation will not extend the deadline by which the Office of the Interconnection or the Market Monitoring Unit must provide their determinations of the Minimum Offer Price Rule exception request.

For the 2022/2023 Delivery Year and subsequent Delivery Years, in making such demonstration, the Capacity Market Seller may rely upon revenues projected by well defined, forward-looking dispatch models, designed to generally follow the rules and processes of PJM's energy and ancillary services markets. Such models must utilize publicly available forward prices for electricity and fuel in the PJM Region. Any modifications made to the forward electricity and fuel prices must similarly use publicly available data. Alternative forward prices for fuel may be used if accompanied by contractual evidence showing the applicability of the alternative fuel price. Where forward fuel markets are not available, publicly available estimates of future fuel prices may be used. The model shall also contain estimates of variable operation and maintenance costs, which may include Maintenance Adders, and emissions allowance prices. Documentation for net revenues also must include, as available and applicable, plant performance and capability information, including heat rate, start-up times and costs, forced outage rates, planned outage schedules, maintenance cycle, fuel costs and other variable operations and maintenance expenses, capacity factors and ancillary service capabilities.

In the alternative, the Capacity Market Seller may request that the Market Monitoring Unit, subject to acceptance by the Office of Interconnection, produce a resourcespecific Energy & Ancillary Services Offset value for such resource using the Forward Hourly LMPs, Forward Hourly Ancillary Service Prices, and either Forward Daily Natural Gas Prices for combustion turbines and combined cycle resources, or forecasted fuel prices for other resource types, and plant parameters and capability information specific to the dispatch of the resource, as outlined above. In addition to the documentation identified herein and in the PJM Manuals, the Capacity Market Seller shall provide any additional supporting information reasonably requested by the Office of the Interconnection or the Market Monitoring Unit to evaluate the Sell Offer. Requests for additional documentation will not extend the deadline by which the Office of the Interconnection or the Market Monitoring Unit must provide their determinations of the Minimum Offer Price Rule exception request.

iii) A Sell Offer evaluated hereunder shall be permitted if the information provided reasonably demonstrates that the Sell Offer's competitive, cost-based, fixed, net cost of new entry is below the minimum offer level prescribed by subsection (4), based on competitive cost advantages relative to the costs estimated for subsection (4), including, without limitation, competitive cost advantages resulting from the Capacity Market Seller's business model, financial condition, tax status, access to capital or other similar conditions affecting the applicant's costs, or based on net revenues that are reasonably demonstrated hereunder to be higher than estimated for subsection (4). Capacity Market Sellers shall be asked to demonstrate that claimed cost advantages or sources of net revenue that are irregular or anomalous, that do not reflect arm's-length transactions, or that are not in the ordinary course of the Capacity Market Seller's business are consistent with the standards of this subsection. Failure to adequately support such costs or revenues so as to enable the Office of the Interconnection to make the determination required in this section will result in denial of an exception hereunder by the Office of the Interconnection.

iv) The Market Monitoring Unit shall review the information and documentation in support of the request and shall provide its findings whether the proposed Sell Offer is acceptable, in accordance with the standards and criteria hereunder, in writing, to the Capacity Market Seller and the Office of the Interconnection by no later than ninety (90) days prior to the commencement of the offer period for such auction. The Office of the Interconnection shall also review all exception requests and documentation and shall provide in writing to the Capacity Market Seller, and the Market Monitoring Unit, its determination whether the requested Sell Offer is acceptable and if not it shall calculate and provide to such Capacity Market Seller, a minimum Sell Offer based on the data and documentation received, by no later than sixty-five (65) days prior to the commencement of the offer period for the relevant RPM Auction. If the Office of the Interconnection determines that the requested Sell Offer is acceptable, the Capacity Market Seller Shall notify the Market Monitoring Unit and the Office of the Interconnection, in writing, of the minimum level of Sell Offer to which it agrees to commit by no later than sixty (60) days prior to the commencement of the offer period for the relevant **RPM** Auction.

*h-1)* Minimum Offer Price Rule for Capacity Resources with State Subsidy

(1) General Rule. Any Sell Offer based on either a New Entry Capacity Resource with State Subsidy or a Cleared Capacity Resource with a State Subsidy submitted in any RPM Auction shall have an offer price no lower than the applicable MOPR Floor Offer Price, unless the Capacity Market Seller qualifies for an exemption with respect to such Capacity Resource with a State Subsidy prior to the submission of such offer.

(A) Effect of Exemption. To the extent a Sell Offer in any RPM Auction is based on a Capacity Resource with State Subsidy that qualifies for any of the exemptions defined in Tariff, Attachment DD, sections 5.14(h-1)(4)-(8), the Sell Offer for such resource shall not be limited by the MOPR Floor Offer Price, unless otherwise specified.

(B) Effect of Exception. To the extent a Sell Offer in any RPM Auction for any Delivery Year is based on a Capacity Resource with State Subsidy for which the Capacity Market Seller obtains, prior to the submission of such offer, a resource-specific exception, such offer may include an offer price below the default MOPR Floor Offer Price applicable to such resource type, but no lower than the resource-specific MOPR Floor Offer Price determined in such exception process.

(C) Process for Establishing a Capacity Resource with a State Subsidy.

(i) By no later than one hundred and twenty (120) days prior to the commencement of the offer period of any RPM Auction conducted for the 2022/2023 Delivery Year and all subsequent Delivery Years, each Capacity Market Seller must certify to the Office of Interconnection, in accordance with the PJM Manuals, whether or not each Capacity Resource (other than Demand Resource and Energy Efficiency Resource) that the Capacity Market Seller intends to offer into the RPM Auction qualifies as a Capacity Resource with a State Subsidy (including by way of Jointly Owned Cross-Subsidized Capacity Resource) and identify (with specificity) any State Subsidy. Capacity Market Sellers that intend to offer a Demand Resource or an Energy Efficiency Resource into the RPM Auction shall certify to the Office of Interconnection, in accordance with the PJM Manuals, whether or not such Demand Resource or Energy Efficiency Resource qualifies as a Capacity Resource with a State Subsidy no later than thirty (30) days prior to the commencement of the offer period of any RPM Auction conducted for the 2022/2023 Delivery Year and all subsequent Delivery Years. All Capacity Market Sellers shall be responsible for each certification irrespective of any guidance developed by the Office of the Interconnection and the Market Monitoring Unit. A Capacity Resource shall be deemed a Capacity Resource with State Subsidy if the Capacity Market Seller fails to timely certify whether or not a Capacity Resource is entitled to a State Subsidy, unless the Capacity Market Seller receives a waiver from the Commission or the Capacity Resource previously received a resource-specific exception pursuant to Tariff, Attachment DD, section 5.14(h-1)(3).

(ii) The requirements in subsection (i) above do not apply to Capacity Resources for which the Market Seller designated whether or not it is subject to a State Subsidy and the associated subsidies to which the Capacity Resource is entitled in a prior Delivery Year, unless there has been a change in the set of those State Subsidy(ies), or for those which are eligible for the Demand Resource or Energy Efficiency exemption, Capacity Storage Resource exemption, Self-Supply Entity exemption, or the Renewable Portfolio Standard exemption.

(iii) Once a Capacity Market Seller has certified a Capacity Resource as a Capacity Resource with a State Subsidy, the status of such Capacity Resource will remain unchanged unless and until the Capacity Market Seller (or a subsequent Capacity Market Seller) that owns or controls such Capacity Resource provides a certification of a change in such status, the Office of the Interconnection removes such status, or by FERC order. All Capacity Market Sellers shall have an ongoing obligation to certify to the Office of Interconnection and the Market Monitoring Unit a Capacity Resource's change in status as a Capacity Resource with State Subsidy within 5 days of such change.

(2) *Minimum Offer Price Rule.* Any Sell Offer for a New Entry Capacity Resource with State Subsidy or a Cleared Capacity Resource with State Subsidy that does not qualify for any of the exemptions, as defined in Tariff, Attachment DD, sections 5.14(h-1)(4)-(8), shall have an offer price no lower than the applicable MOPR Floor Offer Price.

(A) New Entry MOPR Floor Offer Price. For a New Entry Capacity Resource with State Subsidy the applicable MOPR Floor Offer Price, based on the net cost of new entry for each resource type, shall be, at the election of the Capacity Market Seller, (i) the resource-specific value determined in accordance with the resource-specific MOPR Floor Offer Price process in Tariff, Attachment DD, section 5.14(h-1)(3) below or (ii) if applicable, the default New Entry MOPR Floor Offer Price for the applicable resource based on the gross cost of new entry values shown in the table below, as adjusted for Delivery Years subsequent to the 2022/2023 Delivery Year, net of estimated net energy and ancillary service revenues for the resource type and Zone in which the resource is located.

Resource Type	Gross Cost of New Entry (2022/2023 \$/ MW-day)
	(Nameplate)

Nuclear	\$2,000
Coal	\$1,068
Combined Cycle	\$320
Combustion Turbine	\$294
Fixed Solar PV	\$271
Tracking Solar PV	\$290
Onshore Wind	\$420
Offshore Wind	\$1,155
Battery Energy Storage	\$532
Generation Backed	\$254
Demand Resource	

The gross cost of new entry values in the table above are expressed in dollars per MW-day in terms of nameplate megawatts. For purposes of submitting a Sell Offer, the gross cost of new entry values must be converted to a net -cost of new entry by subtracting the estimated net energy and ancillary service revenues, as determined below, from the gross cost of new entry. However, the resultant net cost of new entry of the battery energy storage resource type in the table above must be multiplied by 2.5. The net cost of new entry based on nameplate capacity is then converted to Unforced Capacity ("UCAP") MW-day. For Delivery Years through the 2022/2023 Delivery Year, *T*to determine the applicable UCAP MW-day value, the net cost of new entry is adjusted as follows: for thermal generation resource types and battery energy storage resource types, the applicable class average EFORd; for wind and solar generation resource types, the applicable class average capacity value factor; or for Demand Resources and Energy Efficiency Resources, the Forecast Pool Requirement, as applicable to the relevant RPM Auction. For the 2023/2024 Delivery Year and subsequent Delivery Years, to determine the applicable UCAP MW-day value, the net cost of new entry is adjusted as follows: for thermal generation resource types, the applicable class average EFORd; for battery storage, wind, and solar resource types, the applicable ELCC Class Rating; or for Demand Resources and Energy Efficiency Resources, the Forecast Pool Requirement, as applicable to the relevant RPM Auction. The resulting default New Entry MOPR Floor Offer price in UCAP/MW-day terms shall be applied to each MW offered for the Capacity Resource regardless of the actual Sell Offer quantity and regardless of whether the Sell Offer is for a Seasonal Capacity Performance Resource.

The default New Entry MOPR Floor Offer Price for load-backed Demand Resources (i.e., the MW portion of Demand Resources that is not supported by generation) shall be separately determined for each Locational Deliverability Area as the MW-weighted average offer price of load-backed Demand Resources from the most recent three Base Residual Auctions, where the MW weighting shall be determined based on the portion of each Sell Offer for a load-backed portion of the Demand Resource that is supported by end-use customer locations on the registrations used in the pre-registration process for such Base Residual Auctions, as described in the PJM Manuals.

The default gross cost of new entry for Energy Efficiency Resources shall be \$644/ICAP MW-Day, which shall be offset by projected wholesale energy savings, as well as transmission and distribution savings of \$95/ICAP MW-Day, to determine the default New Entry MOPR Floor Offer Price (Net Cost of New Entry), where the projected wholesale energy savings are determined utilizing the cost and performance data of relevant programs offered by representative energy efficiency programs with sufficiently detailed publicly available data. The wholesale energy savings, in \$/ICAP MW-day, shall be calculated prior to each RPM Auction and be equal to the average annual energy savings of 6,221 MWh/ICAP MW times the weighted average of the annual real-time Forward Hourly LMPs of the Zones of the representative energy efficiency programs, where the weighting is developed from the annual energy savings in the relevant Zones, divided by 365.

Commencing with the Base Residual Auction for the 2023/2024 Delivery Year, the Office of the Interconnection shall adjust the default gross costs of new entry in the table above and for loadbacked Demand Resources, and post the preliminary estimates of the adjusted applicable default New Entry MOPR Floor Offer Prices on its website, by no later than one hundred fifty (150) days prior to the commencement of the offer period for each Base Residual Auction. To determine the adjusted applicable default New Entry MOPR Floor Offer Prices for all resource types except for load-backed Demand Resources and Energy Efficiency Resources, the Office of the Interconnection shall adjust the gross costs of new entry utilizing, for combustion turbine and combined cycle resource types, the same Applicable BLS Composite Index applied for such Delivery Year to adjust the CONE value used to determine the Variable Resource Requirement Curve, in accordance with Tariff, Attachment DD, section 5.10(a)(iv), and for all other resource types, the "BLS Producer Price Index Turbines and Turbine Generator Sets" component of the Applicable BLS Composite Index used to determine the Variable Resource Requirement Curve shall be replaced with the "BLS Producer Price Index Final Demand, Goods Less Food & Energy, Private Capital Equipment" when adjusting the gross costs of new entry. The resultant value shall then be then adjusted further by a factor of 1.022 for nuclear, coal, combustion turbine, combine cycle, and generation-backed Demand Resource types or 1.01 for solar, wind, and storage resource types to reflect the annual decline in bonus depreciation scheduled under federal corporate tax law. Updated estimates of the net energy and ancillary service revenues for each default resource type and applicable Zone, which shall include, but are not limited to, consideration of Fuel Costs, Maintenance Adders and Operating Costs, as applicable, pursuant to Operating Agreement, Schedule 2 shall then be subtracted from the adjusted gross costs of new entry to determine the adjusted New Entry MOPR Floor Offer Price. The net energy and ancillary services revenue shall be the the average of the net energy and ancillary services revenues that the resource is projected to receive from the PJM energy and ancillary service markets for the applicable Delivery Year from three separate simulations, with each such simulation using forward prices shaped using historical data from one of each of the three consecutive calendar years preceding the time of the determination for the RPM Auction to take account of year-to-year variability in such hourly shapes. Each net energy and ancillary services revenue simulation shall be conducted in accordance with the following and the PJM Manuals:

(i) for nuclear resource type, the net energy and ancillary services revenue estimate for each Zone shall be determined by the gross energy market revenue determined by the product of [average annual day-ahead Forward Hourly LMPs for such Zone, times 8,760 hours times the annual average equivalent availability factor of all PJM nuclear resources] minus the total annual cost to produce energy determined by the product of [8,760 hours times the annual average equivalent availability factor of all PJM nuclear resources \$9.02/MWh for a single unit plant or \$7.66/MWh for a multi-unit plant] where these hourly cost rates include fuel costs and variable operation and maintenance expenses, inclusive of Maintenance Adder costs, plus reactive services revenue of \$3,350/MW-year;

(ii) for coal resource type, the net energy and ancillary services revenue estimate for each Zone shall be determined by the Projected EAS Dispatch of a 650 MW coal unit (with heat rate of 8,638 BTU/kWh and variable operations and maintenance variable operation and maintenance expenses, inclusive of Maintenance Adder costs, of \$9.50/MWh) using day-ahead and real-time Forward Hourly LMPs for such Zone and Forward Hourly Ancillary Service Prices, and daily forecasted coal prices, as set forth in the PJM Manuals, plus reactive services revenue of \$3,350/MW-year;

(iii) for combustion turbine resource type, the net energy and ancillary services revenue estimate for each Zone shall be determined in a manner consistent with the methodology described in Tariff, Attachment DD, section 5.10(a)(v-1)(B) for the Reference Resource combustion turbine.

(iv) for combined cycle resource type, the net energy and ancillary services revenue estimate for each Zone shall be determined in the same manner as that prescribed for a combustion turbine resource type, except that the heat rate assumed for the combined cycle resource shall be 6,501 BTU/kwh, the variable operations and maintenance expenses for such resource, inclusive of Maintenance Adder costs, shall be \$2.11/MWh, plus reactive services revenue of \$3,350/MW-year.

(v) for solar PV resource type, the net energy and ancillary services revenue estimate for each Zone shall be determined using a solar resource model that provides the average MW output level, expressed as a percentage of nameplate rating, by hour of day (for each of the 24-hours of a day) and by calendar month (for each of the twelve months of a year). The annual net energy market revenues are determined by multiplying the solar output level of each hour by the real-time Forward Hourly LMP for such Zone and applicable to such hour with this product summed across all of the hours of an annual period, plus reactive services revenue of \$3,350/MW-year. Two separate solar resource models are used, one model for a fixed panel resource and a second model for a tracking panel resource;

(vi) for onshore wind resource type, the net energy and ancillary services revenue estimate for each Zone shall be determined using a wind resource model that provides the average MW output level, expressed as a percentage of nameplate rating, by hour of day (for each of the 24-hours of a day) and by calendar month (for each of the twelve months of a year). The annual energy market revenues are determined by multiplying the wind output level of each hour by the real-time Forward Hourly LMP for such Zone applicable to such hour with this product summed across all of the hours of an annual period, plus reactive services revenue of \$3,350/MW-year;

(vii) for offshore wind resource type, the net energy and ancillary services revenue estimate for each Zone shall be determined by the gross energy market revenue equal to the product of [the average annual real-time Forward Hourly LMP for such Zone times 8,760 hours times an assumed annual capacity factor of 45%], plus reactive services revenue of \$3,350/MW-year;

(viii) for Capacity Storage Resource, the net energy and ancillary services revenue estimate shall be estimated by the Projected EAS Dispatch of a 1 MW, 4MWh resource, with an 85% roundtrip efficiency, and assumed to be dispatched between 95% and 5% state of charge against day-ahead and real-time Forward Hourly LMPs for such Zone and Forward Hourly Ancillary Service Prices, plus reactive services revenue of \$3,350/MW-year; and *(ix)* for generation-backed Demand Resource, the net energy and ancillary services revenue estimate shall be zero dollars.

Beginning with the Delivery Year that commences June 1, 2022, and continuing no later than for every fourth Delivery Year thereafter, the Office of the Interconnection shall review the default gross cost of new entry values. Such review may include, without limitation, analyses of the fixed development, construction, operation, and maintenance costs for such resource types. Based on the results of such review, PJM shall propose either to modify or retain the default gross cost of new entry values stated in the table above and the default gross cost of new entry value for Energy Efficiency Resources. The Office of the Interconnection shall post publicly and solicit stakeholder comment regarding the proposal. If, as a result of this process, changes to the default gross cost of new entry values are proposed, the Office of the Interconnection shall file such proposed modifications with the FERC by October 1, prior to the conduct of the Base Residual Auction for the first Delivery Year in which the new values would be applied.

New Entry Capacity Resource with State Subsidy for which there is no default MOPR Floor Offer Price provided in accordance with this section, including hybrid resources, must seek a resource-specific value determined in accordance with the resource-specific MOPR Floor Offer Price process below to participate in an RPM Auction. Failure to obtain a resource-specific MOPR Floor Offer Price will result in the Office of the Interconnection rejecting any Sell Offer based on such resource for the relevant RPM Auction.

(B) Cleared MOPR Floor Offer Prices.

(i) For a Cleared Capacity Resource with State Subsidy, the applicable Cleared MOPR Floor Offer Price shall be, at the election of the Capacity Market Seller, (a) based on the resource-specific MOPR Floor Offer Price, as determined in accordance with Tariff, Attachment DD, section 5.14(h-1)(3) below, or (b) if available, the default Avoidable Cost Rate for the applicable resource type shown in the table below, as adjusted for Delivery Years subsequent for the 2022/2023 Delivery Year to reflect changes in avoidable costs, net of projected PJM market revenues equal to the resource's net energy and ancillary service revenues for the resource type, as determined in accordance with subsection (ii) below.

Existing Resource Type	Default Gross ACR (2022/2023 (\$/MW-day) (Nameplate)
Nuclear - single	\$697
Nuclear - dual	\$445
Coal	\$80
Combined Cycle	\$56
Combustion Turbine	\$50
Solar PV	\$40
(fixed and tracking)	
Wind Onshore	\$8 <i>3</i>
Generation-backed	\$3

Demand Response	
Load-backed Demand Response	\$0
Energy Efficiency	\$0

The default gross Avoidable Cost Rate values in the table above are expressed in dollars per MW-day in terms of nameplate megawatts. For purposes of submitting a Sell Offer, the default Avoidable Cost Rate values must be net of estimated net energy and ancillary service revenues, and then the difference is ultimately converted to Unforced Capacity ("UCAP") MW-day, where the UCAP MW-day value will be determined based on: for Delivery Years through the 2022/2023 Delivery Year, the resource-specific EFORd for thermal generation resource types and battery energy storage resource types, resource-specific capacity value factor for solar and wind generation resource types (based on the ratio of Capacity Interconnection Rights to nameplate capacity, appropriately time-weighted for any winter Capacity Interconnection Rights), or the Forecast Pool Requirement for Demand Resources and Energy Efficiency Resources, as applicable to the relevant RPM Auction, and for the 2023/2024 Delivery Year and subsequent Delivery Years, the resource-specific EFORd for thermal generation resource types and on the resource-specific Accredited UCAP value for solar and wind resource types (with appropriate time-weighting for any winter Capacity Interconnection Rights), or the Forecast Pool Requirement for Demand Resources and Energy Efficiency Resources, as applicable to the relevant RPM Auction. The resulting default Cleared MOPR Floor Offer price in UCAP/MWday terms shall be applied to each MW offered for the Capacity Resource regardless of actual Sell Offer quantity and regardless of whether the Sell Offer is for a Seasonal Capacity Performance Resource.

Commencing with the Base Residual Auction for the 2023/2024 Delivery Year, the Office of the Interconnection shall adjust the default Avoidable Cost Rates in the table above, and post the adjusted values on its website, by no later than one hundred fifty (150) days prior to the commencement of the offer period for each Base Residual Auction. To determine the adjusted Avoidable Cost Rates, the Office of the Interconnection shall utilize the 10-year average Handy-Whitman Index in order to adjust the Gross ACR values to account for expected inflation. Updated estimates of the net energy and ancillary service revenues shall be determined on a resource-specific basis in accordance with Tariff, Attachment DD, section 6.8(d) and the PJM Manuals.

Beginning with the Delivery Year that commences June 1, 2022, and continuing no later than for every fourth Delivery Year thereafter, the Office of the Interconnection shall review the default Avoidable Cost Rates for Capacity Resources with State Subsidies that have cleared in an RPM Auction for any prior Delivery Year. Such review may include, without limitation, analyses of the avoidable costs of such resource types. Based on the results of such review, PJM shall propose either to modify or retain the default Avoidable Cost Rate values stated in the table above. The Office of the Interconnection shall post publicly and solicit stakeholder comment regarding the proposal. If, as a result of this process, changes to the default Avoidable Cost Rate values are proposed, the Office of the Interconnection shall file such proposed modifications with the FERC by October 1, prior to the conduct of the Base Residual Auction for the first Delivery Year in which the new values would be applied. Cleared Capacity Resources with State Subsidy for which there is no default MOPR Floor Offer Price provided in accordance with this section, including hybrid resources, must seek a resource-specific value determined in accordance with the resource-specific MOPR Floor Offer Price process below to participate in an RPM Auction. Failure to obtain a resource-specific MOPR Floor Offer Price will result in the Office of the Interconnection rejecting any Sell Offer based on such resource.

(ii) The net energy and ancillary services revenue is equal to forecasted net revenues which shall be determined in accordance with the applicable resource type net energy and ancillary services revenue determination methodology set forth in Tariff, Attachment DD, section 5.14(h-1(2)(A)(i) through (ix) and using the subject resource's operating parameters as determined in accordance with the PJM Manuals based on (a) offers submitted in the Day-ahead Energy Market and Real-time Energy Market over the calendar year preceding the time of the determination for the RPM Auction; (b) the resource-specific operating parameters approved, as applicable, in accordance with Operating Agreement, Schedule 1, section 6.6(b) and Operating Agreement, Schedule 2 (including any Fuel Costs, emissions costs, Maintenance Adders, and Operating Costs); (c) the resource's EFORd; (d) Forward Hourly LMPs at the generation bus as determined in accordance with Tariff, Attachment DD, section 5.10(a)(v-1)(C)(6); and (e) the resource's stated annual revenue requirement for reactive services; plus any unit-specific bilateral contract. In addition, the following resource type-specific parameters shall be considered; (f) for combustion turbine, combined cycle, and coal resource types: the installed capacity rating, ramp rate (which shall be equal to the maximum ramp rate included in the resource's energy offers over the most recent previous calendar year preceding the determination for the RPM Auction), and the heat rate as determined as the resource's average heat rate at full load as submitted to the Market Monitoring Unit and the Office of the Interconnection, where for combined cycle resources heat rates will be determined at base load and at peak load (e.g., without duct burners and with duct burners), as applicable; (g) for nuclear resource type: anticipated refueling schedule; (h) for solar and wind resource types: the resource's output profiles for the most recent three calendar years, as available; and (i) for battery storage resource type: the nameplate capacity rating (on a MW / MWh basis).

To the extent the resource has not achieved commercial operation, the operating parameters used in the simulation of the net energy and ancillary service revenues will be based on the manufacturer's specifications and/or from parameters used for other existing, comparable resources, as developed by the Market Monitoring Unit and the Capacity Market Seller, and accepted by the Office of the Interconnection.

A Capacity Market Seller intending to submit a Sell Offer in any RPM Auction for a Cleared Capacity Resource with State Subsidy based on a net energy and ancillary services revenue determination that does not use the foregoing methodology or parameter inputs stated for that resource type shall, at its election, submit a request for a resource-specific MOPR Floor Offer Price for such Capacity Resource pursuant to Tariff, Attachment DD, section 5.14(h-1)(3) below.

(3) Resource-Specific Exception. A Capacity Market Seller intending to submit a Sell Offer in any RPM Auction for a New Entry Capacity Resource with State Subsidy or a Cleared Capacity Resource with State Subsidy below the applicable default MOPR Floor Offer Price may, at its election, submit a request for a resource-specific exception for such

Capacity Resource. A Sell Offer below the default MOPR Floor Offer Price, but no lower than the resource-specific MOPR Floor Offer Price, shall be permitted if the Capacity Market Seller obtains approval from the Office of the Interconnection or the Commission, prior to the RPM Auction in which it seeks to submit the Sell Offer. The resource-specific MOPR Floor Offer Price determined under this provision shall be based on the resource-specific EFORd for thermal generation resource types, on the resource-specific Accredited UCAP value for-and battery energy storage resource types and for, resource-specific capacity value factor for solar and wind generation resource types (based on the ratio of Capacity Interconnection Rights to nameplate *capacity,* appropriately time-weighted for any winter Capacity Interconnection Rights), or the Forecast Pool Requirement for Demand Resources and Energy Efficiency Resources, as applicable to the relevant RPM Auction and shall be applied to each MW offered by the resource regardless of actual Sell Offer quantity and regardless of whether the Sell Offer is for a Seasonal Capacity Performance Resource. Such Sell Offer is permissible because it is consistent with the competitive, cost-based, fixed, net cost were the resource to rely solely on revenues exclusive of any State Subsidy. All supporting data must be provided for all requests. The following requirements shall apply to requests for such determinations:

(A) The Capacity Market Seller shall submit a written request with all of the required documentation as described below and in the PJM Manuals. For such purpose, the Capacity Market Seller shall submit the resource-specific exception request to the Office of the Interconnection and the Market Monitoring Unit no later than one hundred twenty (120) days prior to the commencement of the offer period for the RPM Auction in which it seeks to submit its Sell Offer. For such purpose, the Office of the Interconnection shall post, by no later than one hundred fifty (150) days prior to the commencement of the offer period for the relevant RPM Auction, a preliminary estimate for the relevant Delivery Year of the default Minimum Floor Offer Prices, determined pursuant to Tariff, Attachment DD, sections 5.14(h-1)(2)(A) and (B). If the final applicable default Minimum Floor Offer Price subsequently established for the relevant Delivery Year is less than the Sell Offer, the Sell Offer shall be permitted and no exception shall be required.

(B) For a resource-specific exception for a New Entry Capacity Resource with State Subsidy, the Capacity Market Seller must include in its request for an exception under this subsection documentation to support the fixed development, construction, operation, and maintenance costs of the Capacity Resource, as well as estimates of offsetting net revenues.

The financial modeling assumptions for calculating Cost of New Entry for Generation Capacity Resources and generation-backed Demand Resources shall be: (i) nominal levelization of gross costs, (ii) asset life of twenty years, (iii) no residual value, (iv) all project costs included with no sunk costs excluded, (v) use first year revenues (which may include revenues from the sale of renewable energy credits for purposes other than state-mandated or state-sponsored programs), and (vi) weighted average cost of capital based on the actual cost of capital for the entity proposing to build the Capacity Resource. Notwithstanding the foregoing, a Capacity Market Seller that seeks to utilize an asset life other than twenty years (but no greater than 35 years) shall provide evidence to support the use of a different asset life, including but not limited to, the asset life term for such resource as utilized in the Capacity Market Seller's financial accounting (e.g., independently audited financial statements), or project financing documents for the resource or evidence of actual costs or financing assumptions of recent comparable projects to the extent the seller has not executed project financing for the resource (e.g., independent project engineer opinion or manufacturer's performance guarantee), or opinions of third-party experts regarding the reasonableness of the financing assumptions used for the project itself or in comparable projects. Capacity Market Sellers may also rely on evidence presented in federal filings, such as its FERC Form No. 1 or an SEC Form 10-K, to demonstrate an asset life other than 20 years of similar asset projects.

Supporting documentation for project costs may include, as applicable and available, a complete project description; environmental permits; vendor quotes for plant or equipment; evidence of actual costs of recent comparable projects; bases for electric and gas interconnection costs and any cost contingencies; bases and support for property taxes, insurance, operations and maintenance ("O&M") contractor costs, and other fixed O&M and administrative or general costs; financing documents for construction-period and permanent financing or evidence of recent debt costs of the seller for comparable investments; and the bases and support for the claimed capitalization ratio, rate of return, cost-recovery period, inflation rate, or other parameters used in financial modeling. In addition to the certification, signed by an officer of the Capacity Market Seller, the request must include a certification that the claimed costs accurately reflect, in all material respects, the seller's reasonably expected costs of new entry and that the request satisfies all standards for a resource-specific exception hereunder. The request also shall identify all revenue sources (exclusive of any State Subsidies) relied upon in the Sell Offer to offset the claimed fixed costs, including, without limitation, long-term power supply contracts, tolling agreements, or tariffs on file with state regulatory agencies, and shall demonstrate that such offsetting revenues are consistent, over a reasonable time period identified by the Capacity Market Seller, with the standard prescribed above. In making such demonstration, the Capacity Market Seller may rely upon revenues projected by well-defined, forward-looking dispatch models designed to generally follow the rules and processes of PJM's energy and ancillary services market. Such models must utilize publicly available forward prices for electricity and fuel in the PJM Region. Any modifications made to the forward electricity and fuel prices must similarly use publicly available data. Alternative forward prices for fuel may be used if accompanied by contractual evidence showing the applicability of the alternative fuel price. Where forward fuel markets are not available, publicly available estimates of future fuel prices may be used. The model shall also contain estimates of variable operation and maintenance expenses, which may include Maintenance Adders, and emissions allowance prices. Documentation for net revenues also must include, as available and applicable, plant performance and capability information, including heat rate, start-up times and costs, forced outage rates, planned outage schedules, maintenance cycle, fuel costs and other variable operations and maintenance expenses, capacity factors, and ancillary service capabilities. Any evaluation of net revenues should be consistent with Operating Agreement, Schedule 2, including, but not limited to, consideration of Fuel Costs, Maintenance Adders and Operating *Costs, as applicable.* 

In the alternative, the Capacity Market Seller may request that the Market Monitoring Unit, subject to acceptance by the Office of Interconnection, produce a resource-specific Energy & Ancillary Services Offset value for such resource using the Forward Hourly LMPs, Forward Hourly Ancillary Service Prices and either Forward Daily Natural Gas Prices for combustion turbines and combined cycle resources, or forecasted fuel prices for other resource types, plus plant parameters and capability information specific to the dispatch of the resource, as outlined above. In addition to the documentation identified herein and in the PJM Manuals, the Capacity Market Seller shall provide any additional supporting information reasonably requested by the Office of the Interconnection or the Market Monitoring Unit to evaluate the Sell Offer. Requests for additional documentation will not extend the deadline by which the Office of the Interconnection or the Market Monitoring Unit must provide their determinations of the Minimum Offer Price Rule exception request.

The default assumptions for calculating resource-specific Cost of New Entry for Energy Efficiency Resources shall be based on, as supported by documentation provided by the Capacity Market Seller: the nominal-levelized annual cost to implement the Energy Efficiency program or to install the Energy Efficiency measure reflective of the useful life of the implemented Energy Efficiency equipment, and the offsetting savings associated with avoided wholesale energy costs and other claimed savings provided by implementing the Energy Efficiency program or installing the Energy Efficiency measure.

The default assumptions for calculating resource-specific Cost of New Entry for load-backed Demand Resources shall be based on, as supported by documentation provided by the Capacity Market Seller, program costs required for the resource to meet the capacity obligations of a Demand Resource, including all fixed operating and maintenance cost and weighted average cost of capital based on the actual cost of capital for the entity proposing to develop the Demand Resource.

For generation-backed Demand Resources, the determination of a resource-specific MOPR Floor Offer Price shall only consider the resource's costs related to participation in the Reliability Pricing Model and meeting a capacity commitment. The Capacity Market Seller must provide supporting documentation (at the end-use customer level) of the cost associated with participation as a Demand Resource and an attestation from the Demand Resource that all other costs are not related to participation as a Demand Resource, such as the costs associated with installation and operation of the generation unit, and will be accrued and paid regardless of participation in the Reliability Pricing Model. To the extent the Capacity Market Seller includes all costs associated with the generation unit supporting the Demand Resource then demand charge management benefits at the retail level (as supported by documentation at the end-use customer level) may also be considered as an additional offset to such costs. Supporting documentation (at the end-use customer level) may include, but is not limited to, historic end-use customer bills and associated analysis that identifies the annual retail avoided cost from the operation of such generation unit or the business case to support installation of the generator or regulatory requirements where the generator would be required absent participation in the Reliability Pricing Model.

(C) For a Resource-Specific Exception for a Cleared Capacity Resource with State Subsidy that is a generation resource, the Capacity Market Seller shall submit a Sell Offer consistent with the unit-specific Market Seller Offer Cap process pursuant to Tariff, Attachment DD, section 6.8; except that the 10% uncertainty adder may not be included in the "Adjustment Factor." In addition and notwithstanding the requirements of Tariff, Attachment DD, section 6.8, the Capacity Market Seller shall, at its election, include in its request for an exception under this subsection documentation to support projected energy and

ancillary services markets revenues. Such a request shall identify all revenue sources (exclusive of any State Subsidies) relied upon in the Sell Offer to offset the claimed fixed costs, including, without limitation, long-term power supply contracts, tolling agreements, or tariffs on file with state regulatory agencies, and shall demonstrate that such offsetting revenues are consistent, over a reasonable time period identified by the Capacity Market Seller, with the standard prescribed above. In making such demonstration, the Capacity Market Seller may rely upon revenues projected by well-defined, forward-looking dispatch models designed to generally follow the rules and processes of PJM's energy and ancillary services market. Such models must utilize publicly available forward prices for electricity and fuel in the PJM Region. Any modifications made to the forward electricity and fuel prices must similarly use publicly available data. Alternative forward prices for fuel may be used if accompanied by contractual evidence showing the applicability of the alternative fuel price. Where forward fuel markets are not avaliable, publicly avaliable estimates of future fuel sources may be used. The model shall also contain estimates of variable operation and maintenance expenses, which may include Maintenance Adders, and emissions allowance prices. Documentation for net revenues also must include, as available and applicable, plant performance and capability information, including heat rate, start-up times and costs, forced outage rates, planned outage schedules, maintenance cycle, fuel costs and other variable operations and maintenance expenses, capacity factors, and ancillary service capabilities. Any evaluation of revenues should include, but would not be not limited to, consideration of Fuel Costs, Maintenance Adders and Operating Costs, as applicable, pursuant to Operating Agreement, Schedule 2.

In the alternative, the Capacity Market Seller may request that the Market Monitoring Unit, subject to acceptance by the Office of Interconnection, produce a resource-specific Energy & Ancillary Services Offset value for such resource using the Forward Hourly LMPs, Forward Hourly Ancillary Service Prices and either Forward Daily Natural Gas Prices for combustion turbines and combined cycle resources, or forecasted fuel prices for other resource types, plus plant parameters and capability information specific to the dispatch of the resource, as outlined above. In addition to the documentation identified herein and in the PJM Manuals, the Capacity Market Seller shall provide any additional supporting information reasonably requested by the Office of the Interconnection or the Market Monitoring Unit to evaluate the Sell Offer. Requests for additional documentation will not extend the deadline by which the Office of the Interconnection or the Market Monitoring Unit must provide their determinations of the Minimum Offer Price Rule exception request.

The resource-specific MOPR Floor Offer Price for a Cleared Capacity Resource with State Subsidy that is a generation-backed Demand Resource will be determined based on only costs associated with the resource participating in the Reliability Pricing Model and satisfying a capacity commitment or, to the extent the Capacity Market Seller includes all costs associated with the generation unit supporting the Demand Resource, then demand charge management benefits at the retail level (as supported by documentation at the end-use customer level) may also be considered as an additional offset to such costs. Supporting documentation (at the enduse customer level) may include but is not limited to, historic end-use customer bills and associated analysis that identifies the annual retail avoided cost from the operation of such generation unit or the business case to support installation of the generator or regulatory requirements where the generator would be required absent participation in the Reliability Pricing Model. (D) A Sell Offer evaluated at the resource-specific exception shall be permitted if the information provided reasonably demonstrates that the Sell Offer's competitive, cost-based, fixed, net cost of new entry is below the default MOPR Floor Offer Price, based on competitive cost advantages relative to the costs estimated by the default MOPR Floor Offer Price, including, without limitation, competitive cost advantages resulting from the Capacity Market Seller's business model, financial condition, tax status, access to capital or other similar conditions affecting the applicant's costs, or based on net revenues that are reasonably demonstrated hereunder to be higher than those estimated by the default MOPR Floor Offer Price. Capacity Market Sellers shall demonstrate that claimed cost advantages or sources of net revenue that are irregular or anomalous, that do not reflect arm's-length transactions, or that are not in the ordinary course of the Capacity Market Seller's business are consistent with the standards of this subsection. Failure to adequately support such costs or revenues so as to enable the Office of the Interconnection to make the determination required in this section will result in denial of a resource-specific exception by the Office of the Interconnection.

(E) The Capacity Market Seller must submit a sworn, notarized certification of a duly authorized officer, certifying that the officer has personal knowledge of the resource-specific exception request and that to the best of his/her knowledge and belief: (1) the information supplied to the Market Monitoring Unit and the Office of Interconnection to support its request for an exception is true and correct; (2) the Capacity Market Seller has disclosed all material facts relevant to the request for the exception; and (3) the request satisfies the criteria for the exception.

(F)The Market Monitoring Unit shall review, in an open and transparent manner with the Capacity Market Seller and the Office of the Interconnection, the information and documentation in support of the request and shall provide its findings whether the proposed Sell Offer is acceptable, in accordance with the standards and criteria hereunder, in writing, to the Capacity Market Seller and the Office of the Interconnection by no later than ninety (90) days prior to the commencement of the offer period for such auction. The Office of the Interconnection shall also review, in an open and transparent manner, all exception requests and documentation and shall provide in writing to the Capacity Market Seller, and the Market Monitoring Unit, its determination whether the requested Sell Offer is acceptable and if not it shall calculate and provide to such Capacity Market Seller, a minimum Sell Offer based on the data and documentation received, by no later than sixty-five (65) days prior to the commencement of the offer period for the relevant RPM Auction. After the Office of the Interconnection determines with the advice and input of Market Monitor, the acceptable minimum Sell Offer, the Capacity Market Seller shall notify the Market Monitoring Unit and the Office of the Interconnection, in writing, of the minimum level of Sell Offer to which it agrees to commit by no later than sixty (60) days prior to the commencement of the offer period for the relevant RPM Auction, and in making such determination, the Capacity Market Seller may consider the applicable default MOPR Floor Offer Price and may select such default value if it is lower than the resource-specific determination. A Capacity Market Seller that is dissatisfied with any determination hereunder may seek any remedies available to it from FERC; provided, however, that the Office of the Interconnection will proceed with administration of the Tariff and market rules based on the lower of the applicable default MOPR Floor Offer Price and the resource-specific determination unless and until ordered to do otherwise by FERC.

## (4) *Competitive Exemption.*

(A)A Capacity Resource with State Subsidy may be exempt from the Minimum Offer Price Rule under this subsection 5.14(h-1) in any RPM Auction if the Capacity Market Seller certifies to the Office of Interconnection, in accordance with the PJM Manuals, that the Capacity Market Seller of such Capacity Resource elects to forego receiving any State Subsidy for the applicable Delivery Year no later than thirty (30) days prior to the commencement of the offer period for the relevant RPM Auction. Notwithstanding the foregoing, the competitive exemption is not available to Capacity Resources with State Subsidy that (A) are owned or offered by Self-Supply Entities, (B) are no longer entitled to receive a State Subsidy but are still considered a Capacity Resource with State Subsidy solely because they have not cleared an RPM Auction since last receiving a State Subsidy, or (C) are Jointly Owned Cross-Subsidized Capacity Resources or is the subject of a bilateral transaction (including but not limited to those reported pursuant to Tariff, Attachment DD, section 4.6) and not all Capacity Market Sellers of the supporting facility unanimously elect the competitive exemption and certify that no State Subsidy will be received associated with supporting the resource. A new Generation Capacity *Resource that is a Capacity Resource with State Subsidy may elect the competitive exemption;* however, in such instance, the applicable MOPR Floor Offer Price will be determined in accordance with the minimum offer price rules for certain new Generation Capacity Resources as provided in Tariff, Attachment DD, section 5.14(h), which apply the minimum offer price rule to the new Generation Capacity Resources located in an LDA where a separate VRR Curve is established as provided in Tariff, Attachment DD, section 5.14(h)(4).

(B)The Capacity Market Seller shall not receive a State *(i)* Subsidy for any part of the relevant Delivery Year in which it elects a competitive exemption or certifies that it is not a Capacity Resource with State Subsidy. In furtherance of this prohibition, if a Capacity Resource that (1) is a New Entry Capacity Resource with State Subsidy that elects the competitive exemption in subsection (4)(A) above and clears an RPM Auction for a given Delivery Year, but prior to the end of that Delivery Year elects to accept a State Subsidy for the associated Delivery Year or an earlier Delivery Year or (2) is not a Capacity Resource with State Subsidy at the time of the RPM Auction for the Delivery Year for which it first cleared an RPM Auction but prior to the end of that Delivery Year receives a State Subsidy for the associated Delivery Year or an earlier Delivery Year, or (3) in the case of Demand Resource, is an end-use customer location MW that receives a State Subsidy and is included in a Demand Resource Registration pursuant to RAA, Schedule 6 to satisfy a Demand Resource commitment that was not designated as a Capacity Resource with State Subsidy at the time it cleared the relevant RPM Auction, then the Capacity Market Seller of that Capacity Resource or end-use customer location MW shall not receive RPM revenues for such resource or end-use customer location MW for any part of that Delivery Year and may not participate in any RPM Auction with such resource or end-use customer location MW, or be eligible to use such resource or enduse customer location MW as replacement capacity starting June 1 of the Delivery Year after the Capacity Market Seller or end-use customer location MW first receives the State Subsidy and continuing for a period of 20 years, except for battery energy storage, for which such participation restriction shall apply for a period of 15 years. A Jointly Owned Cross-Subsidized Capacity Resource that meets the requirements of either of the two preceding subsections (B)(i)(1) or (2), shall not receive RPM revenues for any part of that Delivery Year and may not

participate in any RPM Auction or be eligible to be used as replacement capacity starting June 1 of the Delivery Year and continuing for the number of years specified above, after any joint Capacity Market Seller of the underlying facility first receives the State Subsidy. A Capacity Resource with State Subsidy that is the subject of a bilateral transaction that meets the requirements of either of the two preceding subsections (B)(i)(1) or (2) shall not receive RPM revenues for any part of that Delivery Year and may not participate in any RPM Auction or be eligible to be used as replacement capacity starting June 1 of the Delivery Year and continuing for the number of years specified above if any owner or Capacity Market Seller of the facility receives a State Subsidy. The Capacity Market Seller(s) of any such Capacity Resource or Jointly Owned Cross-Subsidized Capacity Resource shall also return to the Office of the Interconnection any revenues paid to such Capacity Resource associated with their capacity commitment for such Delivery Year and shall retain their RPM commitment and associated obligations for such Delivery Year and for any future Delivery Years in which the resource has already secured a capacity commitment, including any Non-Performance Charges relating to the capacity and remain eligible to collect Performance Payments under this Tariff, Attachment DD, section 10A for the relevant Delivery Year and any subsequent Delivery Years for which it already received an RPM commitment. Notwithstanding the foregoing, Capacity Resources that lose their eligibility to participate in RPM pursuant to this section remain eligible for commitment in an FRR Capacity Plan.

If any Capacity Resource that has previously cleared an (ii) RPM Auction (1) is a Cleared Capacity Resource with State Subsidy that claims the competitive exemption pursuant to subsection (4)(A) above in an RPM Auction and clears such RPM Auction or (2) was not a Capacity Resource with State Subsidy at the time it cleared an RPM Auction for a given Delivery Year but later becomes entitled to receive a State Subsidy for that Delivery Year, and the Capacity Market Seller subsequently elects to accept a State Subsidy for any part of that Delivery Year, or (3) in the case of Demand Resource, is an end-use customer location that receives a State Subsidy and is included in a Demand Resource Registration pursuant to RAA, Schedule 6 to satisfy a Demand Resource commitment that was not designated as a Capacity Resource with State Subsidy at the time it cleared the relevant RPM Auction, then the Capacity Market Seller of that Capacity Resource or end-use customer location may not receive *RPM revenues for such resource or end-use customer location for any part of that Delivery Year,* unless it can demonstrate that it would have cleared in the relevant RPM Auction under an offer consistent with the resource-specific exception process outlined above in subsection 5.14(h-1)(3). All Capacity Market Sellers of a Jointly Owned Cross-Subsidized Capacity Resource that meets the requirements of either of the two preceding subsections (B)(ii)(1) or (2) may not receive RPM revenues for any part of that Delivery Year if any joint Capacity Market Seller of the underlying facility accepts a subsidy for that Delivery Year, unless the Capacity Market Seller can demonstrate that the facility would have cleared in the relevant RPM Auction under an offer consistent with the resource-specific exception process outlined above in subsection 5.14(h-1)(3). A Capacity Resource with State Subsidy that is the subject of a bilateral transaction may not receive RPM revenues for any part of that Delivery Year if any owner or Capacity Market Seller of the underlying facility receives a State Subsidy for that Delivery Year, unless the Capacity Market Seller can demonstrate that the facility would have cleared in the relevant RPM Auction under an offer consistent with the resource-specific exception process outlined above in subsection 5.14(h-1)(3), if any owner or Capacity Market Seller of the facility receives a State Subsidy. The Capacity Market Seller(s) of any such Capacity Resources or

Jointly Owned Cross-Subsidized Capacity Resource shall return to the Office of the Interconnection any revenues paid to such Capacity Resource associated with their capacity commitment for such Delivery Year and shall retain their RPM commitment and associated obligations for the relevant Delivery Year and remain eligible to collect Performance Payments or to pay Non-Performance Charges, as applicable, pursuant to Tariff, Attachment DD, section 10A.

(iii) Any revenues returned to the Office of the Interconnection pursuant to the preceding subsections (i) and (ii) shall be allocated to the relevant load that paid for the State Subsidy (to the extent possible). If the Office of Interconnection cannot identify the relevant load responsible for the State Subsidy, then the returned revenues would be allocated across all load in the RTO that has not selected the FRR Alternative. Such revenues shall be distributed on a pro-rata basis to such LSEs that were charged a Locational Reliability Charge based on their Daily Unforced Capacity Obligations.

(5) Self-Supply Entity exemption. A Capacity Resource that was owned, or bilaterally contracted, by a Self-Supply Entity on December 19, 2019, shall be exempt from the Minimum Offer Price Rule if such Capacity Resource remains owned or bilaterally contracted by such Self-Supply Entity and satisfies at least one of the criteria specified below:

(A) has successfully cleared an RPM Auction prior to

December 19, 2019;

(B) is the subject of an interconnection construction service agreement, interim interconnection service agreement, interconnection service agreement or wholesale market participation agreement executed on or before December 19, 2019; or

(C) is the subject of an unexecuted interconnection construction service agreement, interim interconnection service agreement, interconnection service agreement or wholesale market participation agreement filed by PJM with the Commission on or before December 19, 2019.

(6) Renewable Portfolio Standard Exemption. A Capacity Resource with State Subsidy shall be exempt from the Minimum Offer Price Rule if such Capacity Resource (1) receives or is entitled to receive State Subsidies through renewable energy credits or equivalent credits associated with a state-mandated or state-sponsored renewable portfolio standard ("RPS") program or equivalent program as of December 19, 2019 and (2) satisfies at least one of the following criteria:

(A) has successfully cleared an RPM Auction prior to December 19, 2019;

(B) is the subject of an interconnection construction service agreement, interim interconnection service agreement, interconnection service agreement or wholesale market participation agreement executed on or before December 19, 2019; or (C) is the subject of an unexecuted interconnection construction service agreement, interim interconnection service agreement, interconnection service agreement or wholesale market participation agreement filed by PJM with the Commission on or before December 19, 2019.

(7) Demand Resource and Energy Efficiency Resource Exemption.

(A) A Capacity Resource with State Subsidy that is Demand Resource or an Energy Efficiency Resource shall be exempt from the Minimum Offer Price Rule if such Capacity Resource satisfies at least one of the following criteria:

(i) has successfully cleared an RPM Auction prior to December 19, 2019. For purposes of this subsection (a), individual customer location registrations (or for utility-based residential load curtailment program, based on the total number of participating customers) that participated as Demand Resource and cleared in an RPM Auction prior to December 19, 2019, and were submitted to PJM no later than 45 days prior to the BRA for the 2022/2023 Delivery Year shall be deemed eligible for the Demand Resource and Energy Efficiency Resource Exemption; or

(ii) has completed registration on or before December 19,

2019; or

(iii) is supported by a post-installation measurement and verification report for Energy Efficiency Resources approved by PJM on or before December 19, 2019 (calculated for each installation period, Zone and Sub-Zone by using the greater of the latest approved post-installation measurement and verification report prior to December 19, 2019 or the maximum MW cleared for a Delivery Year across all auctions conducted prior to December 19, 2019).

(B) All registered locations that qualify for the Demand Resource and Energy Efficiency Resource exemption shall continue to remain exempt even if the MW of nominated capacity increases between RPM Auctions unless any MW increase in the nominated capacity is due to an investment made for the sole purpose of increasing the curtailment capability of the location in the capacity market. In such case, the MW of increased capability will not be qualified for the Demand Resource and Energy Efficiency Resource exemption.

(8) Capacity Storage Resource Exemption. A Capacity Resource with State Subsidy that is a Capacity Storage Resource shall be exempt from the Minimum Offer Price Rule if such Capacity Storage Resource satisfies at least one of the following criteria:

(A) has successfully cleared an RPM Auction prior to December 19, 2019;

(B) is the subject of an interconnection construction service agreement, interim interconnection service agreement, interconnection service agreement or wholesale market participation agreement executed on or before December 19, 2019; or
(C) is the subject of an unexecuted interconnection construction service agreement, interim interconnection service agreement, interconnection service agreement or wholesale market participation agreement filed by PJM with the Commission on or before December 19, 2019.

(9) Procedures and Remedies in Cases of Suspected Fraud or Material Misrepresentation or Omissions in Connection with a Capacity Resource with State Subsidy. In the event the Office of the Interconnection, with advice and input from the Market Monitoring Unit, reasonably believes that a certification of a Capacity Resource's status contains fraudulent or material misrepresentations or omissions such that the Capacity Market Seller's Capacity Resource is a Capacity Resource with a State Subsidy (including whether the Capacity Resource is a Jointly Owned Cross-Subsidized Capacity Resource) or does not qualify for a competitive exemption or contains information that is inconsistent with the resource-specific exception, then:

A Capacity Market Seller shall, within five (5) business days upon (A)receipt of the request for additional information, provide any supporting information reasonably requested by the Office of the Interconnection or the Market Monitoring Unit to evaluate whether such Capacity Resource is a Capacity Resource with State Subsidy or whether the Capacity Market Seller is eligible for the competitive exemption. If the Office of the Interconnection determines that the Capacity Resource's status as a Capacity Resource with State Subsidy is different from that specified by the Capacity Market Seller or is not eligible for a competitive exemption pursuant to subsection (4) above, the Office of the Interconnection shall notify, in writing, the Capacity Market Seller of such determination by no later than sixty-five (65) days prior to the commencement of the offer period for the relevant RPM Auction. A Capacity Market Seller that is dissatisfied with any determination hereunder may seek any remedies available to it from FERC; provided, however, if the Office of Interconnection determines that the subject resource is a Capacity Resource with State Subsidy or is not eligible for a competitive exemption pursuant to subsection (4) above, such Capacity Resource shall be subject to the Minimum Offer Price Rule, unless and until ordered to do otherwise by FERC.

