RPM 301
Performance in Reliability Pricing Model
Disclaimer:

PJM has made all efforts possible to accurately document all information in this presentation. The information seen here does not supersede the PJM Operating Agreement or the PJM Tariff both of which can be found by accessing: http://www.pjm.com/documents/agreements/pjm-agreements.aspx

For additional detailed information on any of the topics discussed, please refer to the appropriate PJM manual which can be found by accessing: http://www.pjm.com/documents/manuals.aspx
Introduction
Agenda

• Overview of Resource Performance Assessments
• RPM Commitment Compliance
• Generation-specific Assessments
• Demand Resource-specific Assessments
• Energy Efficiency-specific Assessments
• Non-Performance Assessment
• Replacement Capacity
Objectives

At the conclusion of this training you will be able to . . .

- Describe the performance obligations of committed resources during the Delivery Year
- Describe the process for determining performance shortfalls
- Identify the penalty structure for committed resources that fail to perform
- Describe the requirements for specifying replacement capacity resources
Overview of Delivery Year Performance Assessments
Purpose of Delivery Year Performance Assessments

• Provide the means to assess whether or not a capacity resource honored their commitments and provided the expected reliability services during the Delivery Year

• Incent Capacity Market Sellers to perform through exposure to deficiency/penalty charges or potential credits for over-performance in certain types of assessments

• Provide Load Serving Entities (LSEs), who have paid for committed capacity resources, a reasonable assurance that such resources will perform at adequate levels during the Delivery Year

• Allow LSEs to receive a credit when committed resources fail to perform for certain types of assessments
<table>
<thead>
<tr>
<th>Year Range</th>
<th>Product Commitments</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016/2017-2017/2018</td>
<td>• Limited DR&lt;br&gt;• Extended Summer DR&lt;br&gt;• Annual&lt;br&gt;• Capacity Performance</td>
</tr>
<tr>
<td>2018/2019</td>
<td>• Capacity Performance&lt;br&gt;• Base&lt;br&gt;• Limited DR (FRR)&lt;br&gt;• Ext Summer DR (FRR)&lt;br&gt;• Annual (FRR)</td>
</tr>
<tr>
<td>2019/2020</td>
<td>• Capacity Performance&lt;br&gt;• Base</td>
</tr>
<tr>
<td>2020/2021 &amp; Beyond</td>
<td>• Capacity Performance</td>
</tr>
</tbody>
</table>
Assessments for Annual, Extended Summer Demand Resource (DR), and Limited DR Commitments

**Generation Resource**
- Commitment Compliance
- Peak Hour Period Availability*
- Generation Rating Test*
- Peak Season Maintenance Compliance**

**Demand Resource (DR)**
- Commitment Compliance
- Load Management Event Compliance
- Load Management Test Compliance

**Energy Efficiency Resource (EE)**
- Commitment Compliance
- Measurement & Verification Audit

* Not applicable to wind and solar resources
** Not applicable to hydro and intermittent resources
Assessments for CP & Base Commitments

**Generation Resource**
- Commitment Compliance
- Non-Performance Assessment
- Generation Rating Test*

**Demand Resource (DR)**
- Commitment Compliance
- Non-Performance Assessment
- Load Management Test Compliance

**Energy Efficiency Resource (EE)**
- Commitment Compliance
- Measurement & Verification Audit
- Non-Performance Assessment

* Not applicable to wind and solar resources
Applicability of Performance Assessments

• Resources with RPM Commitments
  – Resources that cleared in RPM Auctions
  – Resources that received make-whole payments
  – Resource specified as replacement resource
  – Resource specified as source of a Locational UCAP transaction

• Resources with FRR Commitments
  – Resources included in FRR Capacity Plan

Portions of the resource that do not have an RPM Commitment or FRR Capacity Plan Commitment during the Delivery Year are not subject to resource performance assessments and the associated deficiency/penalty charges.
Where Can I Find Commitment Level On My Capacity Resource?

Resource Detail screen in eRPM system provides RPM Non-CP Committed MWs, FRR Non-CP Committed MWs, RPM CP Committed MWs, & FRR CP Committed MWs on a resource for a single day in the Delivery Year.

For 16/17 & 17/18 DY:
RPM Non-CP = Annual, Ext Sum, or Limited
FRR Non-CP = Annual, Ext Sum, or Limited

For 18/19 DY:
RPM Non-CP = Base
FRR Non-CP = Annual, Ext Sum, or Limited

For 19/20 DY:
RPM Non-CP = Base
FRR Non-CP = Base
RPM Commitment Compliance
RPM Commitment Compliance is evaluated each day during the Delivery Year on a resource-specific basis to determine if a Resource Provider has enough unforced capacity value to satisfy their Daily RPM Resource Commitments on their generation resources, demand resources, or energy efficiency resources. RPM Commitment Compliance is not determined based on provider’s portfolio of resources (generation, DR, or EE) in a party’s eRPM account. RPM Commitment Compliance is evaluated separately for each resource in a provider’s eRPM account.
RPM Position

- RPM Position is the unforced capacity (UCAP) value of a resource that may be used to satisfy RPM UCAP commitments.
- RPM Position is compared to RPM UCAP commitments to determine if a commitment compliance shortfall results for the resource.
- RPM Position, commitments, and any resulting shortfall are determined on a daily basis throughout the Delivery Year.

<table>
<thead>
<tr>
<th>RPM Position (UCAP) =</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Generation</strong></td>
</tr>
<tr>
<td>(ICAP Owned - FRR ICAP Commitments - Unoffered ICAP)*(1-EFORD)</td>
</tr>
<tr>
<td><strong>Demand Resource</strong></td>
</tr>
<tr>
<td>(ICAP Owned - FRR ICAP Commitments) * DR Factor * FPR</td>
</tr>
<tr>
<td><strong>Energy Efficiency</strong></td>
</tr>
<tr>
<td>(ICAP Owned - FRR ICAP Commitments) * DR Factor * FPR</td>
</tr>
</tbody>
</table>

*DR Factor is eliminated effective with the 2018/2019 DY.*
### ICAP Owned

- ICAP Owned represents the amount of installed capacity a provider owns on the resource on a specific day in Delivery Year.
- Initial ICAP Owned may be adjusted for ICAP amounts transacted in approved unit-specific bilateral sales/purchases for such resource.

<table>
<thead>
<tr>
<th></th>
<th>Initial ICAP Owned</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Generation</strong></td>
<td>Based on provider’s approved Capacity Modifications representing the summer net dependable rating of the unit</td>
</tr>
<tr>
<td><strong>Demand Resource</strong></td>
<td>Based on total Nominated DR Value of a provider’s confirmed registrations in “completed” status linked to the Demand Resource in DR Hub</td>
</tr>
<tr>
<td><strong>Energy Efficiency</strong></td>
<td>Based on a provider’s EE Modifications submitted by PJM to represent the approved Nominated EE Value or CP value for Delivery Year</td>
</tr>
</tbody>
</table>
Seasonal Capacity Performance Impacts (Effective 2020/2021 DY)

- ICAP Value can be different in summer period (June-October & May of Delivery Year) than in non-summer period (November-April of DY)

- Intermittent or Environmentally Limited Resources may have requested and received additional winter Capacity Interconnection Rights resulting in higher ICAP value in non-summer period.

- Nominated DR Value in summer period based on Peak Load Contribution (PLC) and Nominated DR Value in non-summer period based on PLC and Winter Peak Load.

- EE Resource is assigned a Nominated EE Value in summer period and Capacity Performance Value in non-summer period.
Nominated DR Value calculations for CP registration

**FSL Customer**

- Nominated DR Value = lesser of: (a) PLC – [Summer FSL * loss factor] or (b) [Winter Peak Load * Winter Weather Adjustment Factor – Winter FSL] * loss factor
- Nominated DR Value effective for entire DY

**FSL Customer**
(Effective 2020/2021 DY)

- Nominated DR Value for summer-period = PLC-[Summer FSL * loss factor]
- Nominated DR Value for non-summer period = lesser of: (a) PLC – [Summer FSL * loss factor] or (b) [Winter Peak Load * Winter Weather Adjustment Factor – Winter FSL] * loss factor
- If registration indicates Summer-Period DR Only, Nominated DR Value for non-summer period = 0

**GLD Customer**

- Nominated DR Value = lesser of: (a) summer GLD amount * loss factor or (b) winter GLD amount * loss factor
- Nominated DR Value effective for entire DY
- Nominated DR Value shall not exceed PLC

**GLD Customer**
(Effective 2020/2021 DY)

- Nominated DR Value for summer-period = summer GLD amount * loss factor
- Nominated DR Value for non-summer period = lesser of: (a) summer GLD amount * loss factor or (b) winter GLD amount * loss factor
- If registration indicates Summer-Period DR Only, Nominated DR Value for non-summer period = 0
- Nominated DR Value for both summer & non-summer period shall not exceed PLC

**CSP** determines Winter Peak Load based on customer’s peak load between hours ending 7:00 EPT through 21:00 EPT on each of PJM defined 5CP days from December through February two Delivery Years prior to the DY for which registration is submitted.
- PJM calculates and posts Zonal Winter Weather Adjustment Factor.
How Does a Generation Resource Fail RPM Commitment Compliance?

A generation resource’s failure to meet its daily RPM Resource Commitments may be due to the following reasons:

- Unit cancellation
- Unit delay
- Unit derating (decrease in summer ICAP rating)
- Unit retirement
- Unit EFORd increase
RPM Commitment Compliance - Generation

- Final UCAP value for RPM purposes (i.e., RPM Position) will first be assigned to satisfy RPM CP commitments prior to any remaining UCAP value being assigned to satisfy RPM non-CP commitments.

- Based on these assignments, PJM will determine a commitment compliance shortfall due to CP commitments and/or commitment compliance shortfall due to non-CP commitments.
### Example of Commitment Compliance Shortfall for Generation Resource

<table>
<thead>
<tr>
<th>Gen Resource</th>
<th>DY EFORd</th>
<th>Owned (ICAP MW)</th>
<th>FRR Commitments (ICAP MW)</th>
<th>Unoffered (ICAP MW)</th>
<th>RPM Position (UCAP MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEN1</td>
<td>0.05</td>
<td>300</td>
<td>100</td>
<td>0</td>
<td>190</td>
</tr>
</tbody>
</table>

RPM Position (UCAP) = (ICAP Owned-FRR ICAP Commitments-Unoffered ICAP)* (1-EFORd)
RPM Position (UCAP) = (300-100-0) x (1- 0.05)
RPM Position (UCAP) = 190 MW

RPM Position MWs first assigned to satisfy CP commitments prior to any remaining MWs being assigned to satisfy non-CP commitments

<table>
<thead>
<tr>
<th></th>
<th>UCAP Commitments (UCAP MW)</th>
<th>Assigned MWs from RPM Position (UCAP MW)</th>
<th>RPM Commitment Compliance Shortfall (UCAP MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP</td>
<td>160</td>
<td>160</td>
<td>0</td>
</tr>
<tr>
<td>Non-CP</td>
<td>40</td>
<td>30</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>200</td>
<td>190</td>
<td>10</td>
</tr>
</tbody>
</table>

GEN1 is assessed a 10 MW non-CP commitment compliance shortfall
How Does a Demand Resource Fail RPM Commitment Compliance?

A demand resource’s failure to meet its daily RPM Resource Commitments may be due to the following reasons:

- Failure to have enough product-specific sites registered and approved in DR Hub prior to the start of the Delivery Year to support the commitments on the demand resource for such Delivery Year
  - Cancellation or delay of a planned load management program
  - Decrease in Peak Load Contribution (PLC) of end-use customer providing actual load response
  - Decrease in Winter Peak Load of end-use customer providing actual load response (Capacity Performance registrations only)

- Decrease in the DR Factor or FPR from the DR Factor or FPR that was used in the RPM Auction for which the demand resource cleared
RPM Commitment Compliance – Demand Resource

• Final UCAP value for RPM purposes (i.e., RPM Position) will be based on confirmed product-specific registrations in “completed” status linked to the product-specific Demand Resource in DR Hub
  – Effective 2020/2021 Delivery Year, a Capacity Performance Registration includes a Nominated DR Value for summer period and Nominated DR Value for non-summer period

• A product-specific commitment compliance shortfall is determined for a product-specific Demand Resource
### Example of Commitment Compliance Shortfall for Demand Resource

Based on CP product registrations in “completed” status linked to the resource in DR Hub

<table>
<thead>
<tr>
<th>Demand Resource</th>
<th>ICAP Owned (ICAP MW)</th>
<th>FRR Commitments (ICAP MW)</th>
<th>DR Factor*</th>
<th>FPR</th>
<th>RPM Position (UCAP MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSP1 PECO DR CP</td>
<td>50</td>
<td>0</td>
<td>0.951</td>
<td>1.0952</td>
<td>52.1</td>
</tr>
</tbody>
</table>

RPM Position (UCAP) = (ICAP Owned – FRR ICAP Commitments) * DR Factor * FPR
RPM Position (UCAP) = (50 – 0) * 0.951 * 1.0952
RPM Position (UCAP) = 52.1 MW

<table>
<thead>
<tr>
<th>Commitment Type</th>
<th>UCAP Commitments (UCAP MW)</th>
<th>RPM Position (UCAP MW)</th>
<th>RPM Commitment Compliance Shortfall (UCAP MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP</td>
<td>55</td>
<td>52.1</td>
<td>2.9</td>
</tr>
</tbody>
</table>

**CP**

CSP1 PECO DR CP is assessed a 2.9 MW CP commitment compliance shortfall

*DR Factor eliminated effective with 2018/2019 Delivery Year.*
An energy efficiency resource’s failure to meet its daily RPM Resource Commitments may be due to the following reasons:

- Failure to demonstrate the Nominated EE Value or Capacity Performance Value in a Post-Installation EE M&V Report prior to DY
- Decrease in the DR Factor* or FPR from the DR Factor or FPR that was used in the RPM Auction for which such energy efficiency resource cleared

*DR Factor eliminated with the 2018/2019 Delivery Year
Nominated EE Value and CP Value of EE Resource

- Nominated EE Value is the average demand reduction during EE Performance hours
  - EE Performance Hours are defined as hours ending 15:00 through 18:00 EPT during all days from June 1 through August 31, inclusive, of such Delivery Year, that is not a weekend or federal holiday.

