Capacity Performance / Performance Assessment Hour Education

PJM CTC

May 2, 2016

Agenda

Introduction	9:30 a.m. – 9:40 a.m.
Unit Specific Parameters / Real Time Values	9:40 a.m. – 10:45 a.m.
Break	10:45 a.m. – 11:00 a.m.
Dispatch Coordination	11:00 a.m. – 12:00 a.m.
Lunch	12:00 p.m. – 12:45 p.m.
Dispatch Coordination	12:45 p.m. – 1:45 p.m.
Settlements	1:45 p.m. – 2:30 p.m.
Break	2:30 p.m. – 2:40 p.m.
Settlements	2:40 p.m. – 3:50 p.m.
Close	3:50 p.m. – 4:00 p.m.

Introduction

Capacity Performance

- New “Capacity Performance” product in RPM Capacity Market
- Goal: Incorporate stronger performance incentives and more operational availability and diversity during peak conditions
  - Improve resource performance and flexibility
  - Articulate fuel security and operational availability standards
    - Provide investment signals

Capacity Performance Products

- Capacity Performance (CP) Resources must be capable of sustained, predictable operation that allows resource to be available to provide energy and reserves during performance assessment hours throughout the Delivery Year
  - Non-Performance Charges are assessed during emergency conditions throughout entire Delivery Year
- Base Capacity (Base) Resources are those capacity resources that are not capable of sustained, predictable operation throughout the entire Delivery Year; but are capable of providing energy and reserves during hot weather operations
  - Non-Performance Charge assessed during emergency conditions during June through September

Demand Resource Product Type Requirements

Requirement	Limited DR	Extended Summer DR	Annual DR	Base Capacity Demand Resource (18/19 & 19/20 DY only)	Capacity Performance Demand Resource (Effective 18/19 DY)
Availability	Any weekday, other than NERC holidays, during June – Sept. period of DY	Any day during June- October period and following May of DY	Any day during DY (unless on an approved maintenance outage during Oct. - April)	Any day during June-September of DY	Any day during DY (unless on an approved maintenance outage during Oct.-April)
Maximum Number of Interruptions	10 interruptions	Unlimited	Unlimited	Unlimited	Unlimited
Hours of Day Required to Respond *(Hours in EPT)*	12:00 PM – 8:00 PM	10:00 AM – 10:00 PM	Jun – Oct. and following May: 10 AM – 10 PM Nov. – April: 6 AM- 9 PM	10:00 AM – 10:00 PM	Jun – Oct. and following May: 10 AM – 10 PM Nov. – April: 6 AM- 9 PM
Maximum Duration of Interruption	6 Hours	10 Hours	10 Hours	10 Hours	June – Oct : 12 hours Nov – April: 15 hours

Current Limited, Extended Summer and Annual DR definitions eliminated effective 2018/2019 Delivery Year.

Base Residual Auction & CP Transition Auction Results

2016-17 Transition Auction

Obtained the targeted amount of CP (~95,000 MW, 60%)

Competitive Clearing price (below the established cap of $165.27)

	CP	Base
RTO	$134.00	NA

2017-18 Transition Auction

Obtained the targeted amount of CP (~112,000 MW, 70%)

Competitive Clearing price (below the established cap of $210.83)

	CP	Base
RTO	$151.50	NA

2018-19 Base Auction

Obtained more than the targeted 80% of CP (~140,600 MW)

Clearing prices rose as expected (Competitive result)

	CP	Base
RTO	$164.77	$149.98
COMED	$215.00	$200.21
EMAAC	$225.42	$210.63

Unit Specific Parameters and Real Time Values

Unit Specific Parameters

- **Unit Specific Parameter and Process Overview**
- Comparing Unit Specific Parameters with Parameter Limited Schedule Exceptions

Unit Specific Parameter and Process Overview

Unit Specific Operating Parameter Adjustment Process Details	
Why was the process implemented?	PJM was directed by FERC in ER15-623-000, EL15-29-000, ER15-623-001 (CP Order) to implement unit specific parameter limitations for Generation Capacity Resources
What is the Unit Specific Operating Parameter Adjustment Process?	Capacity Market Sellers that do not believe their individual resources can meet the proxy operating parameters due to actual operating constraints may submit adjustment requests for the parameters for their cost based and price-based parameter limited schedules to the PJM team for review. The team includes IMM team members
What parameters are included in the unit specific operating parameter adjustments?	Turn Down Ratio, Minimum Down Time, Minimum Run Time, Maximum Daily Starts, Maximum Weekly Starts, *Hot Start, *Warm Start, *Cold Start, *Notification Time, and *Maximum Run Time ** Additional Parameters for Capacity Performance Resources*

Parameter Applicability

PLS Values	Applicable Delivery Years					
	15/16	16/17	17/18	18/19	19/20	20/21+
Default	Annual →			Annual FRR Only		
Unit Specific or Adjusted Unit Specific		CP	CP	CP Base	CP Base	CP →

- Exceptions may apply regardless of whether the PLS is default, unit specific, or adjusted unit specific
  - Temporary – less than 30 days
  - Period – 31 days to a year
  - Persistent – greater than a year

When Are Unit Specific Parameters Used?

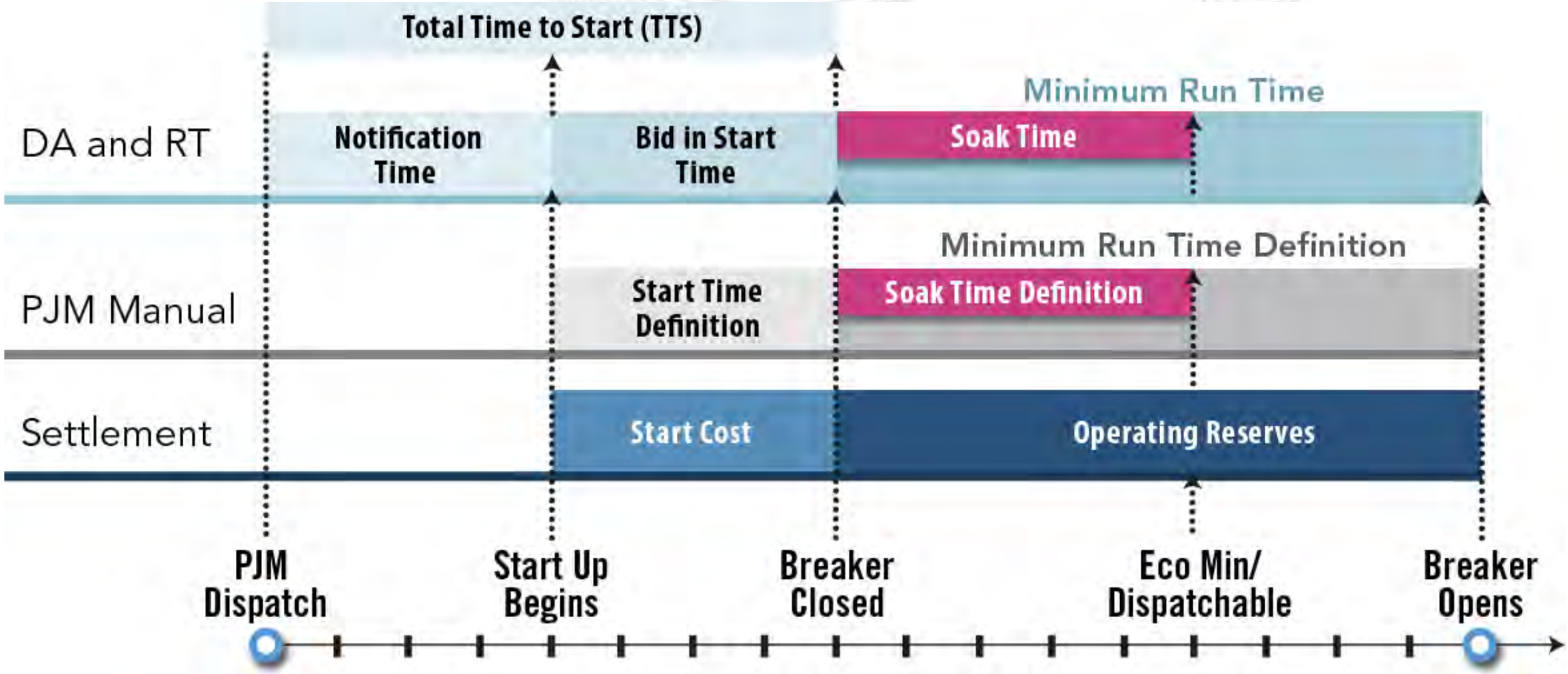
Each Generation Capacity Resource:

- Must make available at least one cost-based schedule with Limited Parameters
- Must make available two price-based schedules
  - One with Limited Parameters
  - One without Limited Parameters

Unit Specific Parameters

Price-Based Schedules	Cost-Based Schedules	Price-Based Parameter Limited Schedule
Normal Operations	• Generator fails the Three Pivotal Supplier Test (TPS) (Example: Controlling Transmission Constraints)	• Hot Weather Alerts (CP and Base Capacity Resources) and Cold Weather Alerts (CP) • Maximum Generation Emergency declared, alert issued, or anticipation of Max Gen Emergency alert

Current Parameter Definitions



Minimum or Proxy Unit Specific Operating Parameters

Capacity Performance and Base Capacity Resource Minimum Unit-Specific Operating Parameters

Technology Classification[2]	Min Down Time Hrs	Min Run Time Hrs	Max Daily Starts	Max Weekly Starts	Start-up Time			Notification Time Cold/Warm/ Hot Hrs	Turn Down Ratio
					Hot Hrs.	Warm Hrs.	Cold Hrs.		
Reciprocating Internal Combustion Units	0.6	1	12	84	0.1	0.1	0.1	0.1	1.0 or more
AERO CT Units	1.1	1	6	42	0.1	0.1	0.1	0.1	1.0 or more
Frame CT Units	1.25	2	4	28	0.25	0.25	0.25	0.1	1.5 or more
Combined Cycle Units	3.5	4	3	21	0.5	0.5	0.5	1	1.5 or more
Petroleum and Natural Gas Steam Units	6	4	2	24	2	3	4	1	2.0 or more
Combined Cycle Based QF Units	4.5	4	3	21	0.5	0.5	0.5	1	1.5 or more
Solid Fuel NUG Units	8	4	3	21	4	6	10	1	1.5 or more
Sub-Critical Coal Units	8	8	2	14	4	6	10	1	2.0 or more
Super-Critical Coal Units - Pre 2000	8	6	1	7	4	6	10	1	1.5 or more
Super-Critical Coal Units - Post 2000	6	6	1	7	2	2.5	5	1	1.5 or more
Capacity Storage Resource	Shall not exceed 1 hr.	TBD	TBD	TBD	Start Time + Notification Time shall not exceed 1 hr.				TBD

Note: Maximum Run Time will be implemented for a minimum of 24 hrs for all technology classifications (value greater than 24 hrs may be entered).

