

Capacity Market Enhancements – Resource Adequacy Analysis Enhancements

Problem / Opportunity Statement

The reliable supply of electric services within the PJM RTO depends on adequate and secure generation and transmission facilities. Resource Adequacy analysis focuses on the supply of electricity, specifically, the process of determining the amount of generating capacity required to:

- provide electrical energy to satisfy customer load, **especially during peak demand periods such as a heat wave or cold snap**
- ensure an acceptable level of generation system reliability – Adequacy

PJM is responsible for performing an annual study to calculate the amount of resource capacity that meets the defined reliability criteria. The objective of the study is to determine the amount of both, installed and accredited unforced capacity that the system requires to meet the RTO-wide resource adequacy criteria. Specifically, the study is performed for at least each of the next five Delivery Years.

Among the key parameters used in the study are two, legacy parameters that pre-date the competitive markets - the Capacity Benefit Margin (CBM) and the Capacity Benefit of Ties (CBOT). Recent events including PJM being a net exporter of energy during emergency events and decreasing capacity reserve margins create a situation to review the CBM and CBOT for their effectiveness and continued use.

Capacity Benefit Margin (CBM)

CBM is one of the “key parameters” used in the Resource Adequacy analysis. The transmission transfer capability preserved as CBM is intended to be used **only in times of emergency generation deficiencies**. The CBM is a reliability margin applied to the flowgate in the Available Transfer Calculation (ATC). CBM is only applied to firm ATC calculations where the PJM Region is the delivery point. PJM consistently applies CBM in planning and operations. For non-PJM flowgates, the PJM uses the CBM values provided by coordination entities for the ATC calculation on these flowgates.

Through the sharing of installed generating capacity via transmission interconnections, systems have relied on transmission import capability to reduce their required installed generating capacity necessary to provide reliable service to Network Customers. In order to ensure that PJM has the ability to import external generation for the purpose of serving Network Customers, a portion of the transfer capability will be set aside. CBM is set aside on paths based on the expected delivery of energy from entities with which the Transmission Provider has emergency energy agreements at the time of the Transmission Provider's forecast peak load. This capability, known as the Capacity Benefit Margin, is a reflection of the mutual benefit of interconnected operations and reservation of this margin allows a system to reduce its installed generating capacity below that which may have otherwise been required if transmission interconnections did not exist.

CBM is determined through the Transmission Planning Evaluation of Import Capability. This evaluation establishes the amount of emergency power that can be **reliably transferred** to the PJM Region from adjacent regions in the event of a PJM Region generation capacity deficiency. To determine the import transfer limit, several emergency scenarios are replicated and the limit represents a normalization of expected values. This transfer limit determines the PJM Region tie benefit that is subsequently used in calculating the PJM Region reserve requirement.

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Under NERC Energy Emergency Alert Level 2, the PJM dispatcher may request import energy over firm transfer capability set aside as CBM. If so, dispatch will waive any real-time operating timing and ramp requirements and document such actions in compliance with MOD-004-1.

The CBM is set at 3,500 MW (UCAP) per Schedule 4 of the PJM Reliability Assurance Agreement (RAA). Schedule 4 of the RAA also provides that periodically PJM, in consultation with the Members Committee, shall review and modify, if necessary, the CBM to balance **external emergency capacity assistance** and internal installed capacity reserves so as to minimize the total cost of the capacity reserves of the Parties, consistent with the Reliability Principles and Standards. PJM will reflect such modification prospectively in its development of the Forecast Pool Requirement for future Planning Periods

Capacity Benefit of Ties (CBOT)

The CBOT is a measure of the reliability value that World interface ties bring into the PJM RTO. The CBOT is the difference between an RRS run with a 3,500 MW CBM and an RRS run with a 0 MW CBM. The CBOT is directly affected by the PJM/World load diversity in the model (more diversity results in a higher CBOT) and the **availability of assistance in the World area**. The 2024 CBOT is set at 1.5% of the forecasted peak load.

CBOT is used in determining the Installed Reserve Margin (IRM). The IRM, expressed as a percentage, refers to the amount of installed capacity in the RTO in excess of the RTO's forecasted peak load for a future Delivery Year, which is required to meet the RTO-wide resource adequacy criteria after accounting for the Capacity Benefit of Ties as shown below. PJM reviews with stakeholders the CBOT prior to performing the annual ELCC/RRS

The CBOT value represents the actual **external emergency capacity assistance** used in the calculation of the Installed Reserve Margin and Forecast Pool Requirement. It is expressed as percent of forecasted peak load

$$IRM = \left[\left(\frac{\text{Total installed capacity in assumed resource portfolio}}{\text{Solved Simulated Annual Peak Load}} \right) - 1 \right] - \text{Capacity Benefit of Ties}$$

External Emergency Capacity Assistance History

Since the Polar Vortex in 2014 when PJM was a net importer during an emergency event and the implementation of Capacity Performance, PJM has been a net exporter during emergency events. There have been two major emergency events since the Polar Vortex, Winter Storm Elliott and Winter Storm Gerri where PJM was a net exporter of energy during most of those events.