- CP Value is the average demand reduction during EE Performance Hours, not to exceed average demand reduction during winter performance hours.
  - Winter Performance Hours are hours ending 8:00 through 9:00 EPT and hours ending 19:00 through 20:00 EPT during all days from January 1 through February 28, inclusive, of such Delivery Year, that is not a weekend or federal holiday.

- The CP value may not be greater than the Nominated EE Value
RPM Commitment Compliance – Energy Efficiency

• Final UCAP Value for RPM purposes (i.e., RPM Position) is based on PJM approved Nominated EE Value or Capacity Performance value for such EE Resource from the Delivery Year Post-Installation M&V Report

<table>
<thead>
<tr>
<th></th>
<th>DY ICAP Owned set to:</th>
<th>Effective dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior to 2020/2021 DY</td>
<td>Nominated EE Value if not CP capable</td>
<td>Entire DY</td>
</tr>
<tr>
<td></td>
<td>Capacity Performance value if fully CP capable</td>
<td>Entire DY</td>
</tr>
<tr>
<td>Effective 2020/2021 DY</td>
<td>Nominated EE Value</td>
<td>June-October &amp; May of DY</td>
</tr>
<tr>
<td></td>
<td>Capacity Performance value</td>
<td>November – April of DY</td>
</tr>
</tbody>
</table>

• RPM Position will first be assigned to satisfy RPM CP commitments prior to any remaining UCAP value being assigned to satisfy RPM non-CP commitments

• Based on these assignments, PJM will determine a commitment compliance shortfall due to CP commitments and/or commitment compliance shortfall due to non-CP commitments
Example of Commitment Compliance Shortfall for Energy Efficiency Resource

RPM Position (UCAP) = (ICAP Owned – FRR ICAP Commitments) * DR Factor  * FPR
RPM Position (UCAP) = (75 – 0) * 1.0  * 1.0952
RPM Position (UCAP) = 82.1 MW

RPM Position MWs first assigned to satisfy CP commitments prior to any remaining MWs being assigned to satisfy non-CP commitments.

<table>
<thead>
<tr>
<th>EE Resource</th>
<th>ICAP Owned (ICAP MW)</th>
<th>FRR Commitments (ICAP MW)</th>
<th>DR Factor*</th>
<th>FPR</th>
<th>RPM Position (UCAP MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>XYZ PECO EE J16M17</td>
<td>75</td>
<td>0</td>
<td>1.0</td>
<td>1.0952</td>
<td>82.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UCAP Commitments (UCAP MW)</th>
<th>Assigned MWs from RPM Position (UCAP MW)</th>
<th>RPM Commitment Compliance Shortfall (UCAP MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP</td>
<td>85</td>
<td>82.1</td>
</tr>
<tr>
<td>Base</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>95</td>
<td>82.1</td>
</tr>
</tbody>
</table>

XYZ PECO EE J16M17 is assessed a 2.9 MW CP commitment compliance shortfall and 10 MW Base (non-CP) commitment compliance shortfall.

*DR Factor eliminated effective with 2018/2019 Delivery Year.
Capacity Resource Deficiency Charges

Daily Capacity Resource Deficiency Charge =

- Daily Capacity Resource Deficiency Charge is assessed daily to provider with positive RPM product-specific commitment shortfall on a delivery day.

- Provider’s Weighted Average Resource Clearing Price (WARCP) for a resource is based on product-specific commitments.
  - WARCP is determined by calculating the weighted average of product-specific resource clearing prices for such resource, weighted by a provider’s product-specific cleared and make-whole MWs for such resource.

- If a provider’s product-specific WARCP for such resource is $0/MW-day, a PJM product-specific WARCP in the LDA is used.
  - PJM product-specific WARCP is determined by calculating the weighted average product-specific resource clearing prices in the LDA across all RPM Auctions, weighted by the total product-specific cleared and make-whole MWS in the LDA.

* Daily Deficiency Rate (DDR) = Provider’s Weighted Average RCP + Higher of (20% * provider’s Weighted Average RCP OR $20/MW-day)
## Example of Product-Specific Daily Deficiency Rate

<table>
<thead>
<tr>
<th>MAAC Resource</th>
<th>Product-type</th>
<th>BRA MWs Cleared (UCAP MWs)</th>
<th>BRA RCP ($/MW-day)</th>
<th>1st IA MWs Cleared (UCAP MWs)</th>
<th>1st IA RCP ($/MW-day)</th>
<th>Total Commitments (UCAP MWs)</th>
<th>Product-specific WARCP ($/MW-day)</th>
<th>Product-specific DDR ($/MW-day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEN X</td>
<td>Base</td>
<td>20</td>
<td>$149.98</td>
<td>5</td>
<td>$22.51</td>
<td>25</td>
<td>$124.49</td>
<td>$149.39</td>
</tr>
<tr>
<td></td>
<td>CP</td>
<td>100</td>
<td>$164.77</td>
<td>0</td>
<td>$27.15</td>
<td>100</td>
<td>$164.77</td>
<td>$197.72</td>
</tr>
<tr>
<td></td>
<td></td>
<td>120</td>
<td></td>
<td>5</td>
<td></td>
<td>125</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Base WARCP = [(20* $149.98/MW-day)+(5 MW *$22.51/MW-day)]/25 MW = $124.49/MW-day  
Base DDR = $124.49/MW-day + (0.2*$124.49/MW-day) = $149.39/MW-day  

Any Base commitment shortfalls will be assessed at **Base DDR of $149.39/MW-day**

CP WARCP = [(100* $164.77/MW-day)+(0 MW *$27.15/MW-day)]/100 MW = $164.77/MW-day  
CP DDR = $164.77/MW-day + (0.2*$164.77/MW-day) = $197.72/MW-day  

Any CP commitment shortfalls will be assessed at **CP DDR of $197.72/MW-day**
Settlement of Capacity Resource Deficiency Charges

• Charges are assessed daily and billed weekly

• Charges are allocated on a pro-rata basis to those LSEs who were charged a Daily Locational Reliability Charge based on their Daily UCAP Obligation

• The Resource Provider still receives Daily RPM Auction Credit for the deficient resource
Generation-Specific Performance Assessments
Generation-Specific Performance Assessments

**Generation Resource with Annual Product-Type Commitments**

- Commitment Compliance
- Peak Hour Period Availability*
- Generation Rating Test*
- Peak Season Maintenance Compliance**

**Generation Resource with CP or Base Commitments**

- Commitment Compliance
- Non-Performance Assessment
- Generation Rating Test*

* Not applicable to wind and solar resources
** Not applicable to hydro and intermittent resources
ICAP Commitment Level Used in Generation-Specific Performance Assessments

• Since RPM Resource Commitments or FRR Capacity Plan Commitments on a unit can vary daily throughout the delivery year, a **Total Unit ICAP Commitment Amount** is calculated for each unit.

• **Total Unit ICAP Commitment Amount** is used as the basis for assessing the performance of a unit for Peak-Hour Period Availability, Generation Rating Test, and PSM Compliance.
Total Unit ICAP Commitment Amount

Total Unit ICAP Commitment Amount (TUICA) = the lesser of:

- Unit Average Daily ICAP Commitment for DY
- Maximum Summer Net Dependable Rating of Unit During DY

- Considers both RPM & FRR Commitments
- Includes Annual commitments & excludes CP commitments for purposes of determining TUICA for Peak Hour Period Availability and Peak Season Maintenance Compliance
- Includes all product-type commitments for purposes of determining TUICA for Generation Rating Test
- For days in which unit’s Daily ICAP Commitment > Daily ICAP Owned, Daily ICAP Owned is used in determining Unit Average Daily ICAP Commitment for DY
## TUICA Example – Single Provider

<table>
<thead>
<tr>
<th>Provider</th>
<th>Resource</th>
<th>17/18 DY ICAP Owned</th>
<th>17/18 DY EFORd</th>
<th>17/18 DY RPM Annual Commitment (UCAP MW)</th>
<th>17/18 DY RPM CP Commitment (UCAP MW)</th>
<th>17/18 DY FRR Annual Commitment (ICAP MW)</th>
<th>Max DY Summer Rating of Resource (ICAP MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company A</td>
<td>GEN2</td>
<td>200</td>
<td>0.05</td>
<td>75</td>
<td>25</td>
<td>100</td>
<td>200</td>
</tr>
</tbody>
</table>

### TUICA for Peak-Hour Period Availability & PSM Compliance:

**Unit Avg Daily ICAP Commitment** =

$$\frac{75 \text{ MW UCAP}/(1-0.05)\times365 \text{ days} + 100 \text{ MW ICAP} \times365 \text{ days}}{365 \text{ days}} = 178.9 \text{ MW}$$

**TUICA** = lesser of (Unit Avg Daily ICAP Commitment, Max DY Summer Rating) = **178.9 MW**

### TUICA for Generation Rating Test:

**Unit Avg Daily ICAP Commitment** =

$$\frac{100 \text{ MW UCAP}/(1-0.05)\times365 \text{ days} + 100 \text{ MW ICAP} \times365 \text{ days}}{365 \text{ days}} = 205.3 \text{ MW}$$

**TUICA** = lesser of (Unit Avg Daily ICAP Commitment, Max DY Summer Rating) = **200 MW**
## TUICA Example – Multiple Providers

<table>
<thead>
<tr>
<th>Provider</th>
<th>Resource</th>
<th>17/18 DY ICAP Owned</th>
<th>17/18 DY EFORd</th>
<th>17/18 DY RPM Annual Commitment (UCAP MW)</th>
<th>17/18 DY RPM CP Commitment (UCAP MW)</th>
<th>17/18 DY FRR Annual Commitment (ICAP MW)</th>
<th>Max DY Summer Rating of Resource (ICAP MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company A</td>
<td>GEN3</td>
<td>200</td>
<td>0.05</td>
<td>100</td>
<td>0</td>
<td>100</td>
<td>500</td>
</tr>
<tr>
<td>Company B</td>
<td>GEN3</td>
<td>300</td>
<td>0.05</td>
<td>200</td>
<td>80</td>
<td>0</td>
<td>500</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>500</td>
<td>300</td>
<td>80</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

### TUICA for Peak-Hour Period Availability & PSM Compliance:

**Unit Avg Daily ICAP Commitment** =

\[
\frac{300 \text{ MW UCAP}/(1-0.05) \cdot 365 \text{ days} + 100 \text{ MW ICAP} \cdot 365 \text{ days}}{365 \text{ days}} = 415.8 \text{ MW}
\]

**TUICA** = lesser of (Unit Avg Daily ICAP Commitment, Max DY Summer Rating) = **415.8 MW**

### TUICA for Generation Rating Test:

**Unit Avg Daily ICAP Commitment** =

\[
\frac{380 \text{ MW UCAP}/(1-0.05) \cdot 365 \text{ days} + 100 \text{ MW ICAP} \cdot 365 \text{ days}}{365 \text{ days}} = 500 \text{ MW}
\]

**TUICA** = lesser of (Unit Avg Daily ICAP Commitment, Max DY Summer Rating) = **500 MW**
Provider’s Share of TUICA for PHPA & PSM Compliance

<table>
<thead>
<tr>
<th>Unit Level</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TUICA (for PHPA &amp; PSM Compliance)</td>
<td>415.8</td>
</tr>
<tr>
<td>Average Daily FRR ICAP Commitment</td>
<td>100.0</td>
</tr>
<tr>
<td>Average Daily RPM ICAP Commitment = TUICA – Avg Daily FRR ICAP Commitment</td>
<td>315.8</td>
</tr>
</tbody>
</table>

Allocated to Providers based on Provider’s share of unit’s RPM Non-CP/Base UCAP commitments

<table>
<thead>
<tr>
<th>Provider</th>
<th>DY RPM Annual Commitments (UCAP MW)</th>
<th>Share of RPM Annual Commitments</th>
<th>Avg Daily RPM ICAP Commitment (MW)</th>
<th>Avg Daily FRR ICAP Commitment (MW)</th>
<th>Provider’s Share of TUICA (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company A</td>
<td>100</td>
<td>.3333</td>
<td>105.3</td>
<td>100</td>
<td>205.3</td>
</tr>
<tr>
<td>Company B</td>
<td>200</td>
<td>.6666</td>
<td>210.5</td>
<td>0</td>
<td>210.5</td>
</tr>
<tr>
<td>Total</td>
<td>300</td>
<td></td>
<td>315.8</td>
<td>100</td>
<td>415.8</td>
</tr>
</tbody>
</table>
Peak Hour Period Availability
Peak Hour Period Availability (PHPA)

- Provides a means to assess whether committed generation resources are available at expected levels during critical peak periods

- Credits or charges resource providers to the extent that they exceed or fall short of that expected availability

- Applies to *generation resources committed as Annual product-type* with the exception of wind and solar resources

- Effective 2018/2019 Delivery Year, PHPA is no longer applicable to RPM commitments

- Effective 2019/2020 Delivery Year, PHPA is no longer applicable to FRR commitments
Peak-Hour Periods

- PJM measures generation availability performance during peak load periods
- The peak hour periods are defined based on summer and winter operating periods when high demand conditions are likely to occur
- Total number of hours is approximately 500 hours (can vary from year to year)

**Defined Peak-Hour Periods**

**Summer:** June through August, hours ending 15:00 LPT through hour ending 19:00 LPT, on non-holiday weekdays

**Winter:** January and February, hours ending 8:00 LPT through 9:00 LPT and hours ending 19:00 LPT through 20:00 LPT, on non-holiday weekdays
How is Peak-Hour Period Availability Measured?

Calculate and Compare for each unit:

- **Target Unforced Capacity (TCAP)**
  - Based on EFORd-5

- **Peak Period Capacity (PCAP)**
  - Based on EFORp

*If EFORp > EFORd-5, a unit PHPA shortfall results*
Equivalent Demand Forced Outage Rate (EFORd-5)

- EFORd-5 determined based on 5 years of outage data excluding OMC events through September 30 prior to the Delivery Year.

- Index similar to EFORd except that it is determined using 5 years instead of one year of outage data.

- Index calculated using GADs data.

- If unit does not have full 5 years of history, EFORd-5 will be calculated using class average EFORd and the available history.

- Class average EFORd will be used for a new generating unit.