Unit Specific Parameter and Process Overview

Unit Specific Operating Parameter Adjustment Process Details	
Who should use the process?	• Capacity Performance resources for DY 2016/17 and beyond • Replacement Capacity Performance resources for DY 2016/17 and beyond* • Base Capacity resources for DY 2018/19 and 2019/2020
What are adjustments used for?	• Will be utilized by PJM Market Settlements for make whole payments • Do not excuse a unit for not performing during a Performance Assessment Hour *
How long are the parameters effective for?	Parameters will remain in place until PJM determines a change is needed based on changed operational capabilities of the resource
What happens if you don't submit adjustments	Proxy parameters by technology classification will be utilized for cost based schedules and price based parameter limited schedules
How are parameters applied to Joint Owned Units and Partial Capacity Performance Resources?	• The same parameters will apply to the all of the MWs of a generation resource • All MWs for a generation resource will be considered Capacity Performance if there are partial MW committed as Capacity Performance

* Topics will be reviewed later in the education session

Replacement Resources

Unit specific proxy parameters will be applied if an adjustment is not submitted by the deadline and a unit becomes a CP resource during the delivery year via a replacement transaction

Example:

- Generation Resource A Super Critical Coal (capacity performance DY 2016/17)- unit specific adjustments approved
- Generation Resource B CT (annual resource) – no unit specific adjustments submitted
- Generation Resource B CT is used as replacement capacity for Generation Resource A Super Critical Coal

The unit specific proxy parameters for Generation Resource B CT will be used for make whole parameters

Unit specific parameters apply to a generation resource. If there are multiple owners or Market Sellers for a generation resource, all owners and Market Sellers shall be bound by the same unit-specific parameters

Example:

- Generation Resource C (CT)
- Market Seller- ABC owns 50 MW - Cleared Capacity Performance DY 2016/17
- Market Seller- XYZ owns 25 MW- Cleared Capacity Performance DY 2016/17

All 75 MW will receive the same adjusted or proxy unit specific parameter values

Partial Capacity and Partial Non-CP Units

Parameter Limited Schedule values for CP resources will be applied to generation resources that have any MW cleared as CP product in the Delivery Year. If a portion of the generation resource is Capacity Performance and a portion is non- Capacity Performance (annual), the unit specific parameters will apply to all of the MW

Example:

- Generation Resource D (CT)
- 75 MW - Cleared Capacity Performance DY 2016/17
- 125 MW - Non- Capacity Performance (Annual Resource) DY 2016/17

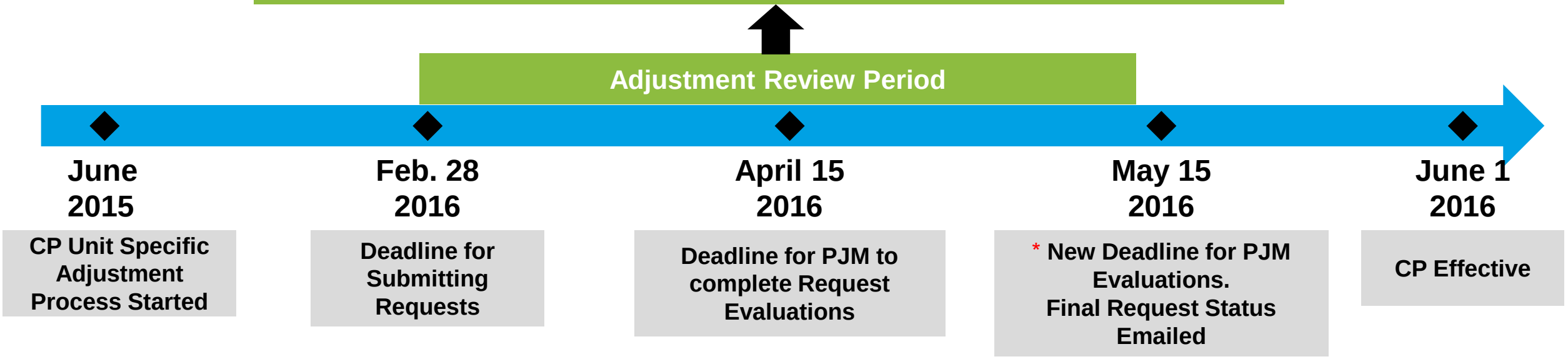
All 200 MW will receive the same adjusted or proxy unit specific parameters

Unit Specific Parameter and Process Overview

Unit Specific Operating Parameter Adjustment Process Details	
When must adjustments be submitted by?	The requests must be submitted by the February 28 and will be evaluated by April 15 (prior to the applicable delivery year). FERC waiver was submitted this year extending the April 15 date to May 15.
When are adjustments effective?	June 1 for the applicable delivery year
How do you submit adjustments?	Email requests with documentation and data to unitspecificpls@pjm.com

Timeline and Required Actions

1. PJM will provide adjustment status as reviews are completed
2. PJM will schedule conference calls
3. Prior to conference calls market seller to:
   - Submit requested documentation
   - Review documentation questions
   - Submit questions
4. After conference calls, market seller to provide requested documentation



**For 2016 only, PJM submitted a waiver to extend the April 15 evaluation deadline which was approved by FERC.*

Required Documentation Examples

Parameter	Example Documentation	
Start Up Time	• OEM (Original Equipment Manufacturer) backup documentation • Control room data	• Startup/loading curves • Detailed start-up sequence listing the required steps along with the time required to perform each step
Maximum Daily/Weekly Starts	OEM backup documentation and/or detailed start-up and shutdown sequences that show why the default start parameters cannot be physically met	
Minimum Run Time	OEM backup documentation for physical unit constraints that requires the unit to be operated for the requested time period	
Minimum Down Time	OEM backup documentation and a detailed shut down sequence listing the required steps to bring the unit into a ready for startup condition along with the time required to perform each step	
Notification Time	Detailed sequence of events of the tasked required prior to startup along with the time required to perform each step	
Turn Down Ratio	• For physical equipment limitation should include OEM backup documentation describing the equipment limitation.	• Emissions related concerns will require inclusion of the applicable air permit as well as emissions data for justification

Start Up Sequence Template

Minimum Down Time and Start-Up Sequence Template

Minimum Down Time Sequence Template		
Hrs.	Step #	Description
N/A	1	Open Breaker
1	2	Turbine Coast Down and Boiler Purging
1	3	Turning Gear
1	4	Align for Start Permissive
3		***TOTAL***

Start-Up Sequence Template			
Cold Start (hrs.)	Hot Start (hrs.)	Step #	Description
1	0.5	1	Start Fans Start Pumps Verify Chemistry
1	0.5	2	Igniters Warm Up
1-2 hrs	0.5	3	Fire Boiler with Main Fuel
1	N/A	4	Heat Boiler
1	N/A	5	Steam to Turbine for Warm Up
1	0.5	6	Roll Turbine (Includes Hold Points - Temp Matching, Vibration)
N/A	N/A	7	Close Turbine Breaker
6-7 hrs	***2***		***TOTAL***

PLEASE NOTE: The following information is representative of a typical start sequence for a Sub-Critical Coal unit. Please add steps and update hours to reflect the physical characteristics of your unit.

Unit Specific Parameters

- Unit Specific Parameter and Process Overview
- **Comparing Unit Specific Parameters with Parameter Limited Schedule Exceptions**

Unit Specific Parameter Adjustment Process vs. Parameter Limited Schedule Exceptions

Unit Specific Operating Parameter Adjustment Process

- Parameters are based on the resource's operating design characteristics
- Parameters will be used to establish the base operating values

ADJUSTMENTS:

May be submitted due to physical operational limitations

CP Resources (2016/2017 and Beyond)

Base Capacity Resources (2018/2019 and 2019/2020

Turn Down Ratio, Minimum Down Time, Minimum Run Time, Maximum Daily Starts, Maximum Weekly Starts, *Hot Start, *Warm Start, *Cold Start, *Notification Time, and *Maximum Run Time

Parameter Limited Schedule Exception

- Exceptions are based on a changed physical condition
- Exceptions are short term and based on a temporary change in the resource's physical condition

EXCEPTIONS:

- Temporary - 30 days or less
- Period - 31 days to no more than 1 year
- Persistent - at least 1 year

CP and Non CP Resources

Turn Down Ratio, Minimum Down Time, Minimum Run Time, Maximum Daily Starts, Maximum Weekly Starts

Example
Unit Specific Parameter Adjustment Process vs. Parameter Limited Schedule Exceptions

Unit Specific Operating Parameter Adjustment Process	Parameter Limited Schedule Exception
• Supercritical Coal Pre 2000 Resource: Additional Start Up Time is required for Start up sequence • Adjustment request was submitted for the Hot, Warm, and Cold Start parameter • The following parameters were approved: • 7.5 hours Hot Start (Proxy value= 4 hrs) • 8.5 hours Warm Start (Proxy value= 6 hrs) • 10 hours Cold Start (Proxy value= 10 hrs)	• Sub-Critical Coal Resource: Rotor pre-heat is required due to damage which occurred to equipment on Jan. 1 • Period Exception request (31 days to no more than 1 year) must be submitted prior to Feb 28 for time required to fix damaged equipment

Real Time Values

- **Real Time Value Overview**
- Real Time Value Implementation Details
- Real Time Value Examples

Real Time Value Overview

Who Uses?	What Parameters?	Why Used?	How Are Parameters Communicated?	When Effective?
CP and Non- CP Resources When the resource cannot operate according to the unit specific parameters (CP and Base Capacity) or default PLS (non-CP) or exceptions	Turn Down Ratio Minimum Down Time Minimum Run Time Maximum Run Time Start Up Time (Hot/Warm/Cold) Notification Time	Meant to capture a resource's current operational capabilities	Markets Gateway Tool Day Ahead: Parameter Limits tool Real Time: 1-Operational restrictions 2-Use hourly updates tab (Notification Time, Eco Min/Eco Max) AND Communicate to dispatch	The parameters are planned to be in place prior to 6/1/16