(B) if the Office of the Interconnection does not provide written notice of suspected fraudulent or material misrepresentation or omission at least sixty-five (65) days before the start of the relevant RPM Auction, then the Office of the Interconnection may file the certification that contains any alleged fraudulent or material misrepresentation or omission with FERC. In such event, if the Office of Interconnection determines that a resource is a Capacity Resource with State Subsidy that is subject to the Minimum Offer Price Rule, the Office of the Interconnection will proceed with administration of the Tariff and market rules on that basis unless and until ordered to do otherwise by FERC. The Office of the Interconnection shall implement any remedies ordered by FERC; and

(C) prior to applying the Minimum Offer Price Rule, the Office of the Interconnection, with advice and input of the Market Monitoring Unit, shall notify the affected Capacity Market Seller and, to the extent practicable, provide the Capacity Market Seller an opportunity to explain the alleged fraudulent or material misrepresentation or omission. Any filing to FERC under this provision shall seek fast track treatment and neither the name nor any identifying characteristics of the Capacity Market Seller or the resource shall be publicly revealed, but otherwise the filing shall be public. The Capacity Market Seller may submit a revised certification for that Capacity Resource for subsequent RPM Auctions, including RPM Auctions held during the pendency of the FERC proceeding. In the event that the Capacity Market Seller is cleared by FERC from such allegations of fraudulent or material misrepresentations or omissions then the certification shall be restored to the extent and in the manner permitted by FERC. The remedies required by this subsection to be requested in any filing to FERC shall not be exclusive of any other remedies or penalties that may be pursued against the Capacity Market Seller.

- i) Capacity Export Charges and Credits
  - (1) Charge

Each Capacity Export Transmission Customer shall incur for each day of each Delivery Year a Capacity Export Charge equal to the Reserved Capacity of Long-Term Firm Transmission Service used for such export ("Export Reserved Capacity") multiplied by (the Final Zonal Capacity Price for such Delivery Year for the Zone encompassing the interface with the Control Area to which such capacity is exported minus the Final Zonal Capacity Price for such Delivery Year for the Zone in which the resources designated for export are located, but not less than zero). If more than one Zone forms the interface with such Control Area, then the amount of Reserved Capacity described above shall be apportioned among such Zones for purposes of the above calculation in proportion to the flows from such resource through each such Zone directly to such interface under CETO/CETL analysis conditions, as determined by the Office of the Interconnection using procedures set forth in the PJM Manuals. The amount of the Reserved Capacity that is associated with a fully controllable facility that crosses such interface shall be completely apportioned to the Zone within which such facility terminates.

(2) Credit

To recognize the value of firm Transmission Service held by any such Capacity Export Transmission Customer, such customer assessed a charge under section 5.14(i)(1) above also shall receive a credit, comparable to the Capacity Transfer Rights provided to Load-Serving Entities under Tariff, Attachment DD, section 5.15. Such credit shall be equal to the locational capacity price difference specified in section 5.14(i)(1) above times the Export Customer's Allocated Share determined as follows:

Export Customer's Allocated Share equals

(Export Path Import \* Export Reserved Capacity) /

(Export Reserved Capacity + Daily Unforced Capacity Obligations of all LSEs in such Zone).

Where:

"Export Path Import" means the megawatts of Unforced Capacity imported into the export interface Zone from the Zone in which the resource designated for export is located. If more than one Zone forms the interface with such Control Area, then the amount of Export Reserved Capacity shall be apportioned among such Zones for purposes of the above calculation in the same manner as set forth in subsection (i)(1) above.

(3) Distribution of Revenues

Any revenues collected from the Capacity Export Charge with respect to any capacity export for a Delivery Year, less the credit provided in subsection (i)(2) for such Delivery Year, shall be distributed to the Load Serving Entities in the export-interface Zone that were assessed a

Locational Reliability Charge for such Delivery Year, pro rata based on the Daily Unforced Capacity Obligations of such Load-serving Entities in such Zone during such Delivery Year. If more than one Zone forms the interface with such Control Area, then the revenues shall be apportioned among such Zones for purposes of the above calculation in the same manner as set forth in subsection (i)(1) above.

## 5.14A [Reserved.]

## 5.14B Generating Unit Capability Verification Test Requirements Transition Provision for RPM Delivery Years 2014/2015, 2015/2016, and 2016/2017

A. This transition provision applies only with respect to Generation Capacity Resources with existing capacity commitments for the 2014/2015, 2015/2016, or 2016/2017 Delivery Years that experience reductions in verified installed capacity available for sale as a direct result of revised generating unit capability verification test procedures effective with the summer 2014 capability tests, as set forth in the PJM Manuals. A Generation Capacity Resource meeting the description of the preceding sentence, and the Capacity Market Seller of such a resource, are hereafter in this section 5.14B referred to as an "Affected Resource" and an "Affected Resource Owner," respectively.

For each of its Affected Resources, an Affected Resource Owner is required to provide B. documentation to the Office of the Interconnection sufficient to show a reduction in installed capacity value as a direct result of the revised capability test procedures. Upon acceptance by the Office of the Interconnection, the Affected Resource's installed capacity value will be updated in the eRPM system to reflect the reduction, and the Affected Resource's Capacity Interconnection Rights value will be updated to reflect the reduction, effective June 1, 2014. The reduction's impact on the Affected Resource's existing capacity commitments for the 2014/2015 Delivery Year will be determined in Unforced Capacity terms, using the final EFORd value established by the Office of the Interconnection for the 2014/2015 Delivery Year as applied to the Third Incremental Auction for the 2014/2015 Delivery Year, to convert installed capacity to Unforced Capacity. The reduction's impact on the Affected Resource's existing capacity commitments for each of the 2015/2016 and 2016/2017 Delivery Years will be determined in Unforced Capacity terms, using the EFORd value from each Sell Offer in each applicable RPM Auction, applied on a pro-rata basis, to convert installed capacity to Unforced Capacity. The Unforced Capacity impact for each Delivery Year represents the Affected Resource's capacity commitment shortfall, resulting wholly and directly from the revised capability test procedures, for which the Affected Resource Owner is subject to a Capacity Resource Deficiency Charge for the Delivery Year, as described in Tariff, Attachment DD, section 8D, unless the Affected Resource Owner (i) provides replacement Unforced Capacity, as described in Tariff, Attachment DD, section 8.1, prior to the start of the Delivery Year to resolve the Affected Resource's total capacity commitment shortfall; or (ii) requests relief from Capacity Resource Deficiency Charges that result wholly and directly from the revised capability test procedures by electing the transition mechanism described in this section 5.14B ("Transition Mechanism").

C. Under the Transition Mechanism, an Affected Resource Owner may elect to have the Unforced Capacity commitments for all of its Affected Resources reduced for the 2014/2015, 2015/2016, or 2016/2017 Delivery Years to eliminate the capacity commitment shortfalls, across all of its Affected Resources, that result wholly and directly from the revised capability test procedures, and for which the Affected Resource Owner otherwise would be subject to Capacity Resource Deficiency Charges for the Delivery Year. In electing this option, the Affected Resource Owner relinquishes RPM Auction Credits associated with the reductions in Unforced Capacity commitments for all of its Affected Resources for the Delivery Year, and Locational Reliability Charges as described in Tariff, Attachment DD, section 5.14(e) of this Attachment DD are adjusted accordingly. Affected Resource Owners wishing to elect the Transition Mechanism for the 2015/2016 Delivery Year must notify the Office of the Interconnection by May 30, 2014. Affected Resource Owners wishing to elect the Transition Mechanism for the 2015/2016 Delivery Year for the Interconnection by July 25, 2014.

D. The Office of the Interconnection will offset the total reduction (across all Affected Resources and Affected Resource Owners) in Unforced Capacity commitments associated with the Transition Mechanism for the 2015/2016 and 2016/2017 Delivery Years by applying corresponding adjustments to the quantity of Buy Bid or Sell Offer activity in the upcoming Incremental Auctions for each of those Delivery Years, as described in Tariff, Attachment DD, sections 5.12(b)(ii) and 5.12(b)(iii).

E. By electing the Transition Mechanism, an Affected Resource Owner may receive relief from applicable Capacity Resource Deficiency Charges for the 2014/2015, 2015/2016, or 2016/2017 Delivery Years, and a Locational UCAP Seller that sells Locational UCAP based on an Affected Resource owned by the Affected Resource Owner may receive relief from applicable Capacity Resource Deficiency Charges for the 2014/2015 Delivery Year, to the extent that the Affected Resource Owner demonstrates, to the satisfaction of the Office of the Interconnection, that an inability to deliver the amount of Unforced Capacity previously committed for the 2014/2015, 2015/2016, or 2016/2017 Delivery Years is due to a reduction in verified installed capacity available for sale as a direct result of revised generating unit capability verification test procedures effective with the summer 2014 capability tests, as set forth in the PJM Manuals; provided, however, that the Affected Resource Owner must provide the Office of the Interconnection with all information deemed necessary by the Office of the Interconnection to assess the merits of the request for relief.

## 5.14C Demand Response Operational Resource Flexibility Transition Provision for RPM Delivery Years 2015/2016 and 2016/2017

A. This transition provision applies only to Demand Resources for which a Curtailment Service Provider has existing RPM commitments for the 2015/2016 or 2016/2017 Delivery

Years (alternatively referred to in this section 5.14C as "Applicable Delivery Years" and each an "Applicable Delivery Year") that (i) cannot satisfy the 30-minute notification requirement as described in Tariff, Attachment DD-1, section A.2 and the parallel provision of RAA, Schedule 6; (ii) are not excepted from the 30-minute notification requirement as described in Tariff, Attachment DD-1, section A.2 and the parallel provision of RAA, Schedule 6; and (iii) cleared in the Base Residual Auction or First Incremental Auction for the 2015/2016 Delivery Year, or cleared in the Base Residual Auction for the 2016/2017 Delivery Year. A Demand Resource meeting these criteria and the Curtailment Service Provider of such a resource are hereafter in this section 5.14C referred to as an "Affected Demand Resource" and an "Affected Curtailment Service Provider," respectively.

B. For this section 5.14C to apply to an Affected Demand Resource, the Affected Curtailment Service Provider must notify the Office of the Interconnection in writing, with regard to the following information by the applicable deadline:

For each applicable Affected Demand Resource: the number of cleared megawatts of Unforced Capacity for the Applicable Delivery Year by end-use customer site that the Affected Curtailment Service Provider cannot deliver, calculated based on the most current information available to the Affected Curtailment Service Provider; the end-use customer name; electric distribution company's account number for the end-use customer; address of end-use customer; type of Demand Resource (i.e., Limited DR, Annual DR, Extended Summer DR); the Zone or sub-Zone in which the end-use customer is located; and, a detailed description of why the end-use customer cannot comply with the 30-minute notification requirement or qualify for one of the exceptions to the 30-minute notification requirement provided in Tariff, Attachment DD-1, section A.2 and the parallel provision of RAA, Schedule 6.

ii) If applicable, a detailed analysis that quantifies the amount of cleared megawatts of Unforced Capacity for the Applicable Delivery Year for prospective customer sales that could not be contracted by the Affected Curtailment Service Provider because of the 30-minute notification requirement provided in Tariff, Attachment DD-1, section A.2 and the parallel provisions of RAA, Schedule 6 that the Affected Curtailment Service Provider cannot deliver, by type of Demand Resource (i.e. Limited DR, Annual DR, Extended Summer DR) and by Zone and sub-Zone, as applicable. The analysis should include the amount of Unforced Capacity expected from prospective customer sales for each Applicable Delivery Year and must include supporting detail to substantiate the difference in reduced sales expectations. The Affected Curtailment Service Provider should maintain records to support its analysis.

1. For the 2015/2016 Delivery Year, the notice shall be provided by no later than seven (7) days prior to the posting by the Office of the Interconnection of planning parameters for the Third Incremental Auction for the 2015/2016 Delivery Year. Such Affected Curtailment Service Provider that utilizes this transition provision may not sell or offer to sell megawatts in the modeled LDA or sub-LDA where an Affected Demand Resource is located in the Third Incremental Auction for the 2015/2016 Delivery Year.

2. For the 2016/2017 Delivery Year, the notice shall be provided by no later than seven (7) days prior to the posting by the Office of the Interconnection of planning parameters for the Second Incremental Auction for the 2016/2017 Delivery Year. Such Affected Curtailment Service Provider that utilizes this transition provision may not sell or offer to sell megawatts in the modeled LDA or sub-LDA where an Affected Demand Resource is located in the Second or Third Incremental Auctions for the 2016/2017 Delivery Year.

3. For the 2016/2017 Delivery Year, the notice shall be provided by no later than seven (7) days prior to the posting by the Office of the Interconnection of planning parameters for the Third Incremental Auction for the 2016/2017 Delivery Year. Such Affected Curtailment Service Provider that utilizes this transition provision must not have sold or offered to sell megawatts in the modeled LDA or sub-LDA where an Affected Demand Resource is located in the Second Incremental Auction for the 2016/2017 Delivery Year, and may not sell or offer to sell megawatts in the modeled LDA or sub-LDA where an Affected Demand Resource is located in the Third Incremental Auction for the 2016/2017 Delivery Year.

C. For the Third Incremental Auction for the 2015/2016 Delivery Year and the First, Second, and Third Incremental Auctions for the 2016/2017 Delivery Year, the Office of the Interconnection shall publish aggregate information on the undeliverable megawatts declared under this transition provision (hereafter, "non-viable megawatts"), by type of Demand Resource and by Zone or sub-Zone, concurrently with its posting of planning parameters for the applicable Scheduled Incremental Auction. Non-viable megawatts for a Scheduled Incremental Auction for an Applicable Delivery Year represent those megawatts meeting the criteria of subsection A above and declared in accordance with subsection B above. Prior to each Third Incremental Auction for an Applicable Delivery Year, the Office of the Interconnection shall apply adjustments equal to the declared non-viable megawatt quantity to the quantity of Buy Bid or Sell Offer activity in the upcoming Scheduled Incremental Auctions for the Applicable Delivery Year, as described in Tariff, Attachment DD, sections 5.12(b)(ii) and 5.12(b)(iii). Prior to the Second Incremental Auction for the 2016/2017 Delivery Year, the Office of the Interconnection shall adjust the recalculated PJM Region Reliability Requirement and recalculated LDA Reliability Requirements, as described in Tariff, Attachment DD, section 5.4(c), by the applicable quantity of declared non-viable megawatts, and shall update the PJM Region Reliability Requirement and each LDA Reliability Requirement for such Second Incremental Auction only if the combined change of the applicable adjustment and applicable recalculation is greater than or equal to the lessor of (i) 500 megawatts or (ii) one percent of the prior PJM Region Reliability Requirement or one percent of the prior LDA Reliability Requirement, as applicable.

D. Prior to the start of each Applicable Delivery Year, the Office of the Interconnection shall reduce, by type of Demand Resource and by Zone or sub-Zone, the capacity commitment of each Affected Curtailment Service Provider that utilizes this transition provision for the Applicable Delivery Year based on the non-viable megawatts declared by the Affected Curtailment Service Provider under this transition provision. If the Affected Curtailment Service Provider cleared megawatts from multiple Affected Demand Resources of the same type and Zone or sub-Zone, or cleared megawatts in multiple RPM Auctions for the Applicable Delivery Year, the Office of the Interconnection shall allocate the reduction in capacity commitment by type of Demand Resource and by Zone or sub-Zone across the applicable Affected Demand Resources and

relevant RPM Auctions. Such allocation shall be performed on a pro-rata basis, based on megawatts cleared by the Affected Demand Resources in the relevant RPM Auctions.

E. For each Applicable Delivery Year, an Affected Curtailment Service Provider that utilizes this transition provision for the Applicable Delivery Year relinquishes an Affected Demand Resource's RPM Auction Credits for the amount of capacity commitment reduction as determined under subsection D above. Locational Reliability Charges as described in Tariff, Attachment DD, section 5.14(e) are also adjusted accordingly.

# 5.14D Capacity Performance and Base Capacity Transition Provision for RPM Delivery Years 2016/2017 and 2017/2018

A. This transition provision applies only for procuring Capacity Performance Resources for the 2016/2017 and 2017/2018 Delivery Years.

B. For both the 2016/2017 and 2017/2018 Delivery Years, PJM will hold a Capacity Performance Transition Incremental Auction to procure Capacity Performance Resources.

1. For each Capacity Performance Transition Incremental Auction, the optimization algorithm shall consider:

- the target quantities of Capacity Performance Resources specified below;
- the Sell Offers submitted in such auction.

The Office of the Interconnection shall submit a Buy Bid based on the quantity of Capacity Performance Resources specified for that Delivery Year. For the 2016/2017 Delivery Year, the Office of the Interconnection shall submit a Buy Bid, at a price no higher than 0.5 times the Net CONE value for the PJM Region determined for the Base Residual Auction for that Delivery Year, for a quantity of Capacity Performance Resources equal to 60 percent of the updated Reliability Requirement for the PJM Region. For the 2017/2018 Delivery Year, the Office of the Interconnection shall submit a Buy Bid, at a price no higher than 0.6 times the Net CONE value for the PJM Region determined for the Base Residual Auction for that Delivery Year, for a quantity of Capacity Performance Resources equal to 70 percent of the updated Reliability Requirement for the PJM Region.

2. For each Capacity Performance Transition Incremental Auction, the Office of the Interconnection shall calculate a clearing price to be paid for each megawatt-day of Unforced Capacity that clears in such auction. For the 2016/2017 Delivery Year, the Capacity Resource Clearing Price for any Capacity Performance Transition Incremental Auction shall not exceed 0.5 times the Net CONE value for the PJM Region determined for the Base Residual Auction for that Delivery Year. For the 2017/2018 Delivery Year, the Capacity Resource Clearing Price for any Capacity Performance Transition Incremental Auction shall not exceed 0.6 times the Net CONE value for the PJM Region determined for the Base Residual Auction for the Net CONE value for the PJM Region determined for the Base Residual Auction for the Net CONE value for the PJM Region determined for the Base Residual Auction for that Delivery Year.

3. A Capacity Market Seller may offer any Capacity Resource that has not been committed in an FRR Capacity Plan, that qualifies as a Capacity Performance Resource under Tariff, Attachment DD, section 5.5A(a) and that (i) has not cleared an RPM Auction for that Delivery Year; or (ii) has cleared in an RPM Auction for that Delivery Year. A Capacity Market Seller may offer an external Generation Capacity Resource to the extent that such resource: (i) is reasonably expected, by the relevant Delivery Year, to meet all applicable requirements to be treated as equivalent to PJM Region internal generation that is not subject to NERC tagging as an interchange transaction; (ii) has long-term firm transmission service confirmed on the complete transmission path from such resource into PJM; and (iii) is, by written commitment of the Capacity Market Seller, subject to the same obligations imposed on Generation Capacity Resources located in the PJM Region by Tariff, Attachment DD, section 6.6 to offer their capacity into RPM Auctions.

4. Capacity Resources that already cleared an RPM Auction for a Delivery Year, retain the capacity obligations for that Delivery Year, and clear in a Capacity Performance Transition Incremental Auction for the same Delivery Year shall: (i) receive a payment equal to the Capacity Resource Clearing Price as established in that Capacity Performance Transition Incremental Auction; and (ii) not be eligible to receive a payment for clearing in any prior RPM Auction for that Delivery Year.

D. All Capacity Performance Resources that clear in a Capacity Performance Transition Incremental Auction will be subject to the Non-Performance Charge set forth in Tariff, Attachment DD, section 10A.

# 5.14E Demand Response Legacy Direct Load Control Transition Provision for RPM Delivery Years 2016/2017, 2017/2018, and 2018/2019

A. This transition provision applies only to Demand Resources for which a Curtailment Service Provider has existing RPM commitments for the 2016/2017, 2017/2018, or 2018/2019 Delivery Years (alternatively referred to in this section 5.14E as "Applicable Delivery Years" and each an "Applicable Delivery Year") that (i) qualified as Legacy Direct Load Control before June 1, 2016 as described in Tariff, Attachment DD-1, section G and the parallel provision of RAA, Schedule 6; (ii) cannot meet the requirements for using statistical sampling for residential non-interval metered customers as described in Tariff, Attachment DD-1, section K and the parallel provision of RAA, Schedule 6; and (iii) cleared in the Base Residual Auction or First Incremental Auction for the 2016/2017 Delivery Year, cleared in the Base Residual Auction for the 2017/2018 Delivery Year, or cleared in the Base Residual Auction for the 2018/2019 Delivery Year. A Demand Resource meeting these criteria and the Curtailment Service Provider of such a resource are hereafter in this section 5.14E referred to as an "Affected Demand Resource" and an "Affected Curtailment Service Provider," respectively.

B. For this section 5.14E to apply to an Affected Demand Resource, the Affected Curtailment Service Provider must notify the Office of the Interconnection in writing, with regard to the following information, by the applicable deadline:

i) For each applicable Affected Demand Resource: the number of cleared megawatts of Unforced Capacity for the Applicable Delivery Year by end-use customer site

that the Affected Curtailment Service Provider cannot deliver, calculated based on the most current information available to the Affected Curtailment Service Provider; electric distribution company's account number for the end-use customer; address of end-use customer; type of Demand Resource (i.e., Limited DR, Annual DR, Extended Summer DR); the Zone or sub-Zone in which the enduse customer is located; and, a detailed description of why the endues customer cannot comply with statistical sampling for residential non-interval metered customers requirement as described in Tariff, Attachment DD-1, section K and the parallel provision of RAA, Schedule 6.

ii) If applicable, a detailed analysis that quantifies the amount of cleared megawatts of Unforced Capacity for the Applicable Delivery Year for prospective customer sales that could not be contracted by the Affected Curtailment Service Provider because of the statistical sampling for residential non-interval metered customers requirement as described in Tariff, Attachment DD-1, section K and the parallel provision of RAA, Schedule 6 that the Affected Curtailment Service Provider cannot deliver, by type of Demand Resource (i.e. Limited DR, Annual DR, Extended Summer DR) and by Zone and sub-Zone, as applicable. The analysis should include the amount of Unforced Capacity expected from prospective customer sales for each Applicable Delivery Year and must include supporting detail to substantiate the difference in reduced sales expectations. The Affected Curtailment Service Provider should maintain records to support its analysis.

1. For the 2016/2017 Delivery Year, the notice shall be provided by no later than seven (7) days prior to the posting by the Office of the Interconnection of planning parameters for the Second and/or Third Incremental Auction for the 2016/2017 Delivery Year. Such Affected Curtailment Service Provider that utilizes this transition provision may not sell or offer to sell megawatts in the matching LDA or sub-LDA where an Affected Demand Resource is located in the Second or Third Incremental Auction for the 2016/2017 Delivery Year.

2. For the 2017/2018 Delivery Year, the notice shall be provided by no later than seven (7) days prior to the posting by the Office of the Interconnection of planning parameters for the First, Second and/or Third Incremental Auction for the 2017/2018 Delivery Year. Such Affected Curtailment Service Provider that utilizes this transition provision may not sell or offer to sell megawatts in the matching LDA or sub-LDA where an Affected Demand Resource is located in the First, Second or Third Incremental Auctions for the 2017/2018 Delivery Year.

3. For the 2018/2019 Delivery Year, the notice shall be provided by no later than seven (7) days prior to the posting by the Office of the Interconnection of planning parameters for the First, Second and/or Third Incremental Auction for the 2018/2019 Delivery Year. Such Affected Curtailment Service Provider that utilizes this transition provision may not sell or offer to sell megawatts in the matching LDA or sub-LDA where an Affected Demand Resource is located in the First, Second or Third Incremental Auctions for the 2018/2019 Delivery Year.

C. For the Second and Third Incremental Auction for the 2016/2017 Delivery Year, the First, Second, and Third Incremental Auctions for the 2017/2018 Delivery Year, and the First,

Second, and Third Incremental Auctions for the 2018/2019 Delivery Year, the Office of the Interconnection shall publish aggregate information on the undeliverable megawatts declared under this transition provision (hereafter, "non-viable megawatts"), by type of Demand Resource and by Zone or sub-Zone, concurrently with its posting of planning parameters for the applicable Scheduled Incremental Auction. Non-viable megawatts for a Scheduled Incremental Auction for an Applicable Delivery Year represent those megawatts meeting the criteria of subsection A above and declared in accordance with subsection B above. Prior to each Scheduled Incremental Auction for an Applicable Delivery Year, the Office of the Interconnection shall apply adjustments equal to the declared non-viable megawatt quantity to the quantity of Buy Bid or Sell Offer activity in the upcoming Scheduled Incremental Auctions for the Applicable Delivery Year, as described in Tariff, Attachment DD, sections 5.12(b)(ii) and 5.12(b)(iii). Prior to the Second Incremental Auction for the 2016/2017 Delivery Year, the First and Second Incremental Auction for the 2017/2018 Delivery Year, and the First and Second Incremental Auction for the 2018/2019 Delivery Year, the Office of the Interconnection shall adjust the recalculated PJM Region Reliability Requirement and recalculated LDA Reliability Requirements, as described in Tariff, Attachment DD, section 5.4(c), by the applicable quantity of declared non-viable megawatts, and shall update the PJM Region Reliability Requirement and each LDA Reliability Requirement for such Incremental Auction only if the combined change of the applicable adjustment and applicable recalculation is greater than or equal to the lessor of (i) 500 megawatts or (ii) one percent of the prior PJM Region Reliability Requirement or one percent of the prior LDA Reliability Requirement, as applicable.

D. Prior to the start of each Applicable Delivery Year, the Office of the Interconnection shall reduce, by type of Demand Resource and by Zone or sub-Zone, the capacity commitment of each Affected Curtailment Service Provider that utilizes this transition provision for the Applicable Delivery Year based on the non-viable megawatts declared by the Affected Curtailment Service Provider under this transition provision. If the Affected Curtailment Service Provider cleared megawatts from multiple Affected Demand Resources of the same type and Zone or sub-Zone, or cleared MWs in multiple RPM Auctions for the Applicable Delivery Year, the Office of the Interconnection shall allocate the reduction in capacity commitment by type of Demand Resources and relevant RPM Auctions. Such allocation shall be performed on a pro-rata basis, based on megawatts cleared by the Affected Demand Resources in the relevant RPM Auctions.

E. For each Applicable Delivery Year, an Affected Curtailment Service Provider that utilizes this transition provision for the Applicable Delivery Year relinquishes an Affected Demand Resource's RPM Auction credits for the amount of capacity commitment reduction as determined under subsection D above. Locational Reliability Charges as described in Tariff, Attachment DD, section 5.14(e) are also adjusted accordingly.

## Section(s) of the PJM Reliability Assurance Agreement

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#### **ARTICLE 1 – DEFINITIONS**

Unless the context otherwise specifies or requires, capitalized terms used herein shall have the respective meanings assigned herein or in the Schedules hereto, or in the PJM Tariff or PJM Operating Agreement if not otherwise defined in this Agreement, for all purposes of this Agreement (such definitions to be equally applicable to both the singular and the plural forms of the terms defined). Unless otherwise specified, all references herein to Articles, Sections or Schedules, are to Articles, Sections or Schedules of this Agreement. As used in this Agreement:

## **Accredited UCAP:**

"Accredited UCAP" shall mean the quantity of Unforced Capacity, as denominated in Effective UCAP, that an ELCC Resource is capable of providing in a given Delivery Year.

#### Agreement:

"Agreement" shall mean this Reliability Assurance Agreement, together with all Schedules hereto, as amended from time to time.

#### **Annual Demand Resource:**

"Annual Demand Resource" shall mean a resource that is placed under the direction of the Office of the Interconnection during the Delivery Year, and will be available for an unlimited number of interruptions during such Delivery Year by the Office of the Interconnection, and will be capable of maintaining each such interruption between the hours of 10:00AM to 10:00PM Eastern Prevailing Time for the months of June through October and the following May, and 6:00AM through 9:00PM Eastern Prevailing Time for the months of November through April unless there is an Office of the Interconnection approved maintenance outage during October through April. The Annual Demand Resource must be available in the corresponding Delivery year to be offered for sale or Self-Supplied in an RPM Auction, or included as an Annual Demand Resource in an FRR Capacity Plan for the corresponding Delivery Year.

#### **Annual Energy Efficiency Resource:**

"Annual Energy Efficiency Resource" shall mean a project, including installation of more efficient devices or equipment or implementation of more efficient processes or systems, meeting the requirements of Reliability Assurance Agreement, Schedule 6 and exceeding thencurrent building codes, appliance standards, or other relevant standards, designed to achieve a continuous (during the summer and winter periods described in such Schedule 6 and the PJM Manuals) reduction in electric energy consumption that is not reflected in the peak load forecast prepared for the Delivery Year for which the Energy Efficiency Resource is proposed, and that is fully implemented at all times during such Delivery Year, without any requirement of notice, dispatch, or operator intervention.

## **Applicable Regional Entity:**

"Applicable Regional Entity" shall have the same meaning as in the PJM Tariff.

## **Base Capacity Demand Resource:**

"Base Capacity Demand Resource" shall mean, for the 2018/2019 and 2019/2020 Delivery Years, a resource that is placed under the direction of the Office of the Interconnection and that will be available June through September of a Delivery Year, and will be available to the Office of the Interconnection for an unlimited number of interruptions during such months, and will be capable of maintaining each such interruption for at least a 10-hour duration between the hours of 10:00AM to 10:00PM Eastern Prevailing Time. The Base Capacity Demand Resource must be available June through September in the corresponding Delivery Year to be offered for sale or self-supplied in an RPM Auction, or included as a Base Capacity Demand Resource in an FRR Capacity Plan for the corresponding Delivery Year.

## **Base Capacity Energy Efficiency Resource:**

"Base Capacity Energy Efficiency Resource" shall mean, for the 2018/2019 and 2019/2020 Delivery Years, a project, including installation of more efficient devices or equipment or implementation of more efficient processes or systems, meeting the requirements of RAA, Schedule 6 and exceeding then-current building codes, appliance standards, or other relevant standards, designed to achieve a continuous (during the summer peak periods as described in Reliability Assurance Agreement, Schedule 6 and the PJM Manuals) reduction in electric energy consumption that is not reflected in the peak load forecast prepared for the Delivery Year for which the Base Capacity Energy Efficiency Resource is proposed, and that is fully implemented at all times during such Delivery Year, without any requirement of notice, dispatch, or operator intervention.

## **Base Capacity Resource:**

"Base Capacity Resource" shall have the same meaning as in Tariff, Attachment DD.

## **Base Residual Auction:**

"Base Residual Auction" shall have the same meaning as in Tariff, Attachment DD.

## **Behind The Meter Generation:**

"Behind The Meter Generation" shall refer to a generating unit that delivers energy to load without using the Transmission System or any distribution facilities (unless the entity that owns or leases the distribution facilities consented to such use of the distribution facilities and such consent has been demonstrated to the satisfaction of the Office of the Interconnection; provided, however, that Behind The Meter Generation does not include (i) at any time, any portion of such generating unit's capacity that is designated as a Capacity Resource or (ii) in any hour, any portion of the output of such generating unit that is sold to another entity for consumption at another electrical location or into the PJM Interchange Energy Market.

#### **Black Start Capability:**

"Black Start Capability" shall mean the ability of a generating unit or station to go from a shutdown condition to an operating condition and start delivering power without assistance from the power system.

## **Capacity Emergency Transfer Objective (CETO):**

"Capacity Emergency Transfer Objective" or "CETO" shall mean the amount of electric energy that a given area must be able to import in order to remain within a loss of load expectation of one event in 25 years when the area is experiencing a localized capacity emergency, as determined in accordance with the PJM Manuals. Without limiting the foregoing, CETO shall be calculated based in part on EFORD determined in accordance with Reliability Assurance Agreement, Schedule 5, Paragraph C.

#### **Capacity Emergency Transfer Limit (CETL):**

Capacity Emergency Transfer Limit" or "CETL" shall mean the capability of the transmission system to support deliveries of electric energy to a given area experiencing a localized capacity emergency as determined in accordance with the PJM Manuals.

#### **Capacity Import Limit:**

For any Delivery Year up to and including the 2019/2020 Delivery Year, "Capacity Import Limit" shall mean, (a) for the PJM Region, (1) the maximum megawatt quantity of external Generation Capacity Resources that PJM determines for each Delivery Year, through appropriate modeling and the application of engineering judgment, the transmission system can receive, in aggregate at the interface of the PJM Region with all external balancing authority areas and deliver to load in the PJM Region under capacity emergency conditions without violating applicable reliability criteria on any bulk electric system facility of 100kV or greater, internal or external to the PJM Region, that has an electrically significant response to transfers on such interface, minus (2) the then-applicable Capacity Benefit Margin; and (b) for certain source zones identified in the PJM manuals as groupings of one or more balancing authority areas, (1) the maximum megawatt quantity of external Generation Capacity Resources that PJM determines the transmission system can receive at the interface of the PJM Region with each such source zone and deliver to load in the PJM Region under capacity emergency conditions without violating applicable reliability criteria on any bulk electric system facility of 100kV or greater, internal or external to the PJM Region, that has an electrically significant response to transfers on such interface, minus the then-applicable Capacity Benefit Margin times (2) the ratio of the maximum import quantity from each such source zone divided by the PJM total maximum import quantity. As more fully set forth in the PJM Manuals, PJM shall make such determination based on the latest peak load forecast for the studied period, the same computer simulation model of loads, generation and transmission topography employed in the determination of Capacity Emergency Transfer Limit for such Delivery Year, including external facilities from an industry standard model of the loads, generation, and transmission topography of the Eastern Interconnection under peak conditions. PJM shall specify in the PJM Manuals the

areas and minimum distribution factors for identifying monitored bulk electric system facilities that have an electrically significant response to such transfers on the PJM interface. Employing such tools, PJM shall model increased power transfers from external areas into PJM to determine the transfer level at which one or more reliability criteria is violated on any monitored bulk electric system facilities that have an electrically significant response to such transfers. For the PJM Region Capacity Import Limit, PJM shall optimize transfers from other source areas not experiencing any reliability criteria violations as appropriate to increase the Capacity Import Limit. The aggregate megawatt quantity of transfers into PJM at the point where any increase in transfers on the interface would violate reliability criteria will establish the Capacity Import Limit. Notwithstanding the foregoing, a Capacity Resource located outside the PJM Region shall not be subject to the Capacity Import Limit if the Capacity Market Seller seeks an exception thereto by demonstrating to PJM, by no later than five (5) business days prior to the commencement of the offer period for the relevant RPM Auction, that such resource meets all of the following requirements:

(i) it has, at the time such exception is requested, met all applicable requirements to be pseudo-tied into the PJM Region, or the Capacity Market Seller has committed in writing that it will meet such requirements, unless prevented from doing so by circumstances beyond the control of the Capacity Market Seller, prior to the relevant Delivery Year;

(ii) at the time such exception is requested, it has long-term firm transmission service confirmed on the complete transmission path from such resource into PJM; and

(iii) it is, by written commitment of the Capacity Market Seller, subject to the same obligations imposed on Generation Capacity Resources located in the PJM Region by Tariff, Attachment DD, section 6.6 to offer their capacity into RPM Auctions; provided, however, that (a) the total megawatt quantity of all exceptions granted hereunder for a Delivery Year, plus the Capacity Import Limit for the applicable interface determined for such Delivery Year, may not exceed the total megawatt quantity of Network External Designated Transmission Service on such interface that PJM has confirmed for such Delivery Year; and (b) if granting a qualified exception would result in a violation of the rule in clause (a), PJM shall grant the requested exception but reduce the Capacity Import Limit by the quantity necessary to ensure that the total quantity of Network External Designated Transmission Service is not exceeded.

## **Capacity Only Option:**

"Capacity Only Option" shall mean participation in Emergency Load Response Program or Pre-Emergency Program which allows, pursuant to Tariff, Attachment DD and as applicable, a capacity payment for the ability to reduce load during a pre-emergency or emergency event.

## **Capacity Performance Resource:**

"Capacity Performance Resource" shall have the same meaning as in Tariff, Attachment DD.

## **Capacity Resources:**

"Capacity Resources" shall mean megawatts of (i) net capacity from Existing Generation Capacity Resources or Planned Generation Capacity Resources meeting the requirements of the Reliability Assurance Agreement, Schedules 9 and Reliability Assurance Agreement, Schedule 10 that are or will be owned by or contracted to a Party and that are or will be committed to satisfy that Party's obligations under the Reliability Assurance Agreement, or to satisfy the reliability requirements of the PJM Region, for a Delivery Year; (ii) net capacity from Existing Generation Capacity Resources or Planned Generation Capacity Resources not owned or contracted for by a Party which are accredited to the PJM Region pursuant to the procedures set forth in such Schedules 9 and 10; or (iii) load reduction capability provided by Demand Resources or Energy Efficiency Resources that are accredited to the PJM Region pursuant to the procedures set forth in the Reliability Assurance Agreement, Schedule 6.

## **Capacity Transfer Right:**

"Capacity Transfer Right" shall have the meaning specified in Tariff, Attachment DD.

## **Combination Resource:**

"Combination Resource" shall mean a Generation Capacity Resource that has a component that has the characteristics of a Limited Duration Resource combined with (i) a component that has the characteristics of an Unlimited Resource or (ii) a component that has the characteristics of a Variable Resource.

## **Compliance Aggregation Area (CAA):**

"Compliance Aggregation Area" or "CAA" shall have the same meaning as in the Tariff.

## Consolidated Transmission Owners Agreement, PJM Transmission Owners Agreement or Transmission Owners Agreement:

"Consolidated Transmission Owners Agreement," "PJM Transmission Owners Agreement" or "Transmission Owners Agreement" shall mean that certain Consolidated Transmission Owners Agreement, dated as of December 15, 2005, by and among the Transmission Owners and by and between the Transmission Owners and PJM Interconnection, L.L.C. on file with the Commission, as amended from time to time.

## **Control Area:**

"Control Area" shall mean an electric power system or combination of electric power systems bounded by interconnection metering and telemetry to which a common generation control scheme is applied in order to:

(a) match the power output of the generators within the electric power system(s) and energy purchased from entities outside the electric power system(s), with the load within the electric power system(s);

(b) maintain scheduled interchange with other Control Areas, within the limits of Good Utility Practice;

(c) maintain the frequency of the electric power system(s) within reasonable limits in accordance with Good Utility Practice and the criteria of NERC and each Applicable Regional Entity;

(d) maintain power flows on transmission facilities within appropriate limits to preserve reliability; and

(e) provide sufficient generating capacity to maintain operating reserves in accordance with Good Utility Practice.

## **Daily Unforced Capacity Obligation:**

"Daily Unforced Capacity Obligation" shall mean the capacity obligation of a Load Serving Entity during the Delivery Year, determined in accordance with the Reliability Assurance Agreement, Schedule 8 or, as to an FRR Entity, in the Reliability Assurance Agreement, Schedule 8.1.

#### **Delivery Year:**

"Delivery Year" shall mean a Planning Period for which a Capacity Resource is committed pursuant to the auction procedures specified in Tariff, Attachment DD or pursuant to an FRR Capacity Plan under RAA, Schedule 8.1.

#### **Demand Resource (DR):**

"Demand Resource" or "DR" shall mean a Limited Demand Resource, Extended Summer Demand Resource, Annual Demand Resource, Base Capacity Demand Resource or Summer-Period Demand Resource with a demonstrated capability to provide a reduction in demand or otherwise control load in accordance with the requirements of RAA, Schedule 6 that offers and that clears load reduction capability in a Base Residual Auction or Incremental Auction or that is committed through an FRR Capacity Plan.

#### **Demand Resource Factor or DR Factor:**

"Demand Resource Factor" or "DR Factor" shall mean, for Delivery Years through May 31, 2018, that factor approved from time to time by the PJM Board used to determine the unforced capacity value of a Demand Resource in accordance with Reliability Assurance Agreement, Schedule 6

#### **Demand Resource Officer Certification Form:**

"Demand Resource Officer Certification Form" shall mean a certification as to an intended Demand Resource Sell Offer, in accordance with Reliability Assurance Agreement, Schedule 6 and Reliability Assurance Agreement, Schedule 8.1 and the PJM Manuals.

## **Demand Resource Registration:**

"Demand Resource Registration" shall mean a registration in the Full Program Option or Capacity Only Option of the Emergency or Pre-Emergency Load Resource Program in accordance with Tariff, Attachment K-Appendix, section 8.

#### **Demand Resource Sell Offer Plan:**

"Demand Resource Sell Offer Plan" shall mean the plan required by Reliability Assurance Agreement, Schedule 6 and Reliability Assurance Agreement, Schedule 8.1 in support of an intended offer of Demand Resources in an RPM Auction, or an intended inclusion of Demand Resources in an FRR Capacity Plan.

## **Effective Nameplate Capacity:**

"Effective Nameplate Capacity" shall mean (i) for each Variable Resource and Combination Resource, the resource's Maximum Facility Output; (ii) for each Limited Duration Resource, the sustained level of output that the unit can provide and maintain over a continuous period, whereby the duration of that continuous period matches the characteristic duration of the corresponding ELCC Class, with consideration given to ambient conditions expected to exist at the time of PJM system peak load, to the extent that such conditions impact such resource's capability.

## **Effective UCAP:**

"Effective UCAP" shall mean a unit of measure that represents the capacity product transacted in the Reliability Pricing Model and included in FRR Capacity Plans. One megawatt of Effective UCAP has the same capacity value of one megawatt of Unforced Capacity.

## **ELCC Class:**

"ELCC Class" shall mean a defined group of ELCC Resources that share a common set of operational characteristics and for which effective load carrying capability analysis, as set forth in RAA, Schedule 9.1, will establish a unique ELCC Class UCAP and corresponding ELCC Class Rating. ELCC Classes shall be defined in the PJM Manuals. ELCC Classes shall be defined such that the members of each ELCC Class are reasonably homogeneous in character and with respect to impact on system resource adequacy. ELCC Classes shall be defined for Limited Duration Resources of no less than four hours duration, and shall include 4-hour, 6-hour, 8-hour, and 10-hour duration characteristics, with matching duration classes for Combination Resources composed in part of one or more such ELCC Classes. Members of an ELCC Class shall share a common method of calculating the ELCC Resource Performance Adjustment, provided that the individual ELCC Resource Performance Adjustment values will generally differ among ELCC Resources.

## **ELCC Class Rating:**

"ELCC Class Rating" shall mean the rating factor, based on effective load carrying capability analysis, that applies to ELCC Resources that are members of an ELCC Class as part of the calculation of their Accredited UCAP.

## **ELCC Class UCAP:**

<u>"ELCC Class UCAP" shall mean the aggregate Effective UCAP all modeled ELCC Resources in a given ELCC Class are capable of providing in a given Delivery Year.</u>

## **ELCC Portfolio UCAP:**

"ELCC Portfolio UCAP" shall mean the aggregate Effective UCAP that all modeled ELCC Resources are capable of providing in a given Delivery Year.

## **ELCC Resource:**

"ELCC Resource" shall mean a Generation Capacity Resource that is a Variable Resource, a Limited Duration Resource, or a Combination Resource.

## **ELCC Resource Performance Adjustment:**

<u>"ELCC Resource Performance Adjustment" shall mean the performance of a specific ELCC</u> <u>Resource relative to the aggregate performance of the ELCC Class to which it belongs as further</u> <u>described in RAA, Schedule 9.1, section E.</u>

## **Electric Cooperative:**

"Electric Cooperative" shall mean an entity owned in cooperative form by its customers that is engaged in the generation, transmission, and/or distribution of electric energy.

## **Electric Distributor:**

"Electric Distributor" shall mean a Member that 1) owns or leases with rights equivalent to ownership of electric distribution facilities that are used to provide electric distribution service to electric load within the PJM Region; or 2) is a generation and transmission cooperative or a joint municipal agency that has a member that owns electric distribution facilities used to provide electric distribution service to electric load within the PJM Region.

## **Emergency:**

"Emergency" shall mean (i) an abnormal system condition requiring manual or automatic action to maintain system frequency, or to prevent loss of firm load, equipment damage, or tripping of system elements that could adversely affect the reliability of an electric system or the safety of persons or property; or (ii) a fuel shortage requiring departure from normal operating procedures in order to minimize the use of such scarce fuel; or (iii) a condition that requires implementation of emergency procedures as defined in the PJM Manuals.

#### **End-Use Customer:**

"End-Use Customer" shall mean a Member that is a retail end-user of electricity within the PJM Region. For purposes of Members Committee sector classification, a Member that is a retail end-user that owns generation may qualify as an End-Use customer if: (1) the average physical unforced capacity owned by the Member and its affiliates in the PJM region over the five Planning Periods immediately preceding the relevant Planning Period does not exceed the average PJM capacity obligation for the Member and its affiliates over the same time period; or (2) the average energy produced by the Member and its affiliates within the PJM region over the five Planning Periods immediately preceding the relevant Planning Period does not exceed the average energy consumed by that Member and its affiliates within the PJM region over the same time period. The foregoing notwithstanding, taking retail service may not be sufficient to qualify a Member as an End-Use Customer.

#### **Energy Efficiency Resource:**

"Energy Efficiency Resource" shall mean a project, including installation of more efficient devices or equipment or implementation of more efficient processes or systems, meeting the requirements of RAA, Schedule 6 and exceeding then-current building codes, appliance standards, or other relevant standards, designed to achieve a continuous (during the periods described in Reliability Assurance Agreement, Schedule 6 and the PJM Manuals) reduction in electric energy consumption that is not reflected in the peak load forecast prepared for the Delivery Year for which the Energy Efficiency Resource is proposed, and that is fully implemented at all times during such Delivery Year, without any requirement of notice, dispatch, or operator intervention. Annual Energy Efficiency Resources, Base Capacity Energy Efficiency Resources and Summer-Period Energy Efficiency Resources are types of Energy Efficiency Resources.

## **Exigent Water Storage:**

"Exigent Water Storage" shall mean water stored in the pondage or reservoir of a hydropower resource which is not typically available during normal operating conditions (as those conditions are described in the relevant FERC hydropower license), but which can be drawn upon during emergency conditions (as described in the FERC hydropower license), including in order to avoid a load shed. In an effective load carrying capability analysis, exigent storage capability from an upstream hydro facility can be considered relative to a downstream hydro facility by assessing cascading storage and flows.

#### **Existing Demand Resource:**

"Existing Demand Resource" shall mean a Demand Resource for which the Demand Resource Provider has identified existing end-use customer sites that are registered for the current Delivery Year with PJM (even if not registered by such Demand Resource Provider) and that the Demand Resource Provider reasonably expects to have under a contract to reduce load based on PJM dispatch instructions by the start of the Delivery Year for which such resource is offered.

#### **Existing Generation Capacity Resource:**

"Existing Generation Capacity Resource" shall mean, for purposes of the must-offer requirement and mitigation of offers for any RPM Auction for a Delivery Year, a Generation Capacity Resource that, as of the date on which bidding commences for such auction: (a) is in service; or (b) is not yet in service, but has cleared any RPM Auction for any prior Delivery Year. A Generation Capacity Resource shall be deemed to be in service if interconnection service has ever commenced (for resources located in the PJM Region), or if it is physically and electrically interconnected to an external Control Area and is in full commercial operation (for resources not located in the PJM Region). The additional megawatts of a Generation Capacity Resource that is being, or has been, modified to increase the number of megawatts of available installed capacity thereof shall not be deemed to be an Existing Generation Capacity Resource until such time as those megawatts (a) are in service; or (b) are not yet in service, but have cleared any RPM Auction for any prior Delivery Year.

#### **Extended Summer Demand Resource:**

"Extended Summer Demand Resource" shall mean, for Delivery Years through May 31, 2018, and for FRR Capacity Plans Delivery Years through May 31, 2019, a resource that is placed under the direction of the Office of the Interconnection and that will be available June through October and the following May, and will be available for an unlimited number of interruptions during such months by the Office of the Interconnection, and will be capable of maintaining each such interruption for at least a 10-hour duration between the hours of 10:00AM to 10:00PM Eastern Prevailing Time. The Extended Summer Demand Resource must be available June through October and the following May in the corresponding Delivery Year to be offered for sale or Self-Supplied in an RPM Auction, or included as an Extended Summer Demand Resource in an FRR Capacity Plan for the corresponding Delivery Year.

#### **Facilities Study Agreement:**

"Facilities Study Agreement" shall have the same meaning as in Tariff, Part VI, section 206.

#### FERC or Commission:

"FERC" or "Commission" shall mean the Federal Energy Regulatory Commission or any successor federal agency, commission or department exercising jurisdiction over the Tariff, Operating Agreement and Reliability Assurance Agreement.

## Firm Point-To-Point Transmission Service:

"Firm Point-To-Point Transmission Service" shall have the meaning specified in the Tariff.

#### Firm Service Level:

"Firm Service Level" or "FSL" of Price Responsive Demand for the 2022/2023 Delivery Year and subsequent Delivery Years shall mean the level, determined at a PRD Substation level, to which Price Responsive Demand shall be reduced during the Delivery Year when an Emergency Action that triggers a Performance Assessment Interval is declared and the Locational Marginal Price exceeds the price associated with such Price Responsive Demand identified by the PRD Provider in its PRD Plan. "Firm Service Level" or "FSL" of Demand Resource shall mean the pre-determined level for which an end-use customer's load shall be reduced, upon notification from the Curtailment Service Provider's market operations center or its agent.

#### Firm Transmission Service:

"Firm Transmission Service" shall mean transmission service that is intended to be available at all times to the maximum extent practicable, subject to an Emergency, an unanticipated failure of a facility, or other event beyond the control of the owner or operator of the facility or the Office of the Interconnection.

#### **Fixed Resource Requirement Alternative or FRR Alternative:**

"Fixed Resource Requirement Alternative" or "FRR Alternative" shall mean an alternative method for a Party to satisfy its obligation to provide Unforced Capacity hereunder, as set forth in the Reliability Assurance Agreement, Schedule 8.1.

#### **Forecast Pool Requirement:**

"Forecast Pool Requirement" or "FPR" shall mean the amount equal to one plus the unforced reserve margin (stated as a decimal number) for the PJM Region required pursuant to this Reliability Assurance Agreement, as approved by the PJM Board pursuant to Reliability Assurance Agreement, Schedule 4.1.

#### FRR Capacity Plan or FRR Plan:

"FRR Capacity Plan" or "FRR Plan" shall mean a long-term plan for the commitment of Capacity Resources and Price Responsive Demand to satisfy the capacity obligations of a Party that has elected the FRR Alternative, as more fully set forth in the Reliability Assurance Agreement, Schedule 8.1.

## **FRR Entity:**

"FRR Entity" shall mean, for the duration of such election, a Party that has elected the FRR Alternative hereunder.

## FRR Service Area:

"FRR Service Area" shall mean (a) the service territory of an IOU as recognized by state law, rule or order; (b) the service area of a Public Power Entity or Electric Cooperative as recognized by franchise or other state law, rule, or order; or (c) a separately identifiable geographic area that is: (i) bounded by wholesale metering, or similar appropriate multi-site aggregate metering, that is visible to, and regularly reported to, the Office of the Interconnection, or that is visible to, and regularly reported to an Electric Distributor and such Electric Distributor agrees to aggregate the load data from such meters for such FRR Service Area and regularly report such aggregated information, by FRR Service Area, to the Office of the Interconnection; and (ii) for which the FRR Entity has or assumes the obligation to provide capacity for all load (including load growth) within such area. In the event that the service obligations of an Electric Cooperative or Public Power Entity are not defined by geographic boundaries but by physical connections to a defined set of customers, the FRR Service Area in such circumstances shall be defined as all customers physically connected to transmission or distribution facilities of such Electric Cooperative or Public Power Entity within an area bounded by appropriate wholesale aggregate metering as described above.

#### **Full Program Option:**

"Full Program Option" shall mean participation in Emergency Load Response Program or Pre-Emergency Program which allows, pursuant to Tariff, Attachment DD and as applicable, (i) an energy payment for load reductions during a pre-emergency or emergency event, and (ii) a capacity payment for the ability to reduce load during a pre-emergency or emergency event.

#### **Full Requirements Service:**

"Full Requirements Service" shall mean wholesale service to supply all of the power needs of a Load Serving Entity to serve end-users within the PJM Region that are not satisfied by its own generating facilities.

#### **Generation Capacity Resource:**

"Generation Capacity Resource" shall mean a Generating Facility, or the contractual right to capacity from a specified Generating Facility, that meets the requirements of RAA, Schedule 9 and RAA, Schedule 10, and, for Generating Facilities that are committed to an FRR Capacity Plan, that meets the requirements of RAA, Schedule 8.1. A Generation Capacity Resource may be an Existing Generation Capacity Resource or a Planned Generation Capacity Resource.

#### **Generation Capacity Resource Provider:**

"Generation Capacity Resource Provider" shall mean a Member that owns, or has the contractual authority to control the output of, a Generation Capacity Resource, that has not transferred such authority to another entity.

#### **Generation Owner:**

"Generation Owner" shall mean a Member that owns or leases with rights equivalent to ownership, or otherwise controls and operates one or more operating generation resources located in the PJM Region. The foregoing notwithstanding, for a planned generation resource to qualify a Member as a Generation Owner, such resource shall have cleared an RPM auction, and for Energy Resources, the resource shall have a FERC-jurisdictional interconnection agreement or wholesale market participation agreement within PJM. Purchasing all or a portion of the output of a generation resource shall not be sufficient to qualify a Member as a Generation Owner. For purposes of Members Committee sector classification, a Member that is primarily a retail end-user of electricity that owns generation may qualify as a Generation Owner if: (1) the generation resource is the subject of a FERC-jurisdictional interconnection agreement or wholesale market participation agreement within PJM; (2) the average physical unforced capacity owned by the Member and its affiliates over the five Planning Periods immediately preceding the relevant Planning Period exceeds the average PJM capacity obligation of the Member and its affiliates over the same time period; and (3) the average energy produced by the Member and its affiliates within PJM over the five Planning Periods immediately preceding the relevant Planning Period exceeds the average energy consumed by the Member and its affiliates within PJM over the same time period.