- EFORd-5 is used to calculate Target Unforced Capacity.
Target Unforced Capacity (TCAP)

Target Unforced Capacity (TCAP) is calculated for each unit committed as Non-CP for RPM or FRR and is equal to:

\[ \text{TCAP} = \text{Total Unit ICAP Commitment Amount} \times (1 - \text{EFORd-5}) \]

TCAP is the “target” used to measure the peak period availability of capacity from the generator in the Delivery Year.
Peak Period Equivalent Forced Outage Rate (EFORp)

• Measure of the probability that a unit will not be available due to forced outages or forced deratings when there is demand on the unit to generate during the defined critical peak hours.

• EFORp determined using following sets of hours from the defined peak periods:
  – Forced outage hours when needed (outage hours exclude Outside Management Control (OMC) events)
  – Forced partial outage hours when needed (outage hours exclude OMC events)
  – Service hours

• “Outage hours when needed” determined by PJM by identifying hours during which the real-time LMP would have exceeded the cost-based offer for the unit or PJM would have (absent the outage) called the unit for operating reserves, taking into account the unit’s operating constraints.
Equivalent Peak Period Forced Outage Rate (EFORp)

\[
\text{EFORp} = \frac{\text{Forced Outage Hours When Needed}}{\text{Service Hours}} + \frac{\text{Equivalent Forced Partial Outage Hours When Needed}}{\text{Forced Outage Hours When Needed}}
\]

If service hours < 50 hours during the peak period, the EFORp will be set to the lesser of the calculated EFORp or the calculated EFORd (based on outage data that covers the entire Delivery Year).
EFORp Calculation Considerations

- If unit was assessed Generation Rating Test Failure Charge, partial forced outages entered by PJM for failing summer/winter capability test will not be considered in calculation of unit’s EFORp.

- During the time period that a unit is delayed or retired, forced outages are not reported on the unit and will not impact the unit’s EFORp.

- For a single-fueled, natural gas-fired unit, forced outages during winter peak-hour period are not used in determining the unit’s EFORp (or EFORd when service hours < 50 hours) if provider can demonstrate that outages were due to non-availability of gas to supply the unit as a result of Outside Management Control (OMC) events:
  - Lack of fuel in the cases where the operator of the unit is not in control of contracts, supply lines, or delivery of fuels is considered an OMC event.
Peak Period Capacity Available (PCAP) =

Total Unit ICAP Commitment Amount \( \times \) 1 - EFORp

The Delivery Year PCAP is compared with the TCAP established prior to Delivery Year to determine a unit Peak Hour Period Capacity Shortfall (i.e., PHPA Shortfall)
Unit Peak-Hour Period Capacity Shortfall

Peak-Hour Period Capacity Shortfall =

\[ \text{TCAP} - \text{PCAP} \]

- **Positive number** indicates under-performance
- **Negative number** indicates over-performance

- Limited to 50% of Total Unit ICAP Commitment Amount * (1 - DY EFORd)
- If 50% limitation is triggered in a DY, the limit will increase to 75% the following DY
- If 75% limitation is triggered in a DY, the limit will increase to 100% in the following DY
- The 50% limit will be reinstated after 3 years of good performance

*Estimates of unit’s EFORp and Peak-Hour Period Capacity Shortfall are provided in December of DY*
Net Peak-Hour Period Capacity Shortfalls

• For each Resource Provider, the net of their Peak-Hour Period Capacity Shortfalls in an LDA are determined.

• An LDA for which netting occurs is comprised of modeled LDAs that experience the same Resource Clearing Prices (Annual product-type) in RPM Auctions for the DY.

• The netting of shortfalls in an LDA is performed across committed units (committed as Annual product-type) within a single account in eRPM.

• There is no netting of shortfalls across multiple accounts in eRPM.

Peak-Hour Period Availability is determined on a unit-specific basis; however unit shortfalls are netted across committed units (committed as Annual product-type) in an eRPM account.
Use of Eligible Available Capacity to Adjust Shortfall

• Eligible available capacity (i.e., uncommitted capacity) in a provider’s account may be used to reduce a positive Net Peak-Hour Period Capacity Shortfall in LDA.

• Eligible available capacity represents the average amount of available capacity for the DY that meets the capacity resource obligations by satisfying:
  – Day-Ahead Energy Market offer requirements
  – Summer/winter capability test requirements
  – eDART and eGADS outage reporting requirements

• On day(s) where there was Performance Assessment Hour(s) that included such unit, eligible available capacity is set to 0 MW.

• An adjustment may not result in a negative or more negative Net Peak-Hour Period Capacity Shortfall in an LDA (representing over performance).
Adjusted Net Peak-Hour Period Capacity Shortfalls

- Adjusted Net Peak-Hour Period Capacity Shortfall in an LDA is separated into shortfall due to RPM commitments and shortfall due to FRR commitments.

- Resource Providers with a positive Adjusted Net Peak Period Capacity Shortfall in an LDA will be assessed a Peak-Hour Period Availability Charge for each day in the Delivery Year.

- Providers with a negative Adjusted Net Peak Period Capacity Shortfall in an LDA may share in the allocation of PHPA Charges.
Peak-Hour Period Availability Screen in eRPM

Data is not final until after the conclusion of the DY. An estimate of EFORp will be available in December of the DY.

Data for committed portion of unit

Data for eligible available portion of unit
Peak-Hour Period Availability Charge

Daily Peak-Hour Period Availability Charge =

Daily Peak-Hour Period Availability Charge Rate \times \text{Adjusted Net Peak Period Capacity Shortfall in LDA}

Different rate for shortfalls in LDA due to RPM commitments vs. shortfalls in LDA due to FRR Commitments

- Charges and Credits are assessed daily and billed retroactively for the entire Delivery Year by the August bill (issued in September) after the conclusion of the Delivery Year
# PHPA Charge Rate

<table>
<thead>
<tr>
<th>Adjusted Net PHPA Shortfall for:</th>
<th>PHPA Charge Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPM</td>
<td>Provider’s Weighted Average Resource Clearing Price (WARCP) in LDA ($/MW-day)</td>
</tr>
<tr>
<td></td>
<td>If Provider’s WARCP = $0/MW-day, then a PJM WARCP in LDA is used</td>
</tr>
<tr>
<td>FRR</td>
<td>Weighted average of resource clearing prices across all RPM Auctions for the LDA encompassing the zone of the FRR Entity, weighted by the quantities cleared in the RPM Auctions</td>
</tr>
</tbody>
</table>

Only cleared MWs/make-whole MWs of Annual (non-CPP) product-type and corresponding DY RCPs for generation resources (excluding solar and wind) are considered in the calculation of provider WARCP or PJM WARCP in LDA.
Allocation of PHPA Charges

Charges for RPM
Allocated to over-performing RPM Resource Providers
Capped at MW amount of over-performance times PHPA Charge Rate

Charges for FRR
Allocated to over-performing FRR Resource Providers
Capped at MW amount of over-performance times PHPA Charge Rate

Remaining Balance
Allocated to RPM LSEs assessed a Locational Reliability Charge and FRR Entities that over-performed
Allocated to LSEs based on Daily UCAP Obligations

DY PHPA Calculator posted on Capacity Market (RPM) web page to help estimate PHPA charges and credits.
Generation Rating Test
Summer & Winter Capability Testing

- During the DY, generation owners are responsible to perform Summer and Winter Net Capability Verification (i.e., Capability Testing) as described in PJM Manual 21 and submit test results through the eGADS system.
  - Solar and wind generation resources are exempt from testing requirement

- Purpose of net capability verification is to demonstrate the unit can achieve the claimed summer or winter net dependable rating of the unit

- PJM will use the results of the summer/winter net capability verification to assess whether a committed unit was able to achieve at least the Total Unit ICAP Commitment Amount (TUICA) in the summer/winter capability test
Testing Periods

- Summer/Winter Net Capability Verification must be performed during both the Summer and Winter testing periods.
- Data collected during summer verification window may be used to satisfy winter test requirements after adjustments to the appropriate ambient winter conditions.
- Hydro and pumped storage units must perform tests during the Summer test period.
- If entire unit is on a forced or planned outage during the entire summer or winter testing period, the unit is expected to submit an out-of-period capability test when the outage ends.
- Unlimited number of tests may be performed during each testing period; however, only one test result for each testing period is submitted in eGADs.

Testing Periods
Summer: June - August
Winter: December - February
Adequate Outage Reporting in eGADs

• Adequate outage reporting in eGADs can prevent the assessment of Generation Rating Test Failure Charge
  – Outage(s) in an amount of the difference between Claimed ICAP and temperature-corrected Test Result exists retroactive to start of test period and lasting until
    • Successful out-of-period test is conducted OR
    • Reduction in claimed ICAP of facility OR
    • Beginning of next test period
  – Outage(s) existed and were reported prior to the conduct of the test
Unit ICAP Shortfall

Unit ICAP Shortfall =

- Total Unit ICAP Commitment Amount*

+ Test Result (i.e., Corrected Net Test Capacity in eGADs)

+ Outage Adjustments reported

* If TUICA > Winter Rating, Winter Rating will be used in place of TUICA for the calculation of Unit ICAP Shortfall for winter testing period

- A positive number indicates a failure to certify the Total Unit ICAP Commitment Amount. (Underperform)
- A negative number indicates the Total Unit ICAP Commitment amount was exceeded. (Over perform)

Shortfalls are assessed on a unit-specific basis. There is no netting of shortfalls across the committed units in a provider’s eRPM account.
Allocation of Unit ICAP Shortfall

Allocated pro-rata based on provider’s share of TUICA

<table>
<thead>
<tr>
<th>Provider</th>
<th>Resource</th>
<th>17/18 DY EFORD</th>
<th>17/18 DY RPM Annual (non-CP) Commitment (UCAP MW)</th>
<th>17/18 DY RPM CP Commitment (UCAP MW)</th>
<th>17/18 DY FRR Annual (non-CP) Commitment (ICAP MW)</th>
<th>Avg Daily RPM ICAP Commitment (ICAP MW)</th>
<th>Avg Daily FRR ICAP Commitment (ICAP MW)</th>
<th>Provider’s Share of TUICA (ICAP MW)</th>
<th>Provider’s Share of TUICA (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company A</td>
<td>GEN3</td>
<td>0.05</td>
<td>100</td>
<td>0</td>
<td>100</td>
<td>105.2</td>
<td>100</td>
<td>205.2</td>
<td>41.0%</td>
</tr>
<tr>
<td>Company B</td>
<td>GEN3</td>
<td>0.05</td>
<td>200</td>
<td>80</td>
<td>0</td>
<td>294.8</td>
<td>0</td>
<td>294.8</td>
<td>59.0%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>300</td>
<td>80</td>
<td>100</td>
<td>400.0</td>
<td>100</td>
<td>500.0</td>
<td>100%</td>
</tr>
</tbody>
</table>
Daily Application of Unit ICAP Shortfall

**Unit ICAP Shortfall for Summer testing period**

Assessed daily for months of June – November of DY

**Unit ICAP Shortfall for Winter testing period**

*Can never be less than the Unit ICAP Shortfall for Summer testing period*

Applied daily for months of Dec – May of DY

**Example 1**

- **Daily Unit ICAP Shortfall for Summer** = 10 MW
- **Calculated Unit ICAP Shortfall for Winter** = 5 MW
  - **Daily Unit ICAP Shortfall for Winter** = 10 MW

**Example 2**

- **Daily Unit ICAP Shortfall for Summer** = 10 MW
- **Calculated Unit ICAP Shortfall for Winter** = 15 MW
  - **Daily Unit ICAP Shortfall for Winter** = 15 MW

- In case of hydro and pumped storage units, the Daily Unit ICAP Shortfall for Summer applies for entire DY.
Resource Provider with a positive Daily Unit ICAP Shortfall will be assessed a **Rating Test Failure Charge** =

\[
\text{Daily Deficiency Rate (DDR) } \times \text{ Daily Unit ICAP Shortfall } \times (1 - \text{ Final DY EFORd})
\]

- DDR applied to product-specific Daily Unit ICAP Shortfall for RPM = Provider’s product-specific Weighted Average Resource Clearing Price (WARCP) for such resource plus the higher of (0.2 * provider’s product-specific WARCP for such resource OR $20/MW-day)

- If provider’s product-specific WARCP is $0/MW-day, a PJM product-specific WARCP in an LDA will be used in the DDR

- DDR applied to product-specific Daily Unit ICAP Shortfall for FRR = 1.2 * product-specific weighted average resource clearing prices across all RPM Auctions for the LDA encompassing the zone of the FRR Entity, weighted by the product-specific quantities cleared in RPM Auctions
Rating Test Failure Charges and Credits

- Generation Resource Rating Test Failure Charges are assessed daily.
- Charges are allocated on a pro-rata basis to those LSEs who were charged a Daily Locational Reliability Charge based on their Daily UCAP Obligation.
- Charges and credits are billed retroactively for the entire Delivery Year in the June bill (issued in July) after the conclusion of the Delivery Year.
Peak Season Maintenance Compliance
Peak Season Maintenance (PSM) Compliance

- Peak Season Maintenance (PSM) Compliance is evaluated for generation resources that are committed to RPM or FRR Alternative

- Applies to generation resources with Annual product-type commitments with the exception of hydro and intermittent resources

- If the unit was not available due to a planned or maintenance outage that occurred without the approval of PJM during the defined Peak Season, a Resource Provider may be assessed a PSM Compliance Penalty Charge

- Effective 2019/2020 Delivery Year, PSM Compliance is no longer applicable

**PEAK SEASON**

Weeks containing the 24th through 36th Wednesdays of the calendar year. All weeks start on a Monday and end on Sunday, except the week with the 36th Wednesday ends on a Friday.
Unit PSM Compliance Shortfall

- If portions of unit were committed by multiple providers, a positive Unit PSM Compliance Shortfall is allocated to each provider based on the provider’s pro-rata share of the Total Unit ICAP Commitment Amount.

- Provider’s shortfall may be further allocated into shortfall due to RPM Annual-product type commitments versus shortfall due to FRR Annual product-type commitments.