***A case by case evaluation will be completed for make whole payments**

- Not all Real Time Values qualify for make-whole payments (i.e.- Notification Time)
- Market Seller shall follow the "Temporary Exception" process if they request the modified operational parameters to be considered for 'Make-Whole' payments

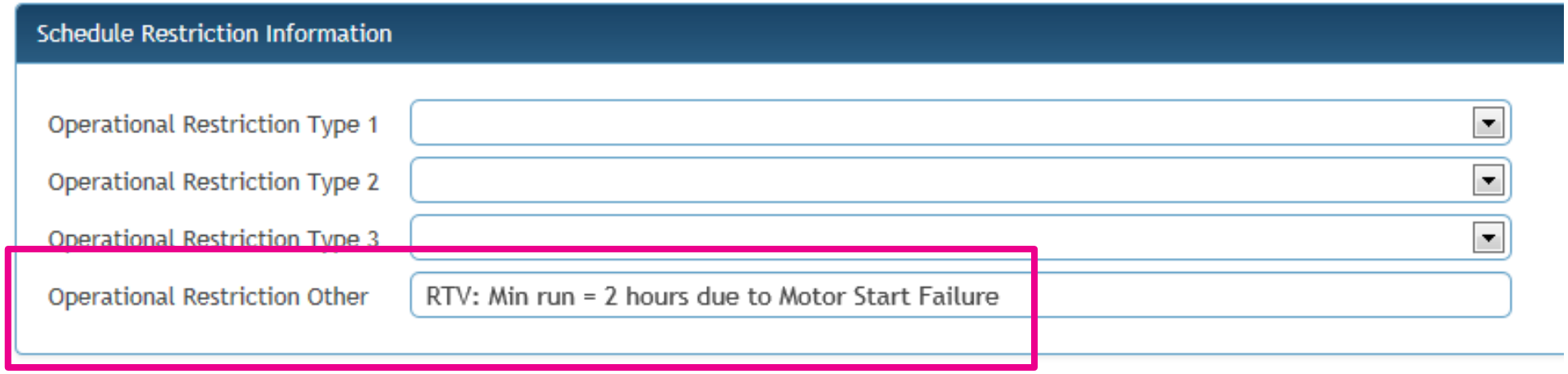
* Tariff, Attachment K Appendix (Section 3.2.3)

Real-Time Values

- Real-Time Value Overview
- **Real-Time Value Implementation Details**
- Real-Time Value Examples

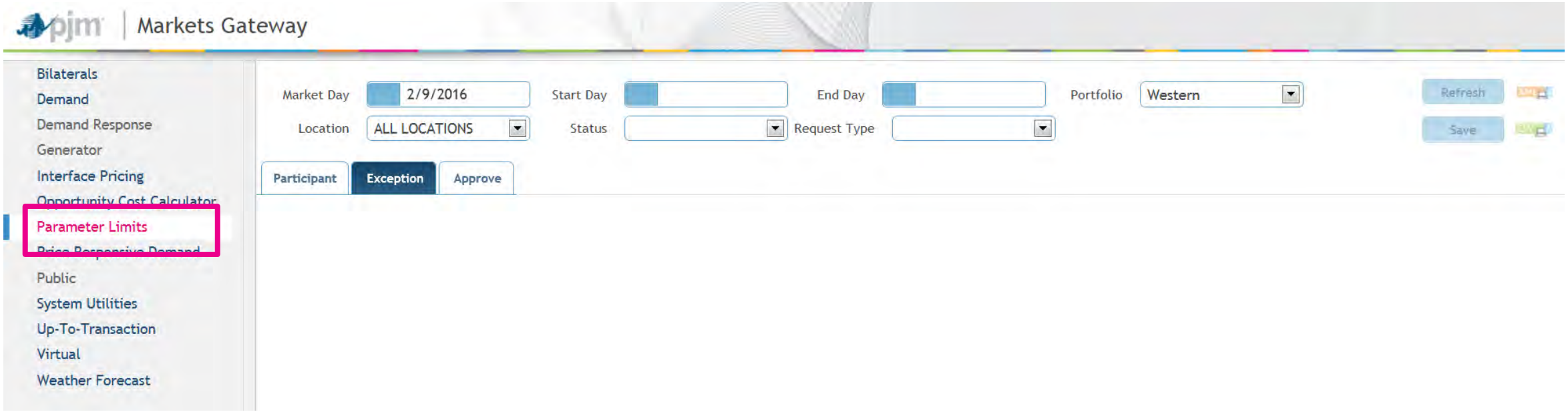
Real-Time Values - Submitting in Real Time

Submitting Real-Time Values in Real Time:
Operational Restrictions Open Text Field

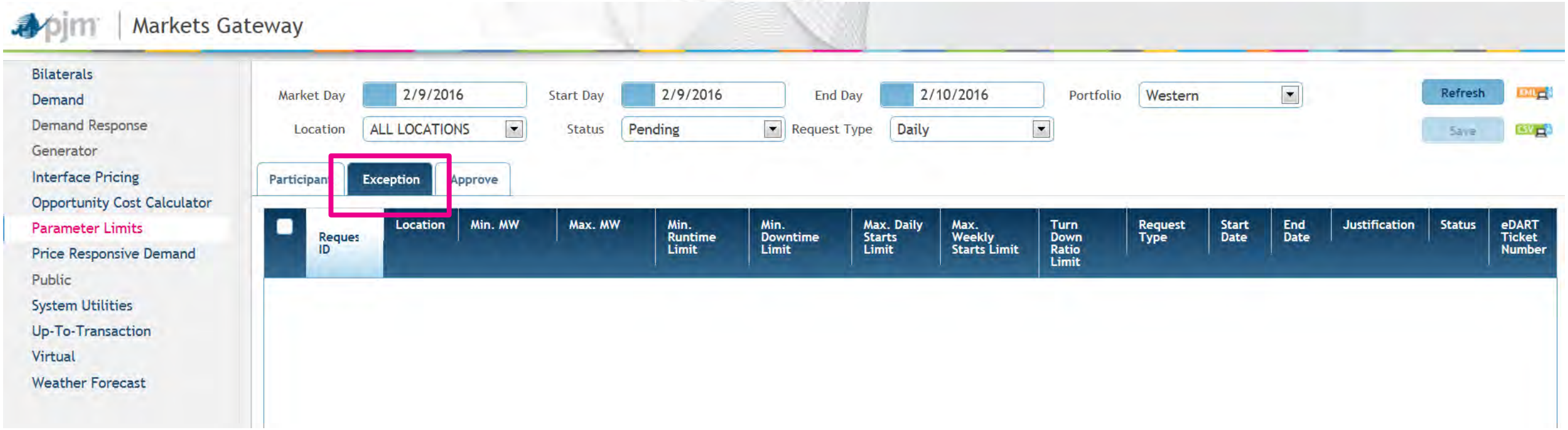


Real-Time Values- Submitting in Day Ahead

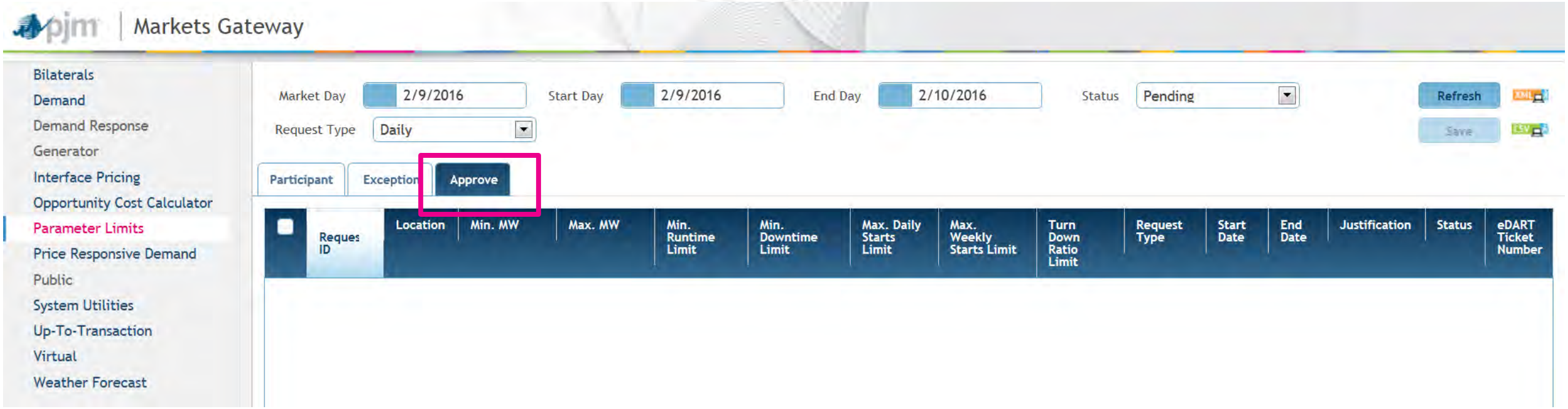
Submitting Real-Time Values in the Day Ahead:
Parameter Limits Tool in Markets Gateway



Exception Tab



Approve Tab



Real Time Values

- Real-Time Value Overview
- Real-Time Value Implementation Details
- **Real-Time Value Examples**

Real-Time Value Examples

Real-Time Values have been implemented for resources to communicate current operational capabilities to PJM dispatch. **A case by case evaluation will be completed for make whole payments.**

Real-Time Values Submitted BEFORE Day-ahead Energy Market (DAM)

Example 1: Unresolved unit specific value

- Unit Specific Value Min Run= 4 hrs
- Before the Day Ahead Market closes, Real Time Value for Min Run= 7 submitted in Markets Gateway due to "unresolved" unit specific value
- Unit is committed for Min Run=7 hrs
- *Unit will NOT be made whole for the extended hours beyond the unit specific parameters*
- **Settlements Example will be reviewed in next slide*

Real Time Values Submitted AFTER DAM Cleared but BEFORE Real-time Energy Market Commitment

Example 2: OFO issued

- Unit Specific Value Min Run = 4 hrs
- Unit has no DA award and Real Time Value for Min Run= 24 submitted due to OFO (Operational Flow Order) issued
- Unit is committed for Min Run= 24 hrs
- *Unit will be made whole for any hours where the revenue is less than the offer (for the ratable fuel)
- * Att. K-Appx. Section 3.2.3

Real-Time Values Submitted AFTER DAM Cleared for resource with preexisting DAM commitment

Example 3:

- Unit Specific Value Min Run= 4 hrs
- Unit is committed for min run= 4 hrs
- OFO is issued so Real Time Value submitted for Min Run= 24 hrs
- *Unit will NOT be made whole for 24 hrs*
- *PJM is NOT required to run unit for 24 hrs*

Settlements – Example 1

- Unit Specific Min Run Time – 4 hours
- Real-Time Value Min Run Time – 7 hours
- Day-ahead Operating Reserves
- Dollar amounts represent hourly net revenue
  - Positive value = Revenue > Offer
  - Negative value = Offer > Revenue
- If all 7 hours were considered under current Operating Reserve calculations, the Operating Reserve Credit = $40

RTV Settlements – Hourly Positive Net Revenue

HE 6	HE 7	HE 8	HE 9	HE 10	HE 11	HE 12
$100	-$50	-$100	-$25	~~-$25~~ $0	~~-$25~~ $0	$85
Unit Specific Min Run Time				Extended Real-Time Value Min Run Time		

Hours during the Extended Real-Time Value Min Run Time with hourly positive net revenue are considered as additional revenue. HE 10 and HE 11 have negative net revenue and are set to $0.