#### **Generator Forced Outage:**

"Generator Forced Outage" shall mean an immediate reduction in output or capacity or removal from service, in whole or in part, of a generating unit by reason of an Emergency or threatened Emergency, unanticipated failure, or other cause beyond the control of the owner or operator of the facility, as specified in the relevant portions of the PJM Manuals. A reduction in output or removal from service of a generating unit in response to changes in market conditions shall not constitute a Generator Forced Outage.

#### **Generator Maintenance Outage:**

"Generator Maintenance Outage" shall mean the scheduled removal from service, in whole or in part, of a generating unit in order to perform repairs on specific components of the facility, if removal of the facility qualifies as a maintenance outage pursuant to the PJM Manuals.

#### **Generator Planned Outage:**

"Generator Planned Outage" shall mean the scheduled removal from service, in whole or in part, of a generating unit for inspection, maintenance or repair with the approval of the Office of the Interconnection in accordance with the PJM Manuals.

## **Good Utility Practice:**

"Good Utility Practice" shall mean any of the practices, methods and acts engaged in or approved by a significant portion of the electric utility industry during the relevant time period, or any of the practices, methods and acts which, in the exercise of reasonable judgment in light of the facts known at the time the decision was made, could have been expected to accomplish the desired result at a reasonable cost consistent with good business practices, reliability, safety and expedition. Good Utility Practice is not intended to be limited to the optimum practice, method, or act to the exclusion of all others, but rather is intended to include acceptable practices, methods, or acts generally accepted in the region; including those practices required by Federal Power Act Section 215(a)(4).

## Hydropower With Non-Pumped Storage:

"Hydropower With Non-Pumped Storage" shall mean a hydropower facility that can capture and store incoming stream flow, without use of pumps, in pondage or a reservoir, and the Generation Owner has the ability, within the constraints available in the applicable operating license, to exert material control over the quantity of stored water and output of the facility throughout an Operating Day.

## **Incremental Auction:**

"Incremental Auction" shall mean any of several auctions conducted for a Delivery Year after the Base Residual Auction for such Delivery Year and before the first day of such Delivery Year, including the First Incremental Auction, Second Incremental Auction, Third Incremental Auction, or Conditional Incremental Auction. Incremental Auctions (other than the Conditional Incremental Auction), shall be held for the purposes of:

 allowing Market Sellers that committed Capacity Resources in the Base Residual Auction for a Delivery Year, which subsequently are determined to be unavailable to deliver the committed Unforced Capacity in such Delivery Year (due to resource retirement, resource cancellation or construction delay, resource derating, EFORd increase, a decrease in the Nominated Demand Resource Value of a Planned Demand Resource, delay or cancellation of a Qualifying Transmission Upgrade, or similar occurrences) to submit Buy Bids for replacement Capacity Resources; and

(ii) allowing the Office of the Interconnection to reduce or increase the amount of committed capacity secured in prior auctions for such Delivery Year if, as a result of changed circumstances or expectations since the prior auction(s), there is, respectively, a significant excess or significant deficit of committed capacity for such Delivery Year, for the PJM Region or for an LDA.

## IOU:

"IOU" shall mean an investor-owned utility with substantial business interest in owning and/or operating electric facilities in any two or more of the following three asset categories: generation, transmission, distribution.

## **Limited Demand Resource:**

"Limited Demand Resource" shall mean, for Delivery Years through May 31, 2018, and for FRR Capacity Plans Delivery Years through May 31, 2019, a resource that is placed under the direction of the Office of the Interconnection and that will, at a minimum, be available for interruption for at least 10 Load Management Events during the summer period of June through September in the Delivery Year, and will be capable of maintaining each such interruption for at least a 6-hour duration. At a minimum, the Limited Demand Resource shall be available for such interruptions on weekdays, other than NERC holidays, from 12:00PM (noon) to 8:00PM Eastern Prevailing Time. The Limited Demand Resource must be available during the summer period of June through September in the corresponding Delivery Year to be offered for sale or Self-Supplied in an RPM Auction, or included as a Limited Demand Resource in an FRR Capacity Plan for the corresponding Delivery Year.

## **Limited Duration Resource:**

"Limited Duration Resource" shall mean a Generation Capacity Resource that is not a Variable Resource, that is not a Combination Resource, and that is not capable of running continuously at Maximum Facility Output for 24 hours or longer. A Capacity Storage Resource is a Limited Duration Resource.

## Load Serving Entity or LSE:

"Load Serving Entity" or "LSE" shall mean any entity (or the duly designated agent of such an entity), including a load aggregator or power marketer, (i) serving end-users within the PJM Region, and (ii) that has been granted the authority or has an obligation pursuant to state or local law, regulation or franchise to sell electric energy to end-users located within the PJM Region. Load Serving Entity shall include any end-use customer that qualifies under state rules or a utility retail tariff to manage directly its own supply of electric power and energy and use of transmission and ancillary services.

## **Locational Reliability Charge:**

"Locational Reliability Charge" shall mean the charge determined pursuant to Operating Agreement, Schedule 8.

## Markets and Reliability Committee:

"Markets and Reliability Committee" shall mean the committee established pursuant to the Operating Agreement as a Standing Committee of the Members Committee.

## Maximum Emergency Service Level:

"Maximum Emergency Service Level" or "MESL" of Price Responsive Demand for the 2017/2018 through the 2021/2022 Delivery Years shall mean the level, determined at a PRD Substation level, to which Price Responsive Demand shall be reduced during the Delivery Year when a Maximum Generation Emergency is declared and the Locational Marginal Price exceeds

the price associated with such Price Responsive Demand identified by the PRD Provider in its PRD Plan.

#### Member:

"Member" shall have the meaning provided in the Operating Agreement.

#### **Members Committee:**

"Members Committee" shall mean the committee specified in Operating Agreement, section 8 composed of the representatives of all the Members.

## **NERC:**

"NERC" shall mean the North American Electric Reliability Corporation or any successor thereto.

## Network External Designated Transmission Service:

"Network External Designated Transmission Service" shall mean the quantity of network transmission service confirmed by PJM for use by a market participant to import power and energy from an identified Generation Capacity Resource located outside the PJM Region, upon demonstration by such market participant that it owns such Generation Capacity Resource, has an executed contract to purchase power and energy from such Generation Capacity Resource, or has a contract to purchase power and energy from such Generation Capacity Resource contingent upon securing firm transmission service from such resource.

#### **Network Resources:**

"Network Resources" shall have the meaning set forth in the PJM Tariff.

## **Network Transmission Service:**

"Network Transmission Service" shall mean transmission service provided pursuant to the rates, terms and conditions set forth in Tariff, Part III or transmission service comparable to such service that is provided to a Load Serving Entity that is also a Transmission Owner.

## **Nominal PRD Value:**

"Nominal PRD Value" shall mean, as to any PRD Provider, an adjustment, determined in accordance with Reliability Assurance Agreement, Schedule 6.1, to the peak-load forecast used to determine the quantity of capacity sought through an RPM Auction, reflecting the aggregate effect of Price Responsive Demand on peak load resulting from the Price Responsive Demand to be provided by such PRD Provider.

#### **Nominated Demand Resource Value:**

"Nominated Demand Resource Value" shall have the meaning specified in Tariff, Attachment DD.

#### Non-Retail Behind the Meter Generation:

"Non-Retail Behind the Meter Generation" shall mean Behind the Meter Generation that is used by municipal electric systems, electric cooperatives, and electric distribution companies to serve load.

#### **Obligation Peak Load:**

"Obligation Peak Load" shall have the meaning specified in Reliability Assurance Agreement, Schedule 8.

#### **Office of the Interconnection:**

"Office of the Interconnection" shall mean the employees and agents of PJM Interconnection, L.L.C., subject to the supervision and oversight of the PJM Board, acting pursuant to the Operating Agreement.

## **Operating Agreement of the PJM Interconnection, L.L.C., Operating Agreement or PJM Operating Agreement:**

"Operating Agreement of the PJM Interconnection, L.L.C.," "Operating Agreement" or "PJM Operating Agreement" shall mean that agreement, dated as of April 1, 1997 and as amended and restated as of June 2, 1997, including all Schedules, Exhibits, Appendices, addenda or supplements hereto, as amended from time to time thereafter, among the Members of the PJM Interconnection, L.L.C, on file with the Commission.

## **Operating Day:**

"Operating Day" shall have the same meaning as provided in the Operating Agreement.

#### **Operating Reserve:**

"Operating Reserve" shall mean the amount of generating capacity scheduled to be available for a specified period of an Operating Day to ensure the reliable operation of the PJM Region, as specified in the PJM Manuals.

## **Ordinary Water Storage:**

"Ordinary Water Storage" shall mean water stored in the pondage or reservoir of a hydropower resource which is typically available during normal operating conditions pursuant to the FERC license governing the operation of the hydropower resource.

## **Other Supplier:**

"Other Supplier" shall mean a Member that: (i) is engaged in buying, selling or transmitting electric energy, capacity, ancillary services, Financial Transmission Rights or other services available under PJM's governing documents in or through the Interconnection or has a good faith intent to do so, and (ii) is not a Generation Owner, Electric Distributor, Transmission Owner or End-Use Customer.

## **Partial Requirements Service:**

"Partial Requirements Service" shall mean wholesale service to supply a specified portion, but not all, of the power needs of a Load Serving Entity to serve end-users within the PJM Region that are not satisfied by its own generating facilities.

## Party:

"Party" shall mean an entity bound by the terms of the Operating Agreement.

## Peak Shaving Adjustment:

"Peak Shaving Adjustment" shall mean a load forecast mechanism that allows load reductions by end-use customers to result in a downward adjustment of the summer load forecast for the associated Zone. Any End-Use Customer identified in an approved peak shaving plan shall not also participate in PJM Markets as Price Responsive Demand, Demand Resource, Base Capacity Demand Resource, Capacity Performance Demand Resource, or Economic Load Response Participant.

## **Percentage Internal Resources Required:**

"Percentage Internal Resources Required" shall mean, for purposes of an FRR Capacity Plan, the percentage of the LDA Reliability Requirement for an LDA that must be satisfied with Capacity Resources located in such LDA.

## **Performance Assessment Interval:**

"Performance Assessment Interval" shall have the meaning specified in Tariff, Attachment DD.

## PJM:

"PJM" shall mean PJM Interconnection, L.L.C., including the Office of the Interconnection as referenced in the PJM Operating Agreement. When such term is being used in the RAA it shall also include the PJM Board.

## PJM Board:

"PJM Board" shall mean the Board of Managers of the LLC, acting pursuant to the Operating Agreement, except when such term is being used in Tariff, Attachment M, in which case PJM Board shall mean the Board of Managers of PJM or its designated representative, exclusive of any members of PJM Management.

## **PJM Manuals:**

"PJM Manuals" shall mean the instructions, rules, procedures and guidelines established by the Office of the Interconnection for the operation, planning and accounting requirements of the PJM Region.

## **PJM Region:**

"PJM Region" shall have the same meaning as provided in the Operating Agreement.

## PJM Region Installed Reserve Margin:

"PJM Region Installed Reserve Margin" shall mean the percent installed reserve margin for the PJM Region required pursuant to Reliability Assurance Agreement, Schedule 4.1, as approved by the PJM Board.

## PJM Tariff, Tariff, O.A.T.T., OATT or PJM Open Access Transmission Tariff:

"PJM Tariff," "Tariff," "O.A.T.T., "OATT" or "PJM Open Access Transmission Tariff" shall mean that certain PJM Open Access Transmission Tariff, including any schedules, appendices, or exhibits attached thereto, on file with FERC and as amended from time to time thereafter.

## **Planned Demand Resource:**

"Planned Demand Resource" shall mean any Demand Resource that does not currently have the capability to provide a reduction in demand or to otherwise control load, but that is scheduled to be capable of providing such reduction or control on or before the start of the Delivery Year for which such resource is to be committed, as determined in accordance with the requirements of Reliability Assurance Agreement, Schedule 6. As set forth in Reliability Assurance Agreement, Schedule 6 and Reliability Assurance Agreement, Schedule 8.1, a Demand Resource Provider submitting a DR Sell Offer Plan shall identify as Planned Demand Resources in such plan all Demand Resources in excess of those that qualify as Existing Demand Resources.

## **Planned External Generation Capacity Resource:**

"Planned External Generation Capacity Resource" shall mean a proposed Generation Capacity Resource, or a proposed increase in the capability of a Generation Capacity Resource, that (a) is to be located outside the PJM Region, (b) participates in the generation interconnection process of a Control Area external to PJM, (c) is scheduled to be physically and electrically interconnected to the transmission facilities of such Control Area on or before the first day of the Delivery Year for which such resource is to be committed to satisfy the reliability requirements

of the PJM Region, and (d) is in full commercial operation prior to the first day of such Delivery Year, such that it is sufficient to provide the Installed Capacity set forth in the Sell Offer forming the basis of such resource's commitment to the PJM Region. Prior to participation in any Base Residual Auction for such Delivery Year, the Capacity Market Seller must demonstrate that it has a fully executed system impact study agreement (or other documentation which is functionally equivalent to a System Impact Study Agreement under the PJM Tariff) or, for resources which are greater than 20MWs participating in a Base Residual Auction for the 2019/2020 Delivery Year and subsequent Delivery Years, an agreement or other documentation which is functionally equivalent to a Facilities Study Agreement under the PJM Tariff), with the transmission owner to whose transmission facilities or distribution facilities the resource is being directly connected, and, as applicable, the transmission provider. Prior to participating in any Incremental Auction for such Delivery Year, the Capacity Market Seller must demonstrate it has entered into an interconnection agreement, or such other documentation that is functionally equivalent to an Interconnection Service Agreement under the PJM Tariff, with the transmission owner to whose transmission facilities or distribution facilities the resource is being directly connected, and, as applicable, the transmission provider. A Planned External Generation Capacity Resource must provide evidence to PJM that it has been studied as a Network Resource, or such other similar interconnection product in such external Control Area, must provide contractual evidence that it has applied for or purchased transmission service to be deliverable to the PJM border, and must provide contractual evidence that it has applied for transmission service to be deliverable to the bus at which energy is to delivered, the agreements for which must have been executed prior to participation in any Reliability Pricing Model Auction for such Delivery Year. Any such resource shall cease to be considered a Planned External Generation Capacity Resource as of the earlier of (i) the date that interconnection service commences as to such resource; or (ii) the resource has cleared an RPM Auction, in which case it shall become an Existing Generation Capacity Resource for purposes of the mitigation of offers for any RPM Auction for all subsequent Delivery Years.

#### **Planned Generation Capacity Resource:**

"Planned Generation Capacity Resource" shall mean a Generation Capacity Resource, or additional megawatts to increase the size of a Generation Capacity Resource that is being or has been modified to increase the number of megawatts of available installed capacity thereof, participating in the generation interconnection process under Tariff, Part IV, Subpart A, as applicable, for which: (i) Interconnection Service is scheduled to commence on or before the first day of the Delivery Year for which such resource is to be committed to RPM or to an FRR Capacity Plan; (ii) for any such resource seeking to offer into a Base Residual Auction, or for any such resource of 20 MWs or less seeking to offer into a Base Residual Auction, a System Impact Study Agreement (or, for resources for which a System Impact Study Agreement is not required, has such other agreement or documentation that is functionally equivalent to a System Impact Study Agreement) has been executed prior to the Base Residual Auction for such Delivery Year; (iii) for any such resource of more than 20 MWs seeking to offer into a Base Residual Auction for the 2019/2020 Delivery Year and subsequent Delivery Years, a Facilities Study Agreement (or, for resources for which a Facilities Study Agreement is not required, has such other agreement or documentation that is functionally equivalent to a Facility Studies Agreement) has been executed prior to the Base Residual Auction for such Delivery Year; and

(iv) an Interconnection Service Agreement has been executed prior to any Incremental Auction for such Delivery Year in which such resource plans to participate. For purposes of the mustoffer requirement and mitigation of offers for any RPM Auction for a Delivery Year, a Generation Capacity Resource shall cease to be considered a Planned Generation Capacity Resource as of the earlier of (i) the date that Interconnection Service commences as to such resource; or (ii) the resource has cleared an RPM Auction for any Delivery Year, in which case it shall become an Existing Generation Capacity Resource for any RPM Auction for all subsequent Delivery Years.

## **Planning Period:**

"Planning Period" shall mean the 12 months beginning June 1 and extending through May 31 of the following year, or such other period approved by the Members Committee.

## **PRD Curve:**

"PRD Curve" shall mean a price-consumption curve at a PRD Substation level, if available, and otherwise at a Zonal (or sub-Zonal LDA, if applicable) level, that details the base consumption level of Price Responsive Demand and the decreasing consumption levels at increasing prices.

## **PRD Provider:**

"PRD Provider" shall mean (i) a Load Serving Entity that provides PRD; or (ii) an entity without direct load serving responsibilities that has entered contractual arrangements with end-use customers served by a Load Serving Entity that satisfy the eligibility criteria for Price Responsive Demand.

## PRD Provider's Zonal Expected Peak Load Value of PRD:

"PRD Provider's Zonal Expected Peak Load Value of PRD" shall mean the expected contribution to Delivery Year peak load of a PRD Provider's Price Responsive Demand, were such demand not to be reduced in response to price, based on the contribution of the end-use customers comprising such Price Responsive Demand to the most recent prior Delivery Year's peak demand, escalated to the Delivery Year in question, as determined in a manner consistent with the Office of the Interconnection's load forecasts used for purposes of the RPM Auctions.

## **PRD Reservation Price:**

"PRD Reservation Price" shall mean an RPM Auction clearing price identified in a PRD Plan for Price Responsive Demand load below which the PRD Provider desires not to commit the identified load as Price Responsive Demand.

## **PRD Substation:**

"PRD Substation" shall mean an electrical substation that is located in the same Zone or in the same sub-Zonal LDA as the end-use customers identified in a PRD Plan or PRD registration and

that, in terms of the electrical topography of the Transmission Facilities comprising the PJM Region, is as close as practicable to such loads.

#### **Price Responsive Demand:**

"Price Responsive Demand" or "PRD" shall mean end-use customer load registered by a PRD Provider pursuant to Reliability Assurance Agreement, Schedule 6.1 that have, as set forth in more detail in the PJM Manuals, the metering capability to record electricity consumption at an interval of one hour or less, Supervisory Control capable of curtailing such load (consistent with applicable RERRA requirements) at each PRD Substation identified in the relevant PRD Plan or PRD registration in response to a Maximum Generation Emergency declared by the Office of the Interconnection (prior to 2022/2023Delivery Year) or a Performance Assessment Interval that triggers a PRD performance assessment (effective with 2022/2023 Delivery Year), and a retail rate structure, or equivalent contractual arrangement, capable of changing retail rates as frequently as an hourly basis, that is linked to or based upon changes in real-time Locational Marginal Prices at a PRD Substation level and that results in a predictable automated response to varying wholesale electricity prices.

#### **Price Responsive Demand Credit:**

"Price Responsive Demand Credit" shall mean a credit, based on committed Price Responsive Demand, as determined under Reliability Assurance Agreement, Schedule 6.1.

#### Price Responsive Demand Plan or PRD Plan:

"Price Responsive Demand Plan" or "PRD Plan" shall mean a plan, submitted by a PRD Provider and received by the Office of the Interconnection in accordance with Reliability Assurance Agreement, Schedule 6.1 and procedures specified in the PJM Manuals, claiming a peak demand limitation due to Price Responsive Demand to support the determination of such PRD Provider's Nominal PRD Value.

## **Public Power Entity:**

"Public Power Entity" shall mean any agency, authority, or instrumentality of a state or of a political subdivision of a state, or any corporation wholly owned by any one or more of the foregoing, that is engaged in the generation, transmission, and/or distribution of electric energy.

## **Qualifying Transmission Upgrades:**

"Qualifying Transmission Upgrades" shall have the meaning specified in Tariff, Attachment DD.

## **Relevant Electric Retail Regulatory Authority:**

"Relevant Electric Retail Regulatory Authority" or "RERRA" shall have the meaning specified in the PJM Operating Agreement.

#### **Reliability Principles and Standards:**

"Reliability Principles and Standards" shall mean the principles and standards established by NERC or an Applicable Regional Entity to define, among other things, an acceptable probability of loss of load due to inadequate generation or transmission capability, as amended from time to time.

## **Required Approvals:**

"Required Approvals" shall mean all of the approvals required for the Operating Agreement to be modified or to be terminated, in whole or in part, including the acceptance for filing by FERC and every other regulatory authority with jurisdiction over all or any part of the Operating Agreement.

## Self-Supply:

"Self-Supply" shall have the meaning provided in Tariff, Attachment DD.

#### **Small Commercial Customer:**

"Small Commercial Customer" shall have the same meaning as in the PJM Tariff.

#### **State Consumer Advocate:**

"State Consumer Advocate" shall mean a legislatively created office from any State, all or any part of the territory of which is within the PJM Region, and the District of Columbia established, inter alia, for the purpose of representing the interests of energy consumers before the utility regulatory commissions of such states and the District of Columbia and the FERC.

#### **State Regulatory Structural Change:**

"State Regulatory Structural Change" shall mean as to any Party, a state law, rule, or order that, after September 30, 2006, initiates a program that allows retail electric consumers served by such Party to choose from among alternative suppliers on a competitive basis, terminates such a program, expands such a program to include classes of customers or localities served by such Party that were not previously permitted to participate in such a program, or that modifies retail electric market structure or market design rules in a manner that materially increases the likelihood that a substantial proportion of the customers of such Party that are eligible for retail choice under such a program (a) that have not exercised such choice will exercise such choice; or (b) that have exercised such choice will no longer exercise such choice, including for example, without limitation, mandating divestiture of utility-owned generation or structural changes to such Party's default service rules that materially affect whether retail choice is economically viable.

#### **Summer-Period Demand Resource:**

Summer-Period Demand Resource shall mean, for the 2020/2021 Delivery Year and subsequent Delivery Years, a resource that is placed under the direction of the Office of the Interconnection, and will be available June through October and the following May of the Delivery Year, and will be available for an unlimited number of interruptions during such months by the Office of the Interconnection, and will be capable of maintaining each such interruption between the hours of 10:00AM to 10:00PM Eastern Prevailing Time. The Summer-Period Demand Resource must be available June through October and the following May in the corresponding Delivery Year to be offered for sale in an RPM Auction, or included as a Summer-Period Demand Resource in an FRR Capacity Plan for the corresponding Delivery Year.

## **Summer-Period Energy Efficiency Resource:**

Summer-Period Energy Efficiency Resource shall mean, for the 2020/2021 Delivery Year and subsequent Delivery Years, a project, including installation of more efficient devices or equipment or implementation of more efficient processes or systems, meeting the requirements of Reliability Assurance Agreement, Schedule 6 and exceeding then-current building codes, appliance standards, or other relevant standards, designed to achieve a continuous (during the summer peak periods as described in Reliability Assurance Agreement, Schedule 6 and the PJM Manuals) reduction in electric energy consumption that is not reflected in the peak load forecast prepared for the Delivery Year for which the Summer-Period Energy Efficiency Resource is proposed, and that is fully implemented at all times during such Delivery Year, without any requirement of notice, dispatch, or operator intervention.

#### **Supervisory Control:**

"Supervisory Control" shall mean the capability to curtail, in accordance with applicable RERRA requirements, load registered as Price Responsive Demand at each PRD Substation identified in the relevant PRD Plan or PRD registration in response to a Maximum Generation Emergency declared by the Office of the Interconnection. Except to the extent automation is not required by the provisions of the Operating Agreement, the curtailment shall be automated, meaning that load shall be reduced automatically in response to control signals sent by the PRD Provider or its designated agent directly to the control equipment where the load is located without the requirement for any action by the end-use customer.

## **Threshold Quantity:**

"Threshold Quantity" shall mean, as to any FRR Entity for any Delivery Year, the sum of (a) the Unforced Capacity equivalent (determined using the Pool-Wide Average EFORD) of the Installed Reserve Margin for such Delivery Year multiplied by the Preliminary Forecast Peak Load for which such FRR Entity is responsible under its FRR Capacity Plan for such Delivery Year, plus (b) the lesser of (i) 3% of the Unforced Capacity amount determined in (a) above or (ii) 450 MW. If the FRR Entity is not responsible for all load within a Zone, the Preliminary Forecast Peak Load for such entity shall be the FRR Entity's Obligation Peak Load last determined prior to the Base Residual Auction for such Delivery Year, times the Base FRR Scaling Factor (as determined in accordance with Reliability Assurance Agreement, Schedule 8.1).

#### **Transmission Facilities:**

"Transmission Facilities" shall mean facilities that: (i) are within the PJM Region; (ii) meet the definition of transmission facilities pursuant to FERC's Uniform System of Accounts or have been classified as transmission facilities in a ruling by FERC addressing such facilities; and (iii) have been demonstrated to the satisfaction of the Office of the Interconnection to be integrated with the PJM Region transmission system and integrated into the planning and operation of the PJM Region to serve all of the power and transmission customers within the PJM Region.

#### **Transmission Owner:**

"Transmission Owner" shall mean a Member that owns or leases with rights equivalent to ownership Transmission Facilities and is a signatory to the PJM Transmission Owners Agreement. Taking transmission service shall not be sufficient to qualify a Member as a Transmission Owner.

#### **Unforced Capacity:**

"Unforced Capacity" shall mean installed capacity rated at summer conditions that is not on average experiencing a forced outage or forced derating, calculated for each Capacity Resource on the 12-month period from October to September without regard to the ownership of or the contractual rights to the capacity of the unit.

## **Unlimited Resource:**

"Unlimited Resource" shall mean a generating unit having the ability to maintain output at a stated capability continuously on a daily basis without interruption. An Unlimited Resource is a Generation Capacity Resource that is not an ELCC Resource.

## Variable Resource:

"Variable Resource" shall mean a Generation Capacity Resource with output that can vary as a function of its energy source, such as wind, solar, run of river hydroelectric power without storage, and landfill gas units without an alternate fuel source. All Intermittent Resources are Variable Resources, with the exception of Hydropower with Non-Pumped Storage.

#### Winter Peak Load (or WPL):

"Winter Peak Load" or "WPL" shall mean the average of the Demand Resource customer's specific peak hourly load between hours ending 7:00 EPT through 21:00 EPT on the PJM defined 5 coincident peak days from December through February two Delivery Years prior the Delivery Year for which the registration is submitted. Notwithstanding, if the average use between hours ending 7:00 EPT through 21:00 EPT on a winter 5 coincident peak day is below 35% of the average hours ending 7:00 EPT through 21:00 EPT over all five of such peak days, then up to two such days and corresponding peak demand values may be excluded from the
calculation. Upon approval by the Office of the Interconnection, a Curtailment Service Provider may provide alternative data to calculate Winter Peak Load, as outlined in the PJM Manuals, when there is insufficient hourly load data for the two Delivery Years prior to the relevant Delivery Year or if more than two days meet the exclusion criteria described above.

#### **Zonal Capacity Price:**

"Zonal Capacity Price" shall mean the clearing price required in each Zone to meet the demand for Unforced Capacity and satisfy Locational Deliverability Requirements for the LDA or LDAs associated with such Zone. If the Zone contains multiple LDAs with different Capacity Resource Clearing Prices, the Zonal Capacity Price shall be a weighted average of the Capacity Resource Clearing Prices for such LDAs, weighted by the Unforced Capacity of Capacity Resources cleared in each such LDA.

#### Zone or Zonal:

"Zone" or "Zonal" shall refer to an area within the PJM Region, as set forth in Tariff, Attachment J and RAA, Schedule 15, or as such areas may be (i) combined as a result of mergers or acquisitions or (ii) added as a result of the expansion of the boundaries of the PJM Region. A Zone shall include any Non-Zone Network Load located outside the PJM Region that is served from such Zone under Tariff, Attachment H-A.

#### Zonal Winter Weather Adjustment Factor (ZWWAF):

"Zonal Winter Weather Adjustment Factor" or "ZWWAF" shall mean the PJM zonal winter weather normalized coincident peak divided by PJM zonal average of 5 coincident peak loads in December through February.

#### **SCHEDULE 9**

#### PROCEDURES FOR ESTABLISHING THE CAPABILITY OF GENERATION CAPACITY RESOURCES

- A. Such rules and procedures as may be required to determine and demonstrate the capability of Generation Capacity Resources for the purposes of meeting a Load Serving Entity's obligations under the Agreement shall be developed by the Office of the Interconnection and maintained in the PJM Manuals.
- **B.** The rules and procedures for determining and demonstrating the capability of generating units to serve load in the PJM Region shall be consistent with achieving uniformity for planning, operating, accounting and reporting purposes.
- C. The rules and procedures shall recognize the difference in types of generating units and the relative ability of units to maintain output at stated capability over a specified period of time. Factors affecting such ability include, but are not limited to, fuel availability, stream flow and/or reservoir storage for hydro units, energy storage capability for Energy Storage Resources, energy source variability and intermittency, mechanical limitations, and system operating policies. For this purpose, the basis for determining and demonstrating the capability of a particular generating unit is dependent upon the category (of the three generating unit types listed below) that describes the unit's attributesshall be as described in RAA, Schedule 9.1.

*i. For generating units having the ability to maintain output at stated capability continuously on a daily basis without interruption, the capability of the generating unit is based on the level of output that the unit can provide under the site conditions expected to exist at the time of PJM system peak load where such conditions include, but are not limited to, ambient air temperature, humidity, barometric pressure, intake water temperature, and cooling system performance. Generating units with the ability to operate continuously across all hours of an operating day without interruption if needed include, but are not limited to, nuclear and fossil fired steam units, combined cycle units, combustion turbine units, reciprocating engine units, and fuel cell units.* 

ii. Generating units with limited energy capability include, but are not limited to, Energy Storage Resources that receive energy from the grid and store the energy for later injection to the grid (e.g., pumped storage hydro units, compressed air energy storage units, flywheel energy storage units and battery storage units) and hydroelectric generating units with reservoir storage capability. The capability of generating units with limited energy capability is based on the sustained level of output that the unit can provide and maintain over a continuous ten-hour period with consideration given to conditions expected to exist at the time of PJM system peak load to the extent that such conditions impact such capability. iii. Generating units with output that varies as a function of an energy source that is noncontinuous and that cannot be directly controlled are unable to provide a stated level of output on demand and are unable to maintain a stated level of output for any specified period of time include, but are not limited to, wind units, solar units, run of river hydroelectric units (without reservoir storage capability) and landfill gas units (without alternate fuel capability). The capability of such generating units is based on the level of output that the unit is expected to be reliably producing as a function of its energy source at the time of system peak loads. Specifically, the capability of a wind or a solar generating unit is determined by the unit's average hourly MW output during 368 summer period hours defined by hours ending 15, 16, 17 and 18 of each day of the months of June, July and August. C. Provisions for Unlimited **Resources** 

For Unlimited Resources, the capability of the generating unit is based on the level of output that the unit can provide under the site conditions expected to exist at the time of PJM system peak load where such conditions include, but are not limited to, ambient air temperature, humidity, barometric pressure, intake water temperature, and cooling system performance. Generating units with the ability to operate continuously across all hours of an Operating Day without interruption if needed include, but are not limited to, nuclear and fossil-fired steam units, combined cycle units, combustion turbine units, reciprocating engine units, and fuel cell units.

#### **D. Provisions for ELCC Resources**

The Office of the Interconnection shall determine the capability of ELCC Resources to meet a Load Serving Entity's obligations under the Agreement using an effective load carrying capability analysis, as set forth in RAA, Schedule 9.1, with additional implementation details provided in the PJM Manuals.

# SCHEDULE 9.1: EFFECTIVE LOAD CARRYING CAPABILITY <u>ANALYSIS</u>

#### A. Overview of Effective Load Carrying Capability Analysis

The inputs of the effective load carrying capability analysis include:

<u>-Historical weather and load data;</u>
<u>-Historical output of existing Variable Resources;</u>
<u>-Estimates of putative historical output for planned Variable Resources;</u>
<u>-Forced outage patterns for Unlimited Resources;</u>
<u>-Resource deployment forecast; and</u>
<u>-Modeling parameters for Limited Duration Resources and Combination Resources.</u>

The outputs of the effective load carrying capability analysis include:

-The ELCC Portfolio UCAP, in MW; -ELCC Class UCAP values, in MW; and -ELCC Class Rating values, in percent.

#### B. Calculation of ELCC Portfolio UCAP

The effective load carrying capability analysis shall identify a scenario in which the aggregate installed capacity "X" of a group of Unlimited Resources with no outages yields the same annual loss of load expectation as the one produced by the scenario with all ELCC Resources that are expected to offer in a given RPM Auction, or otherwise provide capacity, in the Delivery Year being analyzed. The ELCC Portfolio UCAP shall be the value "X".

#### C. Allocation from ELCC Portfolio UCAP to ELCC Class UCAP

The ELCC Portfolio UCAP shall be allocated to each ELCC Class UCAP, in accordance with the applicable effective load carrying capability analysis methodology specified in the PJM Manuals, as subject to adjustment in accordance with RAA, Schedule 9.1, section J, such that the aggregate of all ELCC Class UCAP values is equal to the ELCC Portfolio UCAP.

#### D. Calculation of ELCC Class Rating

(1) The ELCC Class Rating of Variable Resources and Limited Duration Resources shall be the ratio of the applicable ELCC Class UCAP to the aggregate Effective Nameplate Capacity of the modeled ELCC Resources of that ELCC Class that are expected to offer in a given RPM Auction, or otherwise provide capacity, in the Delivery Year being analyzed. (2) For Combination Resources, there shall be an ELCC Class Rating for each component.

(i) For a Combination Resource with a Limited Duration Resource component and a Variable Resource component, the Limited Duration Resource component ELCC Class Rating shall be equal to the quotient of (1) the Combination Resource ELCC Class UCAP minus the [product of the Variable Resource ELCC Class Rating and the aggregate Effective Nameplate Capacity of all the Variable Resource components within the subject Combination Resource class] divided by (2) the aggregate equivalent Effective Nameplate Capacity of all the Limited Duration Resource components within the subject Combination Resource class, and the Variable Resource component ELCC Class Rating shall be equal to the ELCC Class Rating for the ELCC Class to which the Variable Resource component would belong if it were not a component of the Combination Resource.

(ii) For a Combination Resource with a Limited Duration Resource component and an Unlimited Resource component, the Limited Duration Resource component ELCC Class Rating shall be equal to the ELCC Class Rating for the ELCC Class to which the Limited Duration Resource component would belong if it were not a component of the Combination Resource, and the Unlimited Resource component would not have an ELCC Class Rating.

#### E. Calculation of Accredited UCAP and ELCC Resource Performance Adjustment

(1) (a) For Variable Resources and Limited Duration Resources, Accredited UCAP values shall be equal to the product of:

(i) the Effective Nameplate Capacity;(ii) the applicable ELCC Class Rating; and(iii) the ELCC Resource Performance Adjustment.

(b) For Combination Resources, Accredited UCAP values shall be equal to the sum of the Accredited UCAP of each component, but not to exceed the Maximum Facility Output of the resource, where:

(i) The value for a Variable Resource component shall be determined in accordance with subsection (a) above.

(ii) The value for a Limited Duration Resource component shall be equal to the product of:

(A) the Effective Nameplate Capacity determined for the Limited Duration Resource component;

(B) [one minus the EFORd for the Limited Duration Resource component]; and

(C) the applicable Limited Duration Resource component ELCC Class Rating as determined in Section D(2)(i).

(iii) The value for an Unlimited Resource component shall be equal to the product of the installed capacity of the Unlimited Resource component and [one minus the EFORd for the Unlimited Resource component].

(iv) The Accredited UCAP for Hydropower With Non-Pumped Storage, and for each member of an ELCC Class whose members are so distinct from one another that a single ELCC Class Rating fails to capture their physical characteristics, shall be based on a resource-specific effective load carrying capability analysis based on the resource's unique parameters.

(2) The ELCC Resource Performance Adjustment shall be calculated according to the following methods, as further detailed in the PJM Manuals:

(a) For a Variable Resource: based on a metric consisting of the average of (1) actual output during the 200 highest coincident peak load hours over the preceding ten years, regardless of the years in which they occur, and (2) actual output during the 200 highest coincident peak putative net load hours over the preceding ten years, regardless of the years in which they occur, where putative net load is actual load minus the putative hourly output of Variable Resources based on the resource mix of the target year. For Planned Resources or resources less than 10 years old, estimated hypothetical historical output will be used to develop this metric. For a given resource or component, the Performance Adjustment shall equal the ratio of such metric to the average (weighted by the Effective Nameplate Capacity) of such metrics for all units in the applicable Variable Resource ELCC Class.

(b) For Limited Duration Resources: based on EFORd.

(c) For Combination Resources with only an Unlimited Resource component and a Limited Duration Resource component: based on EFORd.

(d) For Combination Resources with a Variable Resource component (except for Hydropower With Non-Pumped Storage): (1) based on the direct metered or estimated output of the Variable Resource component, which is then assessed according to the methodology described in subsection (a) above for Variable Resources and in accordance with the PJM Manuals; and (2) based on the EFORd that is applicable to the Limited Duration Resource component. (e) For Hydropower With Non-Pumped Storage and other Combination Resources that do not fall into the above categories: based on EFORd.

#### F. Installed Capacity of ELCC Resources

Rules and procedures for technically determining and demonstrating the installed capacity of ELCC Resources shall be developed by the Office of the Interconnection and maintained in the PJM Manuals. The installed capacity of a Limited Duration Resource is based on the sustained level of output that the unit can provide and maintain over a continuous period, whereby the duration of that period matches the characteristic duration of the corresponding ELCC Class, with consideration given to ambient conditions expected to exist at the time of PJM system peak load, as described in the PJM Manuals. The installed capacity of a Combination Resource (other than Hydropower With Non-Pumped Storage) is based on the lesser of the Maximum Facility Output or the sum of the equivalent Effective Nameplate Capacity values of the resource's constituent components considered on a stand-alone basis.

#### G. Details of the Effective Load Carrying Capability Methodology

The effective load carrying capability analysis shall compare expected hourly load levels (based on historical weather) with the expected hourly output of the expected future resource mix in order to identify the relative resource adequacy value of the portfolio of all ELCC Classes, as well of each individual ELCC Class, compared to a group of Unlimited Resources with no outages. In performing this analysis, the model inputs shall be scaled to meet the annual loss of load expectation of the Office of the Interconnection. The effective load carrying capability analysis shall compare hourly values for: (i) expected load based on historical weather; (ii) expected Variable Resource output; and (iii) expected output of Limited Duration Resources and of Combination Resources as described below. These expected quantities are based on actual values for load and actual and putative values for Variable Resource output (standalone or as a component of Combination Resources) after June 1, 2012 (inclusive) through the most recent Delivery Year for which complete data exist. For resources that have not existed each year since June 1, 2012, putative output is an estimate of the hourly output that resource would have produced in a historical hour if that resource had existed in that hour. This putative output estimate is developed based on historical weather data consistent with the particular site conditions for each such resource in accordance with the PJM Manuals.

The effective load carrying capability analysis shall simulate forced outages of Unlimited Resources based on actual historical data, and shall simulate the output of Limited Duration Resources and Combination Resources based on their Office of the Interconnection-validated parameters, including the putative output of the Variable Resource component of Combination Resources, as described above. Forced outages of Limited Duration Resources and Combination Resources shall not be simulated in the effective load carrying capability analysis. The quantity of deployed resources studied in the analysis shall be based on resource deployment forecasts and, where applicable, on available information based on Sell Offers submitted in RPM Auctions or Fixed Resource Requirement plans for the applicable Delivery Year.

The ELCC Class UCAP and other results of the effective load carrying capability analysis shall be based on the total Effective UCAP of the ELCC Class as a whole.

The ELCC Class UCAP and corresponding ELCC Class Rating values may increase or decrease from year to year as the expected resource mix and load shape change.

Energy Resources are not included in the effective load carrying capability analysis. Generating units that are expected to only offer or otherwise provide a portion of their Accredited UCAP for that Delivery Year are represented in the analysis in proportion to the expected quantity offered or delivered divided by the Accredited UCAP.

#### H. Methodology to Simulate Output of Certain Resources in the Effective Load Carrying Capability Model

The effective load carrying capability analysis shall simulate the output of Limited Duration Resources and Combination Resources based on their physical parameters, including limited storage capability, and shall simulate the deployment of Demand Resources. The analysis shall simulate output from the subject Limited Duration Resources and Combination Resources in hours in which all output from Unlimited Resources and available output from Variable Resources is insufficient to meet load. The output of the subject Limited Duration Resources and Combination Resources shall be simulated on an hour-by-hour basis in proportion to their Effective Nameplate Capacity without foresight to future hours. The simulated deployment of Demand Resources shall be such that there is adequate Primary Reserves provided by economic resources, if sufficient simulated Demand Resources are available. Primary Reserves shall be assigned to generation resources in order to maximize simulated reliability, provided that assignments to Limited Duration Resources and Combination Resources shall be pro rata according to their Effective Nameplate Capacity. Primary Reserves shall be exhausted prior to identifying a loss of load event in the analysis. Energy Storage Resource charging is during hours with sufficient margin, including between daily peaks if necessary.

#### I. Administration of Effective Load Carrying Capability Analysis

The Office of the Interconnection shall post final ELCC Class UCAP and ELCC Class Rating values at least once per year in a report that also includes appropriate details regarding methodology and inputs. The Office of the Interconnection shall post this report and shall communicate ELCC Resource Performance Adjustment values to applicable Generation Capacity Resource Providers no later than five months prior to the start of the target Delivery Year, as described in the PJM Manuals. Starting with the 2023/2024 Delivery Year, Accredited UCAP values for the applicable Delivery Year shall establish the maximum Unforced Capacity

that an ELCC Resource can physically provide or offer to provide in the applicable Delivery Year.

The Office of the Interconnection shall also post preliminary ELCC Class Rating values for nine subsequent Delivery Years. For any Delivery Year for which a final ELCC Class Rating has not been posted and a preliminary ELCC Class Rating has been posted, the Accredited UCAP of an ELCC Resource for such Delivery Year shall be based on the most recent preliminary ELCC Class Rating value for that Delivery Year, together with the most recently calculated ELCC Resource Performance Adjustment value for that ELCC Resource. Except to the extent specified above or otherwise specified, the preliminary ELCC Class Rating values for future years are non-binding and are only for indicative purposes. A Generation Capacity Resource Provider can offer or provide capacity from an ELCC Resource that is not subject to a capacity market must offer obligation (as specified in Tariff, Attachment DD, Section 6.6) at a level less than the Accredited UCAP for such resource.

In order to facilitate the effective load carrying capability analysis, the Generation Capacity Resource Provider of each ELCC Resource must submit to the Office of the Interconnection the required information as specified in the PJM Manuals by no later than six months prior to an RPM Auction in which the ELCC Resource intends to submit a Sell Offer or otherwise commit to provide capacity, except for Delivery Years prior to the 2026/2027 Delivery Year such required information must be provided to the Office of the Interconnection in accordance with the PJM Manuals. The required information may include relevant physical parameters, relevant historical data such as weather data and actual or estimated historical energy output, and documentation supporting such parameters and historical data. The relevant physical parameters are those that are incorporated into the effective load carrying capability analysis. The parameters required for Hydropower With Non-Pumped Storage shall include Ordinary Water Storage and any applicable Exigent Water Storage. Submitted parameters must indicate the expected duration for which any submitted physical parameters are valid.

The Office of the Interconnection shall evaluate, validate, and approve the foregoing information in accordance with the process set forth in the PJM Manuals. In evaluating the validity of submitted information, the Office of the Interconnection may assess the consistency of such information with observed conditions. If the Office of the Interconnection observes that the information provided by the Generation Capacity Resource Provider of the ELCC Resource is inconsistent with observed conditions, the Office of the Interconnection will coordinate with the Generation Capacity Resource Provider of the ELCC Resource to understand the information and observed conditions before making a determination regarding the validity of the applicable parameters. The Office of the Interconnection may engage the services of a consultant with technical expertise to evaluate the foregoing information.

After the Office of the Interconnection has completed its evaluation of the foregoing information, the Office of the Interconnection shall notify the Generation Capacity Resource Provider in

writing whether the submitted information is considered invalid by no later than September 1 following the submission of the information. The Office of the Interconnection's determination on the validity of the foregoing information shall continue for the applicable Delivery Year and, if requested, for such longer period as the Office of the Interconnection may determine is supported by the data.

In the event that the Office of the Interconnection is unable to validate any of the required information, physical parameters, supporting documentation, or other related information submitted by the Generation Capacity Resource Provider of an ELCC Resource, then the Office of the Interconnection shall calculate Accredited UCAP values for that ELCC Resource based only on the validated information. Such ELCC Resource shall not be permitted to offer or otherwise provide capacity above such Accredited UCAP values until the Office of the Interconnection determines new Accredited UCAP values for such resource.

Generation Capacity Resource Providers of ELCC Resources that are hydropower plants with water storage must provide documentation to support the physical parameters provided for expected load carrying capability analysis modeling, as specified in the PJM Manuals. This documentation must: (a) support the plant's physical capabilities; (b) demonstrate that the parameters do not violate any federal, state, river basin, or other applicable authority operating limitations of the plant; and (c) demonstrate full authorization from FERC, any river basin commissions, and any other applicable authorities to meet those capabilities.

#### J. ELCC Transition Mechanism

(1) A transition mechanism shall be established whereby PJM shall post floor values establishing a lower bound on the ELCC Class Ratings that apply to ELCC Resources in the determination of each ELCC Resource's Accredited UCAP. This transition mechanism can be evaluated at any time and shall be evaluated in conjunction with a quadrennial periodic review of the shape of the Variable Resource Requirement Curve, as described in Tariff, Attachment DD, section 5.10, no later than the end of 2026. Such evaluation shall include an assessment of the efficacy and appropriateness of the transition mechanism and shall make recommendations as to whether some or all aspects of the transition mechanism should be reconsidered through a stakeholder process. The already-established floor values and associated term duration for each cohort should apply for their entire term, as described below, regardless of the outcome of such evaluation, except as described in subsection (3)(f) below.

For purposes of implementing this transition mechanism, ELCC Resources shall be organized into annual cohorts. Each cohort shall share an associated table of floor values on the ELCC Class Ratings spanning the duration described below. Floor values shall be calculated using effective load carrying capability analysis for future years, applying a resource mix that reflects more conservative ELCC Class Ratings than expected, as set forth in subsection (3)(d) below. Floor values shall be posted on an annual cycle, each posting of which shall include floor values for no more than ten calendar years in the future.

Tables of floor values will apply for the Delivery Years as specified below. For new ELCC Resources, the ELCC Class Rating floor values contemplated by this RAA, Schedule 9.1, section J shall apply upon:

(a) completion of one of the following milestones in the New Services Queue: (i) execution of an Interconnection Service Agreement by the Interconnection Customer, or equivalent, for the ELCC Resource; (ii) execution of a Wholesale Market Participation Agreement by the wholesale market participant, or equivalent, for the ELCC Resource; or (iii) posting credit to submit a Sell Offer into the next Base Residual Auction, pursuant to the applicable RPM Auction Credit Rate; and

(b) receipt by the Office of the Interconnection of a written attestation, in a form specified in the PJM Manuals, by the Generation Capacity Resource Provider of the ELCC Resource affirming the Generation Capacity Resource Provider's intent to proceed to provide capacity in the PJM Region. Such attestation shall be provided to the Office of the Interconnection after reaching one of the milestones identified in subsection (a) above.

#### (2) Cohorts

(a) **2021 Cohort**. A table of floor values for Delivery Years 2021/22 through 2033/34 shall apply to ELCC Resources that on or before December 31, 2021 are Existing Generation Capacity Resources or satisfy the requirements of RAA, Schedule 9.1, section J(1)(a) and (b) above. A table of preliminary ELCC Class Rating floor values for Delivery Years 2021/2022 through 2030/2031 shall be posted within six months of this Schedule 9.1 becoming effective but no later than December 31, 2021; preliminary floor values for Delivery Years 2031/2032, 2032/2033, and 2033/2034 shall be posted on or before December 31 of 2022, 2023, and 2024, respectively.

(b) **2022 Cohort.** A table of floor values for Delivery Years 2022/23 through 2034/35 shall apply to ELCC Resources that meet the requirements in RAA, Schedule 9.1, section J(1)(a) and (b) above on or after January 1, 2022 and on or before December 31, 2022. Preliminary floor values for Delivery Years 2022/2023 through 2031/2032 shall be posted on or before December 31, 2021; preliminary floor values for Delivery Years 2032/2033, 2033/2034, and 2034/2035 shall be posted on or before December 31 of 2022, 2023, and 2024, respectively.

(c) **2023 Cohorts and later.** For each of the thirteen consecutive Delivery Years beginning with the Delivery Year that starts in the calendar year in which an ELCC

Resource meets the requirements in RAA, Schedule 9.1, section J(1)(a) and (b) above, a set of ELCC Class Rating floor values shall apply to such ELCC Resources. Preliminary floor values for the first ten Delivery Years in the table shall be posted on or before December 31 prior to the first Delivery Year to which a floor value applies; preliminary floor values for Delivery Years eleven, twelve, and thirteen shall be posted on or before December 31 of each of the immediately following three calendar years, respectively. This timing is reflected in the below table, where "X" is the year in which the ELCC Resource meets the requirements in RAA, Schedule 9.1, section J(1)(a) and (b) above.

<b><u>Calendar Year In which</u></b> Floor Values Are Posted	Target Delivery Year	ELCC Class Rating
for Cohort "X"		
<u>X-1</u>	<u>X/X+1</u>	<u>Value I</u>
<u>X-1</u>	<u>X+1/X+2</u>	Value II
<u>X-1</u>	<u>X+2/X+3</u>	Value III
<u>X-1</u>	<u>X+3/X+4</u>	Value IV
<u>X-1</u>	<u>X+4/X+5</u>	Value V
<u>X-1</u>	<u>X+5/X+6</u>	Value VI
<u>X-1</u>	<u>X+6/X+7</u>	Value VII
<u>X-1</u>	<u>X+7/X+8</u>	Value VIII
<u>X-1</u>	<u>X+8/X+9</u>	Value IX
<u>X-1</u>	<u>X+9/X+10</u>	Value X
<u>X</u>	<u>X+10/X+11</u>	<u>Value XI</u>
<u>X+1</u>	<u>X+11/X+12</u>	Value XII
<u>X+2</u>	<u>X+12/X+13</u>	Value XIII

Preliminary floor values shall be finalized within 120 days of posting. Upon posting the preliminary floor values, the Office of the Interconnection shall conduct a retrospective review to determine if any potential errors occurred in its implementation of this section J, whereby the potential error, if verified, could have a material impact on the posted preliminary floor values. In the event the Office of the Interconnection discovers such a potential error within 60 days of posting such preliminary floor value, the Office of the Interconnection will notify Market Participants of the existence of the potential error as soon as possible, but in no event later than 60 days after posting the applicable preliminary floor value. Within 45 days of identifying a potential error in a preliminary floor value, the Office of the Interconnection shall consult with Market Participants, and provide all available supporting documentation (such documentation shall not contain market sensitive or confidential information), prior to determining whether to modify an initially posted preliminary floor value. If the Office of the Interconnection

determines it is necessary to modify an initially posted preliminary floor value, it shall notify Market Participants of its intent to do so and post such notification on its website by no later than 45 days following the notification of a discovery of a potential error in the preliminary floor value. The Office of the Interconnection shall post on its website the corrected floor value by no later than 120 days following the initial posting of the preliminary floor value. Should any of the above deadlines pass without the associated action on the part of the Office of the Interconnection, the originally posted floor values will be considered final.

To the extent an ELCC Resource satisfies the requirements of RAA, Schedule 9.1, section J(1)(a) and (b) above on or after the January 1 following the posting of the preliminary floor value applicable to that ELCC Resource, and within 60 days of such posting, and the Office of the Interconnection identifies a potential error with respect to that floor value, the Generation Capacity Resource Provider may elect for the ELCC Resource to be included in the cohort for the prior calendar year. Any election to be included in the cohort for the prior calendar year must be provided in writing to the Office of the Interconnection within 10 days after the Office of the Interconnection consults with Market Participants regarding the potential error.

#### (3) General Rules for ELCC Class Rating Floor Values

(a) In a given annual posting cycle, for floor values that are ten years in the future and therefore have not previously been posted, the same floor value shall be posted for use across all cohorts of an ELCC Class for a given Delivery Year for which such floor will be applicable.

(b) For a given resource, at the end of the term of applicability of the original set of ten floor values, as extended with three additional floor values, the rules in place at that time for determining Accredited UCAP (or otherwise determining the amount of Unforced Capacity that such resource is eligible to offer or provide) will apply.

(c) The ELCC Class Rating used to determine the Accredited UCAP of an ELCC Resource is the greater of the applicable floor value or the most recently posted final or preliminary ELCC Class Rating for the target Delivery Year.