Unit PSM Compliance Shortfall =

\[
\text{Summer Net Dependable Rating} \times \text{Amount of Capacity Out-of-Service}^* 
\]

*Includes unapproved planned or maintenance outage during Peak Season.
PSM Compliance Penalty Charge

Resource Provider with a positive Daily Unit PSM Compliance Shortfall will be assessed a **PSM Compliance Penalty Charge** =

- DDR applied to Daily Unit ICAP Shortfall for RPM = Provider’s Weighted Average Resource Clearing Price (WARCP) for such resource’s Annual commitments plus the higher of (0.2 * provider’s WARCP for Annual commitments OR $20/MW-day)

- If provider’s WARCP for Annual commitments = $0/MW-day, a PJM WARCP for Annual product-type in an LDA will be used in the DDR

- DDR applied to Daily Unit ICAP Shortfall for FRR = 1.2 * weighted average resource clearing prices for Annual (non-CP) product-type across all RPM Auctions for the LDA encompassing the zone of the FRR Entity, weighted by the Annual product-type quantities cleared in RPM Auctions.
PSM Compliance Penalty Charges & Credits

- PSM Compliance Penalty Charges are assessed daily for each day during the peak season that the resource is out-of-service on planned or maintenance outage not approved by PJM

- Charges are allocated on a pro-rata basis to those LSEs who were charged a Daily Locational Reliability Charge based on their Daily UCAP Obligation

- Charges and credits are billed retroactively in the June bill (issued in July) after the conclusion of the Delivery Year
Overview of Demand Resource-Specific Performance Assessments
Demand Resource-Specific Performance Assessments

Demand Resource with Limited, Extended Summer, or Annual product-type commitments
- Commitment Compliance
  - Load Management Event Compliance
  - Load Management Test Compliance

Demand Resource with CP or Base commitments
- Commitment Compliance
- Non-Performance Assessment
  - Load Management Test Compliance
Load Management Event Compliance
Load Management Event Compliance

• Curtailment Service Providers (CSPs) that have a Demand Resource with RPM Resource Commitments or FRR Capacity Plan Commitments of Limited, Extended Summer, and Annual product-type are subject to a compliance check performed after each PJM-initiated Load Management event that occurs for which registrations linked to the Demand Resource were dispatched.

• LM Event compliance is only applicable to Limited, Extended Summer, and Annual product-type registrations.

• LM Event compliance is not applicable to a Base or CP product-type registration, which is subject to Non-Performance Assessment.

• Effective 2019/2020 Delivery Year, Load Management Event Compliance is no longer applicable.
# Product Type Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Limited DR</th>
<th>Extended Summer DR</th>
<th>Annual DR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability</td>
<td>Any weekday, other than NERC holidays, during June – Sept. period of DY</td>
<td>Any day during June-October period and following May of DY</td>
<td>Any day during DY (unless on an approved maintenance outage during Oct. - April)</td>
</tr>
<tr>
<td>Maximum Number of Interruptions</td>
<td>10 interruptions</td>
<td>Unlimited</td>
<td>Unlimited</td>
</tr>
<tr>
<td>Hours of Day Required to Respond (Hours in EPT)</td>
<td>12:00 PM – 8:00 PM</td>
<td>10:00 AM – 10:00 PM</td>
<td>Jun – Oct. and following May: 10 AM – 10 PM Nov. – April: 6 AM- 9 PM</td>
</tr>
<tr>
<td>Maximum Duration of Interruption</td>
<td>6 Hours</td>
<td>10 Hours</td>
<td>10 Hours</td>
</tr>
<tr>
<td>Notification</td>
<td>Must be able to reduce load when requested by PJM All Call system within 30 minutes of notification unless an exception request for 60 or 120 minutes notification time is approved by PJM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Registration in DR Hub</td>
<td>Must register sites in Pre- Emergency or Emergency Load Response Program in DR Hub</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Response to zonal/sub-zonal dispatch</td>
<td>Response to zonal dispatch is mandatory for the product-type dispatched within the time period that the product-type is required to respond. Response to sub-zonal dispatch is mandatory if the sub-zone is defined and publicly posted the day before the event.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compliance</td>
<td>Must provide customer-specific compliance and verification information with 45 days after the end of month in which PJM-initiated LM event occurred.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Registration’s Compliance Position

**Registration Compliance Position =**

\[
\text{Nominated ICAP MWs in DR Hub} - \text{Actual Load Reduction for Event}
\]

- **Positive number** indicates under-compliance
- **Negative number** indicates over-compliance

- Nominated ICAP MWs is capped at registration’s MW share of linked Demand Resource’s RPM/FRR commitment on day of event

- Incremental load drop below zero (i.e., exported energy) is not included in the calculation of hourly load reductions

- A registration’s hourly load reductions are averaged over the hours the registration was dispatched to determine an Actual Load Reduction for an Event
  - Where PJM dispatched for at least 30 minute of the clock hour, PJM will measure compliance for partial dispatch clock hours based on a prorated commitment based on number of minutes dispatched during the clock hour. Alternatively, subject to PJM approval, a CSP may submit 1 minute load data for use in compliance calculations
Product Substitution

• CSP may use substitute registration(s) of a different product type to cover the commitment of non-performing registration that cannot respond to a PJM initiated LM event

• The substitute registration(s) and non-performing registration must:
  • Be located in the same geographic location (dispatch area)
  • Have comparable load reduction commitments
  • Have the same designated lead time

• Actual Load Reduction of substitute registration(s) is used in place of non-performing registration
Net CAA Compliance Position

• A CSP’s registration compliance positions will be totaled over all registrations dispatched in a Compliance Aggregation Area (CAA) to determine CSP’s Net CAA Compliance position

• A single Net CAA compliance position (under-compliance MWs or over-compliance MWs) will be determined for each CSP per event

• Net CAA under-compliance MWs will be allocated back to individual under-compliant registrations based on under-compliance ratio share

• Net CAA over-compliance MWs will be allocated back to individual over-compliant registrations based on over-compliance ratio share
Compliance Aggregation Area (CAA) is a geographic area of Zones or sub-Zones that are electrically-contiguous and experience for the Delivery Year, based on Annual RCPs, the same locational price separation in the BRA, in the 1st IA, in the 2nd IA, and the 3rd IA for the Delivery Year.

<table>
<thead>
<tr>
<th>CAA for 16/17 DY</th>
<th>Zones/sub-Zones</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rest of RTO</td>
<td>AEP, APS, COMED, DAY, DEOK, DLCO, DOM, EKPC</td>
</tr>
<tr>
<td>MAAC (excluding PS)</td>
<td>AE, DPL, JCPL, PECO, RECO, BGE, PEPCO, PENLC, METED, PPL</td>
</tr>
<tr>
<td>Rest of PS</td>
<td>Rest of PS</td>
</tr>
<tr>
<td>PS North</td>
<td>PS North</td>
</tr>
<tr>
<td>ATSI</td>
<td>ATSI</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CAA for 16/17 DY</th>
<th>Zones/sub-Zones</th>
</tr>
</thead>
<tbody>
<tr>
<td>BRA</td>
<td>Rest of RTO $59.37, Rest of MAAC $119.13, Rest of EMAAC $119.13, Rest of SWMAAC $119.13, Rest of PS $219.00, PS NORTH $219.00, DPL SOUTH $119.13, Rest of PEPCO $119.13, Rest of ATSI $114.23, ATSI-CLEVELAND $114.23</td>
</tr>
<tr>
<td>1IA</td>
<td>Rest of RTO $60.00, Rest of MAAC $119.13, Rest of EMAAC $119.13, Rest of SWMAAC $119.13, Rest of PS $244.22, PS NORTH $244.22, DPL SOUTH $119.13, Rest of PEPCO $119.13, Rest of ATSI $100.52, ATSI-CLEVELAND $100.52</td>
</tr>
<tr>
<td>2IA</td>
<td>Rest of RTO $31.00, Rest of MAAC $71.00, Rest of EMAAC $71.00, Rest of SWMAAC $71.00, Rest of PS $99.01, PS NORTH $212.53, DPL SOUTH $71.00, Rest of PEPCO $71.00, Rest of ATSI $101.50, ATSI-CLEVELAND $101.50</td>
</tr>
<tr>
<td>3IA</td>
<td>Rest of RTO $5.02, Rest of MAAC $10.02, Rest of EMAAC $10.02, Rest of SWMAAC $10.02, Rest of PS $54.76, PS NORTH $184.97, DPL SOUTH $10.02, Rest of PEPCO $10.02, Rest of ATSI $5.02, ATSI-CLEVELAND $5.02</td>
</tr>
</tbody>
</table>
Load Management Compliance Penalty charges are assessed daily for each day of the Delivery Year to those CSPs with committed registrations that under-complied during an event.

LM Compliance Penalty Rate depends on the time period in which the event is called.

Daily LM Event Compliance Penalty Charge =

- Event Under-Compliance MW for dispatched registration (in UCAP terms)
- LM Event Compliance Penalty Rate for dispatched registration ($/MW-day)

\[
\text{Daily LM Event Compliance Penalty Charge} = \text{Event Under-Compliance MW for dispatched registration} \times \text{LM Event Compliance Penalty Rate for dispatched registration}
\]
LM Event Compliance Penalty Rate

### On-Peak LM Compliance Penalty Rate ($/MW-day)

[Lesser of (1/actual number of on-peak events during the delivery year for dispatched registration, or 50%)] * CSP’s Weighted Daily Revenue Rate for dispatched registration ($/MW-day)

### Off-Peak LM Compliance Penalty Rate ($/MW-day)

1/52 * CSP’s Weighted Daily Revenue Rate for dispatched registration ($/MW-day)

- If CSP’s Weighted Daily Revenue Rate is $0/MW-day, a PJM weighted Daily Revenue Rate applicable to such dispatched registration is used.

- If a LM Event is comprised of both an On-Peak and Off-Peak Periods, the LM Event Compliance Penalty Charge will be the higher of the charges based on:
  
  (A) Under-compliance MWs * On-Peak LM Compliance Penalty Rate
  
  (B) Under-compliance MWs * Off-Peak LM Compliance Penalty Rate

**On Peak Hours**: Any weekday, other than NERC holidays, during June-Sept period of DY from 12 PM to 8 PM

**Off Peak Hours**: All days and hours outside of the above defined On Peak Hours
Settlement of LM Event Compliance Charges

- Event charges for dispatched registrations of the Limited DR product type are to be assessed daily for each day of the Delivery Year and initially billed the third billing month after the event occurs (e.g., June events included in September bill issued in October)
  - Initial billing reflects charges due from June 1 to last day reflected in initial monthly billing. Remaining charges for such event assessed daily and billed monthly for remainder of year

- Event charges for dispatched registrations of the Extended Summer and Annual DR product type to be assessed daily for each day of the Delivery Year and billed as a lump sum after conclusion of DY
  - Billed by later of (1) June following the DY or (2) third billing month following the last event

- Total Charges assessed for all events will be capped at Annual Revenues received by CSP in DY
Allocation of LM Event Compliance Penalty Charges

• Charges for an event are allocated on a pro-rata basis to those CSPs with committed registrations that were subject to such event compliance and provided load reductions in excess of the amount that they were obligated to provide.

• Allocation to each over-performing CSP registration shall not exceed for each registration the volume of over-compliant MWs provided during a single event times 0.2 times the registration’s Weighted Daily Revenue Rate.

• Remaining charges not allocated to over performing providers are allocated to LSEs based on LSE’s Daily UCAP Obligation.

• LM Event Compliance Penalty Credits for an event are allocated when charges are assessed and will have the same bill timing.
Load Management Test Compliance
LM Test Compliance

• In the absence of being dispatched for a PJM initiated LM Event or Emergency Action which triggers a Non-Performance Assessment, CSP’s registration(s) linked to a Demand Resource committed to RPM or FRR Alternative are subject to a CSP initiated LM test to determine if the registration(s) can honor their commitments and provide the promised level of load reduction.

• LM Test Compliance is applicable to registrations of all product types: Limited, Extended Summer, Annual, Base, CP (including Summer-Period DR - Effective 2020/2021 DY)
Testing Requirement

- CSP required to simultaneous test non-dispatched registrations of the same product type in the same zone for a one hour period during required testing hours and period

<table>
<thead>
<tr>
<th>Product</th>
<th>Testing Hours</th>
<th>Testing Period Non-Holiday, Weekday during:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limited</td>
<td>12:00 PM – 8:00 PM EPT</td>
<td>June 1 – September 30 of DY</td>
</tr>
<tr>
<td>Extended Summer Annual Capacity Performance Summer-Period DR</td>
<td>10:00 AM – 10:00 PM EPT</td>
<td>June 1 – October 31 and May of DY</td>
</tr>
<tr>
<td>Base</td>
<td>10:00 AM – 10:00 PM EPT</td>
<td>June 1 – September 30 of DY</td>
</tr>
</tbody>
</table>

- Notify PJM of intent to test 48 hours in advance
  - Test and retest notifications must be submitted in DR Hub

- No limit on the number of tests a CSP can perform
  - Only submit data for specific test that you want PJM to measure compliance
CSP notifies PJM of intent to test

CSP initiates LM Test

DR sites classified as Limited or Base DR reduce load

At the start time specified in the Notification

Testing Window

48 hrs prior to test

CSP submits test data in DR Hub

PJM determines test compliance. Under-compliance MWs in zone reported in eRPM

PJM bills LM Test Charges/Credit starting in Dec
Bill issued in Jan of DY

June

Sept

Oct

Nov 14

Jan

PJM©2017 04/20/2017
LM Resource Test Timeline – Annual, Extended Summer, CP, & Summer-Period DR

CSP notifies PJM of intent to test

CSP initiates LM Test

DR sites classified as Annual, Extended Summer, or CP DR reduce load

At the start time specified in the Notification

48 hrs prior to test

PJM determines test compliance. Under-compliance MWs in zone reported in eRPM

PJM bills LM Test Charges/Credit for Annual, Extended Summer, CP, & Summer-Period DR starting in Aug Bill issued in Sept after conclusion of DY

CSP submits test data in DR Hub.
## Capacity Performance & Summer-Period DR Testing (Effective 2020/2021 Delivery Year)

<table>
<thead>
<tr>
<th>CP Registration with</th>
<th>Not Dispatched for PAH during</th>
<th>Test Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher Nominated DR Value in Summer than non-Summer period</td>
<td>June-October &amp; May of DY</td>
<td>Test simultaneously with other non-dispatched CP registrations during testing period (June-October &amp; May of DY)</td>
</tr>
<tr>
<td>Summer-Period DR Only classification</td>
<td>June-October &amp; May of DY</td>
<td></td>
</tr>
<tr>
<td>Nominated DR Value in Summer = Nominated DR Value in non-Summer Period</td>
<td>Delivery Year</td>
<td></td>
</tr>
</tbody>
</table>
Re-Testing Provision

• If CSP failed to provide the required load reduction by product type in a zone by less than 25% of their Summer Average RPM Commitment by product type in a zone, the CSP can re-test the subset of failed product-specific registrations.