DA Net Revenue (Unit Specific Min Run Time) is -$75.
Eligible for $75 in DA Op Res Credits. Additional DA Revenue (Extended Min Run Time) is $85.

In this case, Additional DA Revenue (Extended Min Run Time) >= DA Op Res Credit, so generating resource receives $0 in DA Op Res Credits.

Required Action Review

- Schedule Updates
- XML Updates
- Updating Availability of Schedules

Required – Submit Parameter Limit Exceptions Query for Unit Parameter Limits XML Updates

Who Needs to Make the Updates?	XML Name	Changes Required	Completion Date	Testing	More Details	Contact For Questions
(1) **All Capacity Performance Market Sellers** who submit Temporary Exceptions (2) **All Capacity Performance and Annual Market Sellers** who submit Real Time Values (Day Ahead)	Submit Parameter Limit Exceptions	(1) 7 new fields -Hot Start -Intermediate Start -Cold Start -Hot Notification -Intermediate Notification -Cold Notification -Maximum Run Time (2) Flag to denote use of Temporary Exception or Real Time Value	For Market Day 6/1/16	The sandbox will be available for members to test updates prior to June 1	Details for XML changes are planned to be reviewed at the May OC	custsvc@pjm.com
(3) **All Market Sellers** who query Unit Parameter Limits	Query for Unit Parameter Limits					

REQUIRED- Cost and Price Based PLS Schedule Updates Via Markets Gateway and XML

Who Needs to Make the Updates?	Changes Required	Completion Date	Testing	More Details	Contact For Questions
All Capacity Performance Market Sellers who submit offers into Markets Gateway	Updates based on approved or proxy unit specific parameters to cost based and price based PLS schedules. Updates can be completed via Markets Gateway UI or XML	Up to 7 days prior for Market Day 6/1/16	The sandbox will be available for members to test validation prior to June 1	Training Video is planned for reviewed at the May OC	custsvc@pjm.com

REQUIRED- Make Price Based PLS Schedule Available

Who Needs to Make the Updates?	Changes Required	Completion Date	More Details	Contact For Questions
All Capacity Performance and Annual Market Sellers who submit offers into Markets Gateway	Price based PLS schedule must be made available in Markets Gateway Updates can be completed via Markets Gateway UI or XML	Up to 7 days prior for Market Day 6/1/16	Training Video is planned for reviewed at the May OC	custsvc@pjm.com

*Please see Manual 11 Section 2.3.3 Market Sellers- “Two price-based schedules must be offered into the Day-ahead Market. One schedule must be a price based parameter limited schedule. The second price schedule is a price-based schedule that is not parameter limited. In addition to the price-based schedules, one cost-based schedule shall be made available for PJM's use in the event that the resource is used to control a transmission constraint. The cost-based schedule shall be parameter-limited.”

Unit Specific Parameter and Real Time Value References

- Unit Specific Parameters: Tariff, Attachment K Appendix (Section 6.6 and 3.2.3) and the parallel provisions of Operating Agreement, Schedule 1
- Manual 11 Section 2.3.4 Minimum Generator Operating Parameters – Parameter Limited Schedules
- Process document posted on pjm.com: http://www.pjm.com/~/media/committees-groups/committees/elc/postings/20150612-june-2015-capacity-performance-parameter-limitations-informational-posting.ashx
- Process FAQs posted on pjm.com: http://www.pjm.com/~/media/committees-groups/committees/elc/postings/20150715-cp-unit-specific-adjustment-request-faqs.ashx
- Email adjustment request(s) and supporting documents by no later than February 28 prior to the upcoming delivery year: unitspecificpls@pjm.com

Dispatch Coordination

Dispatch Coordination Overview

- **Emergency Procedures Tool**
- Performance Assessment Hour (PAH) Ramp Rate
- Performance Assessment Hour (PAH) Triggers
- Summer PAH Scenario Walkthrough

Emergency Procedures Tool – Overview

- 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)
- A full list of potential events reported within the Emergency Procedure tool can be found within the tool's Message Definitions tab as well as within the Emergency Procedures Manual (M-13)
- User access, which permits Email/Text Notification Setup, to Emergency Procedures is available via Account Manager

Emergency Procedures Timestamps

Posting & cancellation timestamps

- The logging times within the Emergency Procedure tool.

Available in History

Effective start & end timestamps

- The timespan during which the Emergency Procedure is in effect. (i.e., The all-call time and/or the call or issuance date/time.)

Replaces posting / cancellation on the dashboard

Applicable start & end timestamps

- The timespan for which the message is applicable.
- Typically the same as *Effective*, unless the message issuance is in advance of the date, such as an alert or advisory.

Stays embedded within the message text for readability; & available via XML

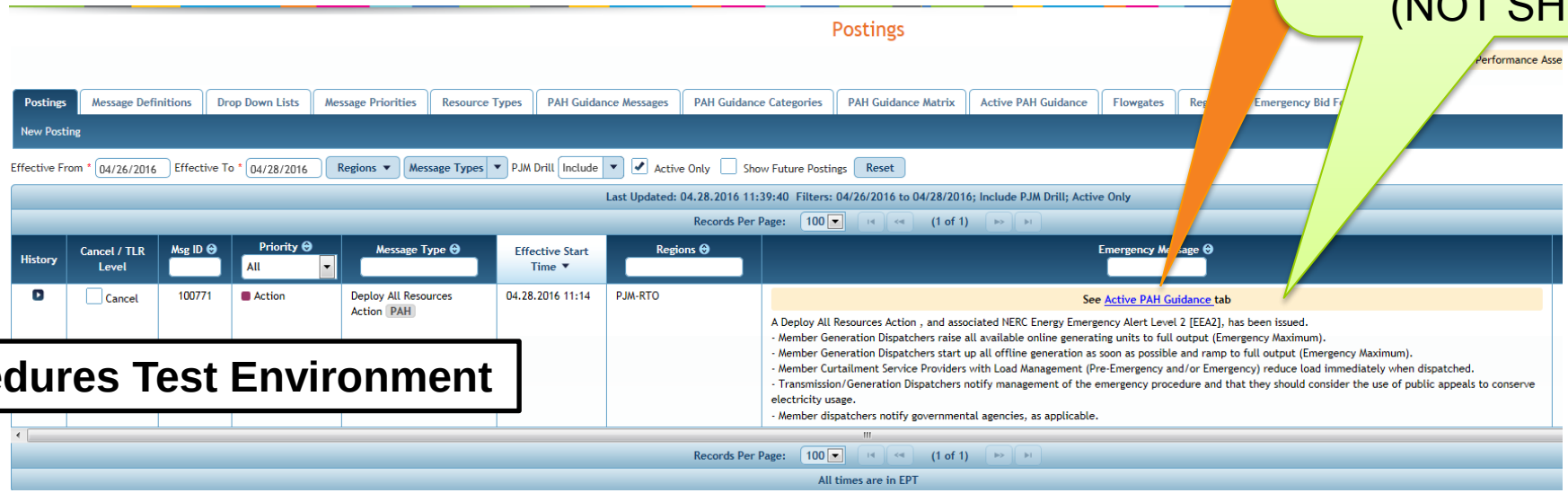
Performance Assessment Hour Flags

Message level PAH flag(s) made visible if:

1. The Emergency Procedures Event is a PAH trigger;
2. AND, the Emergency Procedures event is active. (not canceled)
3. If the message is also for a DRILL, that flag takes precedent. (not shown)

Performance Assessment Message - See Active PAH Guidance tab

DRILL Performance Assessment Message – Drill: See Drill Active PAH Guidance tab (NOT SHOWN)



Emergency Procedures Test Environment

Global Performance Assessment Hour Flags

Global PAH flag(s) when:

1. Any **Active** Emergency Procedures event exists which is a PAH trigger the *Performance Assessment Message* flag appears;
2. Any **Active** DRILL Emergency Procedures event exists which is a PAH trigger the corresponding *DRILL Performance Assessment Message* flag appears **

Performance Assessment Message in effect flag (NOT SHOWN)