(d) The ELCC Class Rating floor values for each ELCC Class shall be calculated using the same form of effective load carrying capability analysis used for calculating ELCC Class Ratings for future years, except that the forecasted resource mix used for calculating the ELCC Class Ratings (the "expected forecast") shall be adjusted for the calculation of the floor value for each ELCC Class (the "floor forecast") in order to reflect a more conservative ELCC Class Rating value. Each ELCC Class shall have a unique floor forecast that accounts for the interaction among ELCC Classes, both the given subject ELCC Class and the other ELCC Classes, through adjusting (up or down) the rate of deployment expected for each ELCC Class. The floor forecast for a given ELCC Class of Variable Resources or Limited Duration Resources shall be developed according to the following method:

(i) Any expected increase in deployment of ELCC Resources in the given subject class in each year shall be accelerated in an exponential fashion such that the increase in deployment after 10 years shall be twice the value in the expected forecast.

(ii) For ELCC Resources in ELCC Classes other than the given subject ELCC Class that show a complementary interaction with the given subject class in the effective load carrying capability analysis, where a complementary interaction occurs in the case that the increase in deployment of the complementary class tends to increase the ELCC Class Rating of the subject class, any expected increase in deployment in a complementary ELCC Class shall be decelerated in an exponential fashion such that the increase in deployment after ten years shall be half the value in the expected forecast; any expected decrease in deployment in a complementary ELCC Class shall be accelerated in an exponential fashion such that the decrease in deployment after ten years shall be twice the value in the expected forecast.

(iii) For ELCC Resources in ELCC Classes showing an antagonistic interaction with the given subject class in the effective load carrying capability analysis, where an antagonistic interaction occurs in the case that the increase in deployment of the antagonistic class tends to decrease the ELCC Class Rating of the subject class, any expected increase in deployment in an antagonistic class shall be accelerated in an exponential fashion such that the increase in deployment after ten years shall be twice the value in the expected forecast; any expected decrease in deployment in an antagonistic class shall be decelerated in an exponential fashion such that the decrease in deployment after ten years shall be half the value in the expected forecast.

For Combination Resources, the applicable floor values will be determined in accordance with a procedure set forth in the PJM Manuals that appropriately reflects and merges the floor values determined for the distinct components of the Combination Resource in a manner consistent with the methodology above.

However, for Hydropower With Non-Pumped Storage, the applicable floor values will be determined, using the foregoing method, on a resource-specific basis and not on an ELCC Class basis.

(e) The ELCC Class Rating used to determine an Accredited UCAP shall not be below the applicable floor value. ELCC Classes shall be organized into groups for the purpose of sharing the risk that a final or preliminary ELCC Class Rating for a Delivery Year is lower than the corresponding ELCC Class Rating in any table of floor values for such Delivery Year. In that event,

(i) for ELCC Resources with a final or preliminary ELCC Class Rating below the applicable floor value, the Accredited UCAP shall be determined using the ELCC Resource's ELCC Resource Performance Adjustment, in accordance with the methods set forth in RAA, Schedule 9.1, section E, and the applicable ELCC Class Rating floor value;

(ii) for ELCC Resources with a final or preliminary ELCC Class Rating above the applicable floor value, the Accredited UCAP shall be determined using the ELCC Resource's ELCC Resource Performance Adjustment, in accordance with the methods set forth in RAA, Schedule 9.1, section E, and the ELCC Class Rating, which is determined in accordance with the methodology set forth in RAA, Schedule 9.1, section D, except that (1) the value used in place of ELCC Class UCAP is equal to [the sum of the ELCC Class UCAP for each ELCC Class of the subject group minus the sum of the Accredited UCAP of the ELCC Resources that are accredited based on floor values], which in turn is allocated to each ELCC Class in accordance with the methodology specified in the PJM Manuals that is consistent with the allocation methodology of RAA, Schedule 9.1, section C for allocating the ELCC Portfolio UCAP among the ELCC Classes, then further adjusted by a factor based on ELCC Resource Performance Adjustment values such that the total Accredited UCAP of all resources of each class does not exceed the ELCC Class UCAP and (2) the relevant aggregate Effective Nameplate Capacity shall be the sum of the Effective Nameplate Capacity of the members of the ELCC Class that are accredited based on a final or preliminary ELCC Class Rating above the applicable floor value.

Provided, however, if the aggregate ELCC Class UCAP of the entire group is less than the aggregate Accredited UCAP of the ELCC Resources of the group that are accredited based on floor values, then the ELCC Class Rating for ELCC Resources with a final or preliminary ELCC Class Rating above the applicable floor value shall be determined in accordance with the methodology set forth in RAA, Schedule 9.1, section D, except that (3) the value used in place of ELCC Class UCAP is equal to [the ELCC Portfolio UCAP minus the aggregate Accredited UCAP of the resources of the group that are accredited based on floor values] which in turn is allocated to each ELCC Class in accordance with the methodology specified in the PJM Manuals that is consistent with the allocation methodology of RAA, Schedule 9.1, section C for allocating the ELCC Portfolio UCAP among the ELCC Classes, then further adjusted by a factor based on ELCC Resource Performance Adjustment values such that the total Accredited UCAP of all resources of each class does not exceed the ELCC Class UCAP, and (4) the relevant aggregate Effective Nameplate Capacity shall be the sum of the Effective Nameplate Capacity of the members of the ELCC Class that are accredited based on a final or preliminary ELCC Class Rating above the applicable floor value.

ELCC Class groups shall be defined in the PJM Manuals. The groups shall be defined in accordance with the following principles: (1) each group shall be composed of ELCC Classes that shall share relevant physical characteristics; and (2) each group is broad enough to include a significant fraction of the ELCC Portfolio UCAP, with consideration given to ELCC Classes that are expected to increase in deployment over the ten-year term of the effective load carrying capability analysis.

(f) While recognizing the general principle that the floor values already issued for a specific resource generally would not be changed, the limited circumstances under which the posted final floor values could be changed include: (i) the Office of the Interconnection no longer performs the effective load carrying capability analysis set forth in this RAA, Schedule 9.1; or (ii) the Office of the Interconnection no longer determines Accredited UCAP prior to conducting an RPM Auction.

Nothing in RAA, Schedule 9.1 is intended to constrain the authority of the PJM Board in any way. The Office of the Interconnection and the PJM Board retain all of their filing rights, including the right to file with FERC as needed to: (iii) change the effective load carrying capability constructs and the effective load carrying capability analysis; (iv) change the methodology specified in this section J for calculating floors that are to be posted in the future; and (v) cease the posting of new floor values. None of the foregoing shall provide a basis for a new transition period or any other form of compensation to a Generation Capacity Resource Provider.

(g) The applicable table of floor values will continue to apply even if an ELCC Resource offers less than their Accredited UCAP.

(h) For purposes of determining floor values in this section J, uprates to individual ELCC Resources are treated as if each uprate is a separate ELCC Resource. The total Accredited UCAP of an ELCC Resource, including all uprates, shall be the sum of the respective Accredited UCAP values.

(i) The floor value applicable to an ELCC Resource is not transferable to a different ELCC Resource.

## Attachment B

# PJM Open Access Transmission Tariff and PJM Reliability Assurance Agreement

(Clean Format)

### Section(s) of the PJM Open Access Transmission Tariff

(Clean Format)

#### ATTACHMENT DD

#### **Reliability Pricing Model**

References to section numbers in this Attachment DD refer to sections of this Attachment DD, unless otherwise specified.

#### 5.6 Sell Offers

Sell Offers shall be submitted or withdrawn via the internet site designated by the Office of the Interconnection, under the procedures and time schedule set forth in the PJM Manuals.

#### 5.6.1 Specifications

A Sell Offer shall state quantities in increments of 0.1 megawatts and shall specify, as appropriate:

a) Identification of the Generation Capacity Resource, Demand Resource, Capacity Storage Resource or Energy Efficiency Resource on which such Sell Offer is based;

b) Minimum and maximum megawatt quantity of installed capacity that the Capacity Market Seller is willing to offer (notwithstanding such specification, the product offered shall be Unforced Capacity), or designate as Self-Supply, from a Generation Capacity Resource;

i) Price, in dollars and cents per megawatt-day, that will be accepted by the Capacity Market Seller for the megawatt quantity of Unforced Capacity offered from such Generation Capacity Resource.

ii) The Sell Offer may take the form of offer segments with varying pricequantity pairs for varying output levels from the underlying resource, but may not take the form of an offer curve with nonzero slope.

c) EFORd of each Generation Capacity Resource offered.

i) If a Capacity Market Seller is offering such resource in a Base Residual Auction, First Incremental Auction, Second Incremental Auction, or Conditional Incremental Auction occurring before the Third Incremental Auction, the Capacity Market Seller shall specify the EFORd to apply to the offer.

ii) If a Capacity Market Seller is committing the resource as Self-Supply, the Capacity Market Seller shall specify the EFORd to apply to the commitment.

iii) The EFORd applied to the Third Incremental Auction will be the final EFORd established by the Office of the Interconnection six (6) months prior to the Delivery Year, based on the actual EFORd in the PJM Region during the 12-month period ending September 30 that last precedes such Delivery Year.

d) The Nominated Demand Resource Value for each Demand Resource offered and the Nominated Energy Efficiency Value for each Energy Efficiency Resource offered. The Office of the Interconnection shall, in both cases, convert such value to an Unforced Capacity basis by multiplying such value by the DR Factor (for Delivery Years through May 31, 2018) times the Forecast Pool Requirement. Demand Resources shall specify the LDA in which the Demand Resource is located, including the location of such resource within any Zone that includes more than one LDA as identified on RAA, Schedule 10.1. e) For Delivery Years through May 31, 2018, a Demand Resource with the potential to qualify as two or more of a Limited Demand Resource, Extended Summer Demand Resource or Annual Demand Resource may submit separate but coupled Sell Offers for each Demand Resource type for which it qualifies at different prices and the auction clearing algorithm will select the Sell Offer that yields the least-cost solution. For such coupled Demand Resource offers, the offer price of an Annual Demand Resource offer must be at least \$.01 per MW-day greater than the offer price of a coupled Extended Summer Demand Resource offer and the offer price of a Extended Summer Demand Resource offer must be at least \$.01 per MW-day greater than the offer price of a coupled Limited Demand Resource offer.

f) For a Qualifying Transmission Upgrade, the Sell Offer shall identify such upgrade, and the Office of the Interconnection shall determine and certify the increase in CETL provided by such upgrade. The Capacity Market Seller may offer the upgrade with an associated increase in CETL to an LDA in accordance with such certification, including an offer price that will be accepted by the Capacity Market Seller, stated in dollars and cents per megawatt-day as a price difference between a Capacity Resource located outside such an LDA and a Capacity Resource located inside such LDA; and the increase in CETL into such LDA to be provided by such Qualifying Transmission Upgrade, as certified by the Office of the Interconnection.

g) For the 2018/2019 and 2019/2020 Delivery Years, each Capacity Market Seller owning or controlling a resource that qualifies as both a Base Capacity Resource and a Capacity Performance Resource may submit separate but coupled Sell Offers for such resource as a Base Capacity Resource and as a Capacity Performance Resource, at different prices, and the auction clearing algorithm will select the Sell Offer that yields the least-cost solution. Submission of a coupled Base Capacity Resource Sell Offer shall be mandatory for any Capacity Performance Resource Sell Offer that exceeds a Sell Offer Price equal to the applicable Net Cost of New Entry times the Balancing Ratio as provided for in Tariff, Attachment DD, section 6.4. For such coupled Sell Offers, the offer price of a Capacity Performance Resource offer must be at least \$.01 per MW-day greater than the offer price of a coupled Base Capacity Resource offer.

A Capacity Market Seller that owns or controls one or more Capacity Storage (h) Resources, Intermittent Resources, Demand Resources, or Energy Efficiency Resources may submit a Sell Offer as a Capacity Performance Resource in a MW quantity consistent with their average expected output during peak-hour periods but for ELCC Resources, for the 2023/2024 Delivery Year and subsequent Delivery Years, such MW quantity shall not to exceed the Accredited UCAP of the resource. Alternatively, a Capacity Market Seller that owns or controls one or more Capacity Storage Resources, Intermittent Resources, Demand Resources, Energy Efficiency Resources, or Environmentally-Limited Resources may submit a Sell Offer which represents the aggregated Unforced Capacity value of such resources, where such Sell Offer shall be considered to be located in the smallest modeled LDA common to the aggregated resources. Such aggregated resources shall be owned by or under contract to the Capacity Market Seller, including all such resources obtained through bilateral contract and reported to the Office of the Interconnection in accordance with the Office of the Interconnection's rules related to its Capacity Exchange tools. If any of the commercially aggregated resources in such Sell Offer are subject to the Minimum Floor Offer Price pursuant to Tariff, Attachment DD, sections 5.14(h) and 5.14(h-1), the Capacity Market Seller that owns or controls such resources may submit a

Sell Offer with a Minimum Floor Offer Price of no lower than the time and MW-weighted average of the applicable MOPR Floor Offer Prices (zero if not applicable) of the aggregated resources in such Sell Offer.

For the 2020/2021 Delivery Year and subsequent Delivery Years, a Capacity (i) Market Seller that owns or controls a resource that qualifies as a Summer-Period Capacity Performance Resource may submit a Sell Offer as a Capacity Performance Resource in a MW quantity consistent with the average expected output of such resource during peak-hour periods, and may submit a separate Sell Offer as a Summer-Period Capacity Performance Resource in a MW quantity consistent with the average expected output of such resource during summer peakhour periods, provided the total Sell Offer MW quantity submitted as both a Capacity Performance Resource and a Summer-Period Capacity Performance Resource does not exceed the Unforced Capacity value of the resource. For the 2020/2021 Delivery Year and subsequent Delivery Years, a Capacity Market Seller that owns or controls a resource that qualifies as a Winter-Period Capacity Performance Resource may submit a Sell Offer as a Capacity Performance Resource in a MW quantity consistent with the average expected output of such resource during peak-hour periods, and may submit a separate Sell Offer as a Winter-Period Capacity Performance Resource in a MW quantity consistent with the average expected output of such resource during winter peak-hour periods, provided the total Sell Offer MW quantity submitted as both a Capacity Performance Resource and a Winter-Period Capacity Performance Resource does not exceed the Unforced Capacity value of the resource. Each segment of a Seasonal Capacity Performance Resource Sell Offer must be submitted as a flexible Sell Offer segment with the minimum MW quantity offered set to zero.

#### 5.6.2 Compliance with PJM Credit Policy

Capacity Market Sellers shall comply with the provisions of the PJM Credit Policy as set forth in Tariff, Attachment Q, including the provisions specific to the Reliability Pricing Model, prior to submission of Sell Offers in any Reliability Pricing Model Auction. A Capacity Market Seller desiring to submit a Credit-Limited Offer shall specify in its Sell Offer the maximum auction credit requirement, in dollars, and the maximum amount of Unforced Capacity, in megawatts, applicable to its Sell Offer.

#### 5.6.3 [reserved]

#### 5.6.4 Qualifying Transmission Upgrades

A Qualifying Transmission Upgrade may not be the subject of any Sell Offer in a Base Residual Auction unless it has been approved by the Office of the Interconnection, including certification of the increase in Import Capability to be provided by such Qualifying Transmission Upgrade, no later than 45 days prior to such Base Residual Auction. No such approval shall be granted unless, at a minimum, a Facilities Study Agreement has been executed with respect to such upgrade, and such upgrade conforms to all applicable standards of the Regional Transmission Expansion Plan process.

#### 5.6.5 Market-based Sell Offers

Subject to section 6, a Market Seller authorized by FERC to sell electric generating capacity at market-based prices, or that is not required to have such authorization, may submit Sell Offers that specify market-based prices in any Base Residual Auction or Incremental Auction.

#### 5.6.6 Availability of Capacity Resources for Sale

(a) The Office of the Interconnection shall determine the quantity of megawatts of available installed capacity that each Capacity Market Seller must offer in any RPM Auction pursuant to Tariff, Attachment DD, section 6.6, through verification of the availability of megawatts of installed capacity from: (i) all Generation Capacity Resources owned by or under contract to the Capacity Market Seller, including all Generation Capacity Resources obtained through bilateral contract; (ii) the results of prior Reliability Pricing Model Auctions, if any, for such Delivery Year (including consideration of any restriction imposed as a consequence of a prior failure to offer); and (iii) such other information as may be available to the Office of the Interconnection. The Office of the Interconnection shall reject Sell Offers or portions of Sell Offers for Capacity Resources in excess of the quantity of installed capacity from such Capacity Market Seller's Capacity Resource that it determines to be available for sale.

The Office of the Interconnection shall determine the quantity of installed (b) capacity available for sale in a Base Residual Auction or Incremental Auction as of the beginning of the period during which Buy Bids and Sell Offers are accepted for such auction, as applicable, in accordance with the time schedule set forth in the PJM Manuals. Removal of a resource from Capacity Resource status shall not be reflected in the determination of available installed capacity unless the associated unit-specific bilateral transaction is approved, the designation of such resource (or portion thereof) as a network resource for the external load is demonstrated to the Office of the Interconnection, or equivalent evidence of a firm external sale is provided prior to the deadline established therefor. The determination of available installed capacity shall also take into account, as they apply in proportion to the share of each resource owned or controlled by a Capacity Market Seller, any approved capacity modifications, and existing capacity commitments established in a prior RPM Auction, an FRR Capacity Plan, Locational UCAP transactions and/or replacement capacity transactions under this Tariff, Attachment DD. To enable the Office of the Interconnection to make this determination, no bilateral transactions for Capacity Resources applicable to the period covered by an auction will be processed from the beginning of the period for submission of Sell Offers and Buy Bids, as appropriate, for that auction until completion of the clearing determination for such auction. Processing of such bilateral transactions will reconvene once clearing for that auction is completed. A Generation Capacity Resource located in the PJM Region shall not be removed from Capacity Resource status to the extent the resource is committed to service of PJM loads as a result of an RPM Auction, FRR Capacity Plan, Locational UCAP transaction and/or by designation as a replacement resource under this Tariff, Attachment DD.

(c) In order for a bilateral transaction for the purchase and sale of a Capacity Resource to be processed by the Office of the Interconnection, both parties to the transaction must notify the Office of the Interconnection of the transfer of the Capacity Resource from the seller to the buyer in accordance with procedures established by the Office of the Interconnection and set forth in the PJM Manuals. If a material change with respect to any of the prerequisites for the application of Tariff, Attachment DD, section 5.6.6 to the Generation Capacity Resource

occurs, the Capacity Resource Owner shall immediately notify the Market Monitoring Unit and the Office of the Interconnection.

#### 5.10 Auction Clearing Requirements

The Office of the Interconnection shall clear each Base Residual Auction and Incremental Auction for a Delivery Year in accordance with the following:

a) Variable Resource Requirement Curve

The Office of the Interconnection shall determine Variable Resource Requirement Curves for the PJM Region and for such Locational Deliverability Areas as determined appropriate in accordance with subsection (a)(iii) for such Delivery Year to establish the level of Capacity Resources that will provide an acceptable level of reliability consistent with the Reliability Principles and Standards. It is recognized that the variable resource requirement reflected in the Variable Resource Requirement Curve can result in an optimized auction clearing in which the level of Capacity Resources committed for a Delivery Year exceeds the PJM Region Reliability Requirement (for Delivery Years through May 31, 2018, less the Short-Term Resource Procurement Target) or Locational Deliverability Area Reliability Requirement (for Delivery Years through May 31, 2018, less the Short-Term Resource Procurement Target for the Zones associated with such LDA) for such Delivery Year. For any auction, the Updated Forecast Peak Load, and Short-Term Resource Procurement Target applicable to such auction, shall be used, and Price Responsive Demand from any applicable approved PRD Plan, including any associated PRD Reservation Prices, shall be reflected in the derivation of the Variable Resource Requirement Curves, in accordance with the methodology specified in the PJM Manuals.

i) Methodology to Establish the Variable Resource Requirement Curve

Prior to the Base Residual Auction, in accordance with the schedule in the PJM Manuals, the Office of the Interconnection shall establish the Variable Resource Requirement Curve for the PJM Region as follows:

- Each Variable Resource Requirement Curve shall be plotted on a graph on which Unforced Capacity is on the x-axis and price is on the y-axis;
- For the 2015/2016, 2016/2017, and 2017/2018 Delivery Years, the Variable Resource Requirement Curve for the PJM Region shall be plotted by combining (i) a horizontal line from the y-axis to point (1), (ii) a straight line connecting points (1) and (2), (iii) a straight line connecting points (2) and (3), and (iv) a vertical line from point (3) to the x-axis, where:
  - For point (1), price equals: {the greater of [the Cost of New Entry] or [1.5 times (the Cost of New Entry minus the Net Energy and Ancillary Service Revenue Offset)]} divided by (one minus the pool-wide average EFORd) and Unforced Capacity equals: [the PJM Region Reliability Requirement multiplied by (100% plus the approved PJM Region Installed Reserve Margin ("IRM")% minus 3%) divided by (100% plus IRM%)], and for Delivery Years

through May 31, 2018, minus the Short-Term Resource Procurement Target;

- For point (2), price equals: (the Cost of New Entry minus the Net Energy and Ancillary Service Revenue Offset) divided by (one minus the pool-wide average EFORd) and Unforced Capacity equals: [the PJM Region Reliability Requirement multiplied by (100% plus IRM% plus 1%) divided by (100% plus IRM%)], and for Delivery Years through May 31, 2018, minus the Short-Term Resource Procurement Target; and
- For point (3), price equals [0.2 times (the Cost of New Entry minus the Net Energy and Ancillary Service Revenue Offset)] divided by (one minus the pool-wide average EFORd) and Unforced Capacity equals: [the PJM Region Reliability Requirement multiplied by (100% plus IRM% plus 5%) divided by (100% plus IRM%)], and for Delivery Years through May 31, 2018, minus the Short-Term Resource Procurement Target;
- For the 2018/2019 Delivery Year and subsequent Delivery Years through and including the Delivery Year commencing June 1, 2021, the Variable Resource Requirement Curve for the PJM Region shall be plotted by combining (i) a horizontal line from the y-axis to point (1), (ii) a straight line connecting points (1) and (2), and (iii) a straight line connecting points (2) and (3), where:
  - For point (1), price equals: {the greater of [the Cost of New Entry] or [1.5 times (the Cost of New Entry minus the Net Energy and Ancillary Service Revenue Offset)]} divided by (one minus the pool-wide average EFORd) and Unforced Capacity equals: [the PJM Region Reliability Requirement multiplied by (100% plus the approved PJM Region Installed Reserve Margin ("IRM")% minus 0.2%) divided by (100% plus IRM%)];
  - For point (2), price equals: [0.75 times (the Cost of New Entry minus the Net Energy and Ancillary Service Revenue Offset)] divided by (one minus the pool-wide average EFORd) and Unforced Capacity equals: [the PJM Region Reliability Requirement multiplied by (100% plus IRM% plus 2.9%) divided by (100% plus IRM%)]; and
  - For point (3), price equals zero and Unforced Capacity equals: [the PJM Region Reliability Requirement multiplied by (100% plus IRM% plus 8.8%) divided by (100% plus IRM%)].
  - For the 2022/2023 Delivery Year and subsequent Delivery Years, the Variable Resource Requirement Curve for the PJM Region shall be plotted

by combining (i) a horizontal line from the y-axis to point (1), (ii) a straight line connecting points (1) and (2), and (iii) a straight line connecting points (2) and (3), where:

- For point (1), price equals: {the greater of [the Cost of New Entry] or [1.5 times (the Cost of New Entry minus the Net Energy and Ancillary Service Revenue Offset)]} divided by (one minus the pool-wide average EFORd) and Unforced Capacity equals: [the PJM Region Reliability Requirement multiplied by (100% plus the approved PJM Region Installed Reserve Margin ("IRM")% minus 1.2%) divided by (100% plus IRM%)];
- For point (2), price equals: [0.75 times (the Cost of New Entry minus the Net Energy and Ancillary Service Revenue Offset)] divided by (one minus the pool-wide average EFORd) and Unforced Capacity equals: [the PJM Region Reliability Requirement multiplied by (100% plus IRM% plus 1.9%) divided by (100% plus IRM%)]; and
- For point (3), price equals zero and Unforced Capacity equals: [the PJM Region Reliability Requirement multiplied by (100% plus IRM% plus 7.8%) divided by (100% plus IRM%)].

ii) For any Delivery Year, the Office of the Interconnection shall establish a separate Variable Resource Requirement Curve for each LDA for which:

- A. the Capacity Emergency Transfer Limit is less than 1.15 times the Capacity Emergency Transfer Objective, as determined by the Office of the Interconnection in accordance with NERC and Applicable Regional Entity guidelines; or
- B. such LDA had a Locational Price Adder in any one or more of the three immediately preceding Base Residual Auctions; or
- C. such LDA is determined in a preliminary analysis by the Office of the Interconnection to be likely to have a Locational Price Adder, based on historic offer price levels; provided however that for the Base Residual Auction conducted for the Delivery Year commencing on June 1, 2012, the Eastern Mid-Atlantic Region ("EMAR"), Southwest Mid-Atlantic Region ("SWMAR"), and Mid-Atlantic Region ("MAR") LDAs shall employ separate Variable Resource Requirement Curves regardless of the outcome of the above three tests; and provided further that the Office of the Interconnection may establish a separate Variable Resource Requirement Curve for an LDA not otherwise qualifying under the above three tests if it finds that such is required to achieve an acceptable level of reliability consistent with the Reliability

Principles and Standards, in which case the Office of the Interconnection shall post such finding, such LDA, and such Variable Resource Requirement Curve on its internet site no later than the March 31 last preceding the Base Residual Auction for such Delivery Year. The same process as set forth in subsection (a)(i) shall be used to establish the Variable Resource Requirement Curve for any such LDA, except that the Locational Deliverability Area Reliability Requirement for such LDA shall be substituted for the PJM Region Reliability Requirement and, for Delivery Years through May 31, 2018, the LDA Short-Term Resource Procurement Target shall be substituted for the PJM Region Short-Term Resource Procurement Target. For purposes of calculating the Capacity Emergency Transfer Limit under this section, all generation resources located in the PJM Region that are, or that qualify to become, Capacity Resources, shall be modeled at their full capacity rating, regardless of the amount of capacity cleared from such resource for the immediately preceding Delivery Year.

For each such LDA, for the 2018/2019 Delivery Year and subsequent Delivery Years, the Office of the Interconnection shall (a) determine the Net Cost of New Entry for each Zone in such LDA, with such Net Cost of New Entry equal to the applicable Cost of New Entry value for such Zone minus the Net Energy and Ancillary Services Revenue Offset value for such Zone, and (b) compute the average of the Net Cost of New Entry values of all such Zones to determine the Net Cost of New Entry for such LDA. The Net Cost of New Entry for use in an LDA in any Incremental Auction for the 2015/2016, 2016/2017, and 2017/2018 Delivery Years shall be the Net Cost of New Entry used for such LDA in the Base Residual Auction for such Delivery Year.

iii) Procedure for ongoing review of Variable Resource Requirement Curve

shape.

Beginning with the Delivery Year that commences June 1, 2018, and continuing no later than for every fourth Delivery Year thereafter, the Office of the Interconnection shall perform a review of the shape of the Variable Resource Requirement Curve, as established by the requirements of the foregoing subsection. Such analysis shall be based on simulation of market conditions to quantify the ability of the market to invest in new Capacity Resources and to meet the applicable reliability requirements on a probabilistic basis. Based on the results of such review, PJM shall prepare a recommendation to either modify or retain the existing Variable Resource Requirement Curve shape. The Office of the Interconnection shall post the recommendation and shall review the recommendation through the stakeholder process to solicit stakeholder input. If a modification of the Variable Resource Requirement Curve shape is recommended, the following process shall be followed:

A) If the Office of the Interconnection determines that the Variable Resource Requirement Curve shape should be modified, Staff of the Office of the Interconnection shall propose a new Variable Resource Requirement Curve shape on or before May 15, prior to the conduct of the Base Residual Auction for the first Delivery Year in which the new values would be applied.

- B) The PJM Members shall review the proposed modification to the Variable Resource Requirement Curve shape.
- C) The PJM Members shall either vote to (i) endorse the proposed modification, (ii) propose alternate modifications or (iii) recommend no modification, by August 31, prior to the conduct of the Base Residual Auction for the first Delivery Year in which the new values would be applied.
- D) The PJM Board of Managers shall consider a proposed modification to the Variable Resource Requirement Curve shape, and the Office of the Interconnection shall file any approved modified Variable Resource Requirement Curve shape with the FERC by October 1, prior to the conduct of the Base Residual Auction for the first Delivery Year in which the new values would be applied.
- iv) Cost of New Entry
  - A) For the Incremental Auctions for the 2019/2020, 2020/2021, and 2021/2022 Delivery Years, the Cost of New Entry for the PJM Region and for each LDA shall be the respective value used in the Base Residual Auction for such Delivery Year and LDA. For the Delivery Year commencing on June 1, 2022, and continuing thereafter unless and until changed pursuant to subsection (B) below, the Cost of New Entry for the PJM Region shall be the average of the Cost of New Entry for each CONE Area listed in this section as adjusted pursuant to subsection (a)(iv)(B).

Geographic Location Within the	Cost of New Entry
PJM Region Encompassing These	in \$/MW-Year
Zones	
PS, JCP&L, AE, PECO, DPL, RECO	108,000
("CONE Area 1")	
BGE, PEPCO ("CONE Area 2")	109,700
AEP, Dayton, ComEd, APS, DQL,	105,500
ATSI, DEOK, EKPC, Dominion,	
OVEC ("CONE Area 3")	
PPL, MetEd, Penelec ("CONE Area	105,500
4")	

B) Beginning with the 2023/2024 Delivery Year, the CONE for each CONE Area shall be adjusted to reflect changes in generating plant construction costs based on changes in the Applicable United States Bureau of Labor Statistics ("BLS") Composite Index, and then adjusted further by a factor of 1.022 to reflect the annual decline in bonus depreciation scheduled under federal corporate tax law, in accordance with the following:

(1) The Applicable BLS Composite Index for any Delivery Year and CONE Area shall be the most recently published twelve-month change, at the time CONE values are required to be posted for the Base Residual Auction for such Delivery Year, in a composite of the BLS Quarterly Census of Employment and Wages for Utility System Construction (weighted 20%), the BLS Producer Price Index for Construction Materials and Components (weighted 55%), and the BLS Producer Price Index Turbines and Turbine Generator Sets (weighted 25%), as each such index is further specified for each CONE Area in the PJM Manuals.

(2) The CONE in a CONE Area shall be adjusted prior to the Base Residual Auction for each Delivery Year by applying the Applicable BLS Composite Index for such CONE Area to the Benchmark CONE for such CONE Area, and then multiplying the result by 1.022.

(3) The Benchmark CONE for a CONE Area shall be the CONE used for such CONE Area in the Base Residual Auction for the prior Delivery Year (provided, however that the Gross CONE values stated in subsection (a)(iv)(A) above shall be the Benchmark CONE values for the 2022/2023 Delivery Year to which the Applicable BLS Composite Index shall be applied to determine the CONE for subsequent Delivery Years), and then multiplying the result by 1.022.

(4) Notwithstanding the foregoing, CONE values for any CONE Area for any Delivery Year shall be subject to amendment pursuant to appropriate filings with FERC under the Federal Power Act, including, without limitation, any filings resulting from the process described in section 5.10(a)(vi)(C) or any filing to establish new or revised CONE Areas.

- v) Net Energy and Ancillary Services Revenue Offset *up to the 2021/2022 Delivery Year:* 
  - A) The Office of the Interconnection shall determine the Net Energy and Ancillary Services Revenue Offset each year for the PJM Region as (A) the annual average of the revenues that would have been received by the Reference Resource from the PJM energy markets during a period of three consecutive calendar years preceding the time of the determination, based on (1) the heat rate and other characteristics of such Reference Resource; (2) fuel prices reported during such period at an appropriate pricing point

for the PJM Region with a fuel transmission adder appropriate for such region, as set forth in the PJM Manuals, assumed variable operation and maintenance expenses for such resource of \$6.93 per MWh, and actual PJM hourly average Locational Marginal Prices recorded in the PJM Region during such period; and (3) an assumption that the Reference Resource would be dispatched for both the Day-Ahead and Real-Time Energy Markets on a Peak-Hour Dispatch basis; plus (B) ancillary service revenues of \$2,199 per MW-year.

- B) The Office of the Interconnection also shall determine a Net Energy and Ancillary Service Revenue Offset each year for each Zone, using the same procedures and methods as set forth in the previous subsection; provided, however, that: (1) the average hourly LMPs for such Zone shall be used in place of the PJM Region average hourly LMPs; (2) if such Zone was not integrated into the PJM Region for the entire applicable period, then the offset shall be calculated using only those whole calendar years during which the Zone was integrated; and (3) a posted fuel pricing point in such Zone, if available, and (if such pricing point is not available in such Zone) a fuel transmission adder appropriate to such Zone from an appropriate PJM Region pricing point shall be used for each such Zone.
- *v-1)* Net Energy and Ancillary Services Revenue Offset for the 2022/2023 Delivery and subsequent Delivery Years:
  - A) The Office of the Interconnection shall determine the Net Energy and Ancillary Services Revenue Offset each year for the PJM *Region as (1) the average of the net energy and ancillary services* revenues that the Reference Resource is projected to receive from the PJM energy and ancillary service markets for the applicable Delivery Year from three separate simulations, with each such simulation using forward prices shaped using historical data from one of the three consecutive calendar years preceding the time of the determination for the RPM Auction to take account of year-toyear variability in such hourly shapes. Each net energy and ancillary services revenue simulation is based on (a) the heat rate and other characteristics of such Reference Resource such as assumed variable operation and maintenance expenses of \$1.95 per MWh and \$11,732/start, and emissions costs; (b) Forward Hourly LMPs for the PJM Region; (c) Forward Hourly Ancillary Services Prices, (d) Forward Daily Natural Gas Prices at an appropriate pricing point for the PJM Region with a fuel transmission adder appropriate for such region, as set forth in the *PJM Manuals; and (e) an assumption that the Reference Resource*

would be dispatched on a Projected EAS Dispatch basis; plus (2) reactive service revenues of \$2,199 per MW-year.

- B) The Office of the Interconnection also shall determine a Net Energy and Ancillary Service Revenue Offset each year for each Zone, using the same procedures and methods as set forth in the previous subsection; provided, however, that: (1) the Forward Hourly LMPs for such Zone shall be used in place of the Forward Hourly LMP for the PJM Region; (2) if such Zone was not integrated into the PJM Region for the entire three calendar years preceeding the time of the determination for the RPM Auction, then simulations shall rely on only those whole calendar years during which the Zone was integrated; and (3) Forward Daily Natural Gas Prices for the fuel pricing point mapped to such Zone.
- *C) "Forward Hourly LMPs" shall be determined as follows:* 
  - (1) Identify the liquid hub to which each Zone is mapped, as specified in the PJM Manuals.
  - (2) For each liquid hub, calculate the average day-ahead onpeak and day-ahead off-peak energy prices for each month during the Delivery Year over the most recent thirty trading days as of 180 days prior to the Base Residual Auction. For each of the remaining steps, the historical prices used herein shall be taken from the most recent three calendar years preceding the time of the determination for the RPM Auction:
  - (3)Determine and add monthly basis differentials between the hub and each of its mapped Zones to the forward monthly day-ahead on-peak and off-peak energy prices for the hub. This differential is developed using the prices for the Planning Period closest in time to the Delivery Year from the most recent long-term Financial Transmission Rights auction conducted prior to the Base Residual Auction. The difference between the annual long-term Financial Transmission Rights auction prices for the Zone and the hub are converted to monthly values by adding, for each month of the year, the difference between (a) the historical monthly average day-ahead congestion price differentials between the Zone and relevant hub and (b) the historical annual average day-ahead congestion price differentials between the Zone and hub. This step is only used when developing forward prices for locations other than the *liquid hubs;*

- (4) Determine and add marginal loss differentials to the forward monthly day-ahead on-peak and off-peak energy prices for the hub. For each month of the year, calculate the marginal loss differential, which is the average of the difference between the loss components of the historical on peak or off peak day-ahead LMPs for the Zone and relevant hub in that month across the three year period scaled by the ratio of (a) the forward monthly average on-peak or offpeak day-ahead LMP at such hub to (b) the average of the historical on-peak or off-peak day-ahead LMPs for such hub in that month across the three year period. This step is only used when developing forward prices for locations other than the liquid hubs;
- (5) Shape the forward monthly day-ahead on-peak and offpeak prices to (a) forward hourly day-ahead LMPs using historic hourly day-ahead LMP shapes for the Zone and (b) forward hourly real-time LMPs using historic hourly realtime LMP shapes for the Zone. The historic hourly shapes are based on the ratio of the historic day-ahead or realtime LMP for the Zone for each given hour in a monthly on-peak or off-peak period to the average of the historic day-ahead or real-time LMP for the Zone for all hours in such monthly on-peak or off-peak period. The historical prices used in this step shall be taken from one of each of the most recent three calendar years preceding the time of the determination for the RPM Auction;
- (6) For unit-specific energy and ancillary service offset calculations, determine and apply basis differentials from the Zone to the generation bus to the forward day-ahead and real-time hourly LMPs for the Zone. The differential for each hour of the year is developed using the difference between the historical DA or RT LMP for the generation bus and the historical DA or RT LMP for the Zone in which the generation bus is located for that same hour; and
- (7) Develop the Forward Hourly LMPs for the PJM Region pricing point. Calculate the load-weighted average of the monthly on-peak and off-peak Zonal LMPs developed in step (4) above, using the historical average load within each monthly on-peak or off-peak period. The loadweighted average monthly on-peak or off-peak Zonal LMPs are then shaped to forward hourly day-ahead and real-time LMPs using the same procedure as defined in step (5) above, except using historical LMPs for the PJM Region pricing point.

- D) Forward Hourly Ancillary Services Prices shall include prices for Synchronized Reserve, Non-Synchronized Reserve, Secondary Reserve and Regulation and shall be determined as follows. The historical prices used herein shall be taken from one of each of the most recent three calendar years preceding the time of the determination for the RPM Auction:
  - (1) For Synchronized Reserve, the forward day-ahead and real-time market clearing prices for the Reserve Zone for each hour of the Delivery Year shall be equal to the historical real-time Synchronized Reserve Market Clearing Price for the Reserve Zone for the corresponding hour of the year.
  - (2) For Non-Synchronized Reserve, the forward day-ahead and real-time market clearing prices for the Reserve Zone for each hour of the Delivery Year shall be equal to the historical real-time Non-Synchronized Reserve Market Clearing Price for the Reserve Zone for the corresponding hour of the year.
  - (3) For Secondary Reserve, the forward day-ahead and realtime Secondary Reserve market clearing price shall be \$0.00/MWh for all hours.
  - (4) For Regulation, the forward real-time Regulation market clearing price shall be calculated by multiplying the historical real-time hourly Regulation market clearing price for each hour of the Delivery Year by the ratio of the real-time Forward Hourly LMP at an appropriate pricing point, as defined in the PJM manuals, to the historic hourly real-time LMP at such pricing point for the corresponding hour of the year; and
- *E)* Forward Daily Natural Gas Prices shall be determined as follows:
  - (1) Map each Zone to the appropriate natural gas hub in the PJM Region, as listed in the PJM Manuals;
  - (2) Map each natural gas hub lacking sufficient liquidity to the liquid hub to which it has the highest historic price correlation;
  - (3) For each sufficiently liquid natural gas hub, calculate the simple average natural gas monthly settlement prices over

the most recent thirty trading days as of 180 days prior to the Base Residual Auction;

- (4) Calculate the forward monthly prices for each illiquid hub by scaling the forward monthly price of the mapped liquid hub by the average ratio of historical monthly prices at the insufficiently liquid hub to the historical monthly prices at the sufficiently liquid over the most recent three calendar years preceding the time of determination for the RPM Auction;
- (5) Shape the forward monthly prices for each hub to Forward Daily Natural Gas Prices using historic daily natural gas price shapes for the hub. The historic daily shapes are based on the ratio of the historic price for the hub for each given day in a month to the average of the historic prices for the hub for all days in such month. The daily prices are then assigned to each hour starting 10am Eastern Prevailing Time each day. The historical prices used in this step shall be taken from one of each of the most recent three calendar years preceding the time of the determination for the RPM Auction.
- vi) Process for Establishing Parameters of Variable Resource Requirement
  - A) The parameters of the Variable Resource Requirement Curve will be established prior to the conduct of the Base Residual Auction for a Delivery Year and will be used for such Base Residual Auction.
  - B) The Office of the Interconnection shall determine the PJM Region Reliability Requirement and the Locational Deliverability Area Reliability Requirement for each Locational Deliverability Area for which a Variable Resource Requirement Curve has been established for such Base Residual Auction on or before February 1, prior to the conduct of the Base Residual Auction for the first Delivery Year in which the new values will be applied, in accordance with the Reliability Assurance Agreement.
  - C) Beginning with the Delivery Year that commences June 1, 2018, and continuing no later than for every fourth Delivery Year thereafter, the Office of the Interconnection shall review the calculation of the Cost of New Entry for each CONE Area.
    - 1) If the Office of the Interconnection determines that the Cost of New Entry values should be modified, the Staff of the

Curve

Office of the Interconnection shall propose new Cost of New Entry values on or before May 15, prior to the conduct of the Base Residual Auction for the first Delivery Year in which the new values would be applied.

- 2) The PJM Members shall review the proposed values.
- 3) The PJM Members shall either vote to (i) endorse the proposed values, (ii) propose alternate values or (iii) recommend no modification, by August 31, prior to the conduct of the Base Residual Auction for the first Delivery Year in which the new values would be applied.
- 4) The PJM Board of Managers shall consider Cost of New Entry values, and the Office of the Interconnection shall file any approved modified Cost of New Entry values with the FERC by October 1, prior to the conduct of the Base Residual Auction for the first Delivery Year in which the new values would be applied.
- D) Beginning with the Delivery Year that commences June 1, 2018, and continuing no later than for every fourth Delivery Year thereafter, the Office of the Interconnection shall review the methodology set forth in this Attachment for determining the Net Energy and Ancillary Services Revenue Offset for the PJM Region and for each Zone.
  - If the Office of the Interconnection determines that the Net Energy and Ancillary Services Revenue Offset methodology should be modified, Staff of the Office of the Interconnection shall propose a new Net Energy and Ancillary Services Revenue Offset methodology on or before May 15, prior to the conduct of the Base Residual Auction for the first Delivery Year in which the new methodology would be applied.
  - 2) The PJM Members shall review the proposed methodology.
  - 3) The PJM Members shall either vote to (i) endorse the proposed methodology, (ii) propose an alternate methodology or (iii) recommend no modification, by August 31, prior to the conduct of the Base Residual Auction for the first Delivery Year in which the new methodology would be applied.
  - 4) The PJM Board of Managers shall consider the Net Revenue Offset methodology, and the Office of the
Interconnection shall file any approved modified Net Energy and Ancillary Services Revenue Offset values with the FERC by October 1, prior to the conduct of the Base Residual Auction for the first Delivery Year in which the new values would be applied.

- vii) In conjunction with a review of the Variable Resource Requirement Curve shape that commences no later than December 31, 2026, the Office of the Interconnection shall review the ELCC transition mechanism set forth in RAA, Schedule 9.1, section J. Based on the results of such review, PJM shall prepare a recommendation to either modify or retain the existing ELCC transition mechanism. The Office of the Interconnection shall post the recommendation and shall review the recommendation through the stakeholder process to solicit stakeholder input.
- b) Locational Requirements

The Office of Interconnection shall establish locational requirements prior to the Base Residual Auction to quantify the amount of Unforced Capacity that must be committed in each Locational Deliverability Area, in accordance with the Reliability Assurance Agreement.

c) Resource Requirements and Constraints

Prior to the Base Residual Auction and each Incremental Auction for the Delivery Years starting on June 1, 2014 and ending May 31, 2017, the Office of the Interconnection shall establish the Minimum Annual Resource Requirement and the Minimum Extended Summer Resource Requirement for the PJM Region and for each Locational Deliverability Area for which the Office of the Interconnection is required under section 5.10(a) above to establish a separate VRR Curve for such Delivery Year. Prior to the Base Residual Auction and Incremental Auctions for the 2017/2018 Delivery Year, the Office of the Interconnection shall establish the Limited Resource Constraints and the Sub-Annual Resource Constraints for the PJM Region and for each Locational Deliverability Area for which the Office of the Interconnection is required under section 5.10(a) above to establish a separate VRR Curve for such Delivery Year. Prior to the Base Residual Auction and Incremental Auctions for 2018/2019 and 2019/2020 Delivery Years, the Office of the Interconnection shall establish the Base Capacity Demand Resource Constraints and the Base Capacity Resource Constraints for the PJM Region and for each Locational Deliverability Area for which the Office of the Interconnection is required under section 5.10(a) above to establish a separate VRR Curve for such Delivery Year. Prior to the Base Residual Auction and Incremental Auctions for 2018/2019 and 2019/2020 Delivery Years, the Office of the Interconnection shall establish the Base Capacity Demand Resource Constraints and the Base Capacity Resource Constraints for the PJM Region and for each Locational Deliverability Area for which the Office of the Interconnection is required under section 5.10(a) above to establish a separate VRR Curve for such Delivery Year.

d) Preliminary PJM Region Peak Load Forecast for the Delivery Year

The Office of the Interconnection shall establish the Preliminary PJM Region Load Forecast for the Delivery Year in accordance with the PJM Manuals by February 1, prior to the conduct of the Base Residual Auction for such Delivery Year.

e) Updated PJM Region Peak Load Forecasts for Incremental Auctions

The Office of the Interconnection shall establish the updated PJM Region Peak Load Forecast for a Delivery Year in accordance with the PJM Manuals by February 1, prior to the conduct of the First, Second, and Third Incremental Auction for such Delivery Year.

#### 5.14 Clearing Prices and Charges

### a) Capacity Resource Clearing Prices

For each Base Residual Auction and Incremental Auction, the Office of the Interconnection shall calculate a clearing price to be paid for each megawatt-day of Unforced Capacity that clears in such auction. The Capacity Resource Clearing Price for each LDA will be the marginal value of system capacity for the PJM Region, without considering locational constraints, adjusted as necessary by any applicable Locational Price Adders, Annual Resource Price Adders, Extended Summer Resource Price Adders, Limited Resource Price Decrements, Sub-Annual Resource Price Decrements, Base Capacity Demand Resource Price Decrements, and Base Capacity Resource Price Decrements, all as determined by the Office of the Interconnection based on the optimization algorithm. If a Capacity Resource is located in more than one Locational Deliverability Area, it shall be paid the highest Locational Price Adder in any applicable LDA in which the Sell Offer for such Capacity Resource cleared. The Annual Resource Price Adder is applicable for Annual Resources only. The Extended Summer Resource Price Adder is applicable for Annual Resources and Extended Summer Resources.

The Locational Price Adder applicable to each cleared Seasonal Capacity Performance Resource is determined during the post-processing of the RPM Auction results consistent with the manner in which the auction clearing algorithm recognizes the contribution of Seasonal Capacity Performance Resource Sell Offers in satisfying an LDA's reliability requirement. For each LDA with a positive Locational Price Adder with respect to the immediate higher level LDA, starting with the lowest level constrained LDAs and moving up, PJM determines the quantity of equally matched Summer-Period Capacity Performance Resources and Winter-Period Capacity Performance Resources located and cleared within that LDA. Up to this quantity, the cleared Summer-Period Capacity Performance Resources and Winter-Period Capacity Performance Resources with the lowest Sell Offer prices will be compensated using the highest Locational Price Adder applicable to such LDA; and any remaining Seasonal Capacity Performance Resources cleared within the LDA are effectively moved to the next higher level constrained LDA, where they are considered in a similar manner for compensation.

b) Resource Make-Whole Payments

If a Sell Offer specifies a minimum block, and only a portion of such block is needed to clear the market in a Base Residual or Incremental Auction, the MW portion of such Sell Offer needed to clear the market shall clear, and such Sell Offer shall set the marginal value of system capacity. In addition, the Capacity Market Seller shall receive a Resource Make-Whole Payment equal to the Capacity Resource Clearing Price in such auction times the difference between the Sell Offer's minimum block MW quantity and the Sell Offer's cleared MW quantity. If the Sell Offer price of a cleared Seasonal Capacity Performance Resource exceeds the applicable Capacity Resource Clearing Price, the Capacity Market Seller shall receive a Resource Make-Whole Payment equal to the difference between the Sell Offer price and Capacity Resource Clearing Price in such RPM Auction. The cost for any such Resource Make-Whole Payments required in a Base Residual Auction or Incremental Auction for adjustment of prior capacity commitments shall be collected pro rata from all LSEs in the LDA in which such payments were made, based on their Daily Unforced Capacity Obligations. The cost for any such Resource Make-Whole

Payments required in an Incremental Auction for capacity replacement shall be collected from all Capacity Market Buyers in the LDA in which such payments were made, on a pro-rata basis based on the MWs purchased in such auction.

c) New Entry Price Adjustment

A Capacity Market Seller that submits a Sell Offer based on a Planned Generation Capacity Resource that clears in the BRA for a Delivery Year may, at its election, submit Sell Offers with a New Entry Price Adjustment in the BRAs for the two immediately succeeding Delivery Years if:

1. Such Capacity Market Seller provides notice of such election at the time it submits its Sell Offer for such resource in the BRA for the first Delivery Year for which such resource is eligible to be considered a Planned Generation Capacity Resource. When the Capacity Market Seller provides notice of such election, it must specify whether its Sell Offer is contingent upon qualifying for the New Entry Price Adjustment. The Office of the Interconnection shall not clear such contingent Sell Offer if it does not qualify for the New Entry Price Adjustment.

2. All or any part of a Sell Offer from the Planned Generation Capacity Resource submitted in accordance with section 5.14(c)(1) is the marginal Sell Offer that sets the Capacity Resource Clearing Price for the LDA.

3. Acceptance of all or any part of a Sell Offer that meets the conditions in section 5.14(c)(1)-(2) in the BRA increases the total Unforced Capacity committed in the BRA (including any minimum block quantity) for the LDA in which such Resource will be located from a megawatt quantity below the LDA Reliability Requirement, minus the Short Term Resource Procurement Target, to a megawatt quantity at or above a megawatt quantity at the price-quantity point on the VRR Curve at which the price is 0.40 times the applicable Net CONE divided by (one minus the pool-wide average EFORd).

4. Such Capacity Market Seller submits Sell Offers in the BRA for the two immediately succeeding Delivery Years for the entire Unforced Capacity of such Generation Capacity Resource committed in the first BRA under section 5.14(c)(1)-(2) equal to the lesser of: A) the price in such seller's Sell Offer for the BRA in which such resource qualified as a Planned Generation Capacity Resource that satisfies the conditions in section 5.14(c)(1)-(3); or B) 0.90 times the Net CONE applicable in the first BRA in which such Planned Generation Capacity Resource meeting the conditions in section 5.14(c)(1)-(3) cleared, on an Unforced Capacity basis, for such LDA.

5. If the Sell Offer is submitted consistent with section 5.14(c)(1)-(4) the foregoing conditions, then:

(i) in the first Delivery Year, the Resource sets the Capacity Resource Clearing Price for the LDA and all cleared resources in the LDA receive the Capacity Resource Clearing Price set by the Sell Offer as the marginal offer, in accordance with Tariff, Attachment DD, section 5.12(a) and section 5.14(a) above.

- (ii) in either of the subsequent two BRAs, if any part of the Sell Offer from the Resource clears, it shall receive the Capacity Resource Clearing Price for such LDA for its cleared capacity and for any additional minimum block quantity pursuant to section 5.14(b) above; or
- (iii) if the Resource does not clear, it shall be deemed resubmitted at the highest price per MW-day at which the megawatt quantity of Unforced Capacity of such Resource that cleared the first-year BRA will clear the subsequent-year BRA pursuant to the optimization algorithm described in Tariff, Attachment DD, section 5.12(a), and
- (iv) the resource with its Sell Offer submitted shall clear and shall be committed to the PJM Region in the amount cleared, plus any additional minimum-block quantity from its Sell Offer for such Delivery Year, but such additional amount shall be no greater than the portion of a minimumblock quantity, if any, from its first-year Sell Offer satisfying section 5.14(c)(1)-(3) above that is entitled to compensation pursuant to section 5.14(b) above; and
- (v) the Capacity Resource Clearing Price, and the resources cleared, shall be re-determined to reflect the resubmitted Sell Offer. In such case, the Resource for which the Sell Offer is submitted pursuant to section 5.14(c)(1)-(4) above shall be paid for the entire committed quantity at the Sell Offer price that it initially submitted in such subsequent BRA. The difference between such Sell Offer price and the Capacity Resource Clearing Price (as well as any difference between the cleared quantity and the committed quantity), will be treated as a Resource Make-Whole Payment in accordance with section 5.14(b) above. Other capacity Resource Clearing Price as determined in such LDA receive the Capacity Resource Clearing Price as determined in section 5.14(a) above.

6. The failure to submit a Sell Offer consistent with section 5.14(c)(i)-(iii) above in the BRA for Delivery Year 3 shall not retroactively revoke the New Entry Price Adjustment for Delivery Year 2. However, the failure to submit a Sell Offer consistent with section 5.14(c)(4) above in the BRA for Delivery Year 2 shall make the resource ineligible for the New Entry Pricing Adjustment for Delivery Years 2 and 3.