• Only registrations that have a reduction less than its Nominated ICAP in initial test are eligible to participate in the retest.

• CSP may elect to maintain the initial test result of a failed registration if CSP notifies PJM 48 hours prior to a retest.

Summer Average RPM Commitment =
Daily average of CSP’s total RPM/FRR commitments from June 1 through September 30 of DY for a product-type and zone.
Re-Testing Provision (Con’t.)

• If no election is made to maintain the initial test result, the retest must be performed for all resources (i.e., end-use customer sites) in the zone that failed the initial test

• Any resource affiliated with a failed resource must also participate in the re-test, even if it passed the initial test
  – Affiliated resources are resources that have ability to shift load and are owned or controlled by the same entity

• Re-test must be performed on comparable day (same time of day and under approximately the same weather conditions of original test)

• No limit on the number of re-tests a CSP can perform
  – Only submit data for specific re-test that you want PJM to measure compliance
Registration Compliance Position for Test

Registration Compliance Position =

- Method to measure actual hourly load reduction and determine a registration’s compliance position for a test is the same method used to measure LM event or Performance Assessment Hour (PAH) compliance.

- The registration’s Nominated ICAP MW value is capped at registration’s MW share of the linked Demand Resource’s Summer Average RPM Commitment as opposed to RPM Commitment on the day of event or PAH.

- If CSP is eligible for re-test provision and re-test data is submitted for a subset of failed registrations in zone, re-test data will be used in determining final load reduction for such registrations.
Net Testing Shortfall

• A CSP’s registration compliance positions will be totaled over all registrations of product-type in zone tested to determine **CSP’s Net Testing Shortfall for zone and product-type**

• A positive Net Testing Shortfall indicates under-compliance
Daily LM Test Failure Charge

Daily LM Test Failure Charge =

Net Testing Shortfall in zone for product-type (in UCAP terms) * Daily LM Test Failure Charge Rate

- Load Management Test Failure Charges are assessed daily for each day in Delivery Year to a CSP that under-complied in a zone for product-type tested

- Daily LM Test Failure Charge Rate = Provider’s Weighted Daily Revenue Rate in zone for product-type tested + greater of (0.20 * Provider’s Weighted Daily Revenue Rate in zone for product-tested, or $20/MW-day)

- If provider’s Weighted Daily Revenue Rate in zone for product-type tested = $0/MW-day, a PJM Weighted Daily Revenue Rate in zone for product-type tested is used
Changes for Seasonal CP (Effective 2020/2021 DY)

• Effective 2020/2021 DY, Net Testing Shortfall in zone may be separated into net testing shortfall in zone due to annual CP commitments and/or summer-period only CP commitments, as appropriate
  – Daily LM Charge Rate for annual CP commitments is based on Provider’s Weighted Daily Revenue Rate for annual CP commitments
  – Daily LM Charge Rate for summer-period only CP commitments is based on Provider’s Weighted Revenue Rate for summer-period only CP commitments

• Daily LM Test Failure Charge applies for each day of the Delivery Year for net testing shortfall in zone due to annual CP commitments

• Daily LM Test Failure Charge applies for June-October and May of Delivery Year for net testing shortfall in zone due on summer-period only CP commitments
Settlement of LM Test Failure Charges/Credits

• Limited & Base DR: Charges assessed daily and billed monthly; provided, however a lump sum payment is required to reflect amounts due, as a result of the testing failure, from the start of the DY to the day the charges are reflected in regular billing (December bill issued in January)

• Extended Summer, Annual, Capacity Performance & Summer-Period DR: Charges assessed daily and charged as a lump sum payment to reflect amounts due for the entire DY in the August bill issued in September after conclusion of the DY

• Charges are allocated on a pro-rata basis to those LSEs who were charged a Daily Locational Reliability Charge based on their Daily UCAP Obligation
Energy Efficiency-Specific Performance Assessments
Energy Efficiency-Specific Performance Assessments

- Energy Efficiency Resource with Annual product-type commitment
  - Commitment
  - Compliance
  - Measurement & Verification Audit

- Energy Efficiency Resource with CP or Base commitments
  - Commitment
  - Compliance
  - Measurement & Verification Audit
  - Non-Performance Assessment
DY Commitment Compliance for EE Resources

- RPM Commitment Compliance is assessed daily during the Delivery Year.

- If Final UCAP value of the EE Resource is not sufficient to support the product-specific commitments on EE Resource, a Daily Capacity Resource Deficiency Charge will be assessed for the product-specific shortfall, unless replacement capacity is specified.

- If an Measurement & Verification Audit conducted during the Delivery Year reveals a UCAP value of the EE resource that is less than the UCAP value supported by M&V data, a product-specific Daily Capacity Resource Deficiency Charge will be assessed for any incremental shortfall retroactively from the start of the Delivery Year.
M&V Audit

- PJM or independent third party may conduct a post-installation M&V Audit of the EE Resource, at the EE Resource Provider’s expense, prior to or during the DY.

- If Audit is performed and results finalized prior to start of DY, the Nominated EE Value and Capacity Performance Value confirmed by the Audit becomes the PJM approved Final Nominated EE Value or Capacity Performance value used to measure RPM Commitment Compliance during the DY.

- If Audit is performed and results finalized after the start of DY, the Nominated EE Value or Capacity Performance value confirmed by the Audit becomes the basis to determine if any incremental product-specific RPM Commitment Compliance Shortfall needs to be assessed retroactively from June 1 of DY to May 31 of DY.
M&V Audit Charge

• PJM will provide documentation regarding cost of audit no later than 2 months after completion of the audit

• M&V Audit Charges to be assessed no later than third billing month after completion of audit
Non-Performance Assessment
Non-Performance Assessment

• Purpose of Non-Performance Assessment is to evaluate the performance of committed capacity resources during emergency conditions

• Non-Performance Assessment is applicable to capacity resources with Base and Capacity Performance (CP) commitments

• Resources with Base or CP commitments that fail to perform are subject to Non-Performance Charge and resources (capacity or energy-only) that over-perform may be eligible for a Bonus Performance Credit
  – Base commitments are exposed to Non-Performance Charges only for under-performance during Emergency Actions in summer months of June – September
  – Base commitments are not subject to Non-Performance Charge, but are eligible for Bonus Performance Credit outside the summer months
Performance Assessment Hour

- Performance Assessment Hour (PAH) is delineated by PJM’s declaration of Emergency Actions.

- Emergency Actions shall mean any emergency action for locational or system-wide capacity shortages that either utilizes pre-emergency mandatory load management reductions or other emergency capacity, or initiates a more severe action.

- Performance is assessed for each hour (or partial hour) that PJM declares specific actions or warnings.

- Compare a resource’s Expected Performance against Actual Performance for each Performance Assessment Hour.
## Performance Assessment Hour Triggers

*(Steps 1-10 in Sections 2 and 5 of Emergency Procedures Manual 13)*

<table>
<thead>
<tr>
<th>Warnings</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot Weather Alerts and Cold Weather Alerts ARE NOT triggers</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pre-Emergency Load Management Reduction Action (30, 60 or 120 minute)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency Load Management Reduction Action (30, 60 or 120 minute)</td>
</tr>
<tr>
<td>Primary Reserve Warning</td>
</tr>
<tr>
<td>Maximum Generation Emergency</td>
</tr>
<tr>
<td>Emergency Voluntary Energy Only Demand Response Reductions</td>
</tr>
<tr>
<td>Voltage Reduction Warning</td>
</tr>
<tr>
<td>Curtailment of Non-Essential Building Load</td>
</tr>
<tr>
<td>Deploy All Resources Action</td>
</tr>
<tr>
<td>Manual Load Dump Warning</td>
</tr>
<tr>
<td>Voltage Reduction Action</td>
</tr>
<tr>
<td>Manual Load Dump Action</td>
</tr>
</tbody>
</table>

*(Section 5.7 of Emergency Procedures Manual 13)*

| Load Shed Directive |
The Emergency Procedures tool informs PJM members, PJM personnel and other interested parties about important and/or emergency events as they occur within the PJM Regional Transmission Organization (RTO).

When a Performance Assessment Hour (PAH) trigger occurs, Emergency Procedure has been designed to create banners and flags in the system to visually express this occurrence.

Users may sign up for email and/or text notification via Account Manager.
Performance Assessment Hour Flags

Message level PAH flag(s) made visible if:

1. The Emergency Procedures Event is a PAH trigger; AND
2. Emergency Procedures event is active (not canceled)

Performance Assessment Message – See Active PAH Guidance tab
PAH Area

- Non-Performance Assessment for a PAH will encompass all resources (capacity and energy only resources) located in area defined by Emergency Action

- Performance of Demand Resources in PAH Area will only be evaluated if dispatched

- If Emergency Action area is PJM-wide, then External Generation Capacity Resources and Net Energy Imports are included in the assessment
# Overview of Expected and Actual Performance for Summer and Non-Summer Performance Assessment Hours

<table>
<thead>
<tr>
<th>Resource Type</th>
<th>Product</th>
<th>Expected Performance</th>
<th>Actual Performance</th>
<th>Expected Performance</th>
<th>Actual Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Performance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Generation/Storage</td>
<td>Base</td>
<td>Committed UCAP * Balancing Ratio</td>
<td>Metered Energy Output + Reserve/Regulation Assignment</td>
<td>Committed UCAP * Balancing Ratio; 0 for Performance Shortfall calculation</td>
<td>Metered Energy Output + Reserve/Regulation Assignment</td>
</tr>
<tr>
<td>Demand Response</td>
<td>Capacity</td>
<td>Committed ICAP</td>
<td>Load Reduction + Reserve/Regulation Assignment</td>
<td>Committed ICAP</td>
<td>Load Reduction + Reserve/Regulation Assignment</td>
</tr>
<tr>
<td></td>
<td>Performance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demand Response</td>
<td>Base</td>
<td>Committed ICAP</td>
<td>Load Reduction + Reserve/Regulation Assignment</td>
<td>0</td>
<td>Load Reduction + Reserve/Regulation Assignment</td>
</tr>
<tr>
<td>Energy Efficiency</td>
<td>Capacity</td>
<td>Committed ICAP</td>
<td>PJM Approved Post-Installation Load Reduction</td>
<td>Committed ICAP</td>
<td>PJM Approved Post-Installation Load Reduction</td>
</tr>
<tr>
<td></td>
<td>Performance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy Efficiency</td>
<td>Base</td>
<td>Committed ICAP</td>
<td>PJM Approved Post-Installation Load Reduction</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Qualifying Trans. Upgrade</td>
<td>Capacity</td>
<td>Committed UCAP</td>
<td>Committed UCAP if In-Service; otherwise 0</td>
<td>Committed UCAP</td>
<td>Committed UCAP if In-Service; otherwise 0</td>
</tr>
<tr>
<td>(QTU)</td>
<td>Performance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy Only Resources</td>
<td>N/A</td>
<td>0</td>
<td>Metered Energy Output + Reserve/Regulation Assignment</td>
<td>0</td>
<td>Metered Energy Output + Reserve/Regulation Assignment</td>
</tr>
<tr>
<td>Energy Imports</td>
<td>N/A</td>
<td>0</td>
<td>Net Energy Import</td>
<td>0</td>
<td>Net Energy Import</td>
</tr>
</tbody>
</table>

Balancing Ratio = \( \frac{\text{Total Generation & Storage Actual Performance} + \text{Net PJM Energy Imports} + \text{DR Bonus Performance}}{\text{Total Generation & Storage Committed UCAP}} \)
Balancing Ratio

Balancing Ratio is used to calculate Expected Performance for generation resources for PAH and PAH area.

Balancing Ratio (BR) =

Total Actual Generation and Storage Performance + Net Energy Imports + DR Bonus Performance

All Generation and Storage Committed UCAP

• BR is capped at 1

• Ratio(s) is calculated for PAH Area(s) declared by the Emergency Action based on the issuance reason
  
  – If Pre-Emergency LM is issued for both PPL and PECO, then PAH area is the combination of PPL and PECO (i.e., PPL/PECO) for PAH
  
  – If Pre-Emergency LM is issued for PPL and Maximum Generation is issued for PECO for a different reason, then two different PAH areas and ratios are created for a PAH – PPL and PECO
Posting of Balancing Ratio

- PJM will post Balancing Ratio on Capacity Market (RPM) web page
  - Preliminary Balancing Ratio: post within two business days after a PAH occurs
    - Will not include the DR Bonus Performance value and retroactive replacements
  - Final Balancing Ratio: post with the issuance of the monthly bill
  - Posting format will be Excel
Performance Shortfall

Performance Shortfall for PAH & PAH Area =

\[
\text{Expected Performance} - \text{Actual Performance}
\]

- Evaluate performance and calculate shortfall/excess for each Performance Assessment Hour (PAH) and PAH Area separately
- Shortfall is classified as shortfall due to CP or Base commitments
- Shortfall subject to Non-Performance Charge
- Excess (Bonus Performance) may be eligible for Performance Credit

- Positive number indicates under-performance (shortfall)
- Negative number indicates over-performance (Bonus Performance)
Assignment of Actual Performance for Generation Resource with both CP and Non-CP Commitments

• For 2016/17 & 2017/18 Delivery Years, Actual Performance is first assigned to meet CP Expected Performance. Actual Performance above the resource’s CP Expected Performance will then be assigned to meet the resource’s Annual commitment with any remaining Actual Performance used for purposes of determining Bonus MWs.