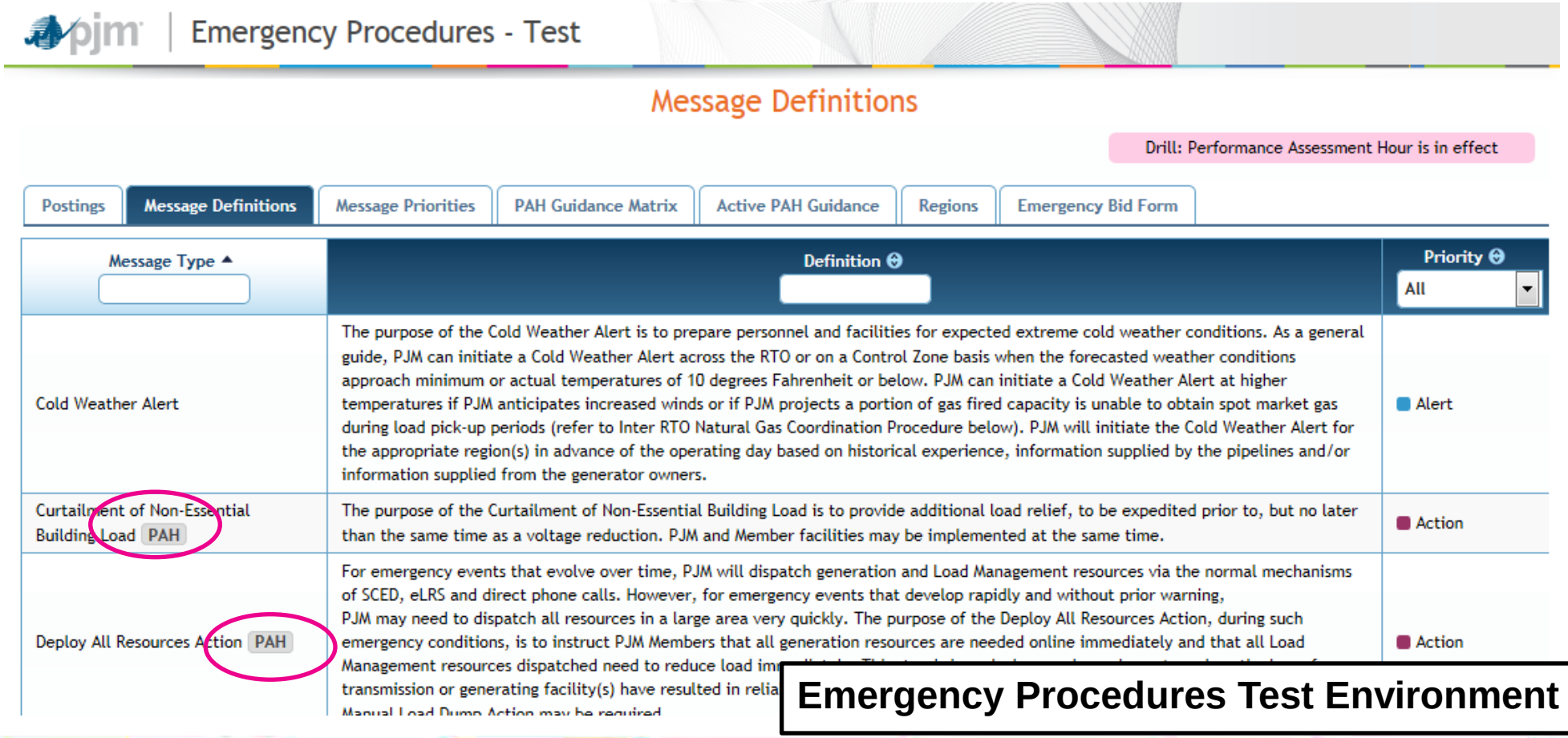
DRILL Performance Assessment Message in effect flag

Emergency Procedures Test Environment

** DRILL PAH are NOT a true Performance Assessment Hour, but useful to recognize impact & functionality.

Performance Assessment Hour Triggers

The message types which trigger PAH are delineated within the Message Definitions tab and indicated via a PAH flag.



Emergency Procedures Test Environment

Additional Tabs

Performance Assessment Hour Guidance Matrix

- Static default PAH Guidance by Resource Type (Online/Offline Generation; Pre-Emergency/Emergency Load Management) and by Emergency Procedure Message Type (PAH Triggers Only)

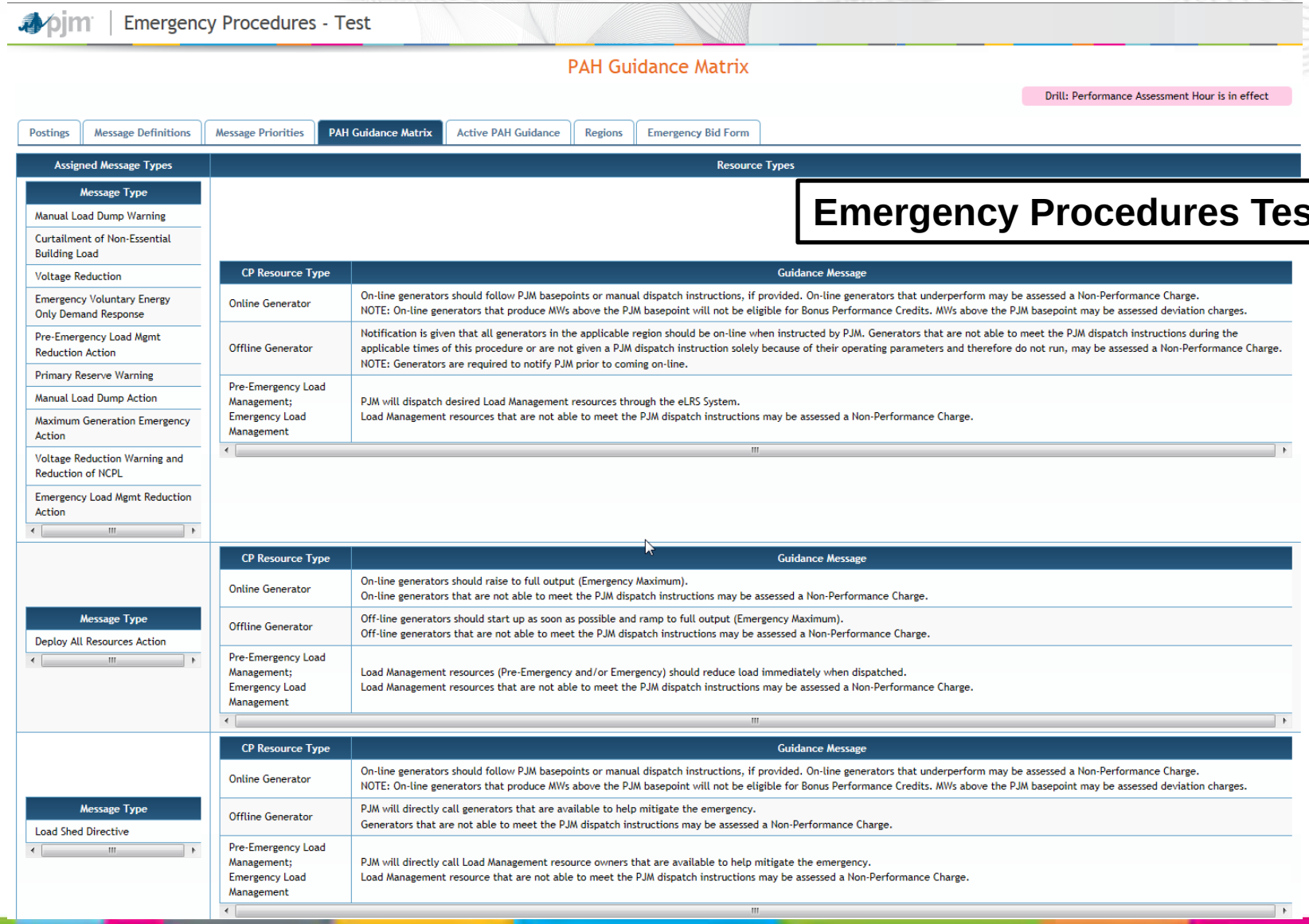
Performance Assessment Guidance

- Active guidance by TO Zone, per resource type
- Available 24x7, and will indicate “No guidance is in effect at this time” on a TO-zonal level whenever a PAH is not in effect for a given TO Zone

Drill Performance Assessment Guidance

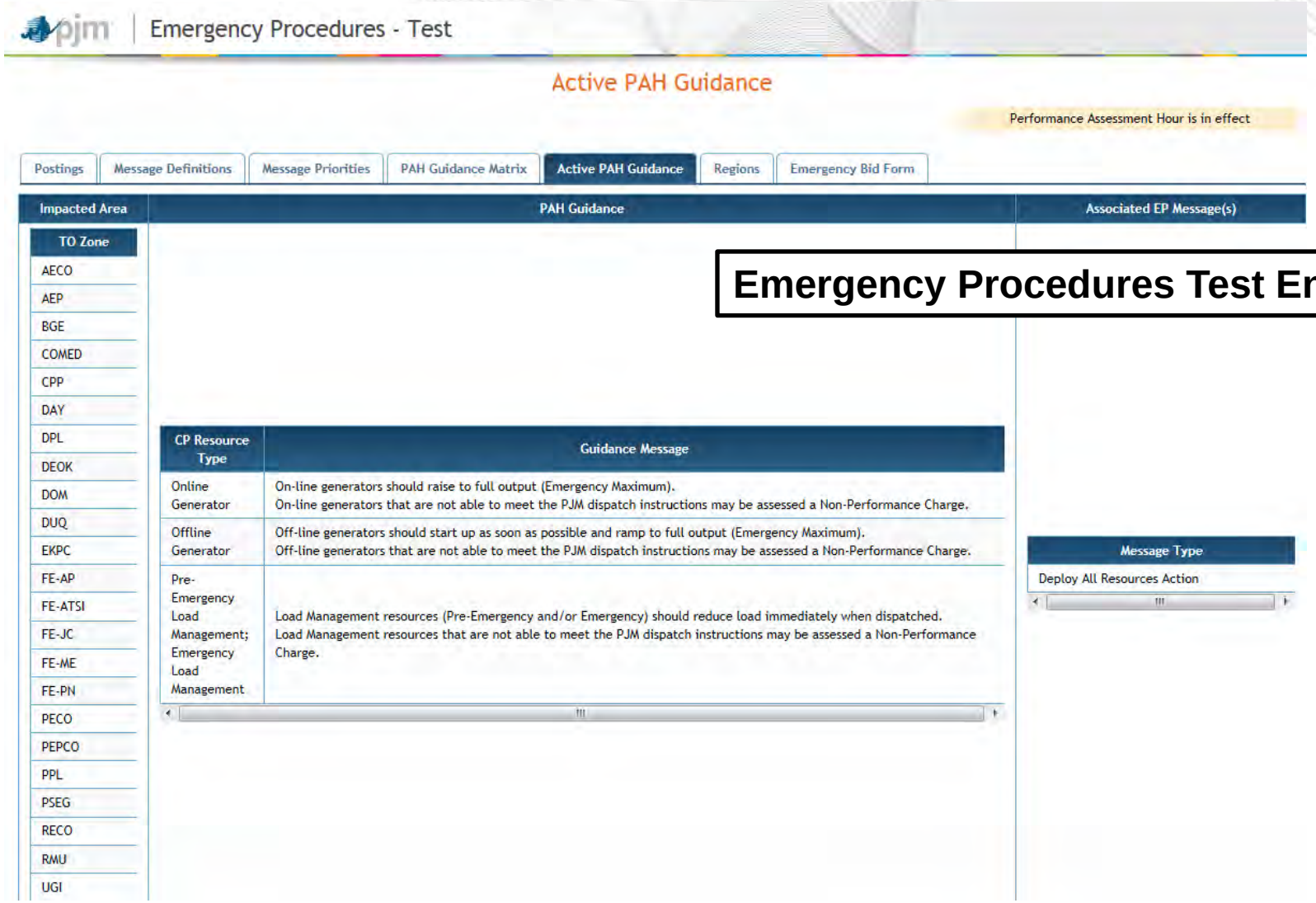
- Active guidance by TO Zone, per resource type
- Appears only during a DRILL when a DRILL-PAH is in effect for at least one region