7. For each Delivery Year that the foregoing conditions are satisfied, the Office of the Interconnection shall maintain and employ in the auction clearing for such LDA a separate VRR Curve, notwithstanding the outcome of the test referenced in Tariff, Attachment DD, section 5.10(a)(ii).

8. On or before August 1, 2012, PJM shall file with FERC under FPA section 205, as determined necessary by PJM following a stakeholder process, tariff changes to

establish a long-term auction process as a not unduly discriminatory means to provide adequate long-term revenue assurances to support new entry, as a supplement to or replacement of this New Entry Price Adjustment.

d) Qualifying Transmission Upgrade Payments

A Capacity Market Seller that submitted a Sell Offer based on a Qualifying Transmission Upgrade that clears in the Base Residual Auction shall receive a payment equal to the Capacity Resource Clearing Price, including any Locational Price Adder, of the LDA into which the Qualifying Transmission Upgrade is to increase Capacity Emergency Transfer Limit, less the Capacity Resource Clearing Price, including any Locational Price Adder, of the LDA from which the upgrade was to provide such increased CETL, multiplied by the megawatt quantity of increased CETL cleared from such Sell Offer. Such payments shall be reflected in the Locational Price Adder determined as part of the Final Zonal Capacity Price for the Zone associated with such LDAs, and shall be funded through a reduction in the Capacity Transfer Rights allocated to Load-Serving Entities under Tariff, Attachment DD, section 5.15, as set forth in that section. PJMSettlement shall be the Counterparty to any cleared capacity transaction resulting from a Sell Offer based on a Qualifying Transmission Upgrade.

e) Locational Reliability Charge

In accordance with the Reliability Assurance Agreement, each LSE shall incur a Locational Reliability Charge (subject to certain offsets and other adjustments as described in Tariff, Attachment DD, section 5.14B, Tariff, Attachment DD, section 5.14C, Tariff, Attachment DD, section 5.14D, Tariff, Attachment DD, section 5.14E and Tariff, Attachment DD, section 5.15) equal to such LSE's Daily Unforced Capacity Obligation in a Zone during such Delivery Year multiplied by the applicable Final Zonal Capacity Price in such Zone. PJMSettlement shall be the Counterparty to the LSEs' obligations to pay, and payments of, Locational Reliability Charges.

f) The Office of the Interconnection shall determine Zonal Capacity Prices in accordance with the following, based on the optimization algorithm:

i) The Office of the Interconnection shall calculate and post the Preliminary Zonal Capacity Prices for each Delivery Year following the Base Residual Auction for such Delivery Year. The Preliminary Zonal Capacity Price for each Zone shall be the sum of: 1) the marginal value of system capacity for the PJM Region, without considering locational constraints; 2) the Locational Price Adder, if any, for the LDA in which such Zone is located; provided however, that if the Zone contains multiple LDAs with different Capacity Resource Clearing Prices, the Zonal Capacity Price shall be a weighted average of the Capacity Resource Clearing Prices for such LDAs, weighted by the Unforced Capacity of Capacity Resources cleared in each such LDA; 3) an adjustment, if required, to account for adders paid to Annual Resources and Extended Summer Demand Resources in the LDA for which the zone is located; 4) an adjustment, if required, to account for Resource Make-Whole Payments; and (5) an adjustment, if required to provide sufficient revenue for payment of any PRD Credits, all as determined in accordance with the optimization algorithm.

The Office of the Interconnection shall calculate and post the Adjusted ii) Zonal Capacity Price following each Incremental Auction. The Adjusted Zonal Capacity Price for each Zone shall equal the sum of: (1) the average marginal value of system capacity weighted by the Unforced Capacity cleared in all auctions previously conducted for such Delivery Year (excluding any Unforced Capacity cleared as replacement capacity); (2) the average Locational Price Adder weighted by the Unforced Capacity cleared in all auctions previously conducted for such Delivery Year (excluding any Unforced Capacity cleared as replacement capacity); (3) an adjustment, if required, to account for adders paid to Annual Resources and Extended Summer Demand Resources for all auctions previously conducted for such Delivery Year (excluding any Unforced Capacity cleared as replacement capacity); (4) an adjustment, if required, to account for Resource Make-Whole Payments for all actions previously conducted (excluding any Resource Make-Whole Payments to be charged to the buyers of replacement capacity); and (5) an adjustment, if required to provide sufficient revenue for payment of any PRD Credits. The Adjusted Zonal Capacity Price may decrease if Unforced Capacity is decommitted or the Resource Clearing Price decreases in an Incremental Auction.

iii) The Office of the Interconnection shall calculate and post the Final Zonal Capacity Price for each Delivery Year after the final auction is held for such Delivery Year, as set forth above. The Final Zonal Capacity Price for each Zone shall equal the Adjusted Zonal Capacity Price, as further adjusted to reflect any decreases in the Nominated Demand Resource Value of any existing Demand Resource cleared in the Base Residual Auction and Second Incremental Auction.

g) Resource Substitution Charge

Each Capacity Market Buyer in an Incremental Auction securing replacement capacity shall pay a Resource Substitution Charge equal to the Capacity Resource Clearing Price resulting from such auction multiplied by the megawatt quantity of Unforced Capacity purchased by such Market Buyer in such auction.

h) Minimum Offer Price Rule for Certain *New* Generation Capacity Resources *that are not Capacity Resources with State Subsidy* 

(1) For purposes of this section, the Net Asset Class Costs of New Entry shall be asset-class estimates of competitive, cost-based nominal levelized Cost of New Entry, net of energy and ancillary service revenues. Determination of the gross Cost of New Entry component of the Net Asset Class Cost of New Entry shall be consistent with the methodology used to determine the Cost of New Entry set forth in Tariff, Attachment DD, section 5.10(a)(iv)(A) of this Attachment. This section only applies to new Generation Capacity Resources that do not receive or are not entitled to receive a State Subsidy, meaning that such resources are not Capacity Resources with State Subsidy. To the extent a new Generation Capacity Resource is a Capacity Resource with State Subsidy, then the provisions in Tariff, Attachment DD, section 5.14(h-1) apply.

The gross Cost of New Entry component of Net Asset Class Cost of New Entry shall be, for purposes of the 2022/2023 Delivery Year and subsequent Delivery Years, the values indicated in the table below for each CONE Area for a combustion turbine generator ("CT"), and

a combined cycle generator ("CC") respectively, and shall be adjusted for subsequent Delivery Years in accordance with subsection (h)(2) below. For purposes of Incremental Auctions for the 2021/2022 Delivery Year, the MOPR Floor Offer Price shall be the same as that used in the Base Residual Auction for such Delivery Year. The estimated energy and ancillary service revenues for each type of plant shall be determined as described in subsection (h)(3) below. Notwithstanding the foregoing, the Net Asset Class Cost of New Entry shall be zero for: (i) Sell Offers based on nuclear, coal or Integrated Gasification Combined Cycle facilities; or (ii) Sell Offers based on hydroelectric, wind, or solar facilities.

	CONE Area 1	CONE Area 2	CONE Area 3	CONE Area 4
CT \$/MW-yr	108,000	109,700	105,500	105,500
CC \$/MW-yr	118,400	122,000	111,900	114,200

(2) Beginning with the Delivery Year that begins on June 1, 2019, the gross Cost of New Entry component of the Net Asset Class Cost of New Entry shall be adjusted to reflect changes in generating plant construction costs in the same manner as set forth for the cost of new entry in Tariff, Attachment DD, section 5.10(a)(iv)(B), provided, however, that the Applicable BLS Composite Index used for CC plants shall be calculated from the three indices referenced in that section but weighted 20% for the wages index, 55% for the construction materials index, and 25% for the turbines index, and provided further that nothing herein shall preclude the Office of the Interconnection from filing to change the Net Asset Class Cost of New Entry for any Delivery Year pursuant to appropriate filings with FERC under the Federal Power Act.

For the 2021/2022 Delivery Year, for purposes of this provision, (3) the net energy and ancillary services revenue estimate for a combustion turbine generator shall be that determined by Tariff, Attachment DD, section 5.10(a)(v)(A), provided that the energy revenue estimate for each CONE Area shall be based on the Zone within such CONE Area that has the highest energy revenue estimate calculated under the methodology in that subsection. The net energy and ancillary services revenue estimate for a combined cycle generator shall be determined in the same manner as that prescribed for a combustion turbine generator in the previous sentence, except that the heat rate assumed for the combined cycle resource shall be 6.553 MMbtu/Mwh, the variable operations and maintenance expenses for such resource shall be \$2.11 per MWh, the Peak-Hour Dispatch scenario for both the Day-Ahead and Real-Time Energy Markets shall be modified to dispatch the CC resource continuously during the full peakhour period, as described in Peak-Hour Dispatch, for each such period that the resource is economic (using the test set forth in such *definition*), rather than only during the four-hour blocks within such period that such resource is economic, and the ancillary service revenues shall be \$3350 per MW-year.

For the 2022/2023 Delivery Year and subsequent Delivery Years, for purposes of this provision, the net energy and ancillary services revenue estimate for a combustion turbine generator shall be that determined by Tariff, Attachment DD, section 5.10(a)(v-1)(A), provided that the energy and ancillary services revenue estimate for each CONE Area shall be based on the Zone within such CONE Area that has the highest energy revenue estimate calculated under the methodology in that subsection. The net energy and ancillary services revenue estimate for a combined cycle generator shall be determined in the same manner as that prescribed for a

combustion turbine generator in the previous sentence, except that the heat rate assumed for the combined cycle resource shall be 6.501 MMbtu/MWh, the variable operations and maintenance expenses for such resource shall be \$2.11 per MWh, a 10% adder will not be included in the energy offer, and the reactive service revenues shall be \$3,350 per MW-year.

(4) Any Sell Offer that is based on *either* (*i*) *or* (*ii*), *and* (*iii*):

i) a Generation Capacity Resource located in the PJM Region that is submitted in an RPM Auction for a Delivery Year unless a Sell Offer based on that resource has cleared an RPM Auction for that or any prior Delivery Year, or until a Sell Offer based on that resource clears an RPM auction for that or any subsequent Delivery Year; or

ii) a Generation Capacity Resource located outside the PJM Region (where such Sell Offer is based solely on such resource) that requires sufficient transmission investment for delivery to the PJM Region to indicate a long-term commitment to providing capacity to the PJM Region, unless a Sell Offer based on that resource has cleared an RPM Auction for that or any prior Delivery Year, or until a Sell offer based on that resource clears an RPM Auction for that or any subsequent Delivery Year;

in any LDA for which a separate VRR Curve is established for use iii) in the Base Residual Auction for the Delivery Year relevant to the RPM Auction in which such offer is submitted, and that is less than 90 percent of the applicable Net Asset Class Cost of New Entry or, if there is no applicable Net Asset Class Cost of New Entry, less than 70 percent of the Net Asset Class Cost of New Entry for a combustion turbine generator as provided in subsection (h)(1) above shall be set to equal 90 percent of the applicable Net Asset Class Cost of New Entry (or set equal to 70 percent of such cost for a combustion turbine, where there is no otherwise applicable net asset class figure), unless the Capacity Market Seller obtains the prior determination from the Office of the Interconnection described in subsection (5) hereof. This provision applies to Sell Offers submitted in Incremental Auctions conducted after December 19, 2011, provided that the Net Asset Class Cost of New Entry values for any such Incremental Auctions for the 2012-13 or 2013-14 Delivery Years shall be the Net Asset Class Cost of New Entry values posted by the Office of the Interconnection for the Base Residual Auction for the 2014-15 Delivery Year.

(5) Unit-Specific Exception. A Sell Offer meeting the criteria in subsection (4) shall be permitted and shall not be re-set to the price level specified in that subsection if the Capacity Market Seller obtains a determination from the Office of the Interconnection or the Commission, prior to the RPM Auction in which it seeks to submit the Sell Offer, that such Sell Offer is permissible because it is consistent with the competitive, cost-based, fixed, net cost of new entry were the resource to rely solely on revenues from PJM-administered markets. The following process and requirements shall apply to requests for such determinations:

i) The Capacity Market Seller may request such a determination by no later than one hundred twenty (120) days prior to the commencement of the offer period for the RPM Auction in which it seeks to submit its Sell Offer, by submitting simultaneously to the Office of the Interconnection and the Market Monitoring Unit a written request with all of the required documentation as described below and in the PJM Manuals. For such purpose, the Office of the Interconnection shall post, by no later than one hundred fifty (150) days prior to the commencement of the offer period for the relevant RPM Auction, a preliminary estimate for the relevant Delivery Year of the minimum offer level expected to be established under subsection (4). If the minimum offer level subsequently established for the relevant Delivery Year is less than the Sell Offer, the Sell Offer shall be permitted and no exception shall be required.

As more fully set forth in the PJM Manuals, the Capacity Market Seller ii) must include in its request for an exception under this subsection documentation to support the fixed development, construction, operation, and maintenance costs of the planned generation resource, as well as estimates of offsetting net revenues, or, sufficient data for the Office of the Interconnection and the Market Monitoring Unit to produce such an estimate. Estimates of costs or revenues shall be supported at a level of detail comparable to the cost and revenue estimates used to support the Net Asset Class Cost of New Entry established under this section 5.14(h). As more fully set forth in the PJM Manuals, supporting documentation for project costs may include, as applicable and available, a complete project description; environmental permits; vendor quotes for plant or equipment; evidence of actual costs of recent comparable projects; bases for electric and gas interconnection costs and any cost contingencies; bases and support for property taxes, insurance, operations and maintenance ("O&M") contractor costs, and other fixed O&M and administrative or general costs; financing documents for construction-period and permanent financing or evidence of recent debt costs of the seller for comparable investments; and the bases and support for the claimed capitalization ratio, rate of return, cost-recovery period, inflation rate, or other parameters used in financial modeling. Such documentation also shall identify and support any sunk costs that the Capacity Market Seller has reflected as a reduction to its Sell Offer. The request shall include a certification, signed by an officer of the Capacity Market Seller, that the claimed costs accurately reflect, in all material respects, the seller's reasonably expected costs of new entry and that the request satisfies all standards for an exception hereunder.

The request also shall identify all revenue sources relied upon in the Sell Offer to offset the claimed fixed costs, including, without limitation, long-term power supply contracts, tolling agreements, or tariffs on file with state regulatory agencies, and shall demonstrate that such offsetting revenues are consistent, over a reasonable time period identified by the Capacity Market Seller, with the standard prescribed above.

*For the 2021/2022 Delivery Year, in* making such demonstration, the Capacity Market Seller may rely upon forecasts of competitive electricity prices in the PJM Region based on well defined models that include fully documented estimates of future fuel prices, variable operation and maintenance expenses, energy demand, emissions allowance prices, and expected environmental or energy policies that affect the seller's forecast of electricity prices in such region, employing input data from sources readily available to the public. Documentation for net revenues also may include, as available and applicable, plant performance and capability information, including heat rate, start-up times and costs, forced outage rates, planned outage schedules, maintenance cycle, fuel costs and other variable operations and maintenance expenses, and ancillary service capabilities. In addition to the documentation identified herein and in the PJM Manuals, the Capacity Market Seller shall provide any additional supporting

information reasonably requested by the Office of the Interconnection or the Market Monitoring Unit to evaluate the Sell Offer. Requests for additional documentation will not extend the deadline by which the Office of the Interconnection or the Market Monitoring Unit must provide their determinations of the Minimum Offer Price Rule exception request.

For the 2022/2023 Delivery Year and subsequent Delivery Years, in making such demonstration, the Capacity Market Seller may rely upon revenues projected by well defined, forward-looking dispatch models, designed to generally follow the rules and processes of PJM's energy and ancillary services markets. Such models must utilize publicly available forward prices for electricity and fuel in the PJM Region. Any modifications made to the forward electricity and fuel prices must similarly use publicly available data. Alternative forward prices for fuel may be used if accompanied by contractual evidence showing the applicability of the alternative fuel price. Where forward fuel markets are not available, publicly available estimates of future fuel prices may be used. The model shall also contain estimates of variable operation and maintenance costs, which may include Maintenance Adders, and emissions allowance prices. Documentation for net revenues also must include, as available and applicable, plant performance and capability information, including heat rate, start-up times and costs, forced outage rates, planned outage schedules, maintenance cycle, fuel costs and other variable operations and maintenance expenses, capacity factors and ancillary service capabilities.

In the alternative, the Capacity Market Seller may request that the Market Monitoring Unit, subject to acceptance by the Office of Interconnection, produce a resourcespecific Energy & Ancillary Services Offset value for such resource using the Forward Hourly LMPs, Forward Hourly Ancillary Service Prices, and either Forward Daily Natural Gas Prices for combustion turbines and combined cycle resources, or forecasted fuel prices for other resource types, and plant parameters and capability information specific to the dispatch of the resource, as outlined above. In addition to the documentation identified herein and in the PJM Manuals, the Capacity Market Seller shall provide any additional supporting information reasonably requested by the Office of the Interconnection or the Market Monitoring Unit to evaluate the Sell Offer. Requests for additional documentation will not extend the deadline by which the Office of the Interconnection or the Market Monitoring Unit must provide their determinations of the Minimum Offer Price Rule exception request.

iii) A Sell Offer evaluated hereunder shall be permitted if the information provided reasonably demonstrates that the Sell Offer's competitive, cost-based, fixed, net cost of new entry is below the minimum offer level prescribed by subsection (4), based on competitive cost advantages relative to the costs estimated for subsection (4), including, without limitation, competitive cost advantages resulting from the Capacity Market Seller's business model, financial condition, tax status, access to capital or other similar conditions affecting the applicant's costs, or based on net revenues that are reasonably demonstrated hereunder to be higher than estimated for subsection (4). Capacity Market Sellers shall be asked to demonstrate that claimed cost advantages or sources of net revenue that are irregular or anomalous, that do not reflect arm's-length transactions, or that are not in the ordinary course of the Capacity Market Seller's business are consistent with the standards of this subsection. Failure to adequately support such costs or revenues so as to enable the Office of the Interconnection to make the determination required in this section will result in denial of an exception hereunder by the Office of the Interconnection.

iv) The Market Monitoring Unit shall review the information and documentation in support of the request and shall provide its findings whether the proposed Sell Offer is acceptable, in accordance with the standards and criteria hereunder, in writing, to the Capacity Market Seller and the Office of the Interconnection by no later than ninety (90) days prior to the commencement of the offer period for such auction. The Office of the Interconnection shall also review all exception requests and documentation and shall provide in writing to the Capacity Market Seller, and the Market Monitoring Unit, its determination whether the requested Sell Offer is acceptable and if not it shall calculate and provide to such Capacity Market Seller, a minimum Sell Offer based on the data and documentation received, by no later than sixty-five (65) days prior to the commencement of the offer period for the relevant RPM Auction. If the Office of the Interconnection determines that the requested Sell Offer is acceptable, the Capacity Market Seller Shall notify the Market Monitoring Unit and the Office of the Interconnection, in writing, of the minimum level of Sell Offer to which it agrees to commit by no later than sixty (60) days prior to the commencement of the offer period for the relevant **RPM** Auction.

*h-1)* Minimum Offer Price Rule for Capacity Resources with State Subsidy

(1) General Rule. Any Sell Offer based on either a New Entry Capacity Resource with State Subsidy or a Cleared Capacity Resource with a State Subsidy submitted in any RPM Auction shall have an offer price no lower than the applicable MOPR Floor Offer Price, unless the Capacity Market Seller qualifies for an exemption with respect to such Capacity Resource with a State Subsidy prior to the submission of such offer.

(A) Effect of Exemption. To the extent a Sell Offer in any RPM Auction is based on a Capacity Resource with State Subsidy that qualifies for any of the exemptions defined in Tariff, Attachment DD, sections 5.14(h-1)(4)-(8), the Sell Offer for such resource shall not be limited by the MOPR Floor Offer Price, unless otherwise specified.

(B) Effect of Exception. To the extent a Sell Offer in any RPM Auction for any Delivery Year is based on a Capacity Resource with State Subsidy for which the Capacity Market Seller obtains, prior to the submission of such offer, a resource-specific exception, such offer may include an offer price below the default MOPR Floor Offer Price applicable to such resource type, but no lower than the resource-specific MOPR Floor Offer Price determined in such exception process.

(C) Process for Establishing a Capacity Resource with a State Subsidy.

(i) By no later than one hundred and twenty (120) days prior to the commencement of the offer period of any RPM Auction conducted for the 2022/2023 Delivery Year and all subsequent Delivery Years, each Capacity Market Seller must certify to the Office of Interconnection, in accordance with the PJM Manuals, whether or not each Capacity Resource (other than Demand Resource and Energy Efficiency Resource) that the Capacity Market Seller intends to offer into the RPM Auction qualifies as a Capacity Resource with a State Subsidy (including by way of Jointly Owned Cross-Subsidized Capacity Resource) and identify (with specificity) any State Subsidy. Capacity Market Sellers that intend to offer a Demand Resource or an Energy Efficiency Resource into the RPM Auction shall certify to the Office of Interconnection, in accordance with the PJM Manuals, whether or not such Demand Resource or Energy Efficiency Resource qualifies as a Capacity Resource with a State Subsidy no later than thirty (30) days prior to the commencement of the offer period of any RPM Auction conducted for the 2022/2023 Delivery Year and all subsequent Delivery Years. All Capacity Market Sellers shall be responsible for each certification irrespective of any guidance developed by the Office of the Interconnection and the Market Monitoring Unit. A Capacity Resource shall be deemed a Capacity Resource with State Subsidy if the Capacity Market Seller fails to timely certify whether or not a Capacity Resource is entitled to a State Subsidy, unless the Capacity Market Seller receives a waiver from the Commission or the Capacity Resource previously received a resource-specific exception pursuant to Tariff, Attachment DD, section 5.14(h-1)(3).

(ii) The requirements in subsection (i) above do not apply to Capacity Resources for which the Market Seller designated whether or not it is subject to a State Subsidy and the associated subsidies to which the Capacity Resource is entitled in a prior Delivery Year, unless there has been a change in the set of those State Subsidy(ies), or for those which are eligible for the Demand Resource or Energy Efficiency exemption, Capacity Storage Resource exemption, Self-Supply Entity exemption, or the Renewable Portfolio Standard exemption.

(iii) Once a Capacity Market Seller has certified a Capacity Resource as a Capacity Resource with a State Subsidy, the status of such Capacity Resource will remain unchanged unless and until the Capacity Market Seller (or a subsequent Capacity Market Seller) that owns or controls such Capacity Resource provides a certification of a change in such status, the Office of the Interconnection removes such status, or by FERC order. All Capacity Market Sellers shall have an ongoing obligation to certify to the Office of Interconnection and the Market Monitoring Unit a Capacity Resource's change in status as a Capacity Resource with State Subsidy within 5 days of such change.

(2) *Minimum Offer Price Rule.* Any Sell Offer for a New Entry Capacity Resource with State Subsidy or a Cleared Capacity Resource with State Subsidy that does not qualify for any of the exemptions, as defined in Tariff, Attachment DD, sections 5.14(h-1)(4)-(8), shall have an offer price no lower than the applicable MOPR Floor Offer Price.

(A) New Entry MOPR Floor Offer Price. For a New Entry Capacity Resource with State Subsidy the applicable MOPR Floor Offer Price, based on the net cost of new entry for each resource type, shall be, at the election of the Capacity Market Seller, (i) the resource-specific value determined in accordance with the resource-specific MOPR Floor Offer Price process in Tariff, Attachment DD, section 5.14(h-1)(3) below or (ii) if applicable, the default New Entry MOPR Floor Offer Price for the applicable resource based on the gross cost of new entry values shown in the table below, as adjusted for Delivery Years subsequent to the 2022/2023 Delivery Year, net of estimated net energy and ancillary service revenues for the resource type and Zone in which the resource is located.

Resource Type	Gross Cost of New Entry (2022/2023 \$/ MW-day)
	(Nameplate)

Nuclear	\$2,000
Coal	\$1,068
Combined Cycle	\$320
Combustion Turbine	\$294
Fixed Solar PV	\$271
Tracking Solar PV	\$290
Onshore Wind	\$420
Offshore Wind	\$1,155
Battery Energy Storage	\$532
Generation Backed	\$254
Demand Resource	

The gross cost of new entry values in the table above are expressed in dollars per MW-day in terms of nameplate megawatts. For purposes of submitting a Sell Offer, the gross cost of new entry values must be converted to a net cost of new entry by subtracting the estimated net energy and ancillary service revenues, as determined below, from the gross cost of new entry. However, the resultant net cost of new entry of the battery energy storage resource type in the table above must be multiplied by 2.5. The net cost of new entry based on nameplate capacity is then converted to Unforced Capacity ("UCAP") MW-day. For Delivery Years through the 2022/2023 Delivery Year, to determine the applicable UCAP MW-day value, the net cost of new entry is adjusted as follows: for thermal generation resource types and battery energy storage resource types, the applicable class average EFORd; for wind and solar generation resource types, the applicable class average capacity value factor; or for Demand Resources and Energy Efficiency Resources, the Forecast Pool Requirement, as applicable to the relevant RPM Auction. For the 2023/2024 Delivery Year and subsequent Delivery Years, to determine the applicable UCAP MW-day value, the net cost of new entry is adjusted as follows: for thermal generation resource types, the applicable class average EFORd; for battery storage, wind, and solar resource types, the applicable ELCC Class Rating; or for Demand Resources and Energy Efficiency Resources, the Forecast Pool Requirement, as applicable to the relevant RPM Auction. The resulting default New Entry MOPR Floor Offer price in UCAP/MW-day terms shall be applied to each MW offered for the Capacity Resource regardless of the actual Sell Offer quantity and regardless of whether the Sell Offer is for a Seasonal Capacity Performance Resource.

The default New Entry MOPR Floor Offer Price for load-backed Demand Resources (i.e., the MW portion of Demand Resources that is not supported by generation) shall be separately determined for each Locational Deliverability Area as the MW-weighted average offer price of load-backed Demand Resources from the most recent three Base Residual Auctions, where the MW weighting shall be determined based on the portion of each Sell Offer for a load-backed portion of the Demand Resource that is supported by end-use customer locations on the registrations used in the pre-registration process for such Base Residual Auctions, as described in the PJM Manuals.

The default gross cost of new entry for Energy Efficiency Resources shall be \$644/ICAP MW-Day, which shall be offset by projected wholesale energy savings, as well as transmission and distribution savings of \$95/ICAP MW-Day, to determine the default New Entry MOPR Floor Offer Price (Net Cost of New Entry), where the projected wholesale energy savings are determined utilizing the cost and performance data of relevant programs offered by representative energy efficiency programs with sufficiently detailed publicly available data. The wholesale energy savings, in \$/ICAP MW-day, shall be calculated prior to each RPM Auction and be equal to the average annual energy savings of 6,221 MWh/ICAP MW times the weighted average of the annual real-time Forward Hourly LMPs of the Zones of the representative energy efficiency programs, where the weighting is developed from the annual energy savings in the relevant Zones, divided by 365.

Commencing with the Base Residual Auction for the 2023/2024 Delivery Year, the Office of the Interconnection shall adjust the default gross costs of new entry in the table above and for loadbacked Demand Resources, and post the preliminary estimates of the adjusted applicable default New Entry MOPR Floor Offer Prices on its website, by no later than one hundred fifty (150) days prior to the commencement of the offer period for each Base Residual Auction. To determine the adjusted applicable default New Entry MOPR Floor Offer Prices for all resource types except for load-backed Demand Resources and Energy Efficiency Resources, the Office of the Interconnection shall adjust the gross costs of new entry utilizing, for combustion turbine and combined cycle resource types, the same Applicable BLS Composite Index applied for such Delivery Year to adjust the CONE value used to determine the Variable Resource Requirement Curve, in accordance with Tariff, Attachment DD, section 5.10(a)(iv), and for all other resource types, the "BLS Producer Price Index Turbines and Turbine Generator Sets" component of the Applicable BLS Composite Index used to determine the Variable Resource Requirement Curve shall be replaced with the "BLS Producer Price Index Final Demand, Goods Less Food & Energy, Private Capital Equipment" when adjusting the gross costs of new entry. The resultant value shall then be then adjusted further by a factor of 1.022 for nuclear, coal, combustion turbine, combine cycle, and generation-backed Demand Resource types or 1.01 for solar, wind, and storage resource types to reflect the annual decline in bonus depreciation scheduled under federal corporate tax law. Updated estimates of the net energy and ancillary service revenues for each default resource type and applicable Zone, which shall include, but are not limited to, consideration of Fuel Costs, Maintenance Adders and Operating Costs, as applicable, pursuant to Operating Agreement, Schedule 2 shall then be subtracted from the adjusted gross costs of new entry to determine the adjusted New Entry MOPR Floor Offer Price. The net energy and ancillary services revenue shall be the the average of the net energy and ancillary services revenues that the resource is projected to receive from the PJM energy and ancillary service markets for the applicable Delivery Year from three separate simulations, with each such simulation using forward prices shaped using historical data from one of each of the three consecutive calendar years preceding the time of the determination for the RPM Auction to take account of year-to-year variability in such hourly shapes. Each net energy and ancillary services revenue simulation shall be conducted in accordance with the following and the PJM Manuals:

(i) for nuclear resource type, the net energy and ancillary services revenue estimate for each Zone shall be determined by the gross energy market revenue determined by the product of [average annual day-ahead Forward Hourly LMPs for such Zone, times 8,760 hours times the annual average equivalent availability factor of all PJM nuclear resources] minus the total annual cost to produce energy determined by the product of [8,760 hours times the annual average equivalent availability factor of all PJM nuclear resources \$9.02/MWh for a single unit plant or \$7.66/MWh for a multi-unit plant] where these hourly cost rates include fuel costs and variable operation and maintenance expenses, inclusive of Maintenance Adder costs, plus reactive services revenue of \$3,350/MW-year;

(ii) for coal resource type, the net energy and ancillary services revenue estimate for each Zone shall be determined by the Projected EAS Dispatch of a 650 MW coal unit (with heat rate of 8,638 BTU/kWh and variable operations and maintenance variable operation and maintenance expenses, inclusive of Maintenance Adder costs, of \$9.50/MWh) using day-ahead and real-time Forward Hourly LMPs for such Zone and Forward Hourly Ancillary Service Prices, and daily forecasted coal prices, as set forth in the PJM Manuals, plus reactive services revenue of \$3,350/MW-year;

(iii) for combustion turbine resource type, the net energy and ancillary services revenue estimate for each Zone shall be determined in a manner consistent with the methodology described in Tariff, Attachment DD, section 5.10(a)(v-1)(B) for the Reference Resource combustion turbine.

(iv) for combined cycle resource type, the net energy and ancillary services revenue estimate for each Zone shall be determined in the same manner as that prescribed for a combustion turbine resource type, except that the heat rate assumed for the combined cycle resource shall be 6,501 BTU/kwh, the variable operations and maintenance expenses for such resource, inclusive of Maintenance Adder costs, shall be \$2.11/MWh, plus reactive services revenue of \$3,350/MW-year.

(v) for solar PV resource type, the net energy and ancillary services revenue estimate for each Zone shall be determined using a solar resource model that provides the average MW output level, expressed as a percentage of nameplate rating, by hour of day (for each of the 24-hours of a day) and by calendar month (for each of the twelve months of a year). The annual net energy market revenues are determined by multiplying the solar output level of each hour by the real-time Forward Hourly LMP for such Zone and applicable to such hour with this product summed across all of the hours of an annual period, plus reactive services revenue of \$3,350/MW-year. Two separate solar resource models are used, one model for a fixed panel resource and a second model for a tracking panel resource;

(vi) for onshore wind resource type, the net energy and ancillary services revenue estimate for each Zone shall be determined using a wind resource model that provides the average MW output level, expressed as a percentage of nameplate rating, by hour of day (for each of the 24-hours of a day) and by calendar month (for each of the twelve months of a year). The annual energy market revenues are determined by multiplying the wind output level of each hour by the real-time Forward Hourly LMP for such Zone applicable to such hour with this product summed across all of the hours of an annual period, plus reactive services revenue of \$3,350/MW-year;

(vii) for offshore wind resource type, the net energy and ancillary services revenue estimate for each Zone shall be determined by the gross energy market revenue equal to the product of [the average annual real-time Forward Hourly LMP for such Zone times 8,760 hours times an assumed annual capacity factor of 45%], plus reactive services revenue of \$3,350/MW-year;

(viii) for Capacity Storage Resource, the net energy and ancillary services revenue estimate shall be estimated by the Projected EAS Dispatch of a 1 MW, 4MWh resource, with an 85% roundtrip efficiency, and assumed to be dispatched between 95% and 5% state of charge against day-ahead and real-time Forward Hourly LMPs for such Zone and Forward Hourly Ancillary Service Prices, plus reactive services revenue of \$3,350/MW-year; and *(ix)* for generation-backed Demand Resource, the net energy and ancillary services revenue estimate shall be zero dollars.

Beginning with the Delivery Year that commences June 1, 2022, and continuing no later than for every fourth Delivery Year thereafter, the Office of the Interconnection shall review the default gross cost of new entry values. Such review may include, without limitation, analyses of the fixed development, construction, operation, and maintenance costs for such resource types. Based on the results of such review, PJM shall propose either to modify or retain the default gross cost of new entry values stated in the table above and the default gross cost of new entry value for Energy Efficiency Resources. The Office of the Interconnection shall post publicly and solicit stakeholder comment regarding the proposal. If, as a result of this process, changes to the default gross cost of new entry values are proposed, the Office of the Interconnection shall file such proposed modifications with the FERC by October 1, prior to the conduct of the Base Residual Auction for the first Delivery Year in which the new values would be applied.

New Entry Capacity Resource with State Subsidy for which there is no default MOPR Floor Offer Price provided in accordance with this section, including hybrid resources, must seek a resource-specific value determined in accordance with the resource-specific MOPR Floor Offer Price process below to participate in an RPM Auction. Failure to obtain a resource-specific MOPR Floor Offer Price will result in the Office of the Interconnection rejecting any Sell Offer based on such resource for the relevant RPM Auction.

(B) Cleared MOPR Floor Offer Prices.

(i) For a Cleared Capacity Resource with State Subsidy, the applicable Cleared MOPR Floor Offer Price shall be, at the election of the Capacity Market Seller, (a) based on the resource-specific MOPR Floor Offer Price, as determined in accordance with Tariff, Attachment DD, section 5.14(h-1)(3) below, or (b) if available, the default Avoidable Cost Rate for the applicable resource type shown in the table below, as adjusted for Delivery Years subsequent for the 2022/2023 Delivery Year to reflect changes in avoidable costs, net of projected PJM market revenues equal to the resource's net energy and ancillary service revenues for the resource type, as determined in accordance with subsection (ii) below.

Existing Resource Type	Default Gross ACR (2022/2023 (\$/MW-day) (Nameplate)
Nuclear - single	\$697
Nuclear - dual	\$445
Coal	\$80
Combined Cycle	\$56
Combustion Turbine	\$50
Solar PV	\$40
(fixed and tracking)	
Wind Onshore	\$83
Generation-backed	\$3

Demand Response	
Load-backed Demand Response	\$0
Energy Efficiency	\$0

The default gross Avoidable Cost Rate values in the table above are expressed in dollars per MW-day in terms of nameplate megawatts. For purposes of submitting a Sell Offer, the default Avoidable Cost Rate values must be net of estimated net energy and ancillary service revenues, and then the difference is ultimately converted to Unforced Capacity ("UCAP") MW-day, where the UCAP MW-day value will be determined based on: for Delivery Years through the 2022/2023 Delivery Year, the resource-specific EFORd for thermal generation resource types, resource-specific capacity value factor for solar and wind generation resource types (based on the ratio of Capacity Interconnection Rights to nameplate capacity, appropriately time-weighted for any winter Capacity Interconnection Rights), or the Forecast Pool Requirement for Demand Resources and Energy Efficiency Resources, as applicable to the relevant RPM Auction, and for the 2023/2024 Delivery Year and subsequent Delivery Years, the resource-specific EFORd for thermal generation resource types and on the resource-specific Accredited UCAP value for solar and wind resource types (with appropriate time-weighting for any winter Capacity Interconnection Rights), or the Forecast Pool Requirement for Demand Resources and Energy Efficiency Resources, as applicable to the relevant RPM Auction. The resulting default Cleared MOPR Floor Offer price in UCAP/MW-day terms shall be applied to each MW offered for the Capacity Resource regardless of actual Sell Offer quantity and regardless of whether the Sell Offer is for a Seasonal Capacity Performance Resource.

Commencing with the Base Residual Auction for the 2023/2024 Delivery Year, the Office of the Interconnection shall adjust the default Avoidable Cost Rates in the table above, and post the adjusted values on its website, by no later than one hundred fifty (150) days prior to the commencement of the offer period for each Base Residual Auction. To determine the adjusted Avoidable Cost Rates, the Office of the Interconnection shall utilize the 10-year average Handy-Whitman Index in order to adjust the Gross ACR values to account for expected inflation. Updated estimates of the net energy and ancillary service revenues shall be determined on a resource-specific basis in accordance with Tariff, Attachment DD, section 6.8(d) and the PJM Manuals.

Beginning with the Delivery Year that commences June 1, 2022, and continuing no later than for every fourth Delivery Year thereafter, the Office of the Interconnection shall review the default Avoidable Cost Rates for Capacity Resources with State Subsidies that have cleared in an RPM Auction for any prior Delivery Year. Such review may include, without limitation, analyses of the avoidable costs of such resource types. Based on the results of such review, PJM shall propose either to modify or retain the default Avoidable Cost Rate values stated in the table above. The Office of the Interconnection shall post publicly and solicit stakeholder comment regarding the proposal. If, as a result of this process, changes to the default Avoidable Cost Rate values are proposed, the Office of the Interconnection shall file such proposed modifications with the FERC by October 1, prior to the conduct of the Base Residual Auction for the first Delivery Year in which the new values would be applied. Cleared Capacity Resources with State Subsidy for which there is no default MOPR Floor Offer Price provided in accordance with this section, including hybrid resources, must seek a resource-specific value determined in accordance with the resource-specific MOPR Floor Offer Price process below to participate in an RPM Auction. Failure to obtain a resource-specific MOPR Floor Offer Price will result in the Office of the Interconnection rejecting any Sell Offer based on such resource.

(ii) The net energy and ancillary services revenue is equal to forecasted net revenues which shall be determined in accordance with the applicable resource type net energy and ancillary services revenue determination methodology set forth in Tariff, Attachment DD, section 5.14(h-1)(2)(A)(i) through (ix) and using the subject resource's operating parameters as determined in accordance with the PJM Manuals based on (a) offers submitted in the Day-ahead Energy Market and Real-time Energy Market over the calendar year preceding the time of the determination for the RPM Auction; (b) the resource-specific operating parameters approved, as applicable, in accordance with Operating Agreement, Schedule 1, section 6.6(b) and Operating Agreement, Schedule 2 (including any Fuel Costs, emissions costs, Maintenance Adders, and *Operating Costs); (c) the resource's EFORd; (d) Forward Hourly LMPs at the generation bus as* determined in accordance with Tariff, Attachment DD, section 5.10(a)(v-1)(C)(6); and (e) the resource's stated annual revenue requirement for reactive services; plus any unit-specific bilateral contract. In addition, the following resource type-specific parameters shall be considered; (f) for combustion turbine, combined cycle, and coal resource types: the installed capacity rating, ramp rate (which shall be equal to the maximum ramp rate included in the resource's energy offers over the most recent previous calendar year preceding the determination for the RPM Auction), and the heat rate as determined as the resource's average heat rate at full load as submitted to the Market Monitoring Unit and the Office of the Interconnection, where for combined cycle resources heat rates will be determined at base load and at peak load (e.g., without duct burners and with duct burners), as applicable; (g) for nuclear resource type: anticipated refueling schedule; (h) for solar and wind resource types: the resource's output profiles for the most recent three calendar years, as available; and (i) for battery storage resource type: the nameplate capacity rating (on a MW / MWh basis).

To the extent the resource has not achieved commercial operation, the operating parameters used in the simulation of the net energy and ancillary service revenues will be based on the manufacturer's specifications and/or from parameters used for other existing, comparable resources, as developed by the Market Monitoring Unit and the Capacity Market Seller, and accepted by the Office of the Interconnection.

A Capacity Market Seller intending to submit a Sell Offer in any RPM Auction for a Cleared Capacity Resource with State Subsidy based on a net energy and ancillary services revenue determination that does not use the foregoing methodology or parameter inputs stated for that resource type shall, at its election, submit a request for a resource-specific MOPR Floor Offer Price for such Capacity Resource pursuant to Tariff, Attachment DD, section 5.14(h-1)(3) below.

(3) Resource-Specific Exception. A Capacity Market Seller intending to submit a Sell Offer in any RPM Auction for a New Entry Capacity Resource with State Subsidy or a Cleared Capacity Resource with State Subsidy below the applicable default MOPR Floor Offer Price may, at its election, submit a request for a resource-specific exception for such Capacity Resource. A Sell Offer below the default MOPR Floor Offer Price, but no lower than the resource-specific MOPR Floor Offer Price, shall be permitted if the Capacity Market Seller obtains approval from the Office of the Interconnection or the Commission, prior to the RPM Auction in which it seeks to submit the Sell Offer. The resource-specific MOPR Floor Offer Price determined under this provision shall be based on the resource-specific EFORd for thermal generation resource types, on the resource-specific Accredited UCAP value for battery energy storage resource types and for solar and wind generation resource types (appropriately timeweighted for any winter Capacity Interconnection Rights), or the Forecast Pool Requirement for Demand Resources and Energy Efficiency Resources, as applicable to the relevant RPM Auction and shall be applied to each MW offered by the resource regardless of actual Sell Offer quantity and regardless of whether the Sell Offer is for a Seasonal Capacity Performance Resource. Such Sell Offer is permissible because it is consistent with the competitive, cost-based, fixed, net cost were the resource to rely solely on revenues exclusive of any State Subsidy. All supporting data must be provided for all requests. The following requirements shall apply to requests for such determinations:

(A) The Capacity Market Seller shall submit a written request with all of the required documentation as described below and in the PJM Manuals. For such purpose, the Capacity Market Seller shall submit the resource-specific exception request to the Office of the Interconnection and the Market Monitoring Unit no later than one hundred twenty (120) days prior to the commencement of the offer period for the RPM Auction in which it seeks to submit its Sell Offer. For such purpose, the Office of the Interconnection shall post, by no later than one hundred fifty (150) days prior to the commencement of the offer period for the relevant RPM Auction, a preliminary estimate for the relevant Delivery Year of the default Minimum Floor Offer Prices, determined pursuant to Tariff, Attachment DD, sections 5.14(h-1)(2)(A) and (B). If the final applicable default Minimum Floor Offer Price subsequently established for the relevant Delivery Year is less than the Sell Offer, the Sell Offer shall be permitted and no exception shall be required.

(B) For a resource-specific exception for a New Entry Capacity Resource with State Subsidy, the Capacity Market Seller must include in its request for an exception under this subsection documentation to support the fixed development, construction, operation, and maintenance costs of the Capacity Resource, as well as estimates of offsetting net revenues.

The financial modeling assumptions for calculating Cost of New Entry for Generation Capacity Resources and generation-backed Demand Resources shall be: (i) nominal levelization of gross costs, (ii) asset life of twenty years, (iii) no residual value, (iv) all project costs included with no sunk costs excluded, (v) use first year revenues (which may include revenues from the sale of renewable energy credits for purposes other than state-mandated or state-sponsored programs), and (vi) weighted average cost of capital based on the actual cost of capital for the entity proposing to build the Capacity Resource. Notwithstanding the foregoing, a Capacity Market Seller that seeks to utilize an asset life other than twenty years (but no greater than 35 years) shall provide evidence to support the use of a different asset life, including but not limited to, the asset life term for such resource as utilized in the Capacity Market Seller's financial accounting (e.g., independently audited financial statements), or project financing documents for the resource or evidence of actual costs or financing assumptions of recent comparable projects to the extent the seller has not executed project financing for the resource (e.g., independent project engineer opinion or manufacturer's performance guarantee), or opinions of third-party experts regarding the reasonableness of the financing assumptions used for the project itself or in comparable projects. Capacity Market Sellers may also rely on evidence presented in federal filings, such as its FERC Form No. 1 or an SEC Form 10-K, to demonstrate an asset life other than 20 years of similar asset projects.

Supporting documentation for project costs may include, as applicable and available, a complete project description; environmental permits; vendor quotes for plant or equipment; evidence of actual costs of recent comparable projects; bases for electric and gas interconnection costs and any cost contingencies; bases and support for property taxes, insurance, operations and maintenance ("O&M") contractor costs, and other fixed O&M and administrative or general costs; financing documents for construction-period and permanent financing or evidence of recent debt costs of the seller for comparable investments; and the bases and support for the claimed capitalization ratio, rate of return, cost-recovery period, inflation rate, or other parameters used in financial modeling. In addition to the certification, signed by an officer of the Capacity Market Seller, the request must include a certification that the claimed costs accurately reflect, in all material respects, the seller's reasonably expected costs of new entry and that the request satisfies all standards for a resource-specific exception hereunder. The request also shall identify all revenue sources (exclusive of any State Subsidies) relied upon in the Sell Offer to offset the claimed fixed costs, including, without limitation, long-term power supply contracts, tolling agreements, or tariffs on file with state regulatory agencies, and shall demonstrate that such offsetting revenues are consistent, over a reasonable time period identified by the Capacity Market Seller, with the standard prescribed above. In making such demonstration, the Capacity Market Seller may rely upon revenues projected by well-defined, forward-looking dispatch models designed to generally follow the rules and processes of PJM's energy and ancillary services market. Such models must utilize publicly available forward prices for electricity and fuel in the PJM Region. Any modifications made to the forward electricity and fuel prices must similarly use publicly available data. Alternative forward prices for fuel may be used if accompanied by contractual evidence showing the applicability of the alternative fuel price. Where forward fuel markets are not available, publicly available estimates of future fuel prices may be used. The model shall also contain estimates of variable operation and maintenance expenses, which may include Maintenance Adders, and emissions allowance prices. Documentation for net revenues also must include, as available and applicable, plant performance and capability information, including heat rate, start-up times and costs, forced outage rates, planned outage schedules, maintenance cycle, fuel costs and other variable operations and maintenance expenses, capacity factors, and ancillary service capabilities. Any evaluation of net revenues should be consistent with Operating Agreement, Schedule 2, including, but not limited to, consideration of Fuel Costs, Maintenance Adders and Operating Costs, as applicable.

In the alternative, the Capacity Market Seller may request that the Market Monitoring Unit, subject to acceptance by the Office of Interconnection, produce a resource-specific Energy & Ancillary Services Offset value for such resource using the Forward Hourly LMPs, Forward Hourly Ancillary Service Prices and either Forward Daily Natural Gas Prices for combustion turbines and combined cycle resources, or forecasted fuel prices for other resource types, plus plant parameters and capability information specific to the dispatch of the resource, as outlined above. In addition to the documentation identified herein and in the PJM Manuals, the Capacity Market Seller shall provide any additional supporting information reasonably requested by the Office of the Interconnection or the Market Monitoring Unit to evaluate the Sell Offer. Requests for additional documentation will not extend the deadline by which the Office of the Interconnection or the Market Monitoring Unit must provide their determinations of the Minimum Offer Price Rule exception request.

The default assumptions for calculating resource-specific Cost of New Entry for Energy Efficiency Resources shall be based on, as supported by documentation provided by the Capacity Market Seller: the nominal-levelized annual cost to implement the Energy Efficiency program or to install the Energy Efficiency measure reflective of the useful life of the implemented Energy Efficiency equipment, and the offsetting savings associated with avoided wholesale energy costs and other claimed savings provided by implementing the Energy Efficiency program or installing the Energy Efficiency measure.

The default assumptions for calculating resource-specific Cost of New Entry for load-backed Demand Resources shall be based on, as supported by documentation provided by the Capacity Market Seller, program costs required for the resource to meet the capacity obligations of a Demand Resource, including all fixed operating and maintenance cost and weighted average cost of capital based on the actual cost of capital for the entity proposing to develop the Demand Resource.

For generation-backed Demand Resources, the determination of a resource-specific MOPR Floor Offer Price shall only consider the resource's costs related to participation in the Reliability Pricing Model and meeting a capacity commitment. The Capacity Market Seller must provide supporting documentation (at the end-use customer level) of the cost associated with participation as a Demand Resource and an attestation from the Demand Resource that all other costs are not related to participation as a Demand Resource, such as the costs associated with installation and operation of the generation unit, and will be accrued and paid regardless of participation in the Reliability Pricing Model. To the extent the Capacity Market Seller includes all costs associated with the generation unit supporting the Demand Resource then demand charge management benefits at the retail level (as supported by documentation at the end-use customer level) may also be considered as an additional offset to such costs. Supporting documentation (at the end-use customer level) may include, but is not limited to, historic end-use customer bills and associated analysis that identifies the annual retail avoided cost from the operation of such generation unit or the business case to support installation of the generator or regulatory requirements where the generator would be required absent participation in the Reliability Pricing Model.

(C) For a Resource-Specific Exception for a Cleared Capacity Resource with State Subsidy that is a generation resource, the Capacity Market Seller shall submit a Sell Offer consistent with the unit-specific Market Seller Offer Cap process pursuant to Tariff, Attachment DD, section 6.8; except that the 10% uncertainty adder may not be included in the "Adjustment Factor." In addition and notwithstanding the requirements of Tariff, Attachment DD, section 6.8, the Capacity Market Seller shall, at its election, include in its request for an exception under this subsection documentation to support projected energy and ancillary services markets revenues. Such a request shall identify all revenue sources (exclusive

of any State Subsidies) relied upon in the Sell Offer to offset the claimed fixed costs, including, without limitation, long-term power supply contracts, tolling agreements, or tariffs on file with state regulatory agencies, and shall demonstrate that such offsetting revenues are consistent, over a reasonable time period identified by the Capacity Market Seller, with the standard prescribed above. In making such demonstration, the Capacity Market Seller may rely upon revenues projected by well-defined, forward-looking dispatch models designed to generally follow the rules and processes of PJM's energy and ancillary services market. Such models must utilize publicly available forward prices for electricity and fuel in the PJM Region. Any modifications made to the forward electricity and fuel prices must similarly use publicly available data. Alternative forward prices for fuel may be used if accompanied by contractual evidence showing the applicability of the alternative fuel price. Where forward fuel markets are not avaliable, publicly avaliable estimates of future fuel sources may be used. The model shall also contain estimates of variable operation and maintenance expenses, which may include Maintenance Adders, and emissions allowance prices. Documentation for net revenues also must include, as available and applicable, plant performance and capability information, including heat rate, start-up times and costs, forced outage rates, planned outage schedules, maintenance cycle, fuel costs and other variable operations and maintenance expenses, capacity factors, and ancillary service capabilities. Any evaluation of revenues should include, but would not be not limited to, consideration of Fuel Costs, Maintenance Adders and Operating Costs, as applicable, pursuant to Operating Agreement, Schedule 2.

In the alternative, the Capacity Market Seller may request that the Market Monitoring Unit, subject to acceptance by the Office of Interconnection, produce a resource-specific Energy & Ancillary Services Offset value for such resource using the Forward Hourly LMPs, Forward Hourly Ancillary Service Prices and either Forward Daily Natural Gas Prices for combustion turbines and combined cycle resources, or forecasted fuel prices for other resource types, plus plant parameters and capability information specific to the dispatch of the resource, as outlined above. In addition to the documentation identified herein and in the PJM Manuals, the Capacity Market Seller shall provide any additional supporting information reasonably requested by the Office of the Interconnection or the Market Monitoring Unit to evaluate the Sell Offer. Requests for additional documentation will not extend the deadline by which the Office of the Interconnection or the Market Monitoring Unit must provide their determinations of the Minimum Offer Price Rule exception request.

The resource-specific MOPR Floor Offer Price for a Cleared Capacity Resource with State Subsidy that is a generation-backed Demand Resource will be determined based on only costs associated with the resource participating in the Reliability Pricing Model and satisfying a capacity commitment or, to the extent the Capacity Market Seller includes all costs associated with the generation unit supporting the Demand Resource, then demand charge management benefits at the retail level (as supported by documentation at the end-use customer level) may also be considered as an additional offset to such costs. Supporting documentation (at the enduse customer level) may include but is not limited to, historic end-use customer bills and associated analysis that identifies the annual retail avoided cost from the operation of such generation unit or the business case to support installation of the generator or regulatory requirements where the generator would be required absent participation in the Reliability Pricing Model. (D) A Sell Offer evaluated at the resource-specific exception shall be permitted if the information provided reasonably demonstrates that the Sell Offer's competitive, cost-based, fixed, net cost of new entry is below the default MOPR Floor Offer Price, based on competitive cost advantages relative to the costs estimated by the default MOPR Floor Offer Price, including, without limitation, competitive cost advantages resulting from the Capacity Market Seller's business model, financial condition, tax status, access to capital or other similar conditions affecting the applicant's costs, or based on net revenues that are reasonably demonstrated hereunder to be higher than those estimated by the default MOPR Floor Offer Price. Capacity Market Sellers shall demonstrate that claimed cost advantages or sources of net revenue that are irregular or anomalous, that do not reflect arm's-length transactions, or that are not in the ordinary course of the Capacity Market Seller's business are consistent with the standards of this subsection. Failure to adequately support such costs or revenues so as to enable the Office of the Interconnection to make the determination required in this section will result in denial of a resource-specific exception by the Office of the Interconnection.