• For 2018/19 & 2019/20 Delivery Years, If resource has both CP and Base commitments, Actual Performance is first assigned to meet CP Expected Performance followed by assignment to Base Expected Performance with any remaining Actual Performance used for purposes of determining Bonus MWs.
Assignment of Actual Performance

2016/17 & 2017/18 Delivery Years

- Bonus
- Annual Commitment (ICAP)
- CP Expected Performance (UCAP)

Actual Performance

2018/19 & 2019/20 Delivery Years

- Bonus
- Base Expected Performance (UCAP)
- CP Expected Performance (UCAP)

Actual Performance
CP and Annual Commitments – Example 1 (2016/17-2017/18 DYs)

<table>
<thead>
<tr>
<th>Unit UCAP = 100 MW</th>
<th>Balancing Ratio (BR) = 0.80</th>
<th>PAH Start at 0900</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP Commitment (UCAP) = 60 MW</td>
<td>Expected Performance = CP Commitment * BR</td>
<td>PAH Stop at 1000</td>
</tr>
<tr>
<td>Annual Commitment (ICAP) = 40 MW</td>
<td>Performance Shortfall = Expected - Actual</td>
<td>DY EFORd = 0</td>
</tr>
</tbody>
</table>

Scheduled/Dispatch = 90 MWh
Actual Performance (PwrMtr) = 90 MWh
Expected Performance = 48 MWh (60 MW * 0.8)

Performance Shortfall = 0 MWh
→ (48 Expected – 90 Actual = - 42 MWh)

Bonus Performance = 2 MWh
→ (90 Actual – 48 Expected – 40 Annual)
Scheduled/Dispatch = 90 MWh
Actual Performance (PwrMtr) = 90 MWh
CP Expected Performance = 48 MWh (60 MW * 0.8)
Base Expected Performance = 32 MWh (40 MW * 0.8)

Performance Shortfall = 0 MWh
\[ (48 \text{ CP Expected} + 32 \text{ Base Expected} - 90 \text{ Actual} = -10 \text{ MWh}) \]

Bonus Performance = 10 MWh
\[ (90 \text{ Actual} - 48 \text{ CP Expected} - 32 \text{ Base Expected}) \]
CP and Base Commitments – Example 3

<table>
<thead>
<tr>
<th>Unit UCAP = 100 MW</th>
<th>Balancing Ratio (BR) = 0.95</th>
<th>PAH Start at 0900</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP Commitment (UCAP) = 60 MW</td>
<td>Expected Performance = CP/Base Commitment * BR</td>
<td>PAH Stop at 1000</td>
</tr>
<tr>
<td>Base Commitment (UCAP) = 40 MW</td>
<td>Performance Shortfall = Expected - Actual</td>
<td>DY EFORd =0</td>
</tr>
</tbody>
</table>

Scheduled/Dispatch = 100 MWh
Actual Performance (PwrMtr) = 90 MWh
CP Expected Performance = 57 MWh (60 MW * 0.95)
Base Expected Performance = 38 MWh (40 MW * 0.95)

Performance Shortfall = 5 MWh
→ (57 CP Expected + 38 Base Expected – 90 Actual)
→ Shortfall applies only to Base Commitment
Exempt MWs for Generation Resources

- A generation resource’s positive Performance Shortfall may be adjusted downward due to Exempt MWs. Exempt MWs consist of:
  - Unavailable MWs associated with approved planned or maintenance outage during PAH
  - MWs for which resource was not scheduled to operate by PJM
  - MWs for which the resource was on-line but was scheduled down by PJM based on the determination by PJM that such scheduling action was appropriate to the security constrained economic dispatch of PJM region

- If resource was needed by PJM and would otherwise have been schedule by PJM to perform, but was not scheduled to operate, or was scheduled down solely due to (1) any operating parameter limitations submitted in resource’s offer or (2) submission of market-based offer higher than cost-based offer, then these MWs will not be considered exempted and will not result in downward adjustment of Performance Shortfall
Scheduled/Dispatch = 50 MWh
Actual Performance (PwrMtr) = 50 MWh
CP Expected Performance = 57 MWh (60 MW * 0.95)
Base Expected Performance = 38 MWh (40 MW * 0.95)

Performance Shortfall = 45 MWh
\[ (57 \text{ CP Expected } + 38 \text{ Base Expected } - 50 \text{ Actual}) \]
\[ 45 \text{ MWh is exempt since PJM only scheduled unit to 50} \]
Adjusted Performance Shortfall = 0 MWh
**Bonus Performance MWs**

- Resource with negative Performance Shortfall (Actual Performance > Expected Performance) may have Bonus Performance quantity and be eligible for Bonus Performance Credit.

- Actual Performance for purposes of calculating Bonus MW shall not exceed the MW level at which the resource was scheduled and dispatched by PJM during the Performance Assessment Hour.

- For self-scheduled generation resources not dispatchable by PJM, the Actual Performance will not exceed the LMP Desired MW value as calculated by PJM based upon the higher of the cost or price schedules submitted for the resource, and will be zero if the LMP Desired MW is less than the lowest point on the higher of the cost or price schedules submitted for the resource.
Scheduled/Dispatch = 90 MWh
Actual Performance (PwrMtr) = 95 MWh
CP Expected Performance = 51 MWh (60 MW * 0.85)
Base Expected Performance = 34 MWh (40 MW * 0.85)

Performance Shortfall = 0 MWh
→ (51 CP Expected + 34 Base Expected - 95 Actual = - 10 MWh)

Bonus Performance = 5 MWh
→ (90 Scheduled – 51 CP Expected – 34 Base Expected = 5 MWh)
→ Actual Performance was capped at level scheduled/dispatched
Actual Performance for Demand Resource

• For a dispatched registration in Emergency Action Area (i.e., PAH Area) for PAH:

  Actual Performance for a registration = Actual Load Reduction plus any real-time reserve or regulation assignment

• For a Demand Resource in Emergency Action Area for PAH:

  Actual Performance for Demand Resource = sum of the Actual Performance of dispatched registrations linked to such Demand Resource

• If Demand Resource is owned by multiple parties, the Actual Performance of a Demand Resource shall be allocated to owners of the Demand Resource based on ICAP ownership share to determine Capacity Market Seller’s Actual Performance for such Demand Resource
### Measurement of Actual Load Reduction (Effective 2017/2018 DY)

<table>
<thead>
<tr>
<th>PAH occurs during:</th>
<th>Actual Load Reduction (MW) =</th>
</tr>
</thead>
</table>
| **June-October & May of DY** | **FSL Customer** - PLC – [hourly metered load * loss factor]  
 **GLD Customer** - Lessor of (a) [Comparison load – hourly metered load] * loss factor or (b) PLC – [hourly metered load * loss factor]  
 *Summer load reduction only recognized if [hourly metered load * loss factor] < PLC* |
| **November – April of DY** | **FSL Customer** - [Winter Peak Load * Zonal Winter Weather Adjustment Factor * loss factor]-[hourly metered load * loss factor]  
 **GLD Customer** - Lessor of (a) [Comparison load – hourly metered load] * loss factor or (b) [Winter Peak Load * Zonal Winter Weather Adjustment Factor * loss factor]-[hourly metered load * loss factor]  
 *Non-summer load reduction only recognized if [hourly metered load * loss factor] < WinterPeak Load*Zonal Winter Weather Adjustment Factor * loss factor* |
Expected Performance for Demand Resource

• Expected Performance for DR for a PAH is equal to Capacity Market Seller’s committed capacity on Demand Resource in ICAP terms (i.e., load reduction quantity the resource committed to provide), adjusted to account for any linked registrations that were not dispatched by PJM

• Expected Performance for a Base commitment is zero during October – May of Delivery Year
Netting Performance for Demand Resources in EAA

• Capacity Market Seller’s Expected Performance minus Actual Performance establishes seller’s initial Performance Shortfall for Demand Resource

• Initial Performance Shortfalls for all Demand Resources in Emergency Action Area (EAA) are netted to determine a seller’s net EAA Performance Shortfall for a PAH

• Net positive EAA Performance Shortfall is allocated to seller’s Demand Resources in EAA that under-complied on pro-rata basis based on under-compliance MWs

• Net negative EAA Performance Shortfall is allocated to seller’s Demand Resources in EAA that over-complied on pro-rata basis based on over-compliance MWs
Performance Netting for Aggregate Resource

• Performance of an Aggregate Resource for a given PAH is based on the net of the performance of the individual underlying resources that were required to perform during the PAH (i.e. the resources located in the PAH area)

• The Non-Performance Charge Rate for an under-performing Aggregate Resource is based on the rate associated with the LDA in which the under-performing underlying resources are located weighted by the under-performance MW quantity of such resources

• The stop-loss of the Aggregate Resource is based on the Non-Performance Charge Rate associated with the LDA in which the Aggregate Resource was modeled in the RPM Auction
Aggregate Resource – Summer PAH Example

<table>
<thead>
<tr>
<th>Resource</th>
<th>LDA</th>
<th>Output (MW)</th>
<th>Expected Performance (MW)*</th>
<th>Actual Performance (MW)</th>
<th>Performance (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar</td>
<td>EMAAC</td>
<td>34</td>
<td>32</td>
<td>34</td>
<td>2</td>
</tr>
<tr>
<td>Wind</td>
<td>ComEd</td>
<td>5</td>
<td>10</td>
<td>5</td>
<td>-5</td>
</tr>
<tr>
<td>Aggregate</td>
<td>Rest of RTO</td>
<td></td>
<td></td>
<td></td>
<td>-3</td>
</tr>
</tbody>
</table>

- Aggregate Resource performance based on net performance of all underlying individual resources since all were located in PAH area.
- Aggregate Resource assessed Non-Performance Charge based on 3 MW under-performance at non-performance charge rate associated with ComEd LDA (100% weighting of the LDA associated with the non-performing underlying resource in this example).

*Expected Performance equals Balancing Ratio times Allocated Commitment MW on underlying resource
Non-Performance Charge

• Committed resource with a positive Performance Shortfall for PAH/PAH Area is subject to Non-Performance Charge =

\[
\text{Non-Performance Charge Rate ($/MWhr) } = \text{Performance Shortfall MW for PAH/PAH Area} \times \text{Non-Performance Charge Rate ($/MWhr)}
\]

• Non-Performance Charge Rate is based on yearly Net CONE (for CP commitments) or yearly Weighted Average Resource Clearing Price (for Base commitments) and a divisor (i.e., an assumed 30 Emergency Action hours per year)
Non-Performance Charge Rate

- Non-Performance Charge Rate for shortfall due to CP commitments ($/MWh) = [modeled LDA Net CONE ($/MW-day in ICAP terms) for which the resource resides * 365 days]/30
  - If LDA Net CONE = $300/MW-day, the Non-Performance Charge Rate = [$300/MW-day * 365 days]/30 = $3,650/MWh
  - For 2016/17 DY, RTO NPCR is $1,896.30/MWh (= (50%)*($311.72/MW-day)*(365 days)/30 hours))
  - For 2017/18 DY, RTO NPCR is $2,420.23/MWh (= (60%)*($331.54/MW-day)*(365 days)/30 hours)

Modeled LDAs and respective Net CONE are provided in DY Planning Parameters posted on Capacity Market (RPM) web page

- Non-Performance Charge Rate for shortfall due to Base commitments ($/MW-hr) = [Weighted Average Resource Clearing Price ($/MW-day) for resource’s base commitments * 365 days]/30
Stop-Loss

- Stop-loss provisions limit the total Non-Performance Charge that can be assessed on each Capacity Resource.

- The maximum yearly Non-Performance Charge is:
  - CP commitments: \(1.5 \times \text{Applicable LDA Net CONE} \times 365 \text{ days} \times \text{max daily CP UCAP MW commitment from June of DY through end of billing month for which Non-Performance Charge was assessed} \)
    - Stop-loss for Seasonal Capacity Performance Resource considers the number of days in the applicable season (Effective 2020/2021 Delivery Year).
  - Base commitments: total capacity revenues due to the resource for Base commitments for the Delivery Year.

- The Stop-Loss for the Transition Years:
  - 2016/2017 CP Stop loss = \$85,333.70 \times \text{max daily CP UCAP MW commitment from June of DY through end of billing month for which Non-Performance Charge was assessed} \)
  - 2017/2018 CP Stop loss = \$108,910.23 \times \text{max daily CP UCAP MW commitment from June of DY through end of billing month for which Non-Performance Charge was assessed} \)
Bonus Performance Credit

- Total Non-Performance Charges are allocated as Bonus Performance Credit to resources that have bonus MW based on over-performing resource’s pro-rata share of total Bonus Performance MW
  - For 2016/17 and 2017/18 Delivery Years, only resources with CP commitment are subject to charge or eligible for credit
  - For 2018/19 Delivery Years and beyond, any type of resource, even if not a Capacity Resource, is eligible for credit
Timing of Non Performance Charges/Credits

• Non Performance Assessments are billed within three calendar months after the calendar month that included the Performance Assessment Hour
  – If PAH occurs on June 30, Charges and Credits billed starting with the September monthly bill
  – If PAH occurs on July 1, Charges and Credits billed starting with the October monthly bill

• Charges and Credits are billed by dividing the total dollar amounts owed/due by the number of months remaining in the Delivery Year
  – Only pay out Credits in same amount collected on Charges
Non Performance Charge/Credit Timing

If a PAH occurs in June, Charges and Credits will be billed starting with the September bill through the May bill.

*Monthly bill is issued on the 5th business day following the end of the billing month*
### Non Performance Charge/Credit Timing Example

#### June 5 PAH Occurrence

<table>
<thead>
<tr>
<th>Resource A</th>
<th>Resource B</th>
<th>Resource C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Non-Performance Charge = $1,350</td>
<td>Total Bonus Credit = $720</td>
<td>Total Bonus Credit = $630</td>
</tr>
<tr>
<td>Per Month billed = $150 ($1,350 / 9)</td>
<td>Per Month billed = $80 ($720 / 9)</td>
<td>Per Month billed = $70 ($630 / 9)</td>
</tr>
</tbody>
</table>

#### August 7 PAH Occurrence

<table>
<thead>
<tr>
<th>Bills</th>
<th>Resource A</th>
<th>Resource B</th>
<th>Resource C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep</td>
<td>$150</td>
<td>$80</td>
<td>$70</td>
</tr>
<tr>
<td>Oct</td>
<td>$150</td>
<td>$80</td>
<td>$70</td>
</tr>
<tr>
<td>Nov</td>
<td>$150</td>
<td>$80</td>
<td>$70</td>
</tr>
<tr>
<td>Dec</td>
<td>$150</td>
<td>$80</td>
<td>$70</td>
</tr>
<tr>
<td>Jan</td>
<td>$150</td>
<td>$80</td>
<td>$70</td>
</tr>
<tr>
<td>Feb</td>
<td>$150</td>
<td>$80</td>
<td>$70</td>
</tr>
<tr>
<td>Mar</td>
<td>$150</td>
<td>$80</td>
<td>$70</td>
</tr>
<tr>
<td>Apr</td>
<td>$150</td>
<td>$80</td>
<td>$70</td>
</tr>
<tr>
<td>May</td>
<td>$150</td>
<td>$80</td>
<td>$70</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Resource A</th>
<th>Resource B</th>
<th>Resource C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>$1,350</td>
<td>$720</td>
<td>$630</td>
</tr>
<tr>
<td></td>
<td>$1,225</td>
<td>$525</td>
<td>$700</td>
</tr>
</tbody>
</table>
Greater of Charge Provision – Deficiency Charges vs. Non-Performance Charges

• To avoid double-penalty, a resource subject to Non-Performance Charge during one or more Performance Assessment Hours occurring during a continuous time period of product-specific (CP or Base) Daily RPM Commitment Shortages shall be assessed a charge equal to the greater of:

  a) Total Daily Capacity Resource Deficiency Charges assessed for product-specific shortages during such continuous time period; or

  b) Total product-specific Non-Performance Charges calculated for the Performance Assessment Hours occurring during such continuous time period

• Sum of Daily Capacity Resource Deficiency Charges and Non-Performance Charges actually billed for such continuous time period may not exceed the resultant greater of charge
Greater of Charge Provision – Rating Test Failure Charges vs Non-Performance Charges

• A resource subject to Non-Performance Assessment Charge during one or more Performance Assessment Hours occurring during a continuous time period of product-specific (CP or Base) Daily ICAP Shortfalls for rating test failures shall be assessed a charge equal to the greater of:
  
a) total Daily Generation Resource Rating Test Failure Charges assessed for product-specific shortages during such continuous time period; or
  
b) total product-specific Non-Performance Charges calculated for the Performance Assessment Hours occurring during such continuous time period

• Sum of Daily Generation Resource Rating Test Failure Charges and Non-Performance Charges actually billed for such continuous time period may not exceed the resultant greater of charge
Greater of Charge Example

- Planned generator located in PPL zone has a 100 MW CP commitment for the 18/19 Delivery Year, but is delayed until September 1
- PJM has Performance Assessment Hours on June 15 and September 15.