PAH Guidance Matrix tab



Emergency Procedures Test Environment

Performance Assessment Guidance Tab



Emergency Procedures Test Environment

XML Release Schedule & Training

May 5

- Release to incorporate primary CP changes into Summer Emergency Procedures Drill slated for May 10

May 26

- Release to incorporate all CP changes into Emergency Procedures tool
- Will include email notification changes as well as other administrative functions

- Informational Messages will be posted on the Emergency Procedures tool as we approach the release schedule dates
- Sample XML files including CP/PAH changes posted at: http://www.pjm.com/markets-and-operations/etools/emerg-procedure.aspx
- Questions/Concerns: Contact PJM Emergency Procedures Admin at EPAdmin@pjm.com

Dispatch Coordination

- Emergency Procedures Tool
- **Performance Assessment Hour (PAH) Ramp Rate**
- Performance Assessment Hour (PAH) Triggers
- Summer PAH Scenario Walkthrough

Background

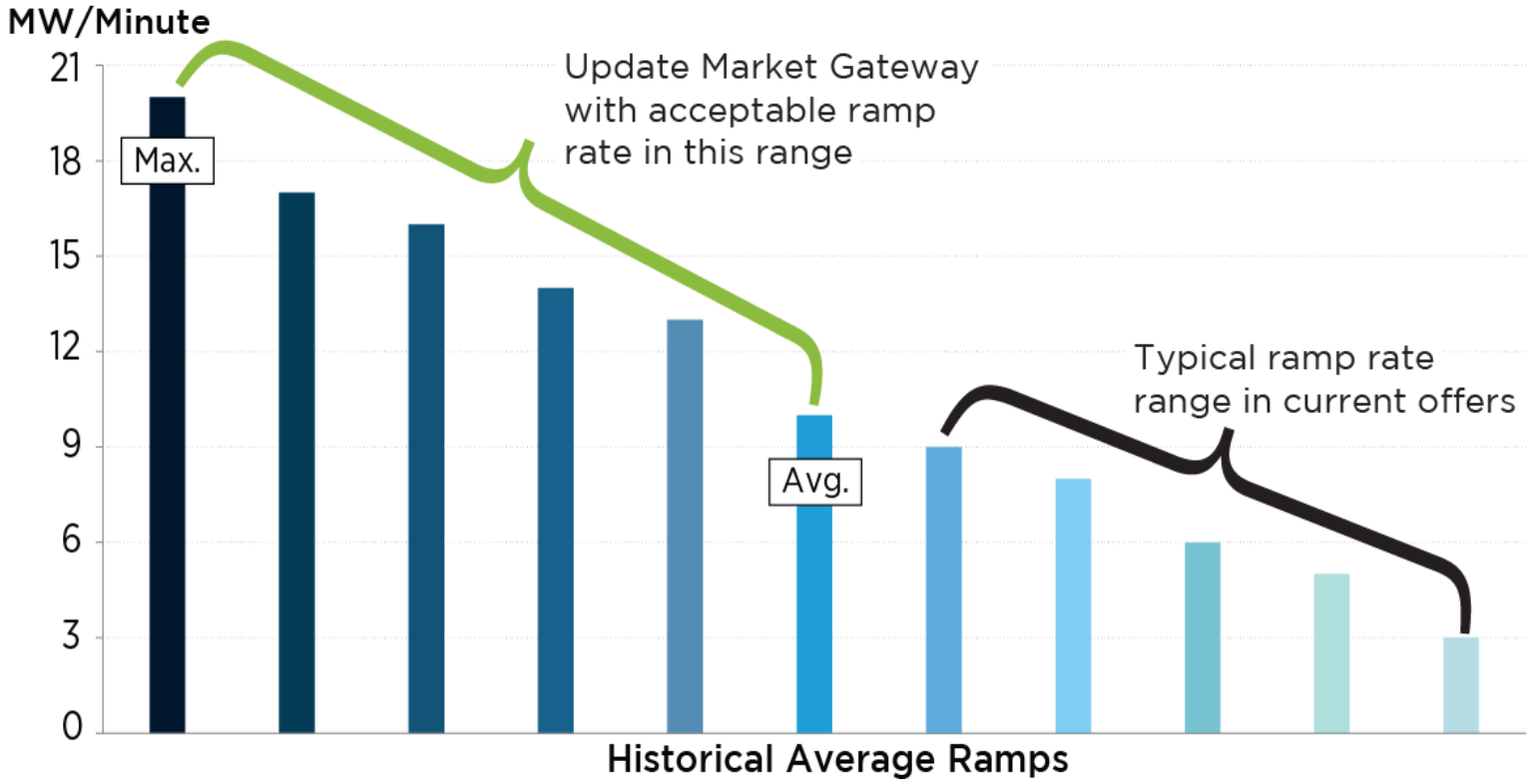
- Currently, the standing FERC order on Capacity Performance and existing PJM OATT language, requires resources to achieve the desired output (non-ramp limited basepoint) communicated by PJM instantaneously during a PAH in order to avoid a performance shortfall
- PJM identified a reliability concern with a potential for resources to ramp to full output in anticipation of a PAH in order to reduce their exposure to non-performance charges, resulting in limited resource operational flexibility and over-generation
- To mitigate this concern, PJM proposed that an online resource's ramp rate should be included in the Performance Shortfall excusal reasons, so far as it is *acceptable*

PJM Acceptable Ramp Rate

- Ramp or Segmented Ramp value established between the historical ramp/segmented ramp average and historical ramp/segmented ramp maximum based on the unit's actual ramp performance between January 1 and March 31, 2016. If unit was not dispatched in that timeframe, then the three month span will be between June 1 – August 31, 2015

- This value will be entered in Markets Gateway by the Market Seller and approved by PJM

- The diagram to the right shows conceptually the range of ramp rate values that may be used as a PJM acceptable ramp rate



Filed PAH Ramp Rate Proposal

Before June 1, 2016

- Members will update their ramp rate values in Markets Gateway with a *PJM acceptable ramp rate*
  - Capacity Performance – effective for the ***April 21, 2016*** Operating Day
  - Non-Capacity Performance – effective for the ***June 1, 2016*** Operating Day
- PJM started to monitor the changes of inputted ramp rates for all resources starting March 1
- PJM, in conjunction with the IMM, will review the newly inputted ramp rates between April 21 and May 15 and ensure the ramp rate reflects the *PJM acceptable ramp rate definition*

Filed PAH Ramp Rate Proposal

After June 1, 2016

When a Hot Weather/Cold Weather Alert is issued on that Operating Day, PJM will run a report comparing the current day's offer ramp rate to the ***April 21 Operating Day*** ramp rate

- PJM will notify specific members if a slower ramp rate is detected
- After being notified, members must provide documentation explaining the reduction
- If PJM does not agree with the reduction, then PJM will assess Non-Performance Charges based on the 'desired' non-ramp limited basepoint

- Performance Shortfalls will be reduced if:
  - An acceptable ramp rate is approved by PJM; and
  - Resource is operating at or above its Economic Minimum

PAH Ramp Rate Implementation Status

- PJM filed PJM OATT revisions with FERC on April 1, 2016 with a requested May 31, 2016 effective date
- If FERC approves the PJM OATT revisions, PJM will proceed with using the PJM accepted ramp rate in the Performance Shortfall calculation during a PAH
- If FERC denies or delays the PJM OATT revisions, PJM will proceed with the current OATT rules
  - Ramp rates will **not** be used in the Performance Shortfall calculation
- PJM, in conjunction with the IMM, is currently reviewing ramp rate updates in Markets Gateway

Dispatch Coordination

- Emergency Procedures Tool
- Performance Assessment Hour (PAH) Ramp Rate
- **Performance Assessment Hour (PAH) Triggers**
- Summer PAH Scenario Walkthrough

Performance Assessment Hour Triggers

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

Warnings

Actions

- Pre-Emergency Load Management Reduction Action (30, 60 or 120 minute)
- Emergency Load Management Reduction Action (30, 60 or 120 minute)
- Primary Reserve Warning
- Maximum Generation Emergency
- Emergency Voluntary Energy Only Demand Response Reductions
- Voltage Reduction Warning
- Curtailment of Non-Essential Building Load
- Deploy All Resources Action NEW
- Manual Load Dump Warning
- Voltage Reduction Action
- Manual Load Dump Action

(***Section 5.7 of*** *Emergency Procedures* ***Manual 13***)

- Load Shed Directive

Deploy All Resources Action

- New Emergency Procedure Action and Performance Assessment Hour Trigger
- Added to allow PJM ability to dispatch all resources in a large area very quickly for emergency events that develop rapidly and without prior warning
- During such emergency conditions, this action will instruct PJM Members that all generation resources are needed online immediately and that all Load Management resources dispatched need to reduce load immediately
- Issued when unplanned events such as the loss of a transmission or generating facility(s) have resulted in reliable operations being jeopardized such that a Voltage Reduction Action or a Manual Load Dump Action may be required

- Emergency Procedures Tool
- Performance Assessment Hour (PAH) Ramp Rate
- Performance Assessment Hour (PAH) Triggers
- **Summer PAH Scenario Walkthrough**

Summer PAH Scenario Walkthrough

- Walk through a ‘slow building’ typical emergency procedure scenario set in the summer peak operations time frame
- Highlight Dispatch communications via All Call and Emergency Procedures
- Identify Emergency Procedure events that result in Performance Assessment Hours