(E) The Capacity Market Seller must submit a sworn, notarized certification of a duly authorized officer, certifying that the officer has personal knowledge of the resource-specific exception request and that to the best of his/her knowledge and belief: (1) the information supplied to the Market Monitoring Unit and the Office of Interconnection to support its request for an exception is true and correct; (2) the Capacity Market Seller has disclosed all material facts relevant to the request for the exception; and (3) the request satisfies the criteria for the exception.

(F)The Market Monitoring Unit shall review, in an open and transparent manner with the Capacity Market Seller and the Office of the Interconnection, the information and documentation in support of the request and shall provide its findings whether the proposed Sell Offer is acceptable, in accordance with the standards and criteria hereunder, in writing, to the Capacity Market Seller and the Office of the Interconnection by no later than ninety (90) days prior to the commencement of the offer period for such auction. The Office of the Interconnection shall also review, in an open and transparent manner, all exception requests and documentation and shall provide in writing to the Capacity Market Seller, and the Market Monitoring Unit, its determination whether the requested Sell Offer is acceptable and if not it shall calculate and provide to such Capacity Market Seller, a minimum Sell Offer based on the data and documentation received, by no later than sixty-five (65) days prior to the commencement of the offer period for the relevant RPM Auction. After the Office of the Interconnection determines with the advice and input of Market Monitor, the acceptable minimum Sell Offer, the Capacity Market Seller shall notify the Market Monitoring Unit and the Office of the Interconnection, in writing, of the minimum level of Sell Offer to which it agrees to commit by no later than sixty (60) days prior to the commencement of the offer period for the relevant RPM Auction, and in making such determination, the Capacity Market Seller may consider the applicable default MOPR Floor Offer Price and may select such default value if it is lower than the resource-specific determination. A Capacity Market Seller that is dissatisfied with any determination hereunder may seek any remedies available to it from FERC; provided, however, that the Office of the Interconnection will proceed with administration of the Tariff and market rules based on the lower of the applicable default MOPR Floor Offer Price and the resource-specific determination unless and until ordered to do otherwise by FERC.

#### (4) *Competitive Exemption.*

(A) A Capacity Resource with State Subsidy may be exempt from the Minimum Offer Price Rule under this subsection 5.14(h-1) in any RPM Auction if the Capacity Market Seller certifies to the Office of Interconnection, in accordance with the PJM Manuals, that the Capacity Market Seller of such Capacity Resource elects to forego receiving any State Subsidy for the applicable Delivery Year no later than thirty (30) days prior to the commencement of the offer period for the relevant RPM Auction. Notwithstanding the foregoing, the competitive exemption is not available to Capacity Resources with State Subsidy that (A) are owned or offered by Self-Supply Entities, (B) are no longer entitled to receive a State Subsidy but are still considered a Capacity Resource with State Subsidy solely because they have not cleared an RPM Auction since last receiving a State Subsidy, or (C) are Jointly Owned Cross-Subsidized Capacity Resources or is the subject of a bilateral transaction (including but not limited to those reported pursuant to Tariff, Attachment DD, section 4.6) and not all Capacity Market Sellers of the supporting facility unanimously elect the competitive exemption and certify that no State Subsidy will be received associated with supporting the resource. A new Generation Capacity *Resource that is a Capacity Resource with State Subsidy may elect the competitive exemption;* however, in such instance, the applicable MOPR Floor Offer Price will be determined in accordance with the minimum offer price rules for certain new Generation Capacity Resources as provided in Tariff, Attachment DD, section 5.14(h), which apply the minimum offer price rule to the new Generation Capacity Resources located in an LDA where a separate VRR Curve is established as provided in Tariff, Attachment DD, section 5.14(h)(4).

The Capacity Market Seller shall not receive a State (B)*(i)* Subsidy for any part of the relevant Delivery Year in which it elects a competitive exemption or certifies that it is not a Capacity Resource with State Subsidy. In furtherance of this prohibition, if a Capacity Resource that (1) is a New Entry Capacity Resource with State Subsidy that elects the competitive exemption in subsection (4)(A) above and clears an RPM Auction for a given Delivery Year, but prior to the end of that Delivery Year elects to accept a State Subsidy for the associated Delivery Year or an earlier Delivery Year or (2) is not a Capacity Resource with State Subsidy at the time of the RPM Auction for the Delivery Year for which it first cleared an RPM Auction but prior to the end of that Delivery Year receives a State Subsidy for the associated Delivery Year or an earlier Delivery Year, or (3) in the case of Demand Resource, is an end-use customer location MW that receives a State Subsidy and is included in a Demand Resource Registration pursuant to RAA, Schedule 6 to satisfy a Demand Resource commitment that was not designated as a Capacity Resource with State Subsidy at the time it cleared the relevant RPM Auction, then the Capacity Market Seller of that Capacity Resource or end-use customer location MW shall not receive RPM revenues for such resource or end-use customer location MW for any part of that Delivery Year and may not participate in any RPM Auction with such resource or end-use customer location MW, or be eligible to use such resource or enduse customer location MW as replacement capacity starting June 1 of the Delivery Year after the Capacity Market Seller or end-use customer location MW first receives the State Subsidy and continuing for a period of 20 years, except for battery energy storage, for which such participation restriction shall apply for a period of 15 years. A Jointly Owned Cross-Subsidized Capacity Resource that meets the requirements of either of the two preceding subsections (B)(i)(1) or (2), shall not receive RPM revenues for any part of that Delivery Year and may not participate in any RPM Auction or be eligible to be used as replacement capacity starting June 1

of the Delivery Year and continuing for the number of years specified above, after any joint Capacity Market Seller of the underlying facility first receives the State Subsidy. A Capacity Resource with State Subsidy that is the subject of a bilateral transaction that meets the requirements of either of the two preceding subsections (B)(i)(1) or (2) shall not receive RPM revenues for any part of that Delivery Year and may not participate in any RPM Auction or be eligible to be used as replacement capacity starting June 1 of the Delivery Year and continuing for the number of years specified above if any owner or Capacity Market Seller of the facility receives a State Subsidy. The Capacity Market Seller(s) of any such Capacity Resource or Jointly Owned Cross-Subsidized Capacity Resource shall also return to the Office of the Interconnection any revenues paid to such Capacity Resource associated with their capacity commitment for such Delivery Year and shall retain their RPM commitment and associated obligations for such Delivery Year and for any future Delivery Years in which the resource has already secured a capacity commitment, including any Non-Performance Charges relating to the capacity and remain eligible to collect Performance Payments under this Tariff, Attachment DD, section 10A for the relevant Delivery Year and any subsequent Delivery Years for which it already received an RPM commitment. Notwithstanding the foregoing, Capacity Resources that lose their eligibility to participate in RPM pursuant to this section remain eligible for commitment in an FRR Capacity Plan.

(ii) If any Capacity Resource that has previously cleared an RPM Auction (1) is a Cleared Capacity Resource with State Subsidy that claims the competitive exemption pursuant to subsection (4)(A) above in an RPM Auction and clears such RPM Auction or (2) was not a Capacity Resource with State Subsidy at the time it cleared an RPM Auction for a given Delivery Year but later becomes entitled to receive a State Subsidy for that Delivery Year, and the Capacity Market Seller subsequently elects to accept a State Subsidy for any part of that Delivery Year, or (3) in the case of Demand Resource, is an end-use customer location that receives a State Subsidy and is included in a Demand Resource Registration pursuant to RAA, Schedule 6 to satisfy a Demand Resource commitment that was not designated as a Capacity Resource with State Subsidy at the time it cleared the relevant RPM Auction, then the Capacity Market Seller of that Capacity Resource or end-use customer location may not receive *RPM revenues for such resource or end-use customer location for any part of that Delivery Year,* unless it can demonstrate that it would have cleared in the relevant RPM Auction under an offer consistent with the resource-specific exception process outlined above in subsection 5.14(h-1)(3). All Capacity Market Sellers of a Jointly Owned Cross-Subsidized Capacity Resource that meets the requirements of either of the two preceding subsections (B)(ii)(1) or (2) may not receive RPM revenues for any part of that Delivery Year if any joint Capacity Market Seller of the underlying facility accepts a subsidy for that Delivery Year, unless the Capacity Market Seller can demonstrate that the facility would have cleared in the relevant RPM Auction under an offer consistent with the resource-specific exception process outlined above in subsection 5.14(h-1)(3). A Capacity Resource with State Subsidy that is the subject of a bilateral transaction may not receive RPM revenues for any part of that Delivery Year if any owner or Capacity Market Seller of the underlying facility receives a State Subsidy for that Delivery Year, unless the Capacity Market Seller can demonstrate that the facility would have cleared in the relevant RPM Auction under an offer consistent with the resource-specific exception process outlined above in subsection 5.14(h-1)(3), if any owner or Capacity Market Seller of the facility receives a State Subsidy. The Capacity Market Seller(s) of any such Capacity Resources or Jointly Owned Cross-Subsidized Capacity Resource shall return to the Office of the

Interconnection any revenues paid to such Capacity Resource associated with their capacity commitment for such Delivery Year and shall retain their RPM commitment and associated obligations for the relevant Delivery Year and remain eligible to collect Performance Payments or to pay Non-Performance Charges, as applicable, pursuant to Tariff, Attachment DD, section 10A.

(iii) Any revenues returned to the Office of the Interconnection pursuant to the preceding subsections (i) and (ii) shall be allocated to the relevant load that paid for the State Subsidy (to the extent possible). If the Office of Interconnection cannot identify the relevant load responsible for the State Subsidy, then the returned revenues would be allocated across all load in the RTO that has not selected the FRR Alternative. Such revenues shall be distributed on a pro-rata basis to such LSEs that were charged a Locational Reliability Charge based on their Daily Unforced Capacity Obligations.

(5) Self-Supply Entity exemption. A Capacity Resource that was owned, or bilaterally contracted, by a Self-Supply Entity on December 19, 2019, shall be exempt from the Minimum Offer Price Rule if such Capacity Resource remains owned or bilaterally contracted by such Self-Supply Entity and satisfies at least one of the criteria specified below:

(A) has successfully cleared an RPM Auction prior to December 19, 2019;

(B) is the subject of an interconnection construction service agreement, interim interconnection service agreement, interconnection service agreement or wholesale market participation agreement executed on or before December 19, 2019; or

(C) is the subject of an unexecuted interconnection construction service agreement, interim interconnection service agreement, interconnection service agreement or wholesale market participation agreement filed by PJM with the Commission on or before December 19, 2019.

(6) Renewable Portfolio Standard Exemption. A Capacity Resource with State Subsidy shall be exempt from the Minimum Offer Price Rule if such Capacity Resource (1) receives or is entitled to receive State Subsidies through renewable energy credits or equivalent credits associated with a state-mandated or state-sponsored renewable portfolio standard ("RPS") program or equivalent program as of December 19, 2019 and (2) satisfies at least one of the following criteria:

(A) has successfully cleared an RPM Auction prior to December 19, 2019;

(B) is the subject of an interconnection construction service agreement, interim interconnection service agreement, interconnection service agreement or wholesale market participation agreement executed on or before December 19, 2019; or

*(C) is the subject of an unexecuted interconnection construction service agreement, interim interconnection service agreement, interconnection service* 

agreement or wholesale market participation agreement filed by PJM with the Commission on or before December 19, 2019.

(7) Demand Resource and Energy Efficiency Resource Exemption.

(A) A Capacity Resource with State Subsidy that is Demand Resource or an Energy Efficiency Resource shall be exempt from the Minimum Offer Price Rule if such Capacity Resource satisfies at least one of the following criteria:

(i) has successfully cleared an RPM Auction prior to December 19, 2019. For purposes of this subsection (a), individual customer location registrations (or for utility-based residential load curtailment program, based on the total number of participating customers) that participated as Demand Resource and cleared in an RPM Auction prior to December 19, 2019, and were submitted to PJM no later than 45 days prior to the BRA for the 2022/2023 Delivery Year shall be deemed eligible for the Demand Resource and Energy Efficiency Resource Exemption; or

2019; or

(ii) has completed registration on or before December 19,

(iii) is supported by a post-installation measurement and verification report for Energy Efficiency Resources approved by PJM on or before December 19, 2019 (calculated for each installation period, Zone and Sub-Zone by using the greater of the latest approved post-installation measurement and verification report prior to December 19, 2019 or the maximum MW cleared for a Delivery Year across all auctions conducted prior to December 19, 2019).

(B) All registered locations that qualify for the Demand Resource and Energy Efficiency Resource exemption shall continue to remain exempt even if the MW of nominated capacity increases between RPM Auctions unless any MW increase in the nominated capacity is due to an investment made for the sole purpose of increasing the curtailment capability of the location in the capacity market. In such case, the MW of increased capability will not be qualified for the Demand Resource and Energy Efficiency Resource exemption.

(8) Capacity Storage Resource Exemption. A Capacity Resource with State Subsidy that is a Capacity Storage Resource shall be exempt from the Minimum Offer Price Rule if such Capacity Storage Resource satisfies at least one of the following criteria:

(A) has successfully cleared an RPM Auction prior to December 19, 2019:

(B) is the subject of an interconnection construction service agreement, interim interconnection service agreement, interconnection service agreement or wholesale market participation agreement executed on or before December 19, 2019; or

*(C) is the subject of an unexecuted interconnection construction service agreement, interim interconnection service agreement, interconnection service* 

agreement or wholesale market participation agreement filed by PJM with the Commission on or before December 19, 2019.

(9) Procedures and Remedies in Cases of Suspected Fraud or Material Misrepresentation or Omissions in Connection with a Capacity Resource with State Subsidy. In the event the Office of the Interconnection, with advice and input from the Market Monitoring Unit, reasonably believes that a certification of a Capacity Resource's status contains fraudulent or material misrepresentations or omissions such that the Capacity Market Seller's Capacity Resource is a Capacity Resource with a State Subsidy (including whether the Capacity Resource is a Jointly Owned Cross-Subsidized Capacity Resource) or does not qualify for a competitive exemption or contains information that is inconsistent with the resource-specific exception, then:

A Capacity Market Seller shall, within five (5) business days upon (A)receipt of the request for additional information, provide any supporting information reasonably requested by the Office of the Interconnection or the Market Monitoring Unit to evaluate whether such Capacity Resource is a Capacity Resource with State Subsidy or whether the Capacity Market Seller is eligible for the competitive exemption. If the Office of the Interconnection determines that the Capacity Resource's status as a Capacity Resource with State Subsidy is different from that specified by the Capacity Market Seller or is not eligible for a competitive exemption pursuant to subsection (4) above, the Office of the Interconnection shall notify, in writing, the Capacity Market Seller of such determination by no later than sixty-five (65) days prior to the commencement of the offer period for the relevant RPM Auction. A Capacity Market Seller that is dissatisfied with any determination hereunder may seek any remedies available to it from FERC; provided, however, if the Office of Interconnection determines that the subject resource is a Capacity Resource with State Subsidy or is not eligible for a competitive exemption pursuant to subsection (4) above, such Capacity Resource shall be subject to the Minimum Offer Price Rule, unless and until ordered to do otherwise by FERC.

(B) if the Office of the Interconnection does not provide written notice of suspected fraudulent or material misrepresentation or omission at least sixty-five (65) days before the start of the relevant RPM Auction, then the Office of the Interconnection may file the certification that contains any alleged fraudulent or material misrepresentation or omission with FERC. In such event, if the Office of Interconnection determines that a resource is a Capacity Resource with State Subsidy that is subject to the Minimum Offer Price Rule, the Office of the Interconnection will proceed with administration of the Tariff and market rules on that basis unless and until ordered to do otherwise by FERC. The Office of the Interconnection shall implement any remedies ordered by FERC; and

(C) prior to applying the Minimum Offer Price Rule, the Office of the Interconnection, with advice and input of the Market Monitoring Unit, shall notify the affected Capacity Market Seller and, to the extent practicable, provide the Capacity Market Seller an opportunity to explain the alleged fraudulent or material misrepresentation or omission. Any filing to FERC under this provision shall seek fast track treatment and neither the name nor any identifying characteristics of the Capacity Market Seller or the resource shall be publicly revealed, but otherwise the filing shall be public. The Capacity Market Seller may submit a revised certification for that Capacity Resource for subsequent RPM Auctions, including RPM Auctions held during the pendency of the FERC proceeding. In the event that the Capacity Market Seller is cleared by FERC from such allegations of fraudulent or material misrepresentations or omissions then the certification shall be restored to the extent and in the manner permitted by FERC. The remedies required by this subsection to be requested in any filing to FERC shall not be exclusive of any other remedies or penalties that may be pursued against the Capacity Market Seller.

- i) Capacity Export Charges and Credits
  - (1) Charge

Each Capacity Export Transmission Customer shall incur for each day of each Delivery Year a Capacity Export Charge equal to the Reserved Capacity of Long-Term Firm Transmission Service used for such export ("Export Reserved Capacity") multiplied by (the Final Zonal Capacity Price for such Delivery Year for the Zone encompassing the interface with the Control Area to which such capacity is exported minus the Final Zonal Capacity Price for such Delivery Year for the Zone in which the resources designated for export are located, but not less than zero). If more than one Zone forms the interface with such Control Area, then the amount of Reserved Capacity described above shall be apportioned among such Zones for purposes of the above calculation in proportion to the flows from such resource through each such Zone directly to such interface under CETO/CETL analysis conditions, as determined by the Office of the Interconnection using procedures set forth in the PJM Manuals. The amount of the Reserved Capacity that is associated with a fully controllable facility that crosses such interface shall be completely apportioned to the Zone within which such facility terminates.

(2) Credit

To recognize the value of firm Transmission Service held by any such Capacity Export Transmission Customer, such customer assessed a charge under section 5.14(i)(1) above also shall receive a credit, comparable to the Capacity Transfer Rights provided to Load-Serving Entities under Tariff, Attachment DD, section 5.15. Such credit shall be equal to the locational capacity price difference specified in section 5.14(i)(1) above times the Export Customer's Allocated Share determined as follows:

Export Customer's Allocated Share equals

(Export Path Import \* Export Reserved Capacity) /

(Export Reserved Capacity + Daily Unforced Capacity Obligations of all LSEs in such Zone).

Where:

"Export Path Import" means the megawatts of Unforced Capacity imported into the export interface Zone from the Zone in which the resource designated for export is located.

If more than one Zone forms the interface with such Control Area, then the amount of Export Reserved Capacity shall be apportioned among such Zones for purposes of the above calculation in the same manner as set forth in subsection (i)(1) above.

#### (3) Distribution of Revenues

Any revenues collected from the Capacity Export Charge with respect to any capacity export for a Delivery Year, less the credit provided in subsection (i)(2) for such Delivery Year, shall be distributed to the Load Serving Entities in the export-interface Zone that were assessed a

Locational Reliability Charge for such Delivery Year, pro rata based on the Daily Unforced Capacity Obligations of such Load-serving Entities in such Zone during such Delivery Year. If more than one Zone forms the interface with such Control Area, then the revenues shall be apportioned among such Zones for purposes of the above calculation in the same manner as set forth in subsection (i)(1) above.

### 5.14A [Reserved.]

### 5.14B Generating Unit Capability Verification Test Requirements Transition Provision for RPM Delivery Years 2014/2015, 2015/2016, and 2016/2017

A. This transition provision applies only with respect to Generation Capacity Resources with existing capacity commitments for the 2014/2015, 2015/2016, or 2016/2017 Delivery Years that experience reductions in verified installed capacity available for sale as a direct result of revised generating unit capability verification test procedures effective with the summer 2014 capability tests, as set forth in the PJM Manuals. A Generation Capacity Resource meeting the description of the preceding sentence, and the Capacity Market Seller of such a resource, are hereafter in this section 5.14B referred to as an "Affected Resource" and an "Affected Resource Owner," respectively.

For each of its Affected Resources, an Affected Resource Owner is required to provide B. documentation to the Office of the Interconnection sufficient to show a reduction in installed capacity value as a direct result of the revised capability test procedures. Upon acceptance by the Office of the Interconnection, the Affected Resource's installed capacity value will be updated in the eRPM system to reflect the reduction, and the Affected Resource's Capacity Interconnection Rights value will be updated to reflect the reduction, effective June 1, 2014. The reduction's impact on the Affected Resource's existing capacity commitments for the 2014/2015 Delivery Year will be determined in Unforced Capacity terms, using the final EFORd value established by the Office of the Interconnection for the 2014/2015 Delivery Year as applied to the Third Incremental Auction for the 2014/2015 Delivery Year, to convert installed capacity to Unforced Capacity. The reduction's impact on the Affected Resource's existing capacity commitments for each of the 2015/2016 and 2016/2017 Delivery Years will be determined in Unforced Capacity terms, using the EFORd value from each Sell Offer in each applicable RPM Auction, applied on a pro-rata basis, to convert installed capacity to Unforced Capacity. The Unforced Capacity impact for each Delivery Year represents the Affected Resource's capacity commitment shortfall, resulting wholly and directly from the revised capability test procedures, for which the Affected Resource Owner is subject to a Capacity Resource Deficiency Charge for the Delivery Year, as described in Tariff, Attachment DD, section 8D, unless the Affected Resource Owner (i) provides replacement Unforced Capacity, as described in Tariff, Attachment DD, section 8.1, prior to the start of the Delivery Year to resolve the Affected Resource's total

capacity commitment shortfall; or (ii) requests relief from Capacity Resource Deficiency Charges that result wholly and directly from the revised capability test procedures by electing the transition mechanism described in this section 5.14B ("Transition Mechanism").

C. Under the Transition Mechanism, an Affected Resource Owner may elect to have the Unforced Capacity commitments for all of its Affected Resources reduced for the 2014/2015, 2015/2016, or 2016/2017 Delivery Years to eliminate the capacity commitment shortfalls, across all of its Affected Resources, that result wholly and directly from the revised capability test procedures, and for which the Affected Resource Owner otherwise would be subject to Capacity Resource Deficiency Charges for the Delivery Year. In electing this option, the Affected Resource Owner relinquishes RPM Auction Credits associated with the reductions in Unforced Capacity commitments for all of its Affected Resources for the Delivery Year, and Locational Reliability Charges as described in Tariff, Attachment DD, section 5.14(e) of this Attachment DD are adjusted accordingly. Affected Resource Owners wishing to elect the Transition Mechanism for the 2015/2016 Delivery Year must notify the Office of the Interconnection by May 30, 2014. Affected Resource Owners wishing to elect the Transition Mechanism for the 2015/2016 Delivery Year for the Interconnection by July 25, 2014.

D. The Office of the Interconnection will offset the total reduction (across all Affected Resources and Affected Resource Owners) in Unforced Capacity commitments associated with the Transition Mechanism for the 2015/2016 and 2016/2017 Delivery Years by applying corresponding adjustments to the quantity of Buy Bid or Sell Offer activity in the upcoming Incremental Auctions for each of those Delivery Years, as described in Tariff, Attachment DD, sections 5.12(b)(ii) and 5.12(b)(iii).

E. By electing the Transition Mechanism, an Affected Resource Owner may receive relief from applicable Capacity Resource Deficiency Charges for the 2014/2015, 2015/2016, or 2016/2017 Delivery Years, and a Locational UCAP Seller that sells Locational UCAP based on an Affected Resource owned by the Affected Resource Owner may receive relief from applicable Capacity Resource Deficiency Charges for the 2014/2015 Delivery Year, to the extent that the Affected Resource Owner demonstrates, to the satisfaction of the Office of the Interconnection, that an inability to deliver the amount of Unforced Capacity previously committed for the 2014/2015, 2015/2016, or 2016/2017 Delivery Years is due to a reduction in verified installed capacity available for sale as a direct result of revised generating unit capability verification test procedures effective with the summer 2014 capability tests, as set forth in the PJM Manuals; provided, however, that the Affected Resource Owner must provide the Office of the Interconnection with all information deemed necessary by the Office of the Interconnection to assess the merits of the request for relief.

# 5.14C Demand Response Operational Resource Flexibility Transition Provision for RPM Delivery Years 2015/2016 and 2016/2017

A. This transition provision applies only to Demand Resources for which a Curtailment Service Provider has existing RPM commitments for the 2015/2016 or 2016/2017 Delivery Years (alternatively referred to in this section 5.14C as "Applicable Delivery Years" and each an "Applicable Delivery Year") that (i) cannot satisfy the 30-minute notification requirement as described in Tariff, Attachment DD-1, section A.2 and the parallel provision of RAA, Schedule 6; (ii) are not excepted from the 30-minute notification requirement as described in Tariff, Attachment DD-1, section A.2 and the parallel provision of RAA, Schedule 6; and (iii) cleared in the Base Residual Auction or First Incremental Auction for the 2015/2016 Delivery Year, or cleared in the Base Residual Auction for the 2016/2017 Delivery Year. A Demand Resource meeting these criteria and the Curtailment Service Provider of such a resource are hereafter in this section 5.14C referred to as an "Affected Demand Resource" and an "Affected Curtailment Service Provider," respectively.

B. For this section 5.14C to apply to an Affected Demand Resource, the Affected Curtailment Service Provider must notify the Office of the Interconnection in writing, with regard to the following information by the applicable deadline:

For each applicable Affected Demand Resource: the number of cleared megawatts of Unforced Capacity for the Applicable Delivery Year by end-use customer site that the Affected Curtailment Service Provider cannot deliver, calculated based on the most current information available to the Affected Curtailment Service Provider; the end-use customer name; electric distribution company's account number for the end-use customer; address of end-use customer; type of Demand Resource (i.e., Limited DR, Annual DR, Extended Summer DR); the Zone or sub-Zone in which the end-use customer is located; and, a detailed description of why the end-use customer cannot comply with the 30-minute notification requirement or qualify for one of the exceptions to the 30-minute notification requirement provided in Tariff, Attachment DD-1, section A.2 and the parallel provision of RAA, Schedule 6.

ii) If applicable, a detailed analysis that quantifies the amount of cleared megawatts of Unforced Capacity for the Applicable Delivery Year for prospective customer sales that could not be contracted by the Affected Curtailment Service Provider because of the 30-minute notification requirement provided in Tariff, Attachment DD-1, section A.2 and the parallel provisions of RAA, Schedule 6 that the Affected Curtailment Service Provider cannot deliver, by type of Demand Resource (i.e. Limited DR, Annual DR, Extended Summer DR) and by Zone and sub-Zone, as applicable. The analysis should include the amount of Unforced Capacity expected from prospective customer sales for each Applicable Delivery Year and must include supporting detail to substantiate the difference in reduced sales expectations. The Affected Curtailment Service Provider should maintain records to support its analysis.

1. For the 2015/2016 Delivery Year, the notice shall be provided by no later than seven (7) days prior to the posting by the Office of the Interconnection of planning parameters for the Third Incremental Auction for the 2015/2016 Delivery Year. Such Affected Curtailment Service Provider that utilizes this transition provision may not sell or offer to sell megawatts in the modeled LDA or sub-LDA where an Affected Demand Resource is located in the Third Incremental Auction for the 2015/2016 Delivery Year.

2. For the 2016/2017 Delivery Year, the notice shall be provided by no later than seven (7) days prior to the posting by the Office of the Interconnection of planning parameters for the Second Incremental Auction for the 2016/2017 Delivery Year. Such Affected

Curtailment Service Provider that utilizes this transition provision may not sell or offer to sell megawatts in the modeled LDA or sub-LDA where an Affected Demand Resource is located in the Second or Third Incremental Auctions for the 2016/2017 Delivery Year.

3. For the 2016/2017 Delivery Year, the notice shall be provided by no later than seven (7) days prior to the posting by the Office of the Interconnection of planning parameters for the Third Incremental Auction for the 2016/2017 Delivery Year. Such Affected Curtailment Service Provider that utilizes this transition provision must not have sold or offered to sell megawatts in the modeled LDA or sub-LDA where an Affected Demand Resource is located in the Second Incremental Auction for the 2016/2017 Delivery Year, and may not sell or offer to sell megawatts in the modeled LDA or sub-LDA where an Affected Demand Resource is located in the Third Incremental Auction for the 2016/2017 Delivery Year.

C. For the Third Incremental Auction for the 2015/2016 Delivery Year and the First, Second, and Third Incremental Auctions for the 2016/2017 Delivery Year, the Office of the Interconnection shall publish aggregate information on the undeliverable megawatts declared under this transition provision (hereafter, "non-viable megawatts"), by type of Demand Resource and by Zone or sub-Zone, concurrently with its posting of planning parameters for the applicable Scheduled Incremental Auction. Non-viable megawatts for a Scheduled Incremental Auction for an Applicable Delivery Year represent those megawatts meeting the criteria of subsection A above and declared in accordance with subsection B above. Prior to each Third Incremental Auction for an Applicable Delivery Year, the Office of the Interconnection shall apply adjustments equal to the declared non-viable megawatt quantity to the quantity of Buy Bid or Sell Offer activity in the upcoming Scheduled Incremental Auctions for the Applicable Delivery Year, as described in Tariff, Attachment DD, sections 5.12(b)(ii) and 5.12(b)(iii). Prior to the Second Incremental Auction for the 2016/2017 Delivery Year, the Office of the Interconnection shall adjust the recalculated PJM Region Reliability Requirement and recalculated LDA Reliability Requirements, as described in Tariff, Attachment DD, section 5.4(c), by the applicable quantity of declared non-viable megawatts, and shall update the PJM Region Reliability Requirement and each LDA Reliability Requirement for such Second Incremental Auction only if the combined change of the applicable adjustment and applicable recalculation is greater than or equal to the lessor of (i) 500 megawatts or (ii) one percent of the prior PJM Region Reliability Requirement or one percent of the prior LDA Reliability Requirement, as applicable.

D. Prior to the start of each Applicable Delivery Year, the Office of the Interconnection shall reduce, by type of Demand Resource and by Zone or sub-Zone, the capacity commitment of each Affected Curtailment Service Provider that utilizes this transition provision for the Applicable Delivery Year based on the non-viable megawatts declared by the Affected Curtailment Service Provider under this transition provision. If the Affected Curtailment Service Provider cleared megawatts from multiple Affected Demand Resources of the same type and Zone or sub-Zone, or cleared megawatts in multiple RPM Auctions for the Applicable Delivery Year, the Office of the Interconnection shall allocate the reduction in capacity commitment by type of Demand Resource and by Zone or sub-Zone across the applicable Affected Demand Resources and relevant RPM Auctions. Such allocation shall be performed on a pro-rata basis, based on megawatts cleared by the Affected Demand Resources in the relevant RPM Auctions.

E. For each Applicable Delivery Year, an Affected Curtailment Service Provider that utilizes this transition provision for the Applicable Delivery Year relinquishes an Affected Demand Resource's RPM Auction Credits for the amount of capacity commitment reduction as determined under subsection D above. Locational Reliability Charges as described in Tariff, Attachment DD, section 5.14(e) are also adjusted accordingly.

# 5.14D Capacity Performance and Base Capacity Transition Provision for RPM Delivery Years 2016/2017 and 2017/2018

A. This transition provision applies only for procuring Capacity Performance Resources for the 2016/2017 and 2017/2018 Delivery Years.

B. For both the 2016/2017 and 2017/2018 Delivery Years, PJM will hold a Capacity Performance Transition Incremental Auction to procure Capacity Performance Resources.

1. For each Capacity Performance Transition Incremental Auction, the optimization algorithm shall consider:

- the target quantities of Capacity Performance Resources specified below;
- the Sell Offers submitted in such auction.

The Office of the Interconnection shall submit a Buy Bid based on the quantity of Capacity Performance Resources specified for that Delivery Year. For the 2016/2017 Delivery Year, the Office of the Interconnection shall submit a Buy Bid, at a price no higher than 0.5 times the Net CONE value for the PJM Region determined for the Base Residual Auction for that Delivery Year, for a quantity of Capacity Performance Resources equal to 60 percent of the updated Reliability Requirement for the PJM Region. For the 2017/2018 Delivery Year, the Office of the Interconnection shall submit a Buy Bid, at a price no higher than 0.6 times the Net CONE value for the PJM Region determined for the Base Residual Auction for that Delivery Year, for a quantity of Capacity Performance Resources equal to 70 percent of the updated Reliability Requirement for the PJM Region.

2. For each Capacity Performance Transition Incremental Auction, the Office of the Interconnection shall calculate a clearing price to be paid for each megawatt-day of Unforced Capacity that clears in such auction. For the 2016/2017 Delivery Year, the Capacity Resource Clearing Price for any Capacity Performance Transition Incremental Auction shall not exceed 0.5 times the Net CONE value for the PJM Region determined for the Base Residual Auction for that Delivery Year. For the 2017/2018 Delivery Year, the Capacity Resource Clearing Price for any Capacity Performance Transition Incremental Auction shall not exceed 0.6 times the Net CONE value for the PJM Region determined for the Base Residual Auction for the Net CONE value for the PJM Region determined for the Base Residual Auction for the Net CONE value for the PJM Region determined for the Base Residual Auction for that Delivery Year.

3. A Capacity Market Seller may offer any Capacity Resource that has not been committed in an FRR Capacity Plan, that qualifies as a Capacity Performance Resource under Tariff, Attachment DD, section 5.5A(a) and that (i) has not cleared an RPM Auction for that Delivery Year; or (ii) has cleared in an RPM Auction for that Delivery Year. A Capacity Market

Seller may offer an external Generation Capacity Resource to the extent that such resource: (i) is reasonably expected, by the relevant Delivery Year, to meet all applicable requirements to be treated as equivalent to PJM Region internal generation that is not subject to NERC tagging as an interchange transaction; (ii) has long-term firm transmission service confirmed on the complete transmission path from such resource into PJM; and (iii) is, by written commitment of the Capacity Market Seller, subject to the same obligations imposed on Generation Capacity Resources located in the PJM Region by Tariff, Attachment DD, section 6.6 to offer their capacity into RPM Auctions.

4. Capacity Resources that already cleared an RPM Auction for a Delivery Year, retain the capacity obligations for that Delivery Year, and clear in a Capacity Performance Transition Incremental Auction for the same Delivery Year shall: (i) receive a payment equal to the Capacity Resource Clearing Price as established in that Capacity Performance Transition Incremental Auction; and (ii) not be eligible to receive a payment for clearing in any prior RPM Auction for that Delivery Year.

D. All Capacity Performance Resources that clear in a Capacity Performance Transition Incremental Auction will be subject to the Non-Performance Charge set forth in Tariff, Attachment DD, section 10A.

# 5.14E Demand Response Legacy Direct Load Control Transition Provision for RPM Delivery Years 2016/2017, 2017/2018, and 2018/2019

A. This transition provision applies only to Demand Resources for which a Curtailment Service Provider has existing RPM commitments for the 2016/2017, 2017/2018, or 2018/2019 Delivery Years (alternatively referred to in this section 5.14E as "Applicable Delivery Years" and each an "Applicable Delivery Year") that (i) qualified as Legacy Direct Load Control before June 1, 2016 as described in Tariff, Attachment DD-1, section G and the parallel provision of RAA, Schedule 6; (ii) cannot meet the requirements for using statistical sampling for residential non-interval metered customers as described in Tariff, Attachment DD-1, section K and the parallel provision of RAA, Schedule 6; and (iii) cleared in the Base Residual Auction or First Incremental Auction for the 2016/2017 Delivery Year, cleared in the Base Residual Auction for the 2017/2018 Delivery Year, or cleared in the Base Residual Auction for the 2018/2019 Delivery Year. A Demand Resource meeting these criteria and the Curtailment Service Provider of such a resource are hereafter in this section 5.14E referred to as an "Affected Demand Resource" and an "Affected Curtailment Service Provider," respectively.

B. For this section 5.14E to apply to an Affected Demand Resource, the Affected Curtailment Service Provider must notify the Office of the Interconnection in writing, with regard to the following information, by the applicable deadline:

i) For each applicable Affected Demand Resource: the number of cleared megawatts of Unforced Capacity for the Applicable Delivery Year by end-use customer site that the Affected Curtailment Service Provider cannot deliver, calculated based on the most current information available to the Affected Curtailment Service Provider; electric distribution company's account number for the end-use customer; address of end-use customer; type of Demand Resource (i.e., Limited
DR, Annual DR, Extended Summer DR); the Zone or sub-Zone in which the enduse customer is located; and, a detailed description of why the endues customer cannot comply with statistical sampling for residential non-interval metered customers requirement as described in Tariff, Attachment DD-1, section K and the parallel provision of RAA, Schedule 6.

ii) If applicable, a detailed analysis that quantifies the amount of cleared megawatts of Unforced Capacity for the Applicable Delivery Year for prospective customer sales that could not be contracted by the Affected Curtailment Service Provider because of the statistical sampling for residential non-interval metered customers requirement as described in Tariff, Attachment DD-1, section K and the parallel provision of RAA, Schedule 6 that the Affected Curtailment Service Provider cannot deliver, by type of Demand Resource (i.e. Limited DR, Annual DR, Extended Summer DR) and by Zone and sub-Zone, as applicable. The analysis should include the amount of Unforced Capacity expected from prospective customer sales for each Applicable Delivery Year and must include supporting detail to substantiate the difference in reduced sales expectations. The Affected Curtailment Service Provider should maintain records to support its analysis.

1. For the 2016/2017 Delivery Year, the notice shall be provided by no later than seven (7) days prior to the posting by the Office of the Interconnection of planning parameters for the Second and/or Third Incremental Auction for the 2016/2017 Delivery Year. Such Affected Curtailment Service Provider that utilizes this transition provision may not sell or offer to sell megawatts in the matching LDA or sub-LDA where an Affected Demand Resource is located in the Second or Third Incremental Auction for the 2016/2017 Delivery Year.

2. For the 2017/2018 Delivery Year, the notice shall be provided by no later than seven (7) days prior to the posting by the Office of the Interconnection of planning parameters for the First, Second and/or Third Incremental Auction for the 2017/2018 Delivery Year. Such Affected Curtailment Service Provider that utilizes this transition provision may not sell or offer to sell megawatts in the matching LDA or sub-LDA where an Affected Demand Resource is located in the First, Second or Third Incremental Auctions for the 2017/2018 Delivery Year.

3. For the 2018/2019 Delivery Year, the notice shall be provided by no later than seven (7) days prior to the posting by the Office of the Interconnection of planning parameters for the First, Second and/or Third Incremental Auction for the 2018/2019 Delivery Year. Such Affected Curtailment Service Provider that utilizes this transition provision may not sell or offer to sell megawatts in the matching LDA or sub-LDA where an Affected Demand Resource is located in the First, Second or Third Incremental Auctions for the 2018/2019 Delivery Year.

C. For the Second and Third Incremental Auction for the 2016/2017 Delivery Year, the First, Second, and Third Incremental Auctions for the 2017/2018 Delivery Year, and the First, Second, and Third Incremental Auctions for the 2018/2019 Delivery Year, the Office of the Interconnection shall publish aggregate information on the undeliverable megawatts declared under this transition provision (hereafter, "non-viable megawatts"), by type of Demand Resource and by Zone or sub-Zone, concurrently with its posting of planning parameters for the applicable

Scheduled Incremental Auction. Non-viable megawatts for a Scheduled Incremental Auction for an Applicable Delivery Year represent those megawatts meeting the criteria of subsection A above and declared in accordance with subsection B above. Prior to each Scheduled Incremental Auction for an Applicable Delivery Year, the Office of the Interconnection shall apply adjustments equal to the declared non-viable megawatt quantity to the quantity of Buy Bid or Sell Offer activity in the upcoming Scheduled Incremental Auctions for the Applicable Delivery Year, as described in Tariff, Attachment DD, sections 5.12(b)(ii) and 5.12(b)(iii). Prior to the Second Incremental Auction for the 2016/2017 Delivery Year, the First and Second Incremental Auction for the 2017/2018 Delivery Year, and the First and Second Incremental Auction for the 2018/2019 Delivery Year, the Office of the Interconnection shall adjust the recalculated PJM Region Reliability Requirement and recalculated LDA Reliability Requirements, as described in Tariff, Attachment DD, section 5.4(c), by the applicable quantity of declared non-viable megawatts, and shall update the PJM Region Reliability Requirement and each LDA Reliability Requirement for such Incremental Auction only if the combined change of the applicable adjustment and applicable recalculation is greater than or equal to the lessor of (i) 500 megawatts or (ii) one percent of the prior PJM Region Reliability Requirement or one percent of the prior LDA Reliability Requirement, as applicable.

D. Prior to the start of each Applicable Delivery Year, the Office of the Interconnection shall reduce, by type of Demand Resource and by Zone or sub-Zone, the capacity commitment of each Affected Curtailment Service Provider that utilizes this transition provision for the Applicable Delivery Year based on the non-viable megawatts declared by the Affected Curtailment Service Provider under this transition provision. If the Affected Curtailment Service Provider cleared megawatts from multiple Affected Demand Resources of the same type and Zone or sub-Zone, or cleared MWs in multiple RPM Auctions for the Applicable Delivery Year, the Office of the Interconnection shall allocate the reduction in capacity commitment by type of Demand Resources and relevant RPM Auctions. Such allocation shall be performed on a pro-rata basis, based on megawatts cleared by the Affected Demand Resources in the relevant RPM Auctions.

E. For each Applicable Delivery Year, an Affected Curtailment Service Provider that utilizes this transition provision for the Applicable Delivery Year relinquishes an Affected Demand Resource's RPM Auction credits for the amount of capacity commitment reduction as determined under subsection D above. Locational Reliability Charges as described in Tariff, Attachment DD, section 5.14(e) are also adjusted accordingly.

# Section(s) of the PJM Reliability Assurance Agreement

(Clean Format)

#### **ARTICLE 1 – DEFINITIONS**

Unless the context otherwise specifies or requires, capitalized terms used herein shall have the respective meanings assigned herein or in the Schedules hereto, or in the PJM Tariff or PJM Operating Agreement if not otherwise defined in this Agreement, for all purposes of this Agreement (such definitions to be equally applicable to both the singular and the plural forms of the terms defined). Unless otherwise specified, all references herein to Articles, Sections or Schedules, are to Articles, Sections or Schedules of this Agreement. As used in this Agreement:

#### Accredited UCAP:

"Accredited UCAP" shall mean the quantity of Unforced Capacity, as denominated in Effective UCAP, that an ELCC Resource is capable of providing in a given Delivery Year.

#### Agreement:

"Agreement" shall mean this Reliability Assurance Agreement, together with all Schedules hereto, as amended from time to time.

#### **Annual Demand Resource:**

"Annual Demand Resource" shall mean a resource that is placed under the direction of the Office of the Interconnection during the Delivery Year, and will be available for an unlimited number of interruptions during such Delivery Year by the Office of the Interconnection, and will be capable of maintaining each such interruption between the hours of 10:00AM to 10:00PM Eastern Prevailing Time for the months of June through October and the following May, and 6:00AM through 9:00PM Eastern Prevailing Time for the months of November through April unless there is an Office of the Interconnection approved maintenance outage during October through April. The Annual Demand Resource must be available in the corresponding Delivery year to be offered for sale or Self-Supplied in an RPM Auction, or included as an Annual Demand Resource in an FRR Capacity Plan for the corresponding Delivery Year.

#### **Annual Energy Efficiency Resource:**

"Annual Energy Efficiency Resource" shall mean a project, including installation of more efficient devices or equipment or implementation of more efficient processes or systems, meeting the requirements of Reliability Assurance Agreement, Schedule 6 and exceeding thencurrent building codes, appliance standards, or other relevant standards, designed to achieve a continuous (during the summer and winter periods described in such Schedule 6 and the PJM Manuals) reduction in electric energy consumption that is not reflected in the peak load forecast prepared for the Delivery Year for which the Energy Efficiency Resource is proposed, and that is fully implemented at all times during such Delivery Year, without any requirement of notice, dispatch, or operator intervention.

## **Applicable Regional Entity:**

"Applicable Regional Entity" shall have the same meaning as in the PJM Tariff.

## **Base Capacity Demand Resource:**

"Base Capacity Demand Resource" shall mean, for the 2018/2019 and 2019/2020 Delivery Years, a resource that is placed under the direction of the Office of the Interconnection and that will be available June through September of a Delivery Year, and will be available to the Office of the Interconnection for an unlimited number of interruptions during such months, and will be capable of maintaining each such interruption for at least a 10-hour duration between the hours of 10:00AM to 10:00PM Eastern Prevailing Time. The Base Capacity Demand Resource must be available June through September in the corresponding Delivery Year to be offered for sale or self-supplied in an RPM Auction, or included as a Base Capacity Demand Resource in an FRR Capacity Plan for the corresponding Delivery Year.

## **Base Capacity Energy Efficiency Resource:**

"Base Capacity Energy Efficiency Resource" shall mean, for the 2018/2019 and 2019/2020 Delivery Years, a project, including installation of more efficient devices or equipment or implementation of more efficient processes or systems, meeting the requirements of RAA, Schedule 6 and exceeding then-current building codes, appliance standards, or other relevant standards, designed to achieve a continuous (during the summer peak periods as described in Reliability Assurance Agreement, Schedule 6 and the PJM Manuals) reduction in electric energy consumption that is not reflected in the peak load forecast prepared for the Delivery Year for which the Base Capacity Energy Efficiency Resource is proposed, and that is fully implemented at all times during such Delivery Year, without any requirement of notice, dispatch, or operator intervention.

## **Base Capacity Resource:**

"Base Capacity Resource" shall have the same meaning as in Tariff, Attachment DD.

## **Base Residual Auction:**

"Base Residual Auction" shall have the same meaning as in Tariff, Attachment DD.

## **Behind The Meter Generation:**

"Behind The Meter Generation" shall refer to a generating unit that delivers energy to load without using the Transmission System or any distribution facilities (unless the entity that owns or leases the distribution facilities consented to such use of the distribution facilities and such consent has been demonstrated to the satisfaction of the Office of the Interconnection; provided, however, that Behind The Meter Generation does not include (i) at any time, any portion of such generating unit's capacity that is designated as a Capacity Resource or (ii) in any hour, any portion of the output of such generating unit that is sold to another entity for consumption at another electrical location or into the PJM Interchange Energy Market.

#### **Black Start Capability:**

"Black Start Capability" shall mean the ability of a generating unit or station to go from a shutdown condition to an operating condition and start delivering power without assistance from the power system.

#### **Capacity Emergency Transfer Objective (CETO):**

"Capacity Emergency Transfer Objective" or "CETO" shall mean the amount of electric energy that a given area must be able to import in order to remain within a loss of load expectation of one event in 25 years when the area is experiencing a localized capacity emergency, as determined in accordance with the PJM Manuals. Without limiting the foregoing, CETO shall be calculated based in part on EFORD determined in accordance with Reliability Assurance Agreement, Schedule 5, Paragraph C.

#### **Capacity Emergency Transfer Limit (CETL):**

Capacity Emergency Transfer Limit" or "CETL" shall mean the capability of the transmission system to support deliveries of electric energy to a given area experiencing a localized capacity emergency as determined in accordance with the PJM Manuals.

#### **Capacity Import Limit:**

For any Delivery Year up to and including the 2019/2020 Delivery Year, "Capacity Import Limit" shall mean, (a) for the PJM Region, (1) the maximum megawatt quantity of external Generation Capacity Resources that PJM determines for each Delivery Year, through appropriate modeling and the application of engineering judgment, the transmission system can receive, in aggregate at the interface of the PJM Region with all external balancing authority areas and deliver to load in the PJM Region under capacity emergency conditions without violating applicable reliability criteria on any bulk electric system facility of 100kV or greater, internal or external to the PJM Region, that has an electrically significant response to transfers on such interface, minus (2) the then-applicable Capacity Benefit Margin; and (b) for certain source zones identified in the PJM manuals as groupings of one or more balancing authority areas, (1) the maximum megawatt quantity of external Generation Capacity Resources that PJM determines the transmission system can receive at the interface of the PJM Region with each such source zone and deliver to load in the PJM Region under capacity emergency conditions without violating applicable reliability criteria on any bulk electric system facility of 100kV or greater, internal or external to the PJM Region, that has an electrically significant response to transfers on such interface, minus the then-applicable Capacity Benefit Margin times (2) the ratio of the maximum import quantity from each such source zone divided by the PJM total maximum import quantity. As more fully set forth in the PJM Manuals, PJM shall make such determination based on the latest peak load forecast for the studied period, the same computer simulation model of loads, generation and transmission topography employed in the determination of Capacity Emergency Transfer Limit for such Delivery Year, including external facilities from an industry standard model of the loads, generation, and transmission topography of the Eastern Interconnection under peak conditions. PJM shall specify in the PJM Manuals the

areas and minimum distribution factors for identifying monitored bulk electric system facilities that have an electrically significant response to such transfers on the PJM interface. Employing such tools, PJM shall model increased power transfers from external areas into PJM to determine the transfer level at which one or more reliability criteria is violated on any monitored bulk electric system facilities that have an electrically significant response to such transfers. For the PJM Region Capacity Import Limit, PJM shall optimize transfers from other source areas not experiencing any reliability criteria violations as appropriate to increase the Capacity Import Limit. The aggregate megawatt quantity of transfers into PJM at the point where any increase in transfers on the interface would violate reliability criteria will establish the Capacity Import Limit. Notwithstanding the foregoing, a Capacity Resource located outside the PJM Region shall not be subject to the Capacity Import Limit if the Capacity Market Seller seeks an exception thereto by demonstrating to PJM, by no later than five (5) business days prior to the commencement of the offer period for the relevant RPM Auction, that such resource meets all of the following requirements:

(i) it has, at the time such exception is requested, met all applicable requirements to be pseudo-tied into the PJM Region, or the Capacity Market Seller has committed in writing that it will meet such requirements, unless prevented from doing so by circumstances beyond the control of the Capacity Market Seller, prior to the relevant Delivery Year;

(ii) at the time such exception is requested, it has long-term firm transmission service confirmed on the complete transmission path from such resource into PJM; and

(iii) it is, by written commitment of the Capacity Market Seller, subject to the same obligations imposed on Generation Capacity Resources located in the PJM Region by Tariff, Attachment DD, section 6.6 to offer their capacity into RPM Auctions; provided, however, that (a) the total megawatt quantity of all exceptions granted hereunder for a Delivery Year, plus the Capacity Import Limit for the applicable interface determined for such Delivery Year, may not exceed the total megawatt quantity of Network External Designated Transmission Service on such interface that PJM has confirmed for such Delivery Year; and (b) if granting a qualified exception would result in a violation of the rule in clause (a), PJM shall grant the requested exception but reduce the Capacity Import Limit by the quantity necessary to ensure that the total quantity of Network External Designated Transmission Service is not exceeded.

## **Capacity Only Option:**

"Capacity Only Option" shall mean participation in Emergency Load Response Program or Pre-Emergency Program which allows, pursuant to Tariff, Attachment DD and as applicable, a capacity payment for the ability to reduce load during a pre-emergency or emergency event.

## **Capacity Performance Resource:**

"Capacity Performance Resource" shall have the same meaning as in Tariff, Attachment DD.

## **Capacity Resources:**

"Capacity Resources" shall mean megawatts of (i) net capacity from Existing Generation Capacity Resources or Planned Generation Capacity Resources meeting the requirements of the Reliability Assurance Agreement, Schedules 9 and Reliability Assurance Agreement, Schedule 10 that are or will be owned by or contracted to a Party and that are or will be committed to satisfy that Party's obligations under the Reliability Assurance Agreement, or to satisfy the reliability requirements of the PJM Region, for a Delivery Year; (ii) net capacity from Existing Generation Capacity Resources or Planned Generation Capacity Resources not owned or contracted for by a Party which are accredited to the PJM Region pursuant to the procedures set forth in such Schedules 9 and 10; or (iii) load reduction capability provided by Demand Resources or Energy Efficiency Resources that are accredited to the PJM Region pursuant to the procedures set forth in the Reliability Assurance Agreement, Schedule 6.

## **Capacity Transfer Right:**

"Capacity Transfer Right" shall have the meaning specified in Tariff, Attachment DD.

## **Combination Resource:**

"Combination Resource" shall mean a Generation Capacity Resource that has a component that has the characteristics of a Limited Duration Resource combined with (i) a component that has the characteristics of an Unlimited Resource or (ii) a component that has the characteristics of a Variable Resource.

## **Compliance Aggregation Area (CAA):**

"Compliance Aggregation Area" or "CAA" shall have the same meaning as in the Tariff.

# Consolidated Transmission Owners Agreement, PJM Transmission Owners Agreement or Transmission Owners Agreement:

"Consolidated Transmission Owners Agreement," "PJM Transmission Owners Agreement" or "Transmission Owners Agreement" shall mean that certain Consolidated Transmission Owners Agreement, dated as of December 15, 2005, by and among the Transmission Owners and by and between the Transmission Owners and PJM Interconnection, L.L.C. on file with the Commission, as amended from time to time.

## **Control Area:**

"Control Area" shall mean an electric power system or combination of electric power systems bounded by interconnection metering and telemetry to which a common generation control scheme is applied in order to:

(a) match the power output of the generators within the electric power system(s) and energy purchased from entities outside the electric power system(s), with the load within the electric power system(s);

(b) maintain scheduled interchange with other Control Areas, within the limits of Good Utility Practice;

(c) maintain the frequency of the electric power system(s) within reasonable limits in accordance with Good Utility Practice and the criteria of NERC and each Applicable Regional Entity;

(d) maintain power flows on transmission facilities within appropriate limits to preserve reliability; and

(e) provide sufficient generating capacity to maintain operating reserves in accordance with Good Utility Practice.