Because PAH on 6/15 occurs during period of continuous commitment compliance shortfalls, a greater of comparison occurs.

Because PAH on 9/15 does not occur during a period of continuous commitment compliance shortfalls, no greater of comparison occurs.
The total Daily Capacity Resource Deficiency Charges assessed for period of June 1-August 31 are greater than the calculated Non-Performance Charge associated with the June 15 PAH. As a result, calculated Non-Performance Charge for the June 15 PAH will not be assessed.
Appendix for Non-Performance Assessment
## Expected Performance vs. Actual Performance
### 2016/17 and 2017/18 Delivery Years

<table>
<thead>
<tr>
<th>Resource Type</th>
<th>Product</th>
<th>Summer Performance Assessment Hour (June - Sept)</th>
<th>Non-Summer Performance Assessment Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Expected Performance</td>
<td>Actual Performance</td>
</tr>
<tr>
<td>Generation/Storage</td>
<td>Annual</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Demand Response</td>
<td>Capacity Performance</td>
<td>Committed ICAP</td>
<td>Load Reduction + Reserve/Regulation Assignment</td>
</tr>
<tr>
<td>Demand Response</td>
<td>Annual, Ext. Summer, Limited</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Demand Response</td>
<td>Economic</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Energy Efficiency</td>
<td>Capacity Performance</td>
<td>Committed ICAP</td>
<td>PJM Approved Post-Installation Load Reduction</td>
</tr>
<tr>
<td>Energy Efficiency</td>
<td>Annual</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Energy Only Resources</td>
<td>N/A</td>
<td>0</td>
<td>NA</td>
</tr>
<tr>
<td>Energy Imports</td>
<td>N/A</td>
<td>0</td>
<td>NA</td>
</tr>
</tbody>
</table>

*Includes External Generation Capacity Resources
# Expected Performance vs. Actual Performance

## 2018/19 Delivery Years & Beyond

<table>
<thead>
<tr>
<th>Resource Type</th>
<th>Product</th>
<th>Summer Performance Assessment Hour (June - Sept)</th>
<th>Non-Summer Performance Assessment Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Expected Performance</strong></td>
<td><strong>Actual Performance</strong></td>
<td></td>
<td><strong>Expected Performance</strong></td>
</tr>
<tr>
<td>Generation/Storage</td>
<td>Capacity Performance</td>
<td>Committed UCAP * Balancing Ratio</td>
<td>Metered Energy Output + Reserve/Regulation Assignment</td>
</tr>
<tr>
<td>Generation/Storage</td>
<td>Base</td>
<td>Committed UCAP * Balancing Ratio</td>
<td>Metered Energy Output + Reserve/Regulation Assignment</td>
</tr>
<tr>
<td>Demand Response</td>
<td>Capacity Performance</td>
<td>Committed ICAP</td>
<td>Load Reduction + Reserve/Regulation Assignment</td>
</tr>
<tr>
<td>Demand Response</td>
<td>Base</td>
<td>Committed ICAP</td>
<td>Load Reduction + Reserve/Regulation Assignment</td>
</tr>
<tr>
<td>Energy Efficiency</td>
<td>Capacity Performance</td>
<td>Committed ICAP</td>
<td>PJM Approved Post-Installation Load Reduction</td>
</tr>
<tr>
<td>Energy Efficiency</td>
<td>Base</td>
<td>Committed ICAP</td>
<td>PJM Approved Post-Installation Load Reduction</td>
</tr>
<tr>
<td>Qualifying Trans. Upgrade (QTU)</td>
<td>Capacity Performance</td>
<td>Committed UCAP</td>
<td>Committed UCAP if In-Service; otherwise 0</td>
</tr>
<tr>
<td>Energy Only Resources</td>
<td>N/A</td>
<td>0</td>
<td>Metered Energy Output + Reserve/Regulation Assignment</td>
</tr>
<tr>
<td>Energy Imports</td>
<td>N/A</td>
<td>0</td>
<td>Net Energy Import</td>
</tr>
</tbody>
</table>

*Only CP product effective with 2020/2021 Delivery Year.*
**Summer Performance Assessment Hour Example**

Emergency Action called for entire RTO during Summer period

- Sample capacity resources below dispatched to their full MW capability except:
  - GEN RES 1 is backed down 30 MW by PJM for a transmission constraint
  - GEN RES 2 and 4 are on Partial and Full Forced Outages respectively

- Applicable LDA Net CONE (ICAP): $300/MW-day; Base WARCP: $150/MW-day
- Non-Performance Charge Rate for Capacity Performance Resources: $3,650/MWh
- Non-Performance Charge Rate for Base Resources: $1,825/MWh
- Generation & Storage Balancing Ratio: 80%

<table>
<thead>
<tr>
<th>Resource</th>
<th>Product</th>
<th>Committed MW</th>
<th>Expected Performance</th>
<th>Actual Performance</th>
<th>Notes</th>
<th>Exempt MW</th>
<th>Performance Shortfall</th>
<th>Charge Rate ($/MWh)</th>
<th>Total Charges ($)</th>
<th>Bonus Performance</th>
<th>Total Credits ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEN RES 1</td>
<td>CP</td>
<td>125.0</td>
<td>100.0</td>
<td>95.0</td>
<td>Dispatched down 30 MW for transmission constraint</td>
<td>5</td>
<td>0.0</td>
<td>$3,650.00</td>
<td>$204,400.00</td>
<td>0.0</td>
<td>$55,480.00</td>
</tr>
<tr>
<td>GEN RES 2</td>
<td>CP</td>
<td>125.0</td>
<td>100.0</td>
<td>44.0</td>
<td>Partial Forced Outage</td>
<td>56.0</td>
<td>56.0</td>
<td>$1,825.00</td>
<td>$116,800.00</td>
<td>0.0</td>
<td>$13,870.00</td>
</tr>
<tr>
<td>GEN RES 3</td>
<td>CP</td>
<td>100.0</td>
<td>80.0</td>
<td>100.0</td>
<td></td>
<td>0.0</td>
<td>0.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GEN RES 4</td>
<td>Base</td>
<td>80.0</td>
<td>64.0</td>
<td>0.0</td>
<td>Full Forced Outage</td>
<td>64.0</td>
<td>64.0</td>
<td>$1,825.00</td>
<td>$116,800.00</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>DR RES 5</td>
<td>CP</td>
<td>30.0</td>
<td>30.0</td>
<td>28.0</td>
<td></td>
<td>2.0</td>
<td>2.0</td>
<td>$3,650.00</td>
<td>$7,300.00</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>DR RES 6</td>
<td>Base</td>
<td>20.0</td>
<td>20.0</td>
<td>25.0</td>
<td></td>
<td>5.0</td>
<td>5.0</td>
<td></td>
<td>$13,870.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE RES 7</td>
<td>CP</td>
<td>20.0</td>
<td>20.0</td>
<td>15.0</td>
<td></td>
<td>5.0</td>
<td>5.0</td>
<td>$3,650.00</td>
<td>$18,250.00</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>GEN RES 8</td>
<td>Energy</td>
<td>0.0</td>
<td>0.0</td>
<td>100.0</td>
<td></td>
<td>0.0</td>
<td>0.0</td>
<td></td>
<td></td>
<td>100.0</td>
<td>$277,400.00</td>
</tr>
</tbody>
</table>

127.0   $346,750.00  125.0  $346,750.00
Winter Performance Assessment Hour Example

Emergency Action called for entire RTO during Winter period

- Sample capacity resources below dispatched to their full MW capability except:
  - GEN RES 1 is backed down 30 MW by PJM for a transmission constraint
  - GEN RES 2 and 4 are on Partial Forced Outages

- Applicable LDA Net CONE (ICAP): $300/MW-day; Base WARCP: $150/MW-day
- Non-Performance Charge Rate for Capacity Performance Resources: $3,650/MWh
- Non-Performance Charge Rate for Base Resources: N/A

<table>
<thead>
<tr>
<th>Resource</th>
<th>Product</th>
<th>Committed MW</th>
<th>Expected Performance</th>
<th>Actual Performance</th>
<th>Notes</th>
<th>Exempt MW</th>
<th>Performance Shortfall</th>
<th>Charge Rate ($/MWh)</th>
<th>Total Charges ($)</th>
<th>Bonus Performance</th>
<th>Total Credits ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEN RES 1</td>
<td>CP</td>
<td>125.0</td>
<td>96.2</td>
<td>95.0</td>
<td></td>
<td>1.2</td>
<td>0.0</td>
<td>3,650.00</td>
<td>77,380.00</td>
<td>0.0</td>
<td>77,380.47</td>
</tr>
<tr>
<td>GEN RES 2</td>
<td>CP</td>
<td>125.0</td>
<td>96.2</td>
<td>75.0</td>
<td></td>
<td>21.2</td>
<td>0.0</td>
<td>3,650.00</td>
<td>18,250.00</td>
<td>0.0</td>
<td>18,250.00</td>
</tr>
<tr>
<td>GEN RES 3</td>
<td>CP</td>
<td>100.0</td>
<td>77.0</td>
<td>100.0</td>
<td></td>
<td>0.0</td>
<td>23.0</td>
<td>77,036.47</td>
<td></td>
<td></td>
<td>77,036.47</td>
</tr>
<tr>
<td>GEN RES 4</td>
<td>Base</td>
<td>80.0</td>
<td>61.6</td>
<td>50.0</td>
<td></td>
<td>N/A</td>
<td>0.0</td>
<td>3,349.41</td>
<td></td>
<td></td>
<td>33,494.12</td>
</tr>
<tr>
<td>DR RES 5</td>
<td>CP</td>
<td>30.0</td>
<td>30.0</td>
<td>25.0</td>
<td></td>
<td>5.0</td>
<td>0.0</td>
<td>3,650.00</td>
<td>18,250.00</td>
<td>0.0</td>
<td>18,250.00</td>
</tr>
<tr>
<td>DR RES 6</td>
<td>Base</td>
<td>20.0</td>
<td>0.0</td>
<td>1.0</td>
<td></td>
<td>N/A</td>
<td>0.0</td>
<td>3,349.41</td>
<td></td>
<td></td>
<td>33,494.12</td>
</tr>
<tr>
<td>EE RES 7</td>
<td>CP</td>
<td>20.0</td>
<td>20.0</td>
<td>15.0</td>
<td></td>
<td>5.0</td>
<td>0.0</td>
<td>3,650.00</td>
<td>18,250.00</td>
<td>0.0</td>
<td>18,250.00</td>
</tr>
<tr>
<td>GEN RES 8</td>
<td>Energy</td>
<td>0.0</td>
<td>0.0</td>
<td>10.0</td>
<td></td>
<td>0.0</td>
<td>0.0</td>
<td>3,650.00</td>
<td>113,880.00</td>
<td>0.0</td>
<td>113,880.00</td>
</tr>
</tbody>
</table>

Example assumes only modeled LDA for DY is RTO

PJM©2017 04/20/2017
Potential Causes of Imbalanced Charge and Bonus Payment Rates

• The area defined by the Emergency Action of a PAH spans multiple modeled LDAs with under-performing resources subject to different penalty rates

• Shortfall MW that are excused from the Non-Performance Assessment (e.g. resource on an approved planned outage)
Non-Performance Assessment Example
Charge Rates not equal to Bonus Credit Rate

Balancing Ratio = Bonus Payment Rate = Total Charges / Bonus MW = \( \frac{\$3,296.51}{0.9} = \frac{\$1,417,501}{430 \text{ MW}} \)