Summer PAH Scenario

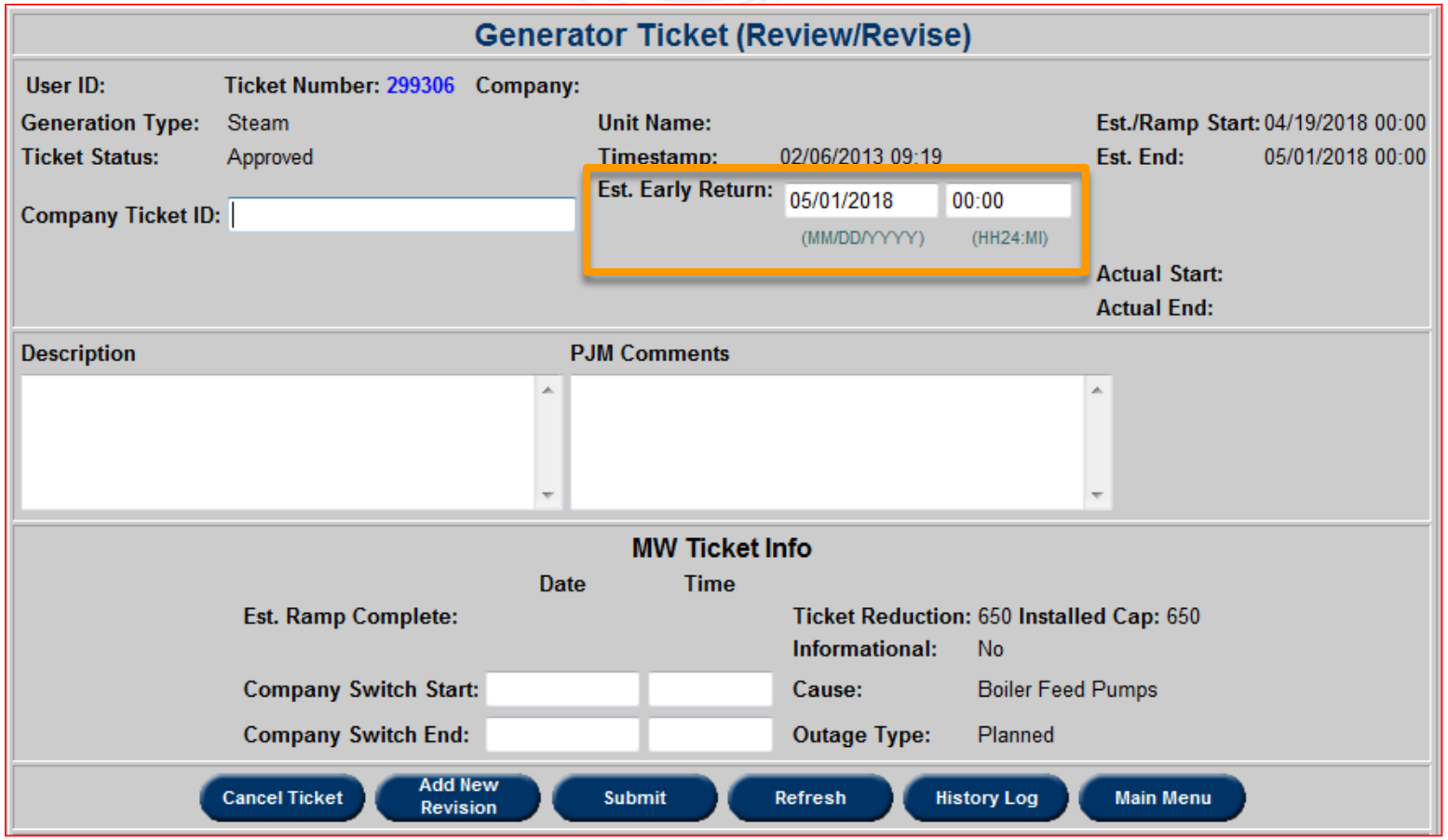
- Peak Summer Time Frame (July-August)
- Extreme hot weather conditions projected throughout the PJM RTO, with temperatures approaching 100°F in Mid-Atlantic, Western and Southern regions for multiple hours in the afternoon
- Anticipating record evening peak between 17:00-18:00

+3 Days Prior to Peak Event

- **In anticipation of constrained operations, Dispatch issues Unit Startup Notification Alert as early as 6 days in advance**
  - This alert ensures that all offline units with long lead times are placed into a state of readiness to be brought online within 48 hours by PJM
- **Within 3 days of an event, Dispatch issues Hot Weather Alert (HWA) via All Call and Emergency Procedures message**
  - The HWA Emergency Procedures message will also include a request for generation owners to update Early Return Time for all Planned outages via eDART
- **At least 3 days in advance of event, Dispatch performs long lead analyses to study the need to schedule long lead offline units, as well as recall maintenance outages for reliability based on projected system conditions**
  - Dispatch implements 72-hr Maintenance Outage Recall via eDART
  - Dispatch schedules long lead offline units and 'offer caps' them

Planned Outage Est. Early Return Time in eDART

When Hot Weather Alert is issued, members should update Estimated Early Return in eDART for all Planned Outage tickets

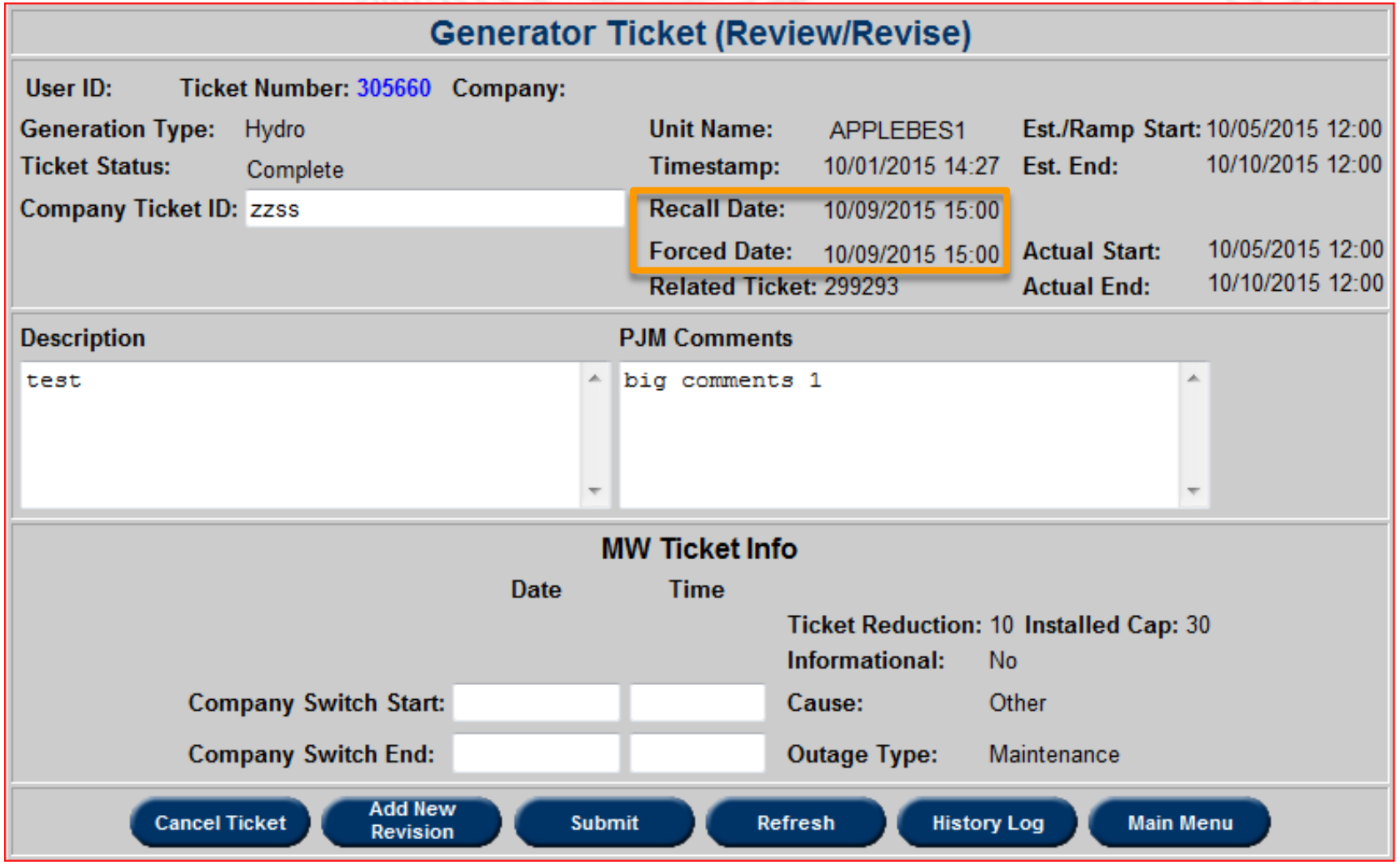


72-Hour Maintenance Outage Recall via eDART

- When Dispatch implements a 72-hr Maintenance Outage recall, PJM will notify all affected unit owners verbally, and update all maintenance tickets in effect during the recall window with a Recall Date

- If a recalled Maintenance outage is still active after the Recall time, it will be considered a forced outage and a Forced Date will be added to the ticket

Recall/Forced Dates in eDART



One Day Prior to Event

- PJM holds SOS conference calls advising of system conditions
- Day-Ahead (DA) Market Impacts: HWA issuance results in use of the Unit Specific Price PLS schedules for unit DA awards, which may affect parameters visible to Dispatch in real-time
  - Marketers may choose to be scheduled under modified operational parameters by using the temporary Exceptions or Real Time Values processes reviewed earlier
- PJM performs the Reliability Adequacy Commitment (RAC) run and then issues Maximum Generation Emergency/Load Management Alerts, and other Emergency Procedure Alerts as conditions indicate
  - Issuance of a Max Gen Emergency/Load Management Alert triggers a request in eLRS that Curtailment Service Providers shall, on an hourly basis, provide any updates to their information for the remaining hours of the day beginning at 10:00 and continuing until 19:00

Operating Day – Leading into Evening Peak

- Load Forecasts are continuously evaluated by Dispatch
- At **13:00**, Dispatch initiates an *Emergency Energy Request* for Emergency Bids
- At **13:30**, Dispatch implements IXM curtailments of all non-firm exports for the time frame from 16:00 - 18:00

Operating Day – During Evening Peak

13:45 Dispatch requests all 2-hr Pre-Emergency Load Management for RTO to reduce at 15:45

15:45 Performance Assessment Hour (RTO) starts once 2-hr Pre-ELM for RTO is loaded

16:00 Dispatch requests all 1-hr Pre-Emergency Load Management for RTO to reduce at 17:00

16:15 Dispatch declares a Maximum Generation Emergency Action for RTO

16:30 Dispatch declares a Voltage Reduction Warning (RTO) and requests curtailment of all non-essential building load. Also at 16:30, Dispatch requests all 30-min Pre-Emergency Load Management for RTO to reduce at 17:00