Polar Vortex

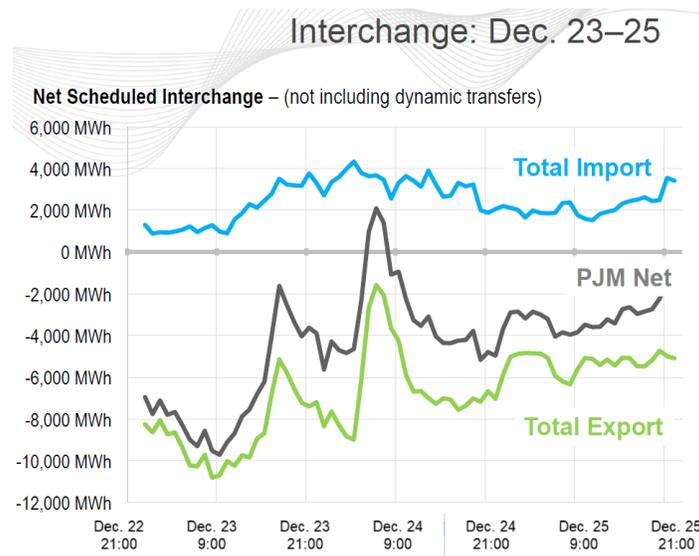
PJM was a net importer of energy during the Polar Vortex. However, in PJM's "Analysis of Operational Events and Market Impacts During the January 2014 Cold Weather Events" PJM notes "the amount of power imported is difficult for PJM to forecast and is not under PJM's control; therefore, PJM must schedule internal resources to ensure adequate generation is available".

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Winter Storm Elliott

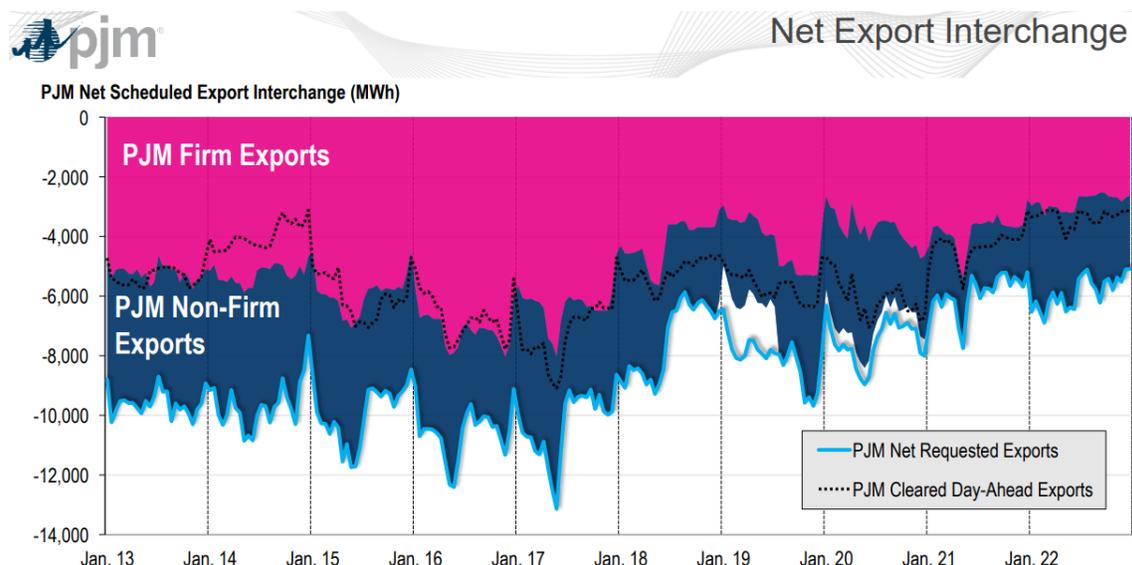
On both Dec. 23 and Dec. 24, 2022, PJM coordinated closely with its neighbors to maximize both firm and non-firm transfers. PJM provided emergency energy to adjacent systems as system conditions allowed on both Dec. 23 and Dec. 24 before eventually having to reduce exports in order to serve consumers within the PJM footprint. Transmission constraints also limited PJM's ability to support export transactions across the southern interfaces

As shown below, during Winter Storm Elliott (WSE), PJM began exporting to neighbors on PJM total exports began increasing and peaked on Dec. 23 at 9 a.m. at 10,811 MWh. There were only a few hours on the morning of Dec 24th that PJM imported energy.



Winter Storm Gerri

PJM was able to aid neighbors at the depth of cold snap, exporting nearly 10% of PJM's own needs. As shown below, PJM was a net exporter of energy during the entire Jan 13 thru Jan 22 event.



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PJM's Decreasing Reserve Margins

PJM's recent Base Residual Auction for 25/26 DY indicates tightening reserves margins. The 25/26 BRA cleared with reserve margin of 18.5% vs IRM of 17.8% (see below). Tightening BRA reserve margins means less energy to export.



Load Forecasting Enhancement

PJM has stated on several occasions that the Eastern Interconnection relies on mutual aid. The PJM exports shown above for Winter Storms Elliott and Gerri attest to PJM's commitment to provide mutual aid to the Eastern Interconnection during emergency events. Since PJM has been a net exporter of energy during the emergency events, and the source of the export energy is PJM generation, this export energy should be considered PJM "load" and PJM should consider including a certain amount of exports in the PJJ Load Forecast. This is especially important in light of the decreasing reserve margins in PJM.

[Separate but Related Issue – for consideration

As a net exporter of energy during emergency events, while exporting energy during CP events, PJM should consider pricing that energy at the Non-Performance Penalty Rate.]