## **Daily Unforced Capacity Obligation:**

"Daily Unforced Capacity Obligation" shall mean the capacity obligation of a Load Serving Entity during the Delivery Year, determined in accordance with the Reliability Assurance Agreement, Schedule 8 or, as to an FRR Entity, in the Reliability Assurance Agreement, Schedule 8.1.

#### **Delivery Year:**

"Delivery Year" shall mean a Planning Period for which a Capacity Resource is committed pursuant to the auction procedures specified in Tariff, Attachment DD or pursuant to an FRR Capacity Plan under RAA, Schedule 8.1.

#### **Demand Resource (DR):**

"Demand Resource" or "DR" shall mean a Limited Demand Resource, Extended Summer Demand Resource, Annual Demand Resource, Base Capacity Demand Resource or Summer-Period Demand Resource with a demonstrated capability to provide a reduction in demand or otherwise control load in accordance with the requirements of RAA, Schedule 6 that offers and that clears load reduction capability in a Base Residual Auction or Incremental Auction or that is committed through an FRR Capacity Plan.

#### **Demand Resource Factor or DR Factor:**

"Demand Resource Factor" or "DR Factor" shall mean, for Delivery Years through May 31, 2018, that factor approved from time to time by the PJM Board used to determine the unforced capacity value of a Demand Resource in accordance with Reliability Assurance Agreement, Schedule 6

#### **Demand Resource Officer Certification Form:**

"Demand Resource Officer Certification Form" shall mean a certification as to an intended Demand Resource Sell Offer, in accordance with Reliability Assurance Agreement, Schedule 6 and Reliability Assurance Agreement, Schedule 8.1 and the PJM Manuals.

#### **Demand Resource Registration:**

"Demand Resource Registration" shall mean a registration in the Full Program Option or Capacity Only Option of the Emergency or Pre-Emergency Load Resource Program in accordance with Tariff, Attachment K-Appendix, section 8.

#### **Demand Resource Sell Offer Plan:**

"Demand Resource Sell Offer Plan" shall mean the plan required by Reliability Assurance Agreement, Schedule 6 and Reliability Assurance Agreement, Schedule 8.1 in support of an intended offer of Demand Resources in an RPM Auction, or an intended inclusion of Demand Resources in an FRR Capacity Plan.

## **Effective Nameplate Capacity:**

"Effective Nameplate Capacity" shall mean (i) for each Variable Resource and Combination Resource, the resource's Maximum Facility Output; (ii) for each Limited Duration Resource, the sustained level of output that the unit can provide and maintain over a continuous period, whereby the duration of that continuous period matches the characteristic duration of the corresponding ELCC Class, with consideration given to ambient conditions expected to exist at the time of PJM system peak load, to the extent that such conditions impact such resource's capability.

## **Effective UCAP:**

"Effective UCAP" shall mean a unit of measure that represents the capacity product transacted in the Reliability Pricing Model and included in FRR Capacity Plans. One megawatt of Effective UCAP has the same capacity value of one megawatt of Unforced Capacity.

## **ELCC Class:**

"ELCC Class" shall mean a defined group of ELCC Resources that share a common set of operational characteristics and for which effective load carrying capability analysis, as set forth in RAA, Schedule 9.1, will establish a unique ELCC Class UCAP and corresponding ELCC Class Rating. ELCC Classes shall be defined in the PJM Manuals. ELCC Classes shall be defined such that the members of each ELCC Class are reasonably homogeneous in character and with respect to impact on system resource adequacy. ELCC Classes shall be defined for Limited Duration Resources of no less than four hours duration, and shall include 4-hour, 6-hour, 8-hour, and 10-hour duration characteristics, with matching duration classes for Combination Resources composed in part of one or more such ELCC Classes. Members of an ELCC Class shall share a common method of calculating the ELCC Resource Performance Adjustment,

provided that the individual ELCC Resource Performance Adjustment values will generally differ among ELCC Resources.

## **ELCC Class Rating:**

"ELCC Class Rating" shall mean the rating factor, based on effective load carrying capability analysis, that applies to ELCC Resources that are members of an ELCC Class as part of the calculation of their Accredited UCAP.

## **ELCC Class UCAP:**

"ELCC Class UCAP" shall mean the aggregate Effective UCAP all modeled ELCC Resources in a given ELCC Class are capable of providing in a given Delivery Year.

## **ELCC Portfolio UCAP:**

"ELCC Portfolio UCAP" shall mean the aggregate Effective UCAP that all modeled ELCC Resources are capable of providing in a given Delivery Year.

## **ELCC Resource:**

"ELCC Resource" shall mean a Generation Capacity Resource that is a Variable Resource, a Limited Duration Resource, or a Combination Resource.

## **ELCC Resource Performance Adjustment:**

"ELCC Resource Performance Adjustment" shall mean the performance of a specific ELCC Resource relative to the aggregate performance of the ELCC Class to which it belongs as further described in RAA, Schedule 9.1, section E.

## **Electric Cooperative:**

"Electric Cooperative" shall mean an entity owned in cooperative form by its customers that is engaged in the generation, transmission, and/or distribution of electric energy.

## **Electric Distributor:**

"Electric Distributor" shall mean a Member that 1) owns or leases with rights equivalent to ownership of electric distribution facilities that are used to provide electric distribution service to electric load within the PJM Region; or 2) is a generation and transmission cooperative or a joint municipal agency that has a member that owns electric distribution facilities used to provide electric distribution service to electric load within the PJM Region.

## **Emergency:**

"Emergency" shall mean (i) an abnormal system condition requiring manual or automatic action to maintain system frequency, or to prevent loss of firm load, equipment damage, or tripping of system elements that could adversely affect the reliability of an electric system or the safety of persons or property; or (ii) a fuel shortage requiring departure from normal operating procedures in order to minimize the use of such scarce fuel; or (iii) a condition that requires implementation of emergency procedures as defined in the PJM Manuals.

#### **End-Use Customer:**

"End-Use Customer" shall mean a Member that is a retail end-user of electricity within the PJM Region. For purposes of Members Committee sector classification, a Member that is a retail end-user that owns generation may qualify as an End-Use customer if: (1) the average physical unforced capacity owned by the Member and its affiliates in the PJM region over the five Planning Periods immediately preceding the relevant Planning Period does not exceed the average PJM capacity obligation for the Member and its affiliates over the same time period; or (2) the average energy produced by the Member and its affiliates within the PJM region over the five Planning Periods immediately preceding the relevant Planning Period does not exceed the average energy consumed by that Member and its affiliates within the PJM region over the same time period. The foregoing notwithstanding, taking retail service may not be sufficient to qualify a Member as an End-Use Customer.

#### **Energy Efficiency Resource:**

"Energy Efficiency Resource" shall mean a project, including installation of more efficient devices or equipment or implementation of more efficient processes or systems, meeting the requirements of RAA, Schedule 6 and exceeding then-current building codes, appliance standards, or other relevant standards, designed to achieve a continuous (during the periods described in Reliability Assurance Agreement, Schedule 6 and the PJM Manuals) reduction in electric energy consumption that is not reflected in the peak load forecast prepared for the Delivery Year for which the Energy Efficiency Resource is proposed, and that is fully implemented at all times during such Delivery Year, without any requirement of notice, dispatch, or operator intervention. Annual Energy Efficiency Resources, Base Capacity Energy Efficiency Resources and Summer-Period Energy Efficiency Resources are types of Energy Efficiency Resources.

#### **Exigent Water Storage:**

"Exigent Water Storage" shall mean water stored in the pondage or reservoir of a hydropower resource which is not typically available during normal operating conditions (as those conditions are described in the relevant FERC hydropower license), but which can be drawn upon during emergency conditions (as described in the FERC hydropower license), including in order to avoid a load shed. In an effective load carrying capability analysis, exigent storage capability from an upstream hydro facility can be considered relative to a downstream hydro facility by assessing cascading storage and flows.

#### **Existing Demand Resource:**

"Existing Demand Resource" shall mean a Demand Resource for which the Demand Resource Provider has identified existing end-use customer sites that are registered for the current Delivery Year with PJM (even if not registered by such Demand Resource Provider) and that the Demand Resource Provider reasonably expects to have under a contract to reduce load based on PJM dispatch instructions by the start of the Delivery Year for which such resource is offered.

#### **Existing Generation Capacity Resource:**

"Existing Generation Capacity Resource" shall mean, for purposes of the must-offer requirement and mitigation of offers for any RPM Auction for a Delivery Year, a Generation Capacity Resource that, as of the date on which bidding commences for such auction: (a) is in service; or (b) is not yet in service, but has cleared any RPM Auction for any prior Delivery Year. A Generation Capacity Resource shall be deemed to be in service if interconnection service has ever commenced (for resources located in the PJM Region), or if it is physically and electrically interconnected to an external Control Area and is in full commercial operation (for resources not located in the PJM Region). The additional megawatts of a Generation Capacity Resource that is being, or has been, modified to increase the number of megawatts of available installed capacity thereof shall not be deemed to be an Existing Generation Capacity Resource until such time as those megawatts (a) are in service; or (b) are not yet in service, but have cleared any RPM Auction for any prior Delivery Year.

#### **Extended Summer Demand Resource:**

"Extended Summer Demand Resource" shall mean, for Delivery Years through May 31, 2018, and for FRR Capacity Plans Delivery Years through May 31, 2019, a resource that is placed under the direction of the Office of the Interconnection and that will be available June through October and the following May, and will be available for an unlimited number of interruptions during such months by the Office of the Interconnection, and will be capable of maintaining each such interruption for at least a 10-hour duration between the hours of 10:00AM to 10:00PM Eastern Prevailing Time. The Extended Summer Demand Resource must be available June through October and the following May in the corresponding Delivery Year to be offered for sale or Self-Supplied in an RPM Auction, or included as an Extended Summer Demand Resource in an FRR Capacity Plan for the corresponding Delivery Year.

#### **Facilities Study Agreement:**

"Facilities Study Agreement" shall have the same meaning as in Tariff, Part VI, section 206.

#### FERC or Commission:

"FERC" or "Commission" shall mean the Federal Energy Regulatory Commission or any successor federal agency, commission or department exercising jurisdiction over the Tariff, Operating Agreement and Reliability Assurance Agreement.

## Firm Point-To-Point Transmission Service:

"Firm Point-To-Point Transmission Service" shall have the meaning specified in the Tariff.

#### Firm Service Level:

"Firm Service Level" or "FSL" of Price Responsive Demand for the 2022/2023 Delivery Year and subsequent Delivery Years shall mean the level, determined at a PRD Substation level, to which Price Responsive Demand shall be reduced during the Delivery Year when an Emergency Action that triggers a Performance Assessment Interval is declared and the Locational Marginal Price exceeds the price associated with such Price Responsive Demand identified by the PRD Provider in its PRD Plan. "Firm Service Level" or "FSL" of Demand Resource shall mean the pre-determined level for which an end-use customer's load shall be reduced, upon notification from the Curtailment Service Provider's market operations center or its agent.

#### Firm Transmission Service:

"Firm Transmission Service" shall mean transmission service that is intended to be available at all times to the maximum extent practicable, subject to an Emergency, an unanticipated failure of a facility, or other event beyond the control of the owner or operator of the facility or the Office of the Interconnection.

#### **Fixed Resource Requirement Alternative or FRR Alternative:**

"Fixed Resource Requirement Alternative" or "FRR Alternative" shall mean an alternative method for a Party to satisfy its obligation to provide Unforced Capacity hereunder, as set forth in the Reliability Assurance Agreement, Schedule 8.1.

#### **Forecast Pool Requirement:**

"Forecast Pool Requirement" or "FPR" shall mean the amount equal to one plus the unforced reserve margin (stated as a decimal number) for the PJM Region required pursuant to this Reliability Assurance Agreement, as approved by the PJM Board pursuant to Reliability Assurance Agreement, Schedule 4.1.

#### FRR Capacity Plan or FRR Plan:

"FRR Capacity Plan" or "FRR Plan" shall mean a long-term plan for the commitment of Capacity Resources and Price Responsive Demand to satisfy the capacity obligations of a Party that has elected the FRR Alternative, as more fully set forth in the Reliability Assurance Agreement, Schedule 8.1.

## **FRR Entity:**

"FRR Entity" shall mean, for the duration of such election, a Party that has elected the FRR Alternative hereunder.

## FRR Service Area:

"FRR Service Area" shall mean (a) the service territory of an IOU as recognized by state law, rule or order; (b) the service area of a Public Power Entity or Electric Cooperative as recognized by franchise or other state law, rule, or order; or (c) a separately identifiable geographic area that is: (i) bounded by wholesale metering, or similar appropriate multi-site aggregate metering, that is visible to, and regularly reported to, the Office of the Interconnection, or that is visible to, and regularly reported to an Electric Distributor and such Electric Distributor agrees to aggregate the load data from such meters for such FRR Service Area and regularly report such aggregated information, by FRR Service Area, to the Office of the Interconnection; and (ii) for which the FRR Entity has or assumes the obligation to provide capacity for all load (including load growth) within such area. In the event that the service obligations of an Electric Cooperative or Public Power Entity are not defined by geographic boundaries but by physical connections to a defined set of customers, the FRR Service Area in such circumstances shall be defined as all customers physically connected to transmission or distribution facilities of such Electric Cooperative or Public Power Entity within an area bounded by appropriate wholesale aggregate metering as described above.

## **Full Program Option:**

"Full Program Option" shall mean participation in Emergency Load Response Program or Pre-Emergency Program which allows, pursuant to Tariff, Attachment DD and as applicable, (i) an energy payment for load reductions during a pre-emergency or emergency event, and (ii) a capacity payment for the ability to reduce load during a pre-emergency or emergency event.

#### **Full Requirements Service:**

"Full Requirements Service" shall mean wholesale service to supply all of the power needs of a Load Serving Entity to serve end-users within the PJM Region that are not satisfied by its own generating facilities.

#### **Generation Capacity Resource:**

"Generation Capacity Resource" shall mean a Generating Facility, or the contractual right to capacity from a specified Generating Facility, that meets the requirements of RAA, Schedule 9 and RAA, Schedule 10, and, for Generating Facilities that are committed to an FRR Capacity Plan, that meets the requirements of RAA, Schedule 8.1. A Generation Capacity Resource may be an Existing Generation Capacity Resource or a Planned Generation Capacity Resource.

#### **Generation Capacity Resource Provider:**

"Generation Capacity Resource Provider" shall mean a Member that owns, or has the contractual authority to control the output of, a Generation Capacity Resource, that has not transferred such authority to another entity.

#### **Generation Owner:**

"Generation Owner" shall mean a Member that owns or leases with rights equivalent to ownership, or otherwise controls and operates one or more operating generation resources located in the PJM Region. The foregoing notwithstanding, for a planned generation resource to qualify a Member as a Generation Owner, such resource shall have cleared an RPM auction, and for Energy Resources, the resource shall have a FERC-jurisdictional interconnection agreement or wholesale market participation agreement within PJM. Purchasing all or a portion of the output of a generation resource shall not be sufficient to qualify a Member as a Generation Owner. For purposes of Members Committee sector classification, a Member that is primarily a retail end-user of electricity that owns generation may qualify as a Generation Owner if: (1) the generation resource is the subject of a FERC-jurisdictional interconnection agreement or wholesale market participation agreement within PJM; (2) the average physical unforced capacity owned by the Member and its affiliates over the five Planning Periods immediately preceding the relevant Planning Period exceeds the average PJM capacity obligation of the Member and its affiliates over the same time period; and (3) the average energy produced by the Member and its affiliates within PJM over the five Planning Periods immediately preceding the relevant Planning Period exceeds the average energy consumed by the Member and its affiliates within PJM over the same time period.

#### **Generator Forced Outage:**

"Generator Forced Outage" shall mean an immediate reduction in output or capacity or removal from service, in whole or in part, of a generating unit by reason of an Emergency or threatened Emergency, unanticipated failure, or other cause beyond the control of the owner or operator of the facility, as specified in the relevant portions of the PJM Manuals. A reduction in output or removal from service of a generating unit in response to changes in market conditions shall not constitute a Generator Forced Outage.

#### **Generator Maintenance Outage:**

"Generator Maintenance Outage" shall mean the scheduled removal from service, in whole or in part, of a generating unit in order to perform repairs on specific components of the facility, if removal of the facility qualifies as a maintenance outage pursuant to the PJM Manuals.

#### **Generator Planned Outage:**

"Generator Planned Outage" shall mean the scheduled removal from service, in whole or in part, of a generating unit for inspection, maintenance or repair with the approval of the Office of the Interconnection in accordance with the PJM Manuals.

## **Good Utility Practice:**

"Good Utility Practice" shall mean any of the practices, methods and acts engaged in or approved by a significant portion of the electric utility industry during the relevant time period, or any of the practices, methods and acts which, in the exercise of reasonable judgment in light of the facts known at the time the decision was made, could have been expected to accomplish the desired result at a reasonable cost consistent with good business practices, reliability, safety and expedition. Good Utility Practice is not intended to be limited to the optimum practice, method, or act to the exclusion of all others, but rather is intended to include acceptable practices, methods, or acts generally accepted in the region; including those practices required by Federal Power Act Section 215(a)(4).

## Hydropower With Non-Pumped Storage:

"Hydropower With Non-Pumped Storage" shall mean a hydropower facility that can capture and store incoming stream flow, without use of pumps, in pondage or a reservoir, and the Generation Owner has the ability, within the constraints available in the applicable operating license, to exert material control over the quantity of stored water and output of the facility throughout an Operating Day.

## **Incremental Auction:**

"Incremental Auction" shall mean any of several auctions conducted for a Delivery Year after the Base Residual Auction for such Delivery Year and before the first day of such Delivery Year, including the First Incremental Auction, Second Incremental Auction, Third Incremental Auction, or Conditional Incremental Auction. Incremental Auctions (other than the Conditional Incremental Auction), shall be held for the purposes of:

 allowing Market Sellers that committed Capacity Resources in the Base Residual Auction for a Delivery Year, which subsequently are determined to be unavailable to deliver the committed Unforced Capacity in such Delivery Year (due to resource retirement, resource cancellation or construction delay, resource derating, EFORd increase, a decrease in the Nominated Demand Resource Value of a Planned Demand Resource, delay or cancellation of a Qualifying Transmission Upgrade, or similar occurrences) to submit Buy Bids for replacement Capacity Resources; and

(ii) allowing the Office of the Interconnection to reduce or increase the amount of committed capacity secured in prior auctions for such Delivery Year if, as a result of changed circumstances or expectations since the prior auction(s), there is, respectively, a significant excess or significant deficit of committed capacity for such Delivery Year, for the PJM Region or for an LDA.

## IOU:

"IOU" shall mean an investor-owned utility with substantial business interest in owning and/or operating electric facilities in any two or more of the following three asset categories: generation, transmission, distribution.

## **Limited Demand Resource:**

"Limited Demand Resource" shall mean, for Delivery Years through May 31, 2018, and for FRR Capacity Plans Delivery Years through May 31, 2019, a resource that is placed under the direction of the Office of the Interconnection and that will, at a minimum, be available for interruption for at least 10 Load Management Events during the summer period of June through September in the Delivery Year, and will be capable of maintaining each such interruption for at least a 6-hour duration. At a minimum, the Limited Demand Resource shall be available for such interruptions on weekdays, other than NERC holidays, from 12:00PM (noon) to 8:00PM Eastern Prevailing Time. The Limited Demand Resource must be available during the summer period of June through September in the corresponding Delivery Year to be offered for sale or Self-Supplied in an RPM Auction, or included as a Limited Demand Resource in an FRR Capacity Plan for the corresponding Delivery Year.

## **Limited Duration Resource:**

"Limited Duration Resource" shall mean a Generation Capacity Resource that is not a Variable Resource, that is not a Combination Resource, and that is not capable of running continuously at Maximum Facility Output for 24 hours or longer. A Capacity Storage Resource is a Limited Duration Resource.

## Load Serving Entity or LSE:

"Load Serving Entity" or "LSE" shall mean any entity (or the duly designated agent of such an entity), including a load aggregator or power marketer, (i) serving end-users within the PJM Region, and (ii) that has been granted the authority or has an obligation pursuant to state or local law, regulation or franchise to sell electric energy to end-users located within the PJM Region. Load Serving Entity shall include any end-use customer that qualifies under state rules or a utility retail tariff to manage directly its own supply of electric power and energy and use of transmission and ancillary services.

## **Locational Reliability Charge:**

"Locational Reliability Charge" shall mean the charge determined pursuant to Operating Agreement, Schedule 8.

## Markets and Reliability Committee:

"Markets and Reliability Committee" shall mean the committee established pursuant to the Operating Agreement as a Standing Committee of the Members Committee.

## Maximum Emergency Service Level:

"Maximum Emergency Service Level" or "MESL" of Price Responsive Demand for the 2017/2018 through the 2021/2022 Delivery Years shall mean the level, determined at a PRD Substation level, to which Price Responsive Demand shall be reduced during the Delivery Year when a Maximum Generation Emergency is declared and the Locational Marginal Price exceeds

the price associated with such Price Responsive Demand identified by the PRD Provider in its PRD Plan.

#### Member:

"Member" shall have the meaning provided in the Operating Agreement.

#### **Members Committee:**

"Members Committee" shall mean the committee specified in Operating Agreement, section 8 composed of the representatives of all the Members.

## **NERC:**

"NERC" shall mean the North American Electric Reliability Corporation or any successor thereto.

## Network External Designated Transmission Service:

"Network External Designated Transmission Service" shall mean the quantity of network transmission service confirmed by PJM for use by a market participant to import power and energy from an identified Generation Capacity Resource located outside the PJM Region, upon demonstration by such market participant that it owns such Generation Capacity Resource, has an executed contract to purchase power and energy from such Generation Capacity Resource, or has a contract to purchase power and energy from such Generation Capacity Resource contingent upon securing firm transmission service from such resource.

#### **Network Resources:**

"Network Resources" shall have the meaning set forth in the PJM Tariff.

## **Network Transmission Service:**

"Network Transmission Service" shall mean transmission service provided pursuant to the rates, terms and conditions set forth in Tariff, Part III or transmission service comparable to such service that is provided to a Load Serving Entity that is also a Transmission Owner.

## Nominal PRD Value:

"Nominal PRD Value" shall mean, as to any PRD Provider, an adjustment, determined in accordance with Reliability Assurance Agreement, Schedule 6.1, to the peak-load forecast used to determine the quantity of capacity sought through an RPM Auction, reflecting the aggregate effect of Price Responsive Demand on peak load resulting from the Price Responsive Demand to be provided by such PRD Provider.

#### **Nominated Demand Resource Value:**

"Nominated Demand Resource Value" shall have the meaning specified in Tariff, Attachment DD.

#### Non-Retail Behind the Meter Generation:

"Non-Retail Behind the Meter Generation" shall mean Behind the Meter Generation that is used by municipal electric systems, electric cooperatives, and electric distribution companies to serve load.

#### **Obligation Peak Load:**

"Obligation Peak Load" shall have the meaning specified in Reliability Assurance Agreement, Schedule 8.

#### **Office of the Interconnection:**

"Office of the Interconnection" shall mean the employees and agents of PJM Interconnection, L.L.C., subject to the supervision and oversight of the PJM Board, acting pursuant to the Operating Agreement.

# **Operating Agreement of the PJM Interconnection, L.L.C., Operating Agreement or PJM Operating Agreement:**

"Operating Agreement of the PJM Interconnection, L.L.C.," "Operating Agreement" or "PJM Operating Agreement" shall mean that agreement, dated as of April 1, 1997 and as amended and restated as of June 2, 1997, including all Schedules, Exhibits, Appendices, addenda or supplements hereto, as amended from time to time thereafter, among the Members of the PJM Interconnection, L.L.C, on file with the Commission.

## **Operating Day:**

"Operating Day" shall have the same meaning as provided in the Operating Agreement.

#### **Operating Reserve:**

"Operating Reserve" shall mean the amount of generating capacity scheduled to be available for a specified period of an Operating Day to ensure the reliable operation of the PJM Region, as specified in the PJM Manuals.

## **Ordinary Water Storage:**

"Ordinary Water Storage" shall mean water stored in the pondage or reservoir of a hydropower resource which is typically available during normal operating conditions pursuant to the FERC license governing the operation of the hydropower resource.

## **Other Supplier:**

"Other Supplier" shall mean a Member that: (i) is engaged in buying, selling or transmitting electric energy, capacity, ancillary services, Financial Transmission Rights or other services available under PJM's governing documents in or through the Interconnection or has a good faith intent to do so, and (ii) is not a Generation Owner, Electric Distributor, Transmission Owner or End-Use Customer.

## **Partial Requirements Service:**

"Partial Requirements Service" shall mean wholesale service to supply a specified portion, but not all, of the power needs of a Load Serving Entity to serve end-users within the PJM Region that are not satisfied by its own generating facilities.

## Party:

"Party" shall mean an entity bound by the terms of the Operating Agreement.

## Peak Shaving Adjustment:

"Peak Shaving Adjustment" shall mean a load forecast mechanism that allows load reductions by end-use customers to result in a downward adjustment of the summer load forecast for the associated Zone. Any End-Use Customer identified in an approved peak shaving plan shall not also participate in PJM Markets as Price Responsive Demand, Demand Resource, Base Capacity Demand Resource, Capacity Performance Demand Resource, or Economic Load Response Participant.

## **Percentage Internal Resources Required:**

"Percentage Internal Resources Required" shall mean, for purposes of an FRR Capacity Plan, the percentage of the LDA Reliability Requirement for an LDA that must be satisfied with Capacity Resources located in such LDA.

## **Performance Assessment Interval:**

"Performance Assessment Interval" shall have the meaning specified in Tariff, Attachment DD.

## PJM:

"PJM" shall mean PJM Interconnection, L.L.C., including the Office of the Interconnection as referenced in the PJM Operating Agreement. When such term is being used in the RAA it shall also include the PJM Board.

## PJM Board:

"PJM Board" shall mean the Board of Managers of the LLC, acting pursuant to the Operating Agreement, except when such term is being used in Tariff, Attachment M, in which case PJM Board shall mean the Board of Managers of PJM or its designated representative, exclusive of any members of PJM Management.

## **PJM Manuals:**

"PJM Manuals" shall mean the instructions, rules, procedures and guidelines established by the Office of the Interconnection for the operation, planning and accounting requirements of the PJM Region.

## **PJM Region:**

"PJM Region" shall have the same meaning as provided in the Operating Agreement.

## PJM Region Installed Reserve Margin:

"PJM Region Installed Reserve Margin" shall mean the percent installed reserve margin for the PJM Region required pursuant to Reliability Assurance Agreement, Schedule 4.1, as approved by the PJM Board.

## PJM Tariff, Tariff, O.A.T.T., OATT or PJM Open Access Transmission Tariff:

"PJM Tariff," "Tariff," "O.A.T.T., "OATT" or "PJM Open Access Transmission Tariff" shall mean that certain PJM Open Access Transmission Tariff, including any schedules, appendices, or exhibits attached thereto, on file with FERC and as amended from time to time thereafter.

## **Planned Demand Resource:**

"Planned Demand Resource" shall mean any Demand Resource that does not currently have the capability to provide a reduction in demand or to otherwise control load, but that is scheduled to be capable of providing such reduction or control on or before the start of the Delivery Year for which such resource is to be committed, as determined in accordance with the requirements of Reliability Assurance Agreement, Schedule 6. As set forth in Reliability Assurance Agreement, Schedule 6 and Reliability Assurance Agreement, Schedule 8.1, a Demand Resource Provider submitting a DR Sell Offer Plan shall identify as Planned Demand Resources in such plan all Demand Resources in excess of those that qualify as Existing Demand Resources.

## **Planned External Generation Capacity Resource:**

"Planned External Generation Capacity Resource" shall mean a proposed Generation Capacity Resource, or a proposed increase in the capability of a Generation Capacity Resource, that (a) is to be located outside the PJM Region, (b) participates in the generation interconnection process of a Control Area external to PJM, (c) is scheduled to be physically and electrically interconnected to the transmission facilities of such Control Area on or before the first day of the Delivery Year for which such resource is to be committed to satisfy the reliability requirements

of the PJM Region, and (d) is in full commercial operation prior to the first day of such Delivery Year, such that it is sufficient to provide the Installed Capacity set forth in the Sell Offer forming the basis of such resource's commitment to the PJM Region. Prior to participation in any Base Residual Auction for such Delivery Year, the Capacity Market Seller must demonstrate that it has a fully executed system impact study agreement (or other documentation which is functionally equivalent to a System Impact Study Agreement under the PJM Tariff) or, for resources which are greater than 20MWs participating in a Base Residual Auction for the 2019/2020 Delivery Year and subsequent Delivery Years, an agreement or other documentation which is functionally equivalent to a Facilities Study Agreement under the PJM Tariff), with the transmission owner to whose transmission facilities or distribution facilities the resource is being directly connected, and, as applicable, the transmission provider. Prior to participating in any Incremental Auction for such Delivery Year, the Capacity Market Seller must demonstrate it has entered into an interconnection agreement, or such other documentation that is functionally equivalent to an Interconnection Service Agreement under the PJM Tariff, with the transmission owner to whose transmission facilities or distribution facilities the resource is being directly connected, and, as applicable, the transmission provider. A Planned External Generation Capacity Resource must provide evidence to PJM that it has been studied as a Network Resource, or such other similar interconnection product in such external Control Area, must provide contractual evidence that it has applied for or purchased transmission service to be deliverable to the PJM border, and must provide contractual evidence that it has applied for transmission service to be deliverable to the bus at which energy is to delivered, the agreements for which must have been executed prior to participation in any Reliability Pricing Model Auction for such Delivery Year. Any such resource shall cease to be considered a Planned External Generation Capacity Resource as of the earlier of (i) the date that interconnection service commences as to such resource; or (ii) the resource has cleared an RPM Auction, in which case it shall become an Existing Generation Capacity Resource for purposes of the mitigation of offers for any RPM Auction for all subsequent Delivery Years.

#### **Planned Generation Capacity Resource:**

"Planned Generation Capacity Resource" shall mean a Generation Capacity Resource, or additional megawatts to increase the size of a Generation Capacity Resource that is being or has been modified to increase the number of megawatts of available installed capacity thereof, participating in the generation interconnection process under Tariff, Part IV, Subpart A, as applicable, for which: (i) Interconnection Service is scheduled to commence on or before the first day of the Delivery Year for which such resource is to be committed to RPM or to an FRR Capacity Plan; (ii) for any such resource seeking to offer into a Base Residual Auction, or for any such resource of 20 MWs or less seeking to offer into a Base Residual Auction, a System Impact Study Agreement (or, for resources for which a System Impact Study Agreement is not required, has such other agreement or documentation that is functionally equivalent to a System Impact Study Agreement) has been executed prior to the Base Residual Auction for such Delivery Year; (iii) for any such resource of more than 20 MWs seeking to offer into a Base Residual Auction for the 2019/2020 Delivery Year and subsequent Delivery Years, a Facilities Study Agreement (or, for resources for which a Facilities Study Agreement is not required, has such other agreement or documentation that is functionally equivalent to a Facility Studies Agreement) has been executed prior to the Base Residual Auction for such Delivery Year; and

(iv) an Interconnection Service Agreement has been executed prior to any Incremental Auction for such Delivery Year in which such resource plans to participate. For purposes of the mustoffer requirement and mitigation of offers for any RPM Auction for a Delivery Year, a Generation Capacity Resource shall cease to be considered a Planned Generation Capacity Resource as of the earlier of (i) the date that Interconnection Service commences as to such resource; or (ii) the resource has cleared an RPM Auction for any Delivery Year, in which case it shall become an Existing Generation Capacity Resource for any RPM Auction for all subsequent Delivery Years.

## **Planning Period:**

"Planning Period" shall mean the 12 months beginning June 1 and extending through May 31 of the following year, or such other period approved by the Members Committee.

## **PRD Curve:**

"PRD Curve" shall mean a price-consumption curve at a PRD Substation level, if available, and otherwise at a Zonal (or sub-Zonal LDA, if applicable) level, that details the base consumption level of Price Responsive Demand and the decreasing consumption levels at increasing prices.

## **PRD Provider:**

"PRD Provider" shall mean (i) a Load Serving Entity that provides PRD; or (ii) an entity without direct load serving responsibilities that has entered contractual arrangements with end-use customers served by a Load Serving Entity that satisfy the eligibility criteria for Price Responsive Demand.

## PRD Provider's Zonal Expected Peak Load Value of PRD:

"PRD Provider's Zonal Expected Peak Load Value of PRD" shall mean the expected contribution to Delivery Year peak load of a PRD Provider's Price Responsive Demand, were such demand not to be reduced in response to price, based on the contribution of the end-use customers comprising such Price Responsive Demand to the most recent prior Delivery Year's peak demand, escalated to the Delivery Year in question, as determined in a manner consistent with the Office of the Interconnection's load forecasts used for purposes of the RPM Auctions.

## **PRD Reservation Price:**

"PRD Reservation Price" shall mean an RPM Auction clearing price identified in a PRD Plan for Price Responsive Demand load below which the PRD Provider desires not to commit the identified load as Price Responsive Demand.

## **PRD Substation:**

"PRD Substation" shall mean an electrical substation that is located in the same Zone or in the same sub-Zonal LDA as the end-use customers identified in a PRD Plan or PRD registration and

that, in terms of the electrical topography of the Transmission Facilities comprising the PJM Region, is as close as practicable to such loads.

#### **Price Responsive Demand:**

"Price Responsive Demand" or "PRD" shall mean end-use customer load registered by a PRD Provider pursuant to Reliability Assurance Agreement, Schedule 6.1 that have, as set forth in more detail in the PJM Manuals, the metering capability to record electricity consumption at an interval of one hour or less, Supervisory Control capable of curtailing such load (consistent with applicable RERRA requirements) at each PRD Substation identified in the relevant PRD Plan or PRD registration in response to a Maximum Generation Emergency declared by the Office of the Interconnection (prior to 2022/2023Delivery Year) or a Performance Assessment Interval that triggers a PRD performance assessment (effective with 2022/2023 Delivery Year), and a retail rate structure, or equivalent contractual arrangement, capable of changing retail rates as frequently as an hourly basis, that is linked to or based upon changes in real-time Locational Marginal Prices at a PRD Substation level and that results in a predictable automated response to varying wholesale electricity prices.

#### **Price Responsive Demand Credit:**

"Price Responsive Demand Credit" shall mean a credit, based on committed Price Responsive Demand, as determined under Reliability Assurance Agreement, Schedule 6.1.

#### Price Responsive Demand Plan or PRD Plan:

"Price Responsive Demand Plan" or "PRD Plan" shall mean a plan, submitted by a PRD Provider and received by the Office of the Interconnection in accordance with Reliability Assurance Agreement, Schedule 6.1 and procedures specified in the PJM Manuals, claiming a peak demand limitation due to Price Responsive Demand to support the determination of such PRD Provider's Nominal PRD Value.

## **Public Power Entity:**

"Public Power Entity" shall mean any agency, authority, or instrumentality of a state or of a political subdivision of a state, or any corporation wholly owned by any one or more of the foregoing, that is engaged in the generation, transmission, and/or distribution of electric energy.

## **Qualifying Transmission Upgrades:**

"Qualifying Transmission Upgrades" shall have the meaning specified in Tariff, Attachment DD.

## **Relevant Electric Retail Regulatory Authority:**

"Relevant Electric Retail Regulatory Authority" or "RERRA" shall have the meaning specified in the PJM Operating Agreement.

#### **Reliability Principles and Standards:**

"Reliability Principles and Standards" shall mean the principles and standards established by NERC or an Applicable Regional Entity to define, among other things, an acceptable probability of loss of load due to inadequate generation or transmission capability, as amended from time to time.

## **Required Approvals:**

"Required Approvals" shall mean all of the approvals required for the Operating Agreement to be modified or to be terminated, in whole or in part, including the acceptance for filing by FERC and every other regulatory authority with jurisdiction over all or any part of the Operating Agreement.

## Self-Supply:

"Self-Supply" shall have the meaning provided in Tariff, Attachment DD.

#### **Small Commercial Customer:**

"Small Commercial Customer" shall have the same meaning as in the PJM Tariff.

#### **State Consumer Advocate:**

"State Consumer Advocate" shall mean a legislatively created office from any State, all or any part of the territory of which is within the PJM Region, and the District of Columbia established, inter alia, for the purpose of representing the interests of energy consumers before the utility regulatory commissions of such states and the District of Columbia and the FERC.

#### **State Regulatory Structural Change:**

"State Regulatory Structural Change" shall mean as to any Party, a state law, rule, or order that, after September 30, 2006, initiates a program that allows retail electric consumers served by such Party to choose from among alternative suppliers on a competitive basis, terminates such a program, expands such a program to include classes of customers or localities served by such Party that were not previously permitted to participate in such a program, or that modifies retail electric market structure or market design rules in a manner that materially increases the likelihood that a substantial proportion of the customers of such Party that are eligible for retail choice under such a program (a) that have not exercised such choice will exercise such choice; or (b) that have exercised such choice will no longer exercise such choice, including for example, without limitation, mandating divestiture of utility-owned generation or structural changes to such Party's default service rules that materially affect whether retail choice is economically viable.

#### **Summer-Period Demand Resource:**

Summer-Period Demand Resource shall mean, for the 2020/2021 Delivery Year and subsequent Delivery Years, a resource that is placed under the direction of the Office of the Interconnection, and will be available June through October and the following May of the Delivery Year, and will be available for an unlimited number of interruptions during such months by the Office of the Interconnection, and will be capable of maintaining each such interruption between the hours of 10:00AM to 10:00PM Eastern Prevailing Time. The Summer-Period Demand Resource must be available June through October and the following May in the corresponding Delivery Year to be offered for sale in an RPM Auction, or included as a Summer-Period Demand Resource in an FRR Capacity Plan for the corresponding Delivery Year.

#### **Summer-Period Energy Efficiency Resource:**

Summer-Period Energy Efficiency Resource shall mean, for the 2020/2021 Delivery Year and subsequent Delivery Years, a project, including installation of more efficient devices or equipment or implementation of more efficient processes or systems, meeting the requirements of Reliability Assurance Agreement, Schedule 6 and exceeding then-current building codes, appliance standards, or other relevant standards, designed to achieve a continuous (during the summer peak periods as described in Reliability Assurance Agreement, Schedule 6 and the PJM Manuals) reduction in electric energy consumption that is not reflected in the peak load forecast prepared for the Delivery Year for which the Summer-Period Energy Efficiency Resource is proposed, and that is fully implemented at all times during such Delivery Year, without any requirement of notice, dispatch, or operator intervention.

#### **Supervisory Control:**

"Supervisory Control" shall mean the capability to curtail, in accordance with applicable RERRA requirements, load registered as Price Responsive Demand at each PRD Substation identified in the relevant PRD Plan or PRD registration in response to a Maximum Generation Emergency declared by the Office of the Interconnection. Except to the extent automation is not required by the provisions of the Operating Agreement, the curtailment shall be automated, meaning that load shall be reduced automatically in response to control signals sent by the PRD Provider or its designated agent directly to the control equipment where the load is located without the requirement for any action by the end-use customer.

## **Threshold Quantity:**

"Threshold Quantity" shall mean, as to any FRR Entity for any Delivery Year, the sum of (a) the Unforced Capacity equivalent (determined using the Pool-Wide Average EFORD) of the Installed Reserve Margin for such Delivery Year multiplied by the Preliminary Forecast Peak Load for which such FRR Entity is responsible under its FRR Capacity Plan for such Delivery Year, plus (b) the lesser of (i) 3% of the Unforced Capacity amount determined in (a) above or (ii) 450 MW. If the FRR Entity is not responsible for all load within a Zone, the Preliminary Forecast Peak Load for such entity shall be the FRR Entity's Obligation Peak Load last determined prior to the Base Residual Auction for such Delivery Year, times the Base FRR Scaling Factor (as determined in accordance with Reliability Assurance Agreement, Schedule 8.1).

#### **Transmission Facilities:**

"Transmission Facilities" shall mean facilities that: (i) are within the PJM Region; (ii) meet the definition of transmission facilities pursuant to FERC's Uniform System of Accounts or have been classified as transmission facilities in a ruling by FERC addressing such facilities; and (iii) have been demonstrated to the satisfaction of the Office of the Interconnection to be integrated with the PJM Region transmission system and integrated into the planning and operation of the PJM Region to serve all of the power and transmission customers within the PJM Region.

#### **Transmission Owner:**

"Transmission Owner" shall mean a Member that owns or leases with rights equivalent to ownership Transmission Facilities and is a signatory to the PJM Transmission Owners Agreement. Taking transmission service shall not be sufficient to qualify a Member as a Transmission Owner.

#### **Unforced Capacity:**

"Unforced Capacity" shall mean installed capacity rated at summer conditions that is not on average experiencing a forced outage or forced derating, calculated for each Capacity Resource on the 12-month period from October to September without regard to the ownership of or the contractual rights to the capacity of the unit.

#### **Unlimited Resource:**

"Unlimited Resource" shall mean a generating unit having the ability to maintain output at a stated capability continuously on a daily basis without interruption. An Unlimited Resource is a Generation Capacity Resource that is not an ELCC Resource.

#### Variable Resource:

"Variable Resource" shall mean a Generation Capacity Resource with output that can vary as a function of its energy source, such as wind, solar, run of river hydroelectric power without storage, and landfill gas units without an alternate fuel source. All Intermittent Resources are Variable Resources, with the exception of Hydropower with Non-Pumped Storage.

## Winter Peak Load (or WPL):

"Winter Peak Load" or "WPL" shall mean the average of the Demand Resource customer's specific peak hourly load between hours ending 7:00 EPT through 21:00 EPT on the PJM defined 5 coincident peak days from December through February two Delivery Years prior the Delivery Year for which the registration is submitted. Notwithstanding, if the average use between hours ending 7:00 EPT through 21:00 EPT on a winter 5 coincident peak day is below 35% of the average hours ending 7:00 EPT through 21:00 EPT over all five of such peak days, then up to two such days and corresponding peak demand values may be excluded from the

calculation. Upon approval by the Office of the Interconnection, a Curtailment Service Provider may provide alternative data to calculate Winter Peak Load, as outlined in the PJM Manuals, when there is insufficient hourly load data for the two Delivery Years prior to the relevant Delivery Year or if more than two days meet the exclusion criteria described above.

## **Zonal Capacity Price:**

"Zonal Capacity Price" shall mean the clearing price required in each Zone to meet the demand for Unforced Capacity and satisfy Locational Deliverability Requirements for the LDA or LDAs associated with such Zone. If the Zone contains multiple LDAs with different Capacity Resource Clearing Prices, the Zonal Capacity Price shall be a weighted average of the Capacity Resource Clearing Prices for such LDAs, weighted by the Unforced Capacity of Capacity Resources cleared in each such LDA.

## Zone or Zonal:

"Zone" or "Zonal" shall refer to an area within the PJM Region, as set forth in Tariff, Attachment J and RAA, Schedule 15, or as such areas may be (i) combined as a result of mergers or acquisitions or (ii) added as a result of the expansion of the boundaries of the PJM Region. A Zone shall include any Non-Zone Network Load located outside the PJM Region that is served from such Zone under Tariff, Attachment H-A.

## Zonal Winter Weather Adjustment Factor (ZWWAF):

"Zonal Winter Weather Adjustment Factor" or "ZWWAF" shall mean the PJM zonal winter weather normalized coincident peak divided by PJM zonal average of 5 coincident peak loads in December through February.

#### SCHEDULE 9

#### PROCEDURES FOR ESTABLISHING THE CAPABILITY OF GENERATION CAPACITY RESOURCES

- A. Such rules and procedures as may be required to determine and demonstrate the capability of Generation Capacity Resources for the purposes of meeting a Load Serving Entity's obligations under the Agreement shall be developed by the Office of the Interconnection and maintained in the PJM Manuals.
- **B.** The rules and procedures shall recognize the difference in the relative ability of units to maintain output at stated capability over a specified period of time. Factors affecting such ability include, but are not limited to, fuel availability, stream flow *and/or reservoir storage* for hydro units, *energy* storage *capability* for *Energy Storage Resources*, *energy source variability and intermittency*, mechanical limitations, and system operating policies. *For this purpose, the basis for determining and demonstrating the capability of a particular generating unit* shall be as described in RAA, Schedule 9.1.

#### C. Provisions for Unlimited Resources

For Unlimited Resources, the capability of the generating unit is based on the level of output that the unit can provide under the site conditions expected to exist at the time of PJM system peak load where such conditions include, but are not limited to, ambient air temperature, humidity, barometric pressure, intake water temperature, and cooling system performance. Generating units with the ability to operate continuously across all hours of an Operating Day without interruption if needed include, but are not limited to, nuclear and fossil-fired steam units, combined cycle units, combustion turbine units, reciprocating engine units, and fuel cell units.

#### **D. Provisions for ELCC Resources**

The Office of the Interconnection shall determine the capability of ELCC Resources to meet a Load Serving Entity's obligations under the Agreement using an effective load carrying capability analysis, as set forth in RAA, Schedule 9.1, with additional implementation details provided in the PJM Manuals.

# SCHEDULE 9.1: EFFECTIVE LOAD CARRYING CAPABILITY ANALYSIS

## A. Overview of Effective Load Carrying Capability Analysis

The inputs of the effective load carrying capability analysis include:

-Historical weather and load data;
-Historical output of existing Variable Resources;
-Estimates of putative historical output for planned Variable Resources;
-Forced outage patterns for Unlimited Resources;
-Resource deployment forecast; and
-Modeling parameters for Limited Duration Resources and Combination Resources.

The outputs of the effective load carrying capability analysis include:

-The ELCC Portfolio UCAP, in MW; -ELCC Class UCAP values, in MW; and -ELCC Class Rating values, in percent.

## B. Calculation of ELCC Portfolio UCAP

The effective load carrying capability analysis shall identify a scenario in which the aggregate installed capacity "X" of a group of Unlimited Resources with no outages yields the same annual loss of load expectation as the one produced by the scenario with all ELCC Resources that are expected to offer in a given RPM Auction, or otherwise provide capacity, in the Delivery Year being analyzed. The ELCC Portfolio UCAP shall be the value "X".

## C. Allocation from ELCC Portfolio UCAP to ELCC Class UCAP

The ELCC Portfolio UCAP shall be allocated to each ELCC Class UCAP, in accordance with the applicable effective load carrying capability analysis methodology specified in the PJM Manuals, as subject to adjustment in accordance with RAA, Schedule 9.1, section J, such that the aggregate of all ELCC Class UCAP values is equal to the ELCC Portfolio UCAP.

## D. Calculation of ELCC Class Rating

(1) The ELCC Class Rating of Variable Resources and Limited Duration Resources shall be the ratio of the applicable ELCC Class UCAP to the aggregate Effective Nameplate Capacity of the modeled ELCC Resources of that ELCC Class that are expected to offer in a given RPM Auction, or otherwise provide capacity, in the Delivery Year being analyzed. (2) For Combination Resources, there shall be an ELCC Class Rating for each component.

(i) For a Combination Resource with a Limited Duration Resource component and a Variable Resource component, the Limited Duration Resource component ELCC Class Rating shall be equal to the quotient of (1) the Combination Resource ELCC Class UCAP minus the [product of the Variable Resource ELCC Class Rating and the aggregate Effective Nameplate Capacity of all the Variable Resource components within the subject Combination Resource class] divided by (2) the aggregate equivalent Effective Nameplate Capacity of all the Limited Duration Resource components within the subject Combination Resource class, and the Variable Resource component ELCC Class Rating shall be equal to the ELCC Class Rating for the ELCC Class to which the Variable Resource component would belong if it were not a component of the Combination Resource.

(ii) For a Combination Resource with a Limited Duration Resource component and an Unlimited Resource component, the Limited Duration Resource component ELCC Class Rating shall be equal to the ELCC Class Rating for the ELCC Class to which the Limited Duration Resource component would belong if it were not a component of the Combination Resource, and the Unlimited Resource component would not have an ELCC Class Rating.

## E. Calculation of Accredited UCAP and ELCC Resource Performance Adjustment

(1) (a) For Variable Resources and Limited Duration Resources, Accredited UCAP values shall be equal to the product of:

(i) the Effective Nameplate Capacity;

- (ii) the applicable ELCC Class Rating; and
- (iii) the ELCC Resource Performance Adjustment.

(b) For Combination Resources, Accredited UCAP values shall be equal to the sum of the Accredited UCAP of each component, but not to exceed the Maximum Facility Output of the resource, where:

(i) The value for a Variable Resource component shall be determined in accordance with subsection (a) above.

(ii) The value for a Limited Duration Resource component shall be equal to the product of:

(A) the Effective Nameplate Capacity determined for the Limited Duration Resource component;

(B) [one minus the EFORd for the Limited Duration Resource component]; and

(C) the applicable Limited Duration Resource component ELCC Class Rating as determined in Section D(2)(i).

(iii) The value for an Unlimited Resource component shall be equal to the product of the installed capacity of the Unlimited Resource component and [one minus the EFORd for the Unlimited Resource component].

(iv) The Accredited UCAP for Hydropower With Non-Pumped Storage, and for each member of an ELCC Class whose members are so distinct from one another that a single ELCC Class Rating fails to capture their physical characteristics, shall be based on a resource-specific effective load carrying capability analysis based on the resource's unique parameters.

(2) The ELCC Resource Performance Adjustment shall be calculated according to the following methods, as further detailed in the PJM Manuals:

(a) For a Variable Resource: based on a metric consisting of the average of (1) actual output during the 200 highest coincident peak load hours over the preceding ten years, regardless of the years in which they occur, and (2) actual output during the 200 highest coincident peak putative net load hours over the preceding ten years, regardless of the years in which they occur, where putative net load is actual load minus the putative hourly output of Variable Resources based on the resource mix of the target year. For Planned Resources or resources less than 10 years old, estimated hypothetical historical output will be used to develop this metric. For a given resource or component, the Performance Adjustment shall equal the ratio of such metric to the average (weighted by the Effective Nameplate Capacity) of such metrics for all units in the applicable Variable Resource ELCC Class.

(b) For Limited Duration Resources: based on EFORd.

(c) For Combination Resources with only an Unlimited Resource component and a Limited Duration Resource component: based on EFORd.

(d) For Combination Resources with a Variable Resource component (except for Hydropower With Non-Pumped Storage): (1) based on the direct metered or estimated output of the Variable Resource component, which is then assessed according to the methodology described in subsection (a) above for Variable Resources and in accordance with the PJM Manuals; and (2) based on the EFORd that is applicable to the Limited Duration Resource component. (e) For Hydropower With Non-Pumped Storage and other Combination Resources that do not fall into the above categories: based on EFORd.

## F. Installed Capacity of ELCC Resources

Rules and procedures for technically determining and demonstrating the installed capacity of ELCC Resources shall be developed by the Office of the Interconnection and maintained in the PJM Manuals. The installed capacity of a Limited Duration Resource is based on the sustained level of output that the unit can provide and maintain over a continuous period, whereby the duration of that period matches the characteristic duration of the corresponding ELCC Class, with consideration given to ambient conditions expected to exist at the time of PJM system peak load, as described in the PJM Manuals. The installed capacity of a Combination Resource (other than Hydropower With Non-Pumped Storage) is based on the lesser of the Maximum Facility Output or the sum of the equivalent Effective Nameplate Capacity values of the resource's constituent components considered on a stand-alone basis.

## G. Details of the Effective Load Carrying Capability Methodology

The effective load carrying capability analysis shall compare expected hourly load levels (based on historical weather) with the expected hourly output of the expected future resource mix in order to identify the relative resource adequacy value of the portfolio of all ELCC Classes, as well of each individual ELCC Class, compared to a group of Unlimited Resources with no outages. In performing this analysis, the model inputs shall be scaled to meet the annual loss of load expectation of the Office of the Interconnection. The effective load carrying capability analysis shall compare hourly values for: (i) expected load based on historical weather; (ii) expected Variable Resource output; and (iii) expected output of Limited Duration Resources and of Combination Resources as described below. These expected quantities are based on actual values for load and actual and putative values for Variable Resource output (standalone or as a component of Combination Resources) after June 1, 2012 (inclusive) through the most recent Delivery Year for which complete data exist. For resources that have not existed each year since June 1, 2012, putative output is an estimate of the hourly output that resource would have produced in a historical hour if that resource had existed in that hour. This putative output estimate is developed based on historical weather data consistent with the particular site conditions for each such resource in accordance with the PJM Manuals.

The effective load carrying capability analysis shall simulate forced outages of Unlimited Resources based on actual historical data, and shall simulate the output of Limited Duration Resources and Combination Resources based on their Office of the Interconnection-validated parameters, including the putative output of the Variable Resource component of Combination Resources, as described above. Forced outages of Limited Duration Resources and Combination Resources shall not be simulated in the effective load carrying capability analysis. The quantity of deployed resources studied in the analysis shall be based on resource deployment forecasts and, where applicable, on available information based on Sell Offers submitted in RPM Auctions or Fixed Resource Requirement plans for the applicable Delivery Year.

The ELCC Class UCAP and other results of the effective load carrying capability analysis shall be based on the total Effective UCAP of the ELCC Class as a whole.

The ELCC Class UCAP and corresponding ELCC Class Rating values may increase or decrease from year to year as the expected resource mix and load shape change.

Energy Resources are not included in the effective load carrying capability analysis. Generating units that are expected to only offer or otherwise provide a portion of their Accredited UCAP for that Delivery Year are represented in the analysis in proportion to the expected quantity offered or delivered divided by the Accredited UCAP.