### Resource Performance Assessment for a single PAH

<table>
<thead>
<tr>
<th>Company/ Generator</th>
<th>Capacity Commitment (UCAP MW)</th>
<th>Modeled LDA</th>
<th>Expected Performance</th>
<th>Actual Performance</th>
<th>Excused</th>
<th>Performance (Exp - Act)-Excused *</th>
<th>Charge Rate</th>
<th>Charge</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-1</td>
<td>300</td>
<td>EMAAC</td>
<td>270</td>
<td>325</td>
<td>0</td>
<td>-55</td>
<td>$0</td>
<td>$0</td>
<td>$181,308</td>
</tr>
<tr>
<td>A-2</td>
<td>250</td>
<td>PSEG</td>
<td>225</td>
<td>0</td>
<td>5</td>
<td>220</td>
<td>$3,395</td>
<td>$746,977</td>
<td>$0</td>
</tr>
<tr>
<td>A-3</td>
<td>0</td>
<td>EMAAC</td>
<td>0</td>
<td>150</td>
<td>0</td>
<td>-150</td>
<td>$0</td>
<td>$494,477</td>
<td>$0</td>
</tr>
<tr>
<td>B-4</td>
<td>150</td>
<td>PSEG</td>
<td>135</td>
<td>100</td>
<td>0</td>
<td>35</td>
<td>$3,395</td>
<td>$118,837</td>
<td>$0</td>
</tr>
<tr>
<td>B-5</td>
<td>150</td>
<td>EMAAC</td>
<td>135</td>
<td>100</td>
<td>0</td>
<td>35</td>
<td>$3,245</td>
<td>$113,583</td>
<td>$0</td>
</tr>
<tr>
<td>B-6</td>
<td>150</td>
<td>EMAAC</td>
<td>135</td>
<td>0</td>
<td>0</td>
<td>135</td>
<td>$3,245</td>
<td>$438,104</td>
<td>$0</td>
</tr>
<tr>
<td>C-7</td>
<td>0</td>
<td>EMAAC</td>
<td>0</td>
<td>100</td>
<td>0</td>
<td>-100</td>
<td>$0</td>
<td>$329,651</td>
<td>$0</td>
</tr>
<tr>
<td>D-8</td>
<td>0</td>
<td>EMAAC</td>
<td>0</td>
<td>125</td>
<td>0</td>
<td>-125</td>
<td>$0</td>
<td>$412,064</td>
<td>$0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1,000</td>
<td><strong>900</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$1,417,501</td>
<td>$1,417,501</td>
<td></td>
</tr>
</tbody>
</table>
### Load Management Partial Dispatch Clock Hour (FSL)

For this example, negative value = under-compliance & positive value =over-compliance

<table>
<thead>
<tr>
<th>Reference</th>
<th>Variable</th>
<th>Registration</th>
<th>HE14</th>
<th>HE15</th>
<th>HE16</th>
<th>HE17</th>
<th>HE18</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Minutes Dispatched</td>
<td></td>
<td>40</td>
<td>60</td>
<td>60</td>
<td>60</td>
<td>20</td>
</tr>
<tr>
<td>2 = 1/60</td>
<td>% hour dispatched</td>
<td></td>
<td>67%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>33%</td>
</tr>
<tr>
<td>3</td>
<td>Compliance hour</td>
<td>partial</td>
<td>full</td>
<td>full</td>
<td>full</td>
<td>full</td>
<td>na</td>
</tr>
<tr>
<td>4</td>
<td>PLC (MW)</td>
<td>10.0</td>
<td>10.0</td>
<td>10.0</td>
<td>10.0</td>
<td>10.0</td>
<td>na</td>
</tr>
<tr>
<td>5</td>
<td>FSL (MW)</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>na</td>
</tr>
<tr>
<td>6</td>
<td>Load (MW)</td>
<td></td>
<td>7.0</td>
<td>11.0</td>
<td>7.0</td>
<td>4.0</td>
<td>na</td>
</tr>
<tr>
<td>7</td>
<td>Line loss factor</td>
<td>1.1</td>
<td>1.10</td>
<td>1.10</td>
<td>1.10</td>
<td>1.10</td>
<td>na</td>
</tr>
<tr>
<td>8 = 4 - (6*7), floor at 0</td>
<td>Load Reduction (MW) grossed up for losses</td>
<td>2.3</td>
<td>0.0</td>
<td>2.3</td>
<td>5.6</td>
<td>na</td>
<td></td>
</tr>
<tr>
<td>9 = 4 - (5*7)</td>
<td>Capacity commitment ICAP (MW)</td>
<td>4.5</td>
<td>4.5</td>
<td>4.5</td>
<td>4.5</td>
<td>na</td>
<td></td>
</tr>
<tr>
<td>10 = 9 * 2</td>
<td>Expected Performance = Capacity commitment ICAP (MW) * % hour dispatched</td>
<td>3.0</td>
<td>4.5</td>
<td>4.5</td>
<td>4.5</td>
<td>na</td>
<td></td>
</tr>
<tr>
<td>11 = 8 - 10</td>
<td>Hourly Compliance ICAP (MW)</td>
<td>-0.70</td>
<td>-4.50</td>
<td>-2.20</td>
<td>1.10</td>
<td>na</td>
<td></td>
</tr>
</tbody>
</table>
Replacement Capacity
Replacement Resources

• Participants may specify replacement resources in order to avoid or reduce performance assessment shortfalls and associated deficiency/penalty charges

• Replacement Resources include:
  – Generation, DR, EE, or Aggregate Resources with Available ICAP
  – Cleared Buy Bids
  – Locational UCAP
  – Excess Commitment Credits

• Replacement Resource must meet similar locational requirements

• Replacement Resource must meet same or better temporal availability characteristics

• Effective 2019/2020 Delivery Year, available capacity from an EE Resource may only be used to replace the commitment on another EE Resource.

• LSEs may receive credits when DY Reliability Requirements decrease from BRA to 3rd IA resulting in an excess capacity
  • Modeled as generation resource with Available ICAP in LSE account
## Replacement Capacity Options for a Commitment

<table>
<thead>
<tr>
<th>CP Commitment from Transitional IA (16/17-17/18 DY)</th>
<th>CP Commitment (Effective 18/19 DY)</th>
<th>Base Generation Commitment (18/19-19/20 DY)</th>
<th>Base DR/EE Commitment (18/19-19/20 DY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Available MWs from generation, DR, or EE resource eligible to be committed as CP</td>
<td>Available MWs from generation, DR, EE, or Aggregate resource eligible to be committed as CP</td>
<td>Available MWs from a generation or Aggregate Resource eligible to be committed as CP or Base</td>
<td>Available MWs from a generation, DR, EE, or Aggregate resource eligible to be committed as CP or Base</td>
</tr>
<tr>
<td>Cleared Buy Bid of CP product-type</td>
<td>Cleared Buy Bid of CP or Base Generation product type</td>
<td>Cleared Buy Bid of CP, Base Generation, or Base DR/EE product-type</td>
<td></td>
</tr>
<tr>
<td>Locational UCAP of CP product-type. Source of Locational UCAP must be eligible to be committed as CP.</td>
<td>Location UCAP of CP product-type</td>
<td>Locational UCAP of CP or Base Generation product type</td>
<td>Locational UCAP of CP, Base Generation, or Base DR/EE product-type</td>
</tr>
</tbody>
</table>

Energy-only Resources cannot be used to replace a commitment on a capacity resource.
Replacement Capacity Transaction

• Replacement resources for resources committed to RPM may be specified via the eRPM system by entering a Replacement Capacity Transaction.

• Replacement Capacity Transaction allows a provider to reduce or remove the commitment on a committed Capacity Resource.

• Replacement Capacity transaction must be done after the EFORd for the DY has been locked in the eRPM system (November 30 prior to the DY), but before the start of the Delivery Day.
  - Upon request to PJM no later than three business days after a PAH, a retroactive replacement may be permitted under certain conditions.
  - Upon written request to PJM and Monitoring Analytics, an early replacement (earlier than November 30 prior to DY) may be permitted under certain conditions.

• Specifying a replacement resource for resource committed to FRR is accomplished by updating FRR Capacity Plan, as opposed to Replacement Capacity Transaction.
Business Rules for Replacement Capacity Transactions

✓ Start date and end date of the replacement must be specified.

✓ Desired change in Daily RPM Resource Commitments (in UCAP terms) for resource being replaced and replacement resource must be specified.

✓ Change in Daily RPM Resource Commitments cannot result in a negative value for the Daily RPM Resource Commitments for the resource being replaced.

✓ Replacement resource must be located in the same LDA as the resource that is being replaced.

✓ Resources located in a constrained LDA can serve as replacement capacity for a resource located in less constrained parent LDA.

✓ Replacement resource must meet same or better temporal availability characteristics

✓ Replacement capacity to reduce a DR commitment must be specified for the balance of the Delivery Year.
# Prospective vs. Retroactive Replacement

<table>
<thead>
<tr>
<th>Eligible Sources of Replacement Capacity</th>
<th>Replacement Rules</th>
<th>Retroactive Replacement Rules</th>
</tr>
</thead>
<tbody>
<tr>
<td>Available Capacity from another resource</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Locational UCAP</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Cleared Buy Bid</td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Requirements of Replacement Capacity</th>
<th>Replacement Rules</th>
<th>Retroactive Replacement Rules</th>
</tr>
</thead>
<tbody>
<tr>
<td>Must be in the same sub-account as resource being replaced for the transaction's effective time period</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Must have same or better temporal availability as resource being replaced</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Must be located in same LDA (or child LDA) as resource being replaced</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Must be included in the same Non-Performance Assessment as resource being replaced</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Resulting total Daily Resource Commitments on the generation resource used as a replacement resource cannot exceed such replacement resource’s Actual Performance during the Performance Assessment Hours.</td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Timing Restrictions</th>
<th>Replacement Rules</th>
<th>Retroactive Replacement Rules</th>
</tr>
</thead>
<tbody>
<tr>
<td>Must be submitted prior to the effective start date of the transaction</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Must be submitted within 3 business days after the delivery day containing the PAH</td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>
When using available capacity as a replacement resource, the commitment and associated performance obligations are shifted to the specified replacement resource.
Replacement Capacity vs. Bonus Performance

• Retroactive capacity replacements can only be made using available capacity
  – Available capacity is shown in eRPM in the resource position tab
  – Available capacity from generation resource (ICAP MWs) = Daily ICAP Owned – Daily Unoffered ICAP - (Daily RPM Resource Commitments/(1-Final DY EFORd)) – Daily FRR Capacity Plan ICAP Commitments

• Bonus performance is energy production above the Expected Performance
  – May be eligible for bonus performance credits
  – Bonus performance can occur in the absence of available capacity
  – Bonus performance may not be used in replacement transactions
### Example – Before Retroactive Replacement

**eRPM Resource Position: July 1**

<table>
<thead>
<tr>
<th>Resource</th>
<th>Location</th>
<th>Owned Capacity (UCAP MW)</th>
<th>Commitment Capacity (UCAP MW)</th>
<th>Available Capacity (UCAP MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cap Resource 1</td>
<td>AE</td>
<td>100</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>Cap Resource 2</td>
<td>JCPL</td>
<td>150</td>
<td>100</td>
<td>50</td>
</tr>
<tr>
<td>Cap Resource 3</td>
<td>PECO</td>
<td>200</td>
<td>200</td>
<td>0</td>
</tr>
<tr>
<td>Energy Resource 1</td>
<td>AE</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Performance Assessment Hour in EMAAC: July 1 HR Ending 16:00, Assume Balancing Ratio = 1.0**

<table>
<thead>
<tr>
<th>Resource</th>
<th>Location</th>
<th>Output</th>
<th>Expected Performance (MW)</th>
<th>Actual Performance (MW)</th>
<th>Performance Shortfall* (MW)</th>
<th>Performance Assessment Charge/Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cap Resource 1</td>
<td>AE</td>
<td>90</td>
<td>100</td>
<td>90</td>
<td>10</td>
<td>Charge</td>
</tr>
<tr>
<td>Cap Resource 2</td>
<td>JCPL</td>
<td>130</td>
<td>100</td>
<td>130</td>
<td>-30</td>
<td>Credit</td>
</tr>
<tr>
<td>Cap Resource 3</td>
<td>PECO</td>
<td>205</td>
<td>200</td>
<td>205</td>
<td>-5</td>
<td>Credit</td>
</tr>
<tr>
<td>Energy Resource 1</td>
<td>AE</td>
<td>300</td>
<td>0</td>
<td>300</td>
<td>-300</td>
<td>Credit</td>
</tr>
</tbody>
</table>

*Negative Performance Shortfall represents over performance (Bonus Performance).*
## Example - After Retroactive Replacement

### eRPM Resource Position: July 1

<table>
<thead>
<tr>
<th>Resource</th>
<th>Location</th>
<th>Owned Capacity (UCAP MW)</th>
<th>Commitment Capacity (UCAP MW)</th>
<th>Available Capacity (UCAP MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cap Resource 1</td>
<td>AE</td>
<td>100</td>
<td>90</td>
<td>10</td>
</tr>
<tr>
<td>Cap Resource 2</td>
<td>JCPL</td>
<td>150</td>
<td>110</td>
<td>40</td>
</tr>
<tr>
<td>Cap Resource 3</td>
<td>PECO</td>
<td>200</td>
<td>200</td>
<td>0</td>
</tr>
<tr>
<td>Energy Resource 1</td>
<td>AE</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

### Performance Assessment Hour in EMAAC: July 1 HR Ending 16:00, Assume Balancing Ratio = 1.0

<table>
<thead>
<tr>
<th>Resource</th>
<th>Location</th>
<th>Output</th>
<th>Expected Performance (MW)</th>
<th>Actual Performance (MW)</th>
<th>Performance Shortfall* (MW)</th>
<th>Performance Assessment Charge/Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cap Resource 1</td>
<td>AE</td>
<td>90</td>
<td>90</td>
<td>90</td>
<td>0</td>
<td>No Charge</td>
</tr>
<tr>
<td>Cap Resource 2</td>
<td>JCPL</td>
<td>130</td>
<td>110</td>
<td>130</td>
<td>-20</td>
<td>Credit</td>
</tr>
<tr>
<td>Cap Resource 3</td>
<td>PECO</td>
<td>205</td>
<td>200</td>
<td>205</td>
<td>-5</td>
<td>Credit</td>
</tr>
<tr>
<td>Energy Resource 1</td>
<td>AE</td>
<td>300</td>
<td>0</td>
<td>300</td>
<td>-300</td>
<td>Credit</td>
</tr>
</tbody>
</table>

*Retroactively replaced 10 MW of commitment on Cap Resource 1 with 10 MW of Available UCAP from Cap Resource 2.*

*Negative Performance Shortfall represents over performance (Bonus Performance).*
Replacement Capacity Considerations

• Specifying replacement capacity by “Replacement Capacity” transaction or by updating FRR Capacity Plan in eRPM
  – Results in decrease of the TUICA on generation resource being replaced and increase in TUICA of replacement generation resource
  – Will not change the EFORp of any unit. EFORp still based on performance of generation resource during critical peak-hour periods of DY

• For TUICA to be reduced to 0 MW, must specify enough replacement capacity prior to start of Delivery Year

• If specify replacement resource prior to or during delivery year, final performance of replacement resource is not known at time of replacement
Contact Information:

**PJM Client Management & Services**

Telephone:  (610) 666-8980  
Toll Free Telephone:  (866) 400-8980  
Website:  www.pjm.com

The Member Community is PJM’s self-service portal for members to search for answers to their questions or to track and/or open cases with Client Management & Services