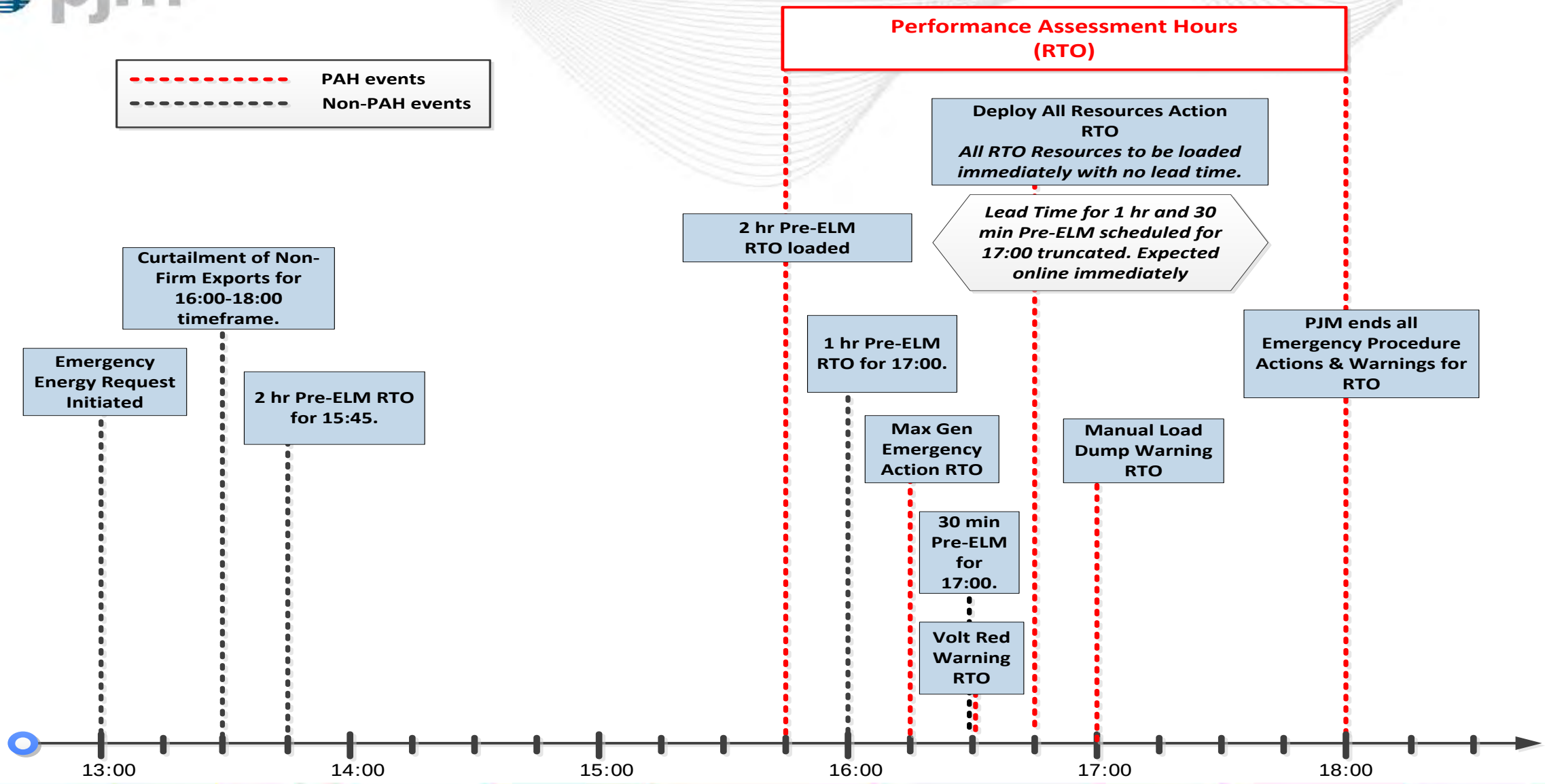
16:45 Upon loss of a large steam unit, Dispatch declares a Deploy All Resources Action for RTO

- This truncates the lead time for all resources in RTO (generators and DR) not yet online

17:00 Dispatch declares a Manual Load Dump Warning for RTO

18:00 Dispatch ends all Emergency Procedure Actions and Warnings for RTO, ending the active RTO PAH

Emergency Procedures Timeline Diagram



Post Event Actions

- When appropriate, Dispatch cancels all active Emergency Procedures Actions and Warnings, resulting in the conclusion of all active Performance Assessment Hours

- Dispatch takes steps to return to state of normal economic operations

- During the days following the PAH event, PJM Markets and Operations will review actual performance of all resources, and all potential excusals as defined by the PJM OATT, for use by PJM Markets Settlements in determination of capacity performance shortfalls/bonuses

Settlements

- **Non-Performance Assessment**
- Examples
- Replacement Transactions
- Billing and Reports

Balancing Ratio (BR) is used to calculate a Capacity/Base Performance resource's Expected Performance value

$$\frac{\text{Total Actual Generation and Storage Performance + Net Energy Imports * + Demand Response Bonus Performance}}{\text{All Generation and Storage Committed UCAP}}$$

Ratios are calculated for each PAH declared by the Emergency Action and is 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 – PPL/PECO
- If Pre-Emergency LM is issued for PPL and Maximum Generation is issued for PECO for a different reason, then two different PAH areas are created – PPL and PECO

Balancing Ratio

- PJM will post Balancing Ratio on PJM.com under the Capacity Market section in Markets & Operations
- Preliminary Balancing Ratio: post within two business days after a PAH occurs
  - Will not include the DR Bonus Performance value and replacements
- Final Balancing Ratio: post with the issuance of the monthly bill
- Posting format will be Excel

Non-Performance Assessment

- Assess performance of resources during Performance Assessment Hours (PAH) triggered by PJM declaration of Emergency Actions
- Compare each resource's Expected Performance against Actual Performance for each PAH that is located in the Emergency Action defined area
  - Actual Performance (generation) = metered output
  - Expected Performance (generation) = UCAP MW Commitment * Balancing Ratio
  - Actual Performance (DR) = load reduction provided dispatched by PJM
  - Expected Performance (DR) = ICAP MW Commitment for DR
- Calculate shortfall/excess for each resource for each PAH separately

Non-Performance Charge

- If Expected Performance is greater than Actual Performance, then the resource has a Performance Shortfall and may be subject to Non-Performance Charges
- Non-Performance Charge = Performance Shortfall MW * Non-Performance Charge Rate
- Non-Performance Charge Rate (NPCR) for Capacity Performance Resources is based on Net CONE of modeled LDA in which resource resides; rate = (Net CONE * 365 days) / 30 hours
  - 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))
- Non-Performance Charge Rate (NPCR) for Base Capacity Resources is based on the weighted average clearing price applicable to the resource; rate = (WARCP * 365 days) / 30 hours

Bonus Performance Credit

- If Actual Performance is greater than Expected Performance, then the resource may have Bonus MW and may 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
- Total Non-Performance Charges are allocated 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, even if not a Capacity Resource, are eligible for credit

Performance Shortfall Excusals

- If a resource is assessed a Performance Shortfall (Expected Performance > Actual Performance), then determine if excusal MWs are allowed
- PJM will make that determination after each PAH occurs
  - Was the resource on a Generator Planned or Maintenance Outage? Full or Partial?
    - Forced Outages, partial or full, are not an excusal
  - Was the resource operating at MW level consistent with PJM Dispatch instructions with PJM acceptable ramp rate. (PAH Ramp Rate proposal)?
  - Did PJM not schedule the resource? Or did PJM schedule the resource down?
    - PJM will review the resource's parameters and offers and determine if PJM's scheduling decisions were solely based on such parameters and/or offers

Expected Performance vs. Actual Performance

Compare a resource's Expected Performance against Actual Performance for each PAH to determine resource's potential Shortfall or Bonus MW

Resource A	
UCAP Commitment	100 MW
Balancing Ratio	0.80
Expected Performance	80 MW
Actual Performance	73 MW
Shortfall/Bonus	7 MW

Resource A has a 7 MW Shortfall and could be subject to a Non-Performance Charge

Resource B	
UCAP Commitment	100 MW
Balancing Ratio	0.80
Expected Performance	80 MW
Actual Performance	93 MW
Shortfall/Bonus	-13 MW

Resource B has 13 MW bonus and could be eligible for a Bonus Performance Credit

= UCAP Commitment * Balancing Ratio

= metered output

= Expected Performance - Actual Performance

This example does not look at exceptions or excused MW consideration, created to show Expected vs Actual calculations

Expected Performance vs. Actual Performance 2016/17 and 2017/18 Delivery Years

		Summer Performance Assessment Hour (June - Sept)		Non-Summer Performance Assessment Hour	
Resource Type	**Product**	**Expected Performance**	**Actual Performance**	**Expected Performance**	**Actual Performance**
Generation/Storage*	Capacity Performance	Committed UCAP * Balancing Ratio	Metered Energy Output + Reserve/Regulation Assignment	Committed UCAP * Balancing Ratio	Metered Energy Output + Reserve/Regulation Assignment
Generation/Storage	Annual	NA	NA	NA	NA
Demand Response	Capacity Performance	Committed ICAP	Load Reduction + Reserve/Regulation Assignment	Committed ICAP	Load Reduction (CBL Method) + Reserve/Regulation Assignment
Demand Response	Annual, Ext. Summer, Limited	NA	NA	NA	NA
Demand Response	Economic	NA	NA	NA	NA
Energy Efficiency	Capacity Performance	Committed ICAP	PJM Approved Post-Installation Load Reduction	Committed ICAP	PJM Approved Post-Installation Load Reduction
Energy Efficiency	Annual	NA	NA	N/A	N/A
Energy Only Resources	N/A	0	NA	0	NA
Energy Imports	N/A	0	NA	0	NA

***Includes External Generation Capacity Resources**

Expected Performance vs. Actual Performance 2018/19 and Beyond Delivery Years

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

***Includes External Generation Capacity Resources**

Non-Performance Assessment Example

Balancing Ratio= .9
Charge Rate= $3,000
Credit Rate = Total Charges / Bonus MW = $3,000/MW ($1,290,000/430 MW)

		Resource Performance Assessment for a single PAH				
Company/ Resource	Capacity Commitment (UCAP MW)	Expected Performance	Actual Performance	Performance (Exp - Act) *	Charge	Credit
A-1	300	270	325	-55	$0	$165,000
A-2	250	225	0	225	$675,000	$0
A-3	0	0	150	-150	$0	$450,000
B-4	150	135	100	35	$105,000	$0
B-5	150	135	100	35	$105,000	$0
B-6	150	135	0	135	$405,000	$0
C-7	0	0	100	-100	$0	$300,000
D-8	0	0	125	-125	$0	$375,000
	1000		900		$1,290,000	$1,290,000

*Positive value indicates Underperformance/Negative value indicates Overperformance