# H. Methodology to Simulate Output of Certain Resources in the Effective Load Carrying Capability Model

The effective load carrying capability analysis shall simulate the output of Limited Duration Resources and Combination Resources based on their physical parameters, including limited storage capability, and shall simulate the deployment of Demand Resources. The analysis shall simulate output from the subject Limited Duration Resources and Combination Resources in hours in which all output from Unlimited Resources and available output from Variable Resources is insufficient to meet load. The output of the subject Limited Duration Resources and Combination Resources shall be simulated on an hour-by-hour basis in proportion to their Effective Nameplate Capacity without foresight to future hours. The simulated deployment of Demand Resources shall be such that there is adequate Primary Reserves provided by economic resources, if sufficient simulated Demand Resources are available. Primary Reserves shall be assigned to generation resources in order to maximize simulated reliability, provided that assignments to Limited Duration Resources and Combination Resources shall be pro rata according to their Effective Nameplate Capacity. Primary Reserves shall be exhausted prior to identifying a loss of load event in the analysis. Energy Storage Resource charging is during hours with sufficient margin, including between daily peaks if necessary.

## I. Administration of Effective Load Carrying Capability Analysis

The Office of the Interconnection shall post final ELCC Class UCAP and ELCC Class Rating values at least once per year in a report that also includes appropriate details regarding methodology and inputs. The Office of the Interconnection shall post this report and shall communicate ELCC Resource Performance Adjustment values to applicable Generation Capacity Resource Providers no later than five months prior to the start of the target Delivery Year, as described in the PJM Manuals. Starting with the 2023/2024 Delivery Year, Accredited UCAP values for the applicable Delivery Year shall establish the maximum Unforced Capacity

that an ELCC Resource can physically provide or offer to provide in the applicable Delivery Year.

The Office of the Interconnection shall also post preliminary ELCC Class Rating values for nine subsequent Delivery Years. For any Delivery Year for which a final ELCC Class Rating has not been posted and a preliminary ELCC Class Rating has been posted, the Accredited UCAP of an ELCC Resource for such Delivery Year shall be based on the most recent preliminary ELCC Class Rating value for that Delivery Year, together with the most recently calculated ELCC Resource Performance Adjustment value for that ELCC Resource. Except to the extent specified above or otherwise specified, the preliminary ELCC Class Rating values for future years are non-binding and are only for indicative purposes. A Generation Capacity Resource Provider can offer or provide capacity from an ELCC Resource that is not subject to a capacity market must offer obligation (as specified in Tariff, Attachment DD, Section 6.6) at a level less than the Accredited UCAP for such resource.

In order to facilitate the effective load carrying capability analysis, the Generation Capacity Resource Provider of each ELCC Resource must submit to the Office of the Interconnection the required information as specified in the PJM Manuals by no later than six months prior to an RPM Auction in which the ELCC Resource intends to submit a Sell Offer or otherwise commit to provide capacity, except for Delivery Years prior to the 2026/2027 Delivery Year such required information must be provided to the Office of the Interconnection in accordance with the PJM Manuals. The required information may include relevant physical parameters, relevant historical data such as weather data and actual or estimated historical energy output, and documentation supporting such parameters and historical data. The relevant physical parameters are those that are incorporated into the effective load carrying capability analysis. The parameters required for Hydropower With Non-Pumped Storage shall include Ordinary Water Storage and any applicable Exigent Water Storage. Submitted parameters must indicate the expected duration for which any submitted physical parameters are valid.

The Office of the Interconnection shall evaluate, validate, and approve the foregoing information in accordance with the process set forth in the PJM Manuals. In evaluating the validity of submitted information, the Office of the Interconnection may assess the consistency of such information with observed conditions. If the Office of the Interconnection observes that the information provided by the Generation Capacity Resource Provider of the ELCC Resource is inconsistent with observed conditions, the Office of the Interconnection will coordinate with the Generation Capacity Resource to understand the information and observed conditions before making a determination regarding the validity of the applicable parameters. The Office of the Interconnection may engage the services of a consultant with technical expertise to evaluate the foregoing information.

After the Office of the Interconnection has completed its evaluation of the foregoing information, the Office of the Interconnection shall notify the Generation Capacity Resource Provider in
writing whether the submitted information is considered invalid by no later than September 1 following the submission of the information. The Office of the Interconnection's determination on the validity of the foregoing information shall continue for the applicable Delivery Year and, if requested, for such longer period as the Office of the Interconnection may determine is supported by the data.

In the event that the Office of the Interconnection is unable to validate any of the required information, physical parameters, supporting documentation, or other related information submitted by the Generation Capacity Resource Provider of an ELCC Resource, then the Office of the Interconnection shall calculate Accredited UCAP values for that ELCC Resource based only on the validated information. Such ELCC Resource shall not be permitted to offer or otherwise provide capacity above such Accredited UCAP values until the Office of the Interconnection determines new Accredited UCAP values for such resource.

Generation Capacity Resource Providers of ELCC Resources that are hydropower plants with water storage must provide documentation to support the physical parameters provided for expected load carrying capability analysis modeling, as specified in the PJM Manuals. This documentation must: (a) support the plant's physical capabilities; (b) demonstrate that the parameters do not violate any federal, state, river basin, or other applicable authority operating limitations of the plant; and (c) demonstrate full authorization from FERC, any river basin commissions, and any other applicable authorities to meet those capabilities.

### J. ELCC Transition Mechanism

(1) A transition mechanism shall be established whereby PJM shall post floor values establishing a lower bound on the ELCC Class Ratings that apply to ELCC Resources in the determination of each ELCC Resource's Accredited UCAP. This transition mechanism can be evaluated at any time and shall be evaluated in conjunction with a quadrennial periodic review of the shape of the Variable Resource Requirement Curve, as described in Tariff, Attachment DD, section 5.10, no later than the end of 2026. Such evaluation shall include an assessment of the efficacy and appropriateness of the transition mechanism and shall make recommendations as to whether some or all aspects of the transition mechanism should be reconsidered through a stakeholder process. The already-established floor values and associated term duration for each cohort should apply for their entire term, as described below, regardless of the outcome of such evaluation, except as described in subsection (3)(f) below.

For purposes of implementing this transition mechanism, ELCC Resources shall be organized into annual cohorts. Each cohort shall share an associated table of floor values on the ELCC Class Ratings spanning the duration described below. Floor values shall be calculated using effective load carrying capability analysis for future years, applying a resource mix that reflects more conservative ELCC Class Ratings than expected, as set forth in subsection (3)(d) below.

Floor values shall be posted on an annual cycle, each posting of which shall include floor values for no more than ten calendar years in the future.

Tables of floor values will apply for the Delivery Years as specified below. For new ELCC Resources, the ELCC Class Rating floor values contemplated by this RAA, Schedule 9.1, section J shall apply upon:

(a) completion of one of the following milestones in the New Services Queue: (i) execution of an Interconnection Service Agreement by the Interconnection Customer, or equivalent, for the ELCC Resource; (ii) execution of a Wholesale Market Participation Agreement by the wholesale market participant, or equivalent, for the ELCC Resource; or (iii) posting credit to submit a Sell Offer into the next Base Residual Auction, pursuant to the applicable RPM Auction Credit Rate; and

(b) receipt by the Office of the Interconnection of a written attestation, in a form specified in the PJM Manuals, by the Generation Capacity Resource Provider of the ELCC Resource affirming the Generation Capacity Resource Provider's intent to proceed to provide capacity in the PJM Region. Such attestation shall be provided to the Office of the Interconnection after reaching one of the milestones identified in subsection (a) above.

#### (2) Cohorts

(a) **2021 Cohort**. A table of floor values for Delivery Years 2021/22 through 2033/34 shall apply to ELCC Resources that on or before December 31, 2021 are Existing Generation Capacity Resources or satisfy the requirements of RAA, Schedule 9.1, section J(1)(a) and (b) above. A table of preliminary ELCC Class Rating floor values for Delivery Years 2021/2022 through 2030/2031 shall be posted within six months of this Schedule 9.1 becoming effective but no later than December 31, 2021; preliminary floor values for Delivery Years 2031/2032, 2032/2033, and 2033/2034 shall be posted on or before December 31 of 2022, 2023, and 2024, respectively.

(b) **2022 Cohort.** A table of floor values for Delivery Years 2022/23 through 2034/35 shall apply to ELCC Resources that meet the requirements in RAA, Schedule 9.1, section J(1)(a) and (b) above on or after January 1, 2022 and on or before December 31, 2022. Preliminary floor values for Delivery Years 2022/2023 through 2031/2032 shall be posted on or before December 31, 2021; preliminary floor values for Delivery Years 2032/2033, 2033/2034, and 2034/2035 shall be posted on or before December 31 of 2022, 2023, and 2024, respectively.

(c) **2023 Cohorts and later.** For each of the thirteen consecutive Delivery Years beginning with the Delivery Year that starts in the calendar year in which an ELCC

Resource meets the requirements in RAA, Schedule 9.1, section J(1)(a) and (b) above, a set of ELCC Class Rating floor values shall apply to such ELCC Resource. Preliminary floor values for the first ten Delivery Years in the table shall be posted on or before December 31 prior to the first Delivery Year to which a floor value applies; preliminary floor values for Delivery Years eleven, twelve, and thirteen shall be posted on or before December 31 of each of the immediately following three calendar years, respectively. This timing is reflected in the below table, where "X" is the year in which the ELCC Resource meets the requirements in RAA, Schedule 9.1, section J(1)(a) and (b) above.

Calendar Year In which Floor Values Are Posted for Cohort "X"	Target Delivery Year	ELCC Class Rating Floor for Cohort X
X-1	X/X+1	Value I
X-1	X+1/X+2	Value II
X-1	X+2/X+3	Value III
X-1	X+3/X+4	Value IV
X-1	X+4/X+5	Value V
X-1	X+5/X+6	Value VI
X-1	X+6/X+7	Value VII
X-1	X+7/X+8	Value VIII
X-1	X+8/X+9	Value IX
X-1	X+9/X+10	Value X
X	X+10/X+11	Value XI
X+1	X+11/X+12	Value XII
X+2	X+12/X+13	Value XIII

Preliminary floor values shall be finalized within 120 days of posting. Upon posting the preliminary floor values, the Office of the Interconnection shall conduct a retrospective review to determine if any potential errors occurred in its implementation of this section J, whereby the potential error, if verified, could have a material impact on the posted preliminary floor values. In the event the Office of the Interconnection discovers such a potential error within 60 days of posting such preliminary floor value, the Office of the Interconnection will notify Market Participants of the existence of the potential error as soon as possible, but in no event later than 60 days after posting the applicable preliminary floor value. Within 45 days of identifying a potential error in a preliminary floor value, the Office of the Interconnection shall consult with Market Participants, and provide all available supporting documentation (such documentation shall not contain market sensitive or confidential information), prior to determining whether to modify an initially posted preliminary floor value. If the Office of the Interconnection

determines it is necessary to modify an initially posted preliminary floor value, it shall notify Market Participants of its intent to do so and post such notification on its website by no later than 45 days following the notification of a discovery of a potential error in the preliminary floor value. The Office of the Interconnection shall post on its website the corrected floor value by no later than 120 days following the initial posting of the preliminary floor value. Should any of the above deadlines pass without the associated action on the part of the Office of the Interconnection, the originally posted floor values will be considered final.

To the extent an ELCC Resource satisfies the requirements of RAA, Schedule 9.1, section J(1)(a) and (b) above on or after the January 1 following the posting of the preliminary floor value applicable to that ELCC Resource, and within 60 days of such posting, and the Office of the Interconnection identifies a potential error with respect to that floor value, the Generation Capacity Resource Provider may elect for the ELCC Resource to be included in the cohort for the prior calendar year. Any election to be included in the cohort for the prior calendar year must be provided in writing to the Office of the Interconnection within 10 days after the Office of the Interconnection consults with Market Participants regarding the potential error.

(3) General Rules for ELCC Class Rating Floor Values

(a) In a given annual posting cycle, for floor values that are ten years in the future and therefore have not previously been posted, the same floor value shall be posted for use across all cohorts of an ELCC Class for a given Delivery Year for which such floor will be applicable.

(b) For a given resource, at the end of the term of applicability of the original set of ten floor values, as extended with three additional floor values, the rules in place at that time for determining Accredited UCAP (or otherwise determining the amount of Unforced Capacity that such resource is eligible to offer or provide) will apply.

(c) The ELCC Class Rating used to determine the Accredited UCAP of an ELCC Resource is the greater of the applicable floor value or the most recently posted final or preliminary ELCC Class Rating for the target Delivery Year.

(d) The ELCC Class Rating floor values for each ELCC Class shall be calculated using the same form of effective load carrying capability analysis used for calculating ELCC Class Ratings for future years, except that the forecasted resource mix used for calculating the ELCC Class Ratings (the "expected forecast") shall be adjusted for the calculation of the floor value for each ELCC Class (the "floor forecast") in order to reflect a more conservative ELCC Class Rating value. Each ELCC Class shall have a unique floor forecast that accounts for the interaction among ELCC Classes, both the given subject ELCC Class and the other ELCC Classes, through adjusting (up or down) the rate of deployment expected for each ELCC Class. The floor forecast for a given ELCC Class of Variable Resources or Limited Duration Resources shall be developed according to the following method:

(i) Any expected increase in deployment of ELCC Resources in the given subject class in each year shall be accelerated in an exponential fashion such that the increase in deployment after 10 years shall be twice the value in the expected forecast.

(ii) For ELCC Resources in ELCC Classes other than the given subject ELCC Class that show a complementary interaction with the given subject class in the effective load carrying capability analysis, where a complementary interaction occurs in the case that the increase in deployment of the complementary class tends to increase the ELCC Class Rating of the subject class, any expected increase in deployment in a complementary ELCC Class shall be decelerated in an exponential fashion such that the increase in deployment after ten years shall be half the value in the expected forecast; any expected decrease in deployment in a complementary ELCC Class shall be accelerated in an exponential fashion such that the increase in deployment after ten years shall be half the value in the expected forecast; any expected decrease in deployment in a complementary ELCC Class shall be accelerated in an exponential fashion such that the decrease in deployment after ten years shall be twice the value in the expected forecast.

(iii) For ELCC Resources in ELCC Classes showing an antagonistic interaction with the given subject class in the effective load carrying capability analysis, where an antagonistic interaction occurs in the case that the increase in deployment of the antagonistic class tends to decrease the ELCC Class Rating of the subject class, any expected increase in deployment in an antagonistic class shall be accelerated in an exponential fashion such that the increase in deployment after ten years shall be twice the value in the expected forecast; any expected decrease in deployment in an antagonistic class shall be decelerated in an exponential fashion such that the decrease in deployment after ten years shall be half the value in the expected forecast.

For Combination Resources, the applicable floor values will be determined in accordance with a procedure set forth in the PJM Manuals that appropriately reflects and merges the floor values determined for the distinct components of the Combination Resource in a manner consistent with the methodology above.

However, for Hydropower With Non-Pumped Storage, the applicable floor values will be determined, using the foregoing method, on a resource-specific basis and not on an ELCC Class basis.

(e) The ELCC Class Rating used to determine an Accredited UCAP shall not be below the applicable floor value. ELCC Classes shall be organized into groups for the purpose of sharing the risk that a final or preliminary ELCC Class Rating for a Delivery Year is lower than the corresponding ELCC Class Rating in any table of floor values for such Delivery Year. In that event,

(i) for ELCC Resources with a final or preliminary ELCC Class Rating below the applicable floor value, the Accredited UCAP shall be determined using the ELCC Resource's ELCC Resource Performance Adjustment, in accordance with the methods set forth in RAA, Schedule 9.1, section E, and the applicable ELCC Class Rating floor value;

(ii) for ELCC Resources with a final or preliminary ELCC Class Rating above the applicable floor value, the Accredited UCAP shall be determined using the ELCC Resource's ELCC Resource Performance Adjustment, in accordance with the methods set forth in RAA, Schedule 9.1, section E, and the ELCC Class Rating, which is determined in accordance with the methodology set forth in RAA, Schedule 9.1, section D, except that (1) the value used in place of ELCC Class UCAP is equal to [the sum of the ELCC Class UCAP for each ELCC Class of the subject group minus the sum of the Accredited UCAP of the ELCC Resources that are accredited based on floor values], which in turn is allocated to each ELCC Class in accordance with the methodology specified in the PJM Manuals that is consistent with the allocation methodology of RAA, Schedule 9.1, section C for allocating the ELCC Portfolio UCAP among the ELCC Classes, then further adjusted by a factor based on ELCC Resource Performance Adjustment values such that the total Accredited UCAP of all resources of each class does not exceed the ELCC Class UCAP and (2) the relevant aggregate Effective Nameplate Capacity shall be the sum of the Effective Nameplate Capacity of the members of the ELCC Class that are accredited based on a final or preliminary ELCC Class Rating above the applicable floor value.

Provided, however, if the aggregate ELCC Class UCAP of the entire group is less than the aggregate Accredited UCAP of the ELCC Resources of the group that are accredited based on floor values, then the ELCC Class Rating for ELCC Resources with a final or preliminary ELCC Class Rating above the applicable floor value shall be determined in accordance with the methodology set forth in RAA, Schedule 9.1, section D, except that (3) the value used in place of ELCC Class UCAP is equal to [the ELCC Portfolio UCAP minus the aggregate Accredited UCAP of the resources of the group that are accredited based on floor values] which in turn is allocated to each ELCC Class in accordance with the methodology specified in the PJM Manuals that is consistent with the allocation methodology of RAA, Schedule 9.1, section C for allocating the ELCC Portfolio UCAP among the ELCC Classes, then further adjusted by a factor based on ELCC Resource Performance Adjustment values such that the total Accredited UCAP of all resources of each class does not exceed the ELCC Class UCAP, and (4) the relevant aggregate Effective Nameplate Capacity shall be the sum of the Effective Nameplate Capacity of the members of the ELCC Class that are accredited based on a final or preliminary ELCC Class Rating above the applicable floor value.

ELCC Class groups shall be defined in the PJM Manuals. The groups shall be defined in accordance with the following principles: (1) each group shall be composed of ELCC Classes that shall share relevant physical characteristics; and (2) each group is broad enough to include a significant fraction of the ELCC Portfolio UCAP, with consideration given to ELCC Classes that are expected to increase in deployment over the ten-year term of the effective load carrying capability analysis.

(f) While recognizing the general principle that the floor values already issued for a specific resource generally would not be changed, the limited circumstances under which the posted final floor values could be changed include: (i) the Office of the Interconnection no longer performs the effective load carrying capability analysis set forth in this RAA, Schedule 9.1; or (ii) the Office of the Interconnection no longer determines Accredited UCAP prior to conducting an RPM Auction.

Nothing in RAA, Schedule 9.1 is intended to constrain the authority of the PJM Board in any way. The Office of the Interconnection and the PJM Board retain all of their filing rights, including the right to file with FERC as needed to: (iii) change the effective load carrying capability constructs and the effective load carrying capability analysis; (iv) change the methodology specified in this section J for calculating floors that are to be posted in the future; and (v) cease the posting of new floor values. None of the foregoing shall provide a basis for a new transition period or any other form of compensation to a Generation Capacity Resource Provider.

(g) The applicable table of floor values will continue to apply even if an ELCC Resource offers less than their Accredited UCAP.

(h) For purposes of determining floor values in this section J, uprates to individual ELCC Resources are treated as if each uprate is a separate ELCC Resource. The total Accredited UCAP of an ELCC Resource, including all uprates, shall be the sum of the respective Accredited UCAP values.

(i) The floor value applicable to an ELCC Resource is not transferable to a different ELCC Resource.

## Attachment C

# Affidavit of Dr. Patricio Rocha Garrido on Behalf of PJM Interconnection, L.L.C.

#### UNITED STATES OF AMERICA BEFORE THE FEDERAL ENERGY REGULATORY COMMISSION

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PJM Interconnection, L.L.C.

Docket No. ER21-\_\_\_-000

#### AFFIDAVIT OF DR. PATRICIO ROCHA GARRIDO ON BEHALF OF PJM INTERCONNECTION, L.L.C.

- 1. My name is Dr. Patricio Rocha Garrido. My business address is 2750 Monroe Blvd., Audubon, Pennsylvania, 19403. I am a Senior Engineer in Resource Adequacy Planning in the System Planning division of PJM Interconnection, L.L.C. ("PJM"). I am submitting this affidavit on behalf of PJM in support of its Federal Power Act section 205 proposal in this proceeding.
- 2. Specifically, in this affidavit, I provide support for PJM's proposal to establish an Effective Load Carrying Capability ("ELCC") construct.

#### **Qualifications**

- 3. I joined PJM in 2011. As a Senior Lead Engineer with the Resource Adequacy Planning department, I am responsible for performing long-term resource adequacy studies involving loss-of-load probability calculations whose results serve as inputs into PJM's Reliability Pricing Model as well as PJM's Regional Expansion Transmission Plan. I have also collaborated with PJM's planning and operations groups in projects related to long-term load forecasting, short-term solar forecasting, and net-interchange schedule forecasting models. Prior to joining PJM, as a graduate student/research assistant, I performed research and wrote articles on topics pertinent to restructured electricity markets, namely generation capacity expansion and financial transmission rights. I am a member of the IEEE Power and Energy Society and a participant in interregional resource adequacy working groups.
- 4. I hold a Bachelor of Science degree in Industrial Engineering from the University of La Frontera-Chile, and a Masters and Ph.D. degree in Industrial Engineering from the University of South Florida.

#### Analytical Methodology and Dispatch.

#### Overview

5. PJM's capacity market, the Reliability Pricing Model ("RPM"), is a construct in which Market Participants submit an offer composed of a price component (in \$/megawatts-day) and a quantity component (in megawatts ("MW")). The megawatt units in both components are denominated in Unforced Capacity ("UCAP"). This denomination is intended to reflect the megawatts that, on-average, resources can be expected to deliver when the PJM system is experiencing reliability issues. Assuming transmission conditions are adequate in the

system, reliability issues can occur when load is high, resource unavailability is high, or under a combination of both these conditions.

- 6. To ensure that the market outcome is competitive, the megawatts offered by resource owners into the market must be comparable, i.e., 1 megawatt offered by Resource A must be comparable to 1 megawatt offered by Resource B. Achieving comparability between offered megawatts is straightforward for Unlimited Resources due to the fact that the large majority of unplanned outages experienced by these resources are random, which means that the chance of having a large amount of these resources is not associated with the occurrence of reliability issues due to high resource unavailability and an off-the-shelf metric that simply quantifies the frequency of random outages, such as the Equivalent Demand Forced Outage Rate ("EFORd"), is appropriate to establish the UCAP value of a resource that belongs to the Unlimited Resources category.
- 7. For other resource categories, such as Variable Resources, Limited Duration Resources, and Combination Resources, the calculation of EFORd may not be feasible and, even if feasible, the EFORd metric is not adequate to establish the UCAP-equivalent for ELCC Resources, i.e., the "Accredited UCAP," of such resources because: (i) the outages experienced by these resources are not random and instead have established patterns that may cause a large quantity of the resources to be unavailable simultaneously, potentially causing system reliability issues; and/or (ii) the duration limitations of a large quantity of these resources may be reached simultaneously, potentially causing system reliability issues. In other words, a high penetration level of these resource unavailability.
- 8. Currently, PJM has alternative rules in place to calculate the UCAP value of the resource types that will now be categorized as Variable Resources, Limited Duration Resources, and Combination Resources. However, these rules are also inadequate because they do not capture the fact that a high penetration level of these resource types is associated with the occurrence of reliability issues due to the potential for high resource unavailability. Furthermore, these rules tend to be broad and/or inaccurate in the way they attempt to represent hours in which the PJM system is expected to experience reliability issues. For instance, the current rules for a subset of Variable Resources, wind and solar resources, use the performance period between hour ending 1500 and hour ending 1800 of every day from June 1 to August 31.<sup>1</sup> This is clearly very broad as PJM is not expected to experience reliability issues 368 hours every summer. Another example is the current rule used for Limited Duration Resources which is based on requiring resources to have a sustained performance level during a period of 10 hours. This rule is also inadequate because it implies that all system reliability issues are expected to have a duration of exactly 10 hours.
- 9. Developing an adequate methodology to calculate the Accredited UCAP value of Variable Resources, Limited Duration Resources, and Combination Resources requires estimating

<sup>&</sup>lt;sup>1</sup> PJM Manual 21: *Rules and Procedures for Determination of Generating Capability*, Revision: 14 at Appendix B (Calculating Capacity Values for Wind and Solar Capacity Resources) (July 25, 2019), https://www.pjm.com/-/media/documents/manuals/m21.ashx.

the performance of these resources during system reliability events, while taking into account that the penetration level of these resources may cause some of the system reliability events. To achieve this, it is necessary to simulate the PJM system under a given portfolio of resources as well as multiple load scenarios and resource performance scenarios.

- 10. ELCC is a methodology that calculates the amount of additional peak load that a system can serve at a constant reliability level once an additional amount of resources X is added to the system. To perform the calculation, the system is simulated twice: first, under a portfolio that does not include the additional resources X and then, under a portfolio that includes the additional resources X (the simulations also include multiple load scenarios and resource performance scenarios). Both simulated cases must maintain a constant level of reliability, where reliability is measured using a metric such as Loss of Load Expectation ("LOLE") or other reliability metric. The megawatt-difference in peak load between the second case and the first case constitutes the ELCC of the additional resources X. This value is a good reflection of the expected performance of the additional resources X during system reliability events and, therefore, a good proxy for Accredited UCAP value. There are some variations (described later in this affidavit) to the ELCC methodology as applied to Variable Resources, Limited Duration Resources, and Combination Resources intended to make the ELCC result compatible with the rules employed to estimate the UCAP value of Unlimited Resources. In general, however, the key elements of the ELCC methodology are as described above.
- 11. PJM is proposing to use ELCC as the methodology to calculate the Accredited UCAP value of Variable Resources, Limited Duration Resources, and Combination Resources. In practice, an ELCC Resource's Accredited UCAP value corresponds to the maximum amount of megawatts of capacity that such a resource can offer or provide in PJM.

#### **ELCC Inputs**

- 12. PJM's proposed ELCC methodology models the performance of resource portfolios under a range of future system conditions. The inputs determining the range of future system conditions are Load Uncertainty and Resource Performance Uncertainty. The resulting range of future system conditions can be denominated as ELCC Scenarios. Each one of the ELCC Scenarios has a probability of occurrence associated with it. Therefore, the ELCC methodology is probabilistic in nature.
- 13. To yield an Accredited UCAP value that is applicable to an entire delivery year, the ELCC Scenarios must cover a full delivery year. Due to data availability and software capabilities, PJM is proposing to perform the ELCC analysis on an hourly basis. Therefore, in general, each ELCC Scenario will cover 8,760 hours (if a specific scenario is meant to represent a leap year, then such a scenario will cover 8,784 hours).
- 14. Modeling Load Uncertainty in the ELCC methodology entails deriving multiple 8,760 Hourly Load Scenarios to cover a range of load conditions. PJM is proposing to consider the following components to derive the Hourly Load Scenarios:

- a) Hourly Load Shapes. The ELCC model is prospective in the sense that it simulates future system conditions. One of the key system conditions is load. It is complex to forecast future hourly load shapes because of the challenges associated with: i) forecasting weather (as well as other variables that can impact hourly loads); and ii) capturing the temporal dependency between hourly load values. A simplified approach to forecast future hourly load shapes is to assume that a future hourly load shape is likely to resemble historical hourly load shapes. PJM is proposing to follow this simplified approach. A range of future Hourly Load Shapes ("HLS") will be derived consistent with: (i) actual weather experienced during historical years; and (ii) the most recent PJM load forecast model. Specifically, the actual weather during the historical years will be input into the PJM load forecast model to derive HLS for a future target delivery year. This step, which involves using the PJM load forecast model, ensures that the resulting HLS reflects expected changes in load patterns due to a variety of factors whose future impact on load conditions may differ from what history may indicate. Examples of such factors include: behind-the-meter solar resource penetration; plug-in hybrid penetration levels; and peak load shaving behavior. Initially, PJM is proposing to derive HLS with weather/load data from the period 2012/2013 Delivery Year thru 2019/2020 Delivery Year (this would yield a total of 8 HLS). To capture a wide range of load conditions, PJM is also proposing to roll in more weather/load data as this data becomes available in future years. The choice of not using weather/load data prior to 2012/2013 Delivery Year is dictated by the unavailability or sparsity of wind and solar performance data during that period. As I discuss later, wind and solar performance is dependent on weather in the same way that load is dependent on weather; therefore, the ELCC model should attempt to preserve the correlation between load and wind/solar performance. Inclusion of HLS built with data from certain historical years (i.e., prior to the 2012/2013 Delivery Year) when wind/solar performance data is not available for those years would be inconsistent with this ELCC model development principle.
- b) Probability for each HLS. The HLS described above represent different load shape scenarios for a future delivery year. Therefore, each HLS must have an associated probability of occurrence. If the number of HLS is sufficiently large (i.e., 50 or greater), then it would be fair to assume that each HLS is equally likely to occur. However, if the number of HLS is not sufficiently large, as in the PJM proposal, the probability of occurrence of each HLS must be estimated so that the impact of any potential outlier HLS is properly assessed. PJM is proposing to estimate the probability of occurrence of each HLS through the following procedure:
  - i. Gather the monthly peak load values produced by the weather scenarios (~300 scenarios) used in the PJM load forecast process. These weather scenarios are derived using weather data from the most recent ~20 years.
  - Calculate the summer and winter peaks for each of the ~300 weather scenarios, then use cluster analysis (k-means algorithm, specifically) to group the weather scenarios represented by pairs (summer peak, winter peak) into a limited set of clusters. The result of this step provides information such as: there are X% of

the  $\sim$ 300 weather scenarios in a cluster C that is representative of extreme summer peaks and extreme winter peaks.

- iii. Determine the summer and winter peaks in the HLS. For instance, if there are 8 HLS, there will be 8 pairs (summer peak, winter peak).
- iv. For each pair in the previous step, determine the most representative cluster based on the summer and winter peak values. For instance, if year 1 has an HLS with an extreme summer peak and an extreme winter peak, then the year 1 HLS is representative of the cluster C with extreme summer and extreme winter peaks. The probability assigned to year 1 is P1%, which is the share of weather scenarios in cluster C with an extreme summer peak and an extreme winter peak (out of the ~300 weather scenarios).
- c) <u>Variability for each HLS</u>. In addition to the HLS and the probabilities associated with them, it is necessary to model some variability around the HLS. The reason for this is illustrated via the following example: when an HLS is identified as representative of a cluster C with extreme summer and winter peaks, it cannot be assumed that the specific HLS is the only way in which a year with extreme summer and winter peaks can materialize. Instead, there are possible variations around the HLS that are also representative of the cluster. This component is concerned with deriving those possible variations. The derivation process employs the cluster's monthly peak load values produced by the weather scenarios used in the PJM load forecast process. For instance, if the HLS for year 1 is representative of cluster C are used to derive the variability for the year 1 HLS. The procedure to derive the variability is as follows:
  - i. Identify the monthly peaks from the weather scenarios in the cluster that the HLS is representative of.
  - ii. Using the 12 monthly peak load values from the representative cluster's weather scenarios, determine the parameters of a multivariate normal distribution. A multivariate normal distribution is used instead of a normal distribution to account for correlation between monthly peak loads.
  - iii. Using Monte Carlo sampling and the multivariate normal distribution, derive 1,000 variation scenarios for each of the HLS. These variations are the Hourly Load Scenarios for each HLS.
- 15. Modeling Resource Performance Uncertainty in the ELCC methodology entails deriving the hourly output of each resource associated with each Hourly Load Scenario. The procedure to derive the hourly output differs by resource category and/or resource class.
  - a. <u>Unlimited Resources</u>. Though Unlimited Resources are not the focus of the ELCC methodology calculation (because there are adequate rules to calculate the UCAP of such resources), their patterns of availability and unavailability must be modeled to capture their impact on the occurrence of system reliability issues. The metrics that are

key to model these availability/unavailability patterns are the Effective Equivalent Forced Outage Rate - Demand ("EEFORd"), the Equivalent Planned Outage Factor ("EPOF"), and the Equivalent Maintenance Outage Factor ("EMOF"). Jointly, these metrics capture all the types of outages that Unlimited Resources experience. From the EEFORd metric, two additional metrics can be derived for each unit: the Mean Time to Failure ("MTTF") and the Mean Time to Repair ("MTTR"). PJM is proposing to calculate these metrics for each unit based on historical Generator Availability Data System ("GADS") data from the most recent 5-year period prior to running the ELCC methodology. PJM is also proposing to use Monte Carlo sampling to derive the availability/unavailability patterns related to forced outages and a deterministic scheduling algorithm to derive the availability/unavailability patterns related to planned and maintenance outages. Five assumptions underlie the Unlimited Resources modeling: (i) units can only experience full forced outages (i.e., partial outages are not explicitly modeled by the Monte Carlo sampling; they are captured, to some extent, in the MTTF and MTTR metrics); (ii) the time a unit is not on a forced outage is a random variable assumed to be exponentially distributed where the sole parameter of the distribution is the MTTF; (iii) the time a unit is on a forced outage is a random variable assumed to be exponentially distributed where the sole parameter of the distribution is the MTTR; (iv) the scheduling of planned outages and maintenance outages is performed taking into account the simulated load scenarios to reflect the fact that these types of outages largely do not occur during peak load periods; and (v) all of the above assumptions apply to the modeling used in all weeks of the year except the winter peak week; for the winter peak week, PJM is proposing to use the approach currently used in PJM's main resource adequacy study, the Reserve Requirement Study, that is intended to reflect the amount of concurrent outages that historically have occurred under winter peak conditions. Using the above modeling assumptions and principles, PJM will develop 1,000 scenarios for each of the HLS reflecting hourly availability/unavailability of Unlimited Resources.

b. Variable Resources. The focus of the ELCC methodology calculation includes Variable Resources. As noted earlier, ELCC is an appropriate methodology to calculate the Accredited UCAP value of ELCC Resources, such as Variable Resources, because it provides a means to simulate the performance of such resources during system reliability events while taking into account the fact that the penetration level of these resources may cause some of the system reliability events. As a direct consequence, the modeling of resource performance for Variable Resources in the ELCC model should strive to capture the relationship between the output of Variable Resources and load conditions in the system. As I describe above in paragraph 14, load uncertainty is captured in the ELCC model via the Hourly Load Scenarios, which are based on weather/load data from multiple historical years. PJM is proposing to derive Hourly Output Shapes ("HOS") for Variable Resources based on the historical actual and historical putative performance of the Variable Resources for the same set of historical years considered in the Hourly Load Scenarios creation. In this way, the historical relationship between the output of Variable Resources and load conditions in the system is not lost in the ELCC model. If there are N HLS based on N years' worth of weather/load data, then there are N HOS for each class belonging to the Variable

Resources category. The derivation of a class HOS for a historical weather year H is described by the following procedure:

- i. Calculate hourly actual metered output in MW and hourly actual Maximum Facility Output ("MFO") in MW from all units in the class that were classified as existing in year H.
- ii. Calculate hourly total putative output in MW and hourly putative MFO in MW from all units in the class that were classified as planned in year H.
- iii. Calculate the hourly total output in MW (by including actual and putative outputs) and hourly total MFO (associated with both actual and putative outputs).
- iv. For each hour, divide the hourly total output by the hourly total MFO. The result constitutes the HOS for historical weather year H.
- v. Multiply each of the HOS created in the previous step by the forecasted penetration level of the class (in MFO MW) for the future target delivery year.
- c. <u>Limited Duration Resources and Combination Resources</u>. Unfortunately, modeling the resource performance for Limited Duration Resources and Combination Resources cannot be directly based on historical performance (as is the case for Variable Resources). This is because: (i) these resource categories can vary their output based on system conditions, which is not necessarily the case for Variable Resources; and (ii) the simulated scenarios in the ELCC model are *based* on historical weather/load data and resource performance data for some resource categories, but they do not represent identical system conditions as those experienced historically. These circumstances demand that the resource performance modeling for Limited Duration Resources and Combination Resources in the ELCC model be based on a simulated dispatch, which should be reflective of the rest of system conditions (load, other resources' performance) simulated in the ELCC model. Due to software limitations and other complexities, PJM is not proposing to simulate an economic dispatch in the ELCC model. Instead, PJM is proposing a simulated dispatch that is governed by the following principles:
  - i. Consistency with the status quo for dispatching economic resources relative to Demand Resources (i.e., Pre-Emergency Load Response and Emergency Load Response). This entails that all economic resources (including Limited Duration Resources and Combination Resources) must be exhausted prior to deploying Demand Resources, through PJM's Pre-Emergency Load Response and Emergency Load Response Programs, to maintain Primary Reserves, and that load is not shed to maintain Primary Reserves.
  - ii. *Imperfect foresight*. This is to say that the simulated dispatch for Limited Duration Resources and Combination Resources at time t is not dependent on

the ELCC model's simulated system conditions in the future (e.g., at t + 1, t + 2, etc.). Choosing to follow this principle recognizes that making dispatch decisions at time t based on expected system conditions at future intervals is challenging due to the uncertainty surrounding the expected system conditions at future intervals.

- iii. Limited Duration Resources and Combination Resources are dispatched after Unlimited Resources and Variable Resources. This principle recognizes that to take advantage of the flexibility provided by Limited Duration Resources and Combination Resources, and thus maximize their reliability benefit to the PJM system, it is essential to dispatch these resources after Unlimited Resources and Variable Resources.
- iv. *Recognizing variability of resources within some ELCC Classes.* There are some classes in the Limited Duration Resources and Combination Resources category whose members (i.e., the individual units) exhibit heterogeneity in the parameters impacting their potential dispatch. Such classes, therefore, do not lend themselves to be modeled, for simulated dispatch purposes, in an aggregate fashion. An example of such class is Hydropower with Non-Pumped Storage. The members of this class, for instance, show a wide range of values for the parameter that describes how quickly they can replenish their storage component (this parameter is a function of hourly streamflow data and storage size).

In addition to *dispatching* resources, PJM is proposing a simulated dispatch algorithm that also includes simulating the charging or charging-equivalent process whereby Limited Duration Resources and Combination Resources replenish their storage components. The procedure to derive the simulated dispatch for Limited Duration Resources and Combination Resources applied to each hour in each ELCC Scenario is the following:

- i. Calculate the *Margin Threshold* as total available resources prior to dispatching Limited Duration Resources and Combination Resources minus load.
- ii. Calculate the *Estimated Installed Capacity ("ICAP") Threshold* as the estimated total ICAP of Limited Duration Resources and Combination Resources minus the targeted Primary Reserves assumed to be provided by Limited Duration Resources and Combination Resources.
- iii. Calculate the *Dispatch Threshold* as the absolute value of the *Margin Threshold* minus the *Estimated ICAP Threshold*.
- iv. If the *Margin Threshold* is greater than zero, charging for resources that require charging can proceed. However, the charging can only occur to the extent that the additional load in the system does not cause the *Margin Threshold* to be less than zero. PJM is proposing to recognize differences between classes within the

Limited Duration Resources and Combination Resources category regarding the charging or charging-equivalent process. This entails using hourly streamflow data to replenish the storage component of resources within the Hydropower With Non-Pumped Storage class, charging the storage component in closed-loop solar-storage resources only to the extent that the solar component can support that charging, and reflecting charging constraints on standalone storage resources and storage components in open-loop solarstorage resources.<sup>2</sup>

- v. If the *Margin Threshold* is less than zero, the Limited Duration Resources and Combination Resources are assigned a targeted dispatch. If the *Dispatch Threshold* is less than zero, Limited Duration Resources and Combination Resources are assigned to supply load commensurate with the full *Margin Threshold*. Demand Resources receive no assignment. If the *Dispatch Threshold* is greater than or equal to zero, Limited Duration Resources and Combination Resources are assigned to supply load commensurate with the *Estimated ICAP Threshold*. Demand Resources receive an assignment equal to the *Margin Threshold* minus *Estimated ICAP Threshold* (i.e., the portion of the margin that was not assigned to Limited Duration Resources and Combination Resources).
- vi. The previous step determines the load assignment for the entire Limited Duration Resources and Combination Resources category. The load assignment for each ELCC Classes within the category is determined based on a ratio which is calculated as that class's estimated ICAP divided by the estimated total ICAP of Limited Duration Resources and Combination Resources.
- vii. If a load assignment cannot be partially or fully supplied by an ELCC Class because of power or energy limitations, Demand Resources will receive the unsupplied portion of the assignment. If all Demand Resources are exhausted, the other ELCC Classes will receive the assignment based on an availability-derived order, from most-available class to less-available class.
- viii. For ELCC Classes that require specific modeling of the individual units in the Simulated Dispatch (e.g., Hydropower With Non-Pumped Storage), the load assignment received by the class will be further allocated to the individual units in the class based on the same logic described in vi and vii (the two immediately preceding steps).
- d. <u>Demand Resources</u>. Like Unlimited Resources, Demand Resources are not the focus of the ELCC methodology calculation (because there are adequate rules to calculate the UCAP of such resources), but their performance must be modeled to capture their impact on the occurrence of system reliability issues. The simulated dispatch of

<sup>&</sup>lt;sup>2</sup> Closed-loop solar-storage resources refer to resources configured such that the storage component cannot charge from the grid, only from the solar component. Open-loop solar-storage resources, on the other hand, are configured such that the storage component can charge from the grid.

Demand Resource takes into consideration the principles described above for the simulated dispatch of Limited Duration Resources and Combination Resources. In general, Demand Resources are the resources of last resort. Most of the Demand Resources in PJM are categorized as Firm Service Level ("FSL"). In simple terms, FSL means that Demand Resources, when dispatched, must reduce their megawatt consumption to a firm level, which is reflective of 50/50 (median) peak load conditions, regardless of their megawatt consumption at the time of the dispatch. For example, if all Demand Resources are dispatched to perform in hours H1 and H2, the total megawatts observed by PJM dispatchers at H1 and H2 may be different, even if there is 100% compliance from the Demand Resources in both hours. To capture this feature in the ELCC model, the amount of Demand Resources available to perform during each hour of the simulation is calculated as Nominated DR Value (a constant value for an entire delivery year) times F, where F is defined as the ratio of simulated hourly load (in MW) to 50/50 peak load (in MW).

16. The inputs described above are not technically *input* into the ELCC model. In fact, some of these inputs are actually calculated by the ELCC software itself prior to making the ELCC calculation. However, they can be classified as inputs in the sense that they are the drivers of the LOLE calculation and, in the end, the ELCC results.

#### Loss of Load Expectation ("LOLE") and ELCC Calculations

- 17. Before describing the mechanics of the LOLE and ELCC calculations, it is necessary to describe the calculation of the probability for each ELCC Scenario. As indicated in the "ELCC Inputs" section of this affidavit, there are 1,000 Hourly Load Scenarios for each HLS. Resource performance for all resource categories is then simulated for each of these load scenarios. If there are N HLS, then the total number of ELCC Scenarios is N times 1,000. The probability of each ELCC Scenario can be calculated by using the Probability for each HLS described in paragraph 14(b). For example, if the HLS based on year 1 has an associated probability equal to P1, then each of the 1,000.
- 18. As mentioned above, the ELCC methodology requires measuring reliability using a resource adequacy metric as well as a target value for that metric. PJM is proposing to use LOLE as well as the well-known resource adequacy LOLE criterion of 1-day-in-10 years (translated as 0.1 days per year when applied to a single year). These elements of the PJM proposal provide consistency with other parameters used in RPM and with PJM's planning standards.
- 19. In the ELCC simulation, a loss of load occurs when the hourly load is greater than the hourly output of all the resources considered available in the simulation. The PJM proposal considers calculating LOLE as follows:
  - a. For each ELCC Scenario, count the number of days in a year that include at least one hour of loss of load.

- b. Multiply the quantities from the previous step by the corresponding probability associated with each ELCC scenario (these probabilities were discussed in paragraph 17).
- c. Add up all the quantities calculated in the previous step. The result is the LOLE of the simulated system.
- 20. In its most general form, calculating the ELCC of a group of ELCC Resources requires simulating the system twice. The first simulation (General Case "Excluding") excludes the ELCC Resources; it only includes Unlimited Resources and Demand Resources. The second simulation (General Case "Including") includes the ELCC Resources in addition to the Unlimited Resources and Demand Resources. By means of shifting (up or down) peak load values (and the associated load scenarios), both cases are iteratively run until a LOLE of 0.1 days per year is achieved by each case. The mathematical difference between the peak load values is then calculated (Peak Load Value General Case "Including" minus Peak Load Value General Case "Excluding"). The result corresponds to the ELCC of the group of ELCC Resources, because this additional load can be served by the system due to the addition of the group of ELCC Resources, maintaining the same level of reliability (as measured by LOLE).
- 21. Applying the above general ELCC form to the PJM system produces ELCC results that are inconsistent with the UCAP values that PJM currently calculates for Unlimited Resources. For instance, using the general ELCC form results in an ELCC of less than 100% for a generation resource that performs perfectly without forced outages during an entire delivery year (8,760 hours). Clearly, this ELCC result is inconsistent with the UCAP value that PJM currently calculates for an Unlimited Resource with those characteristics (i.e., 100%).
- 22. To address the above inconsistency, PJM is proposing to perform a variation of the general ELCC methodology to calculate the ELCC of a group of ELCC Resources. The variation also considers simulating the system twice. The first simulation (PJM Case "Including") includes the ELCC Resources in addition to the Unlimited Resources and Demand Resources. The second simulation (PJM Case "Excluding") excludes the ELCC Resources, including Unlimited Resources, Demand Resources, and a variable amount of Perfect Generation (i.e., generation that is assumed to have no outages and no use limitations). The PJM Case "Including" is run until an LOLE of 0.1 days per year is achieved. At that point, the peak load value for the case is recorded. The PJM Case "Excluding" is then run by inputting the peak load value from the PJM Case "Including" and determining the amount of Perfect Generation necessary to add to the system in order to achieve an LOLE of 0.1 days per year. This added amount of Perfect Generation is the ELCC of the group of ELCC Resources. In other words, PJM is proposing to calculate ELCC by determining the amount of Perfect Generation that provides the same reliability benefit as that provided by the ELCC Resources under evaluation.

#### **ELCC Outputs**

- 23. The PJM proposal considers a hierarchical approach to ultimately determine the Accredited UCAP value of each ELCC Resource. At the top level of the hierarchy stands the ELCC Portfolio UCAP, which establishes the Effective UCAP value of the entire set of ELCC Resources under evaluation. The mid-level of the hierarchy belongs to the ELCC Class UCAP values. Each of these values establishes the Effective UCAP value for the entire set of resources that are members of an ELCC Class. The sum of the ELCC Class UCAP values must be equal to the ELCC Portfolio UCAP. Lastly, at the bottom of the hierarchy rests the Accredited UCAP values which establish the Effective UCAP value of each individual ELCC Resource. In general, the sum of the Accredited UCAP value of that ELCC Class.
- 24. The justification for the above hierarchical approach is rooted in what can be described as both a feature and a challenge of the ELCC methodology. ELCC is well equipped to assess the reliability value of an entire portfolio of resources, capturing the diversity benefit or lack thereof generated by the portfolio. Conversely, ELCC does not provide an unambiguous way to isolate ELCC Class UCAP values or an individual resource's Accredited UCAP value. This challenge notwithstanding, there are intuitive and consistent approaches to derive a good ELCC-based estimate of ELCC Class UCAP values or an individual resource's Accredited UCAP value. The PJM proposal considers one of those approaches.
- 25. PJM is proposing to first calculate the ELCC Portfolio UCAP value. This is an unambiguous value. It is produced by following the ELCC methodology as proposed by PJM and described in paragraph 22. This quantity is then allocated among ELCC Classes to determine ELCC Class UCAP values. The allocation process is a heuristic that requires multiple additional ELCC runs and generally includes the following steps:
  - a. For each ELCC Class, determine the ELCC of resources belonging to the ELCC Class in the absence of all other ELCC Classes (ELCC "First-In" runs).
  - b. For each ELCC Class, determine the ELCC of resources belonging to the ELCC Class in the presence of all other ELCC Classes (ELCC "Last-In" runs).
  - c. Use the ELCC results from the First-In and Last-In runs to allocate the ELCC Portfolio UCAP value and establish the ELCC Class UCAP values.
- 26. PJM is also proposing to allocate the ELCC Class UCAP values to each ELCC Resource to determine each resource's Accredited UCAP value based on an ELCC Resource Performance Adjustment heuristic that varies by ELCC Class.
- 27. The allocation heuristics described above are needed to derive an Accredited UCAP value for each ELCC Resource. They are not introduced arbitrarily by PJM. They are also designed to maintain consistency with the overall ELCC Portfolio UCAP result.

#### **Further Comments**

- 28. There are other supplemental assumptions underlying the ELCC methodology proposed by PJM. Transmission limitations are not explicitly modeled in the ELCC simulations. Instead, it is assumed that there are no transmission-related reliability issues within the PJM footprint. This assumption is also used in PJM's main resource adequacy study, the Reserve Requirement Study. The justification for it is the fact that PJM has a Regional Transmission Expansion Process ("RTEP"), with a look-ahead planning horizon of five years, which ensures that specific areas of the PJM footprint have the necessary transmission infrastructure to receive the required level of energy imports. Nevertheless, it is likely that some aspects of this RTEP process will need to change as the penetration level of ELCC Resources increases.
- 29. Also anchored in the above assumption is the fact that PJM is proposing to derive ELCC results based on a simulation for the entire PJM footprint, without making additional ELCC simulations targeted for specific areas of the footprint. It can be argued that if each specific area of the footprint has the transmission infrastructure necessary to support the required energy import levels, each area's expected loss of load patterns should be consistent with the loss of load patterns of the entire PJM Region. It follows then that there is no need for ELCC simulations targeted for specific areas of the footprint and that ELCC values based on region-wide runs should suffice.
- 30. Another assumption is the modeling of all Demand Resources in the ELCC simulations as having an annual capacity commitment, while in practice there are also two additional types: a Demand Resource that is a Summer-Period Capacity Performance Resource and Price Responsive Demand ("PRD"). Annual Demand Resources represent the bulk of the Demand Resources in the PJM footprint (approximately 8,000 MW); the other two types currently account and are expected to account for less than 1,000 MW (summer-period Demand Resources: ~300 MW, PRD: ~500 MW). Making this assumption implies the following: (i) the actual performance of PRD resembles that of annual Demand Resources during reliability events; (ii) the actual performance of summer-period Demand Resources resembles that of annual Demand Resources during summer reliability events; and (iii) the actual performance of the winter-only resources that are expected to pair with the summerperiod Demand Resources resembles that of annual Demand Resources during winter reliability events. Out of the three implications, the first two are rooted in actual practical considerations while the latter implication is adopted as a matter of simplicity (and has a negligible impact on the ELCC results).
- 31. An additional aspect (that is not necessarily an assumption) of the overall methodology so far unaddressed in this affidavit is the relationship between PJM's Reserve Requirement Study and the ELCC methodology. The Reserve Requirement Study models load uncertainty and resource performance uncertainty to calculate the parameter necessary to determine the Reliability Requirement (expressed in megawatts of Unforced Capacity) for each RPM Auction. This parameter is the Forecast Pool Requirement ("FPR"). In fact, the Reliability Requirement for a future delivery year is defined as the FPR times the median ("50/50") peak load forecast. Because the Reserve Requirement Study uses the LOLE criterion of 1-day-in-10 years, the FPR can be described as the level of Unforced Capacity

reserves above the median ("50/50") peak load forecast required to meet this LOLE criterion.

- 32. Evidently, there are many similarities between the Reserve Requirement Study and the ELCC methodology. Both studies model load and resource performance uncertainty at the PJM Region level and use the LOLE criterion of 1-day-in-10 years as the reliability standard. While the Reserve Requirement Study is concerned with calculating the reliability requirement for an auction, the ELCC is concerned with determining the megawatt valuation that ELCC Resources can offer into an auction to meet that reliability requirement. One could even make the argument that the FPR could be derived using one of the ELCC cases, as opposed to using the Reserve Requirement Study to derive it. PJM is exploring this option. However, as of today, PJM is proposing to be as consistent as possible in the assumptions input into the Reserve Requirement Study and the ELCC methodology, recognizing that the studies are run using different models (and software), and that these models have different specific input data requirements. Examples of this search for consistency include: the performance of energy-only resources is not modeled in either study (because such resources are not obligated to perform during system reliability events or at any other time for that matter), load uncertainty is modeled in both studies using the PJM load forecast as a key source and resource performance uncertainty for Unlimited Resources is modeled in both studies using PJM's Generator Availability Data System data from the most recent five-year period as a key source.
- 33. This concludes my affidavit.

#### UNITED STATES OF AMERICA BEFORE THE FEDERAL ENERGY REGULATORY COMMISSION

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**PJM Interconnection, L.L.C.** 

Docket No. ER21-\_\_\_-000

#### **VERIFICATION OF DR. PATRICIO ROCHA GARRIDO**

Dr. Patricio Rocha Garrido, being first duly sworn, deposes and states that he is the Dr. Patricio Rocha Garrido referred to in the foregoing document entitled "Affidavit of Dr. Patricio Rocha Garrido," that he has read the same and is familiar with the contents thereof, and that the testimony set forth therein is true and correct to the best of his knowledge, information, and belief.

Dated: October 28, 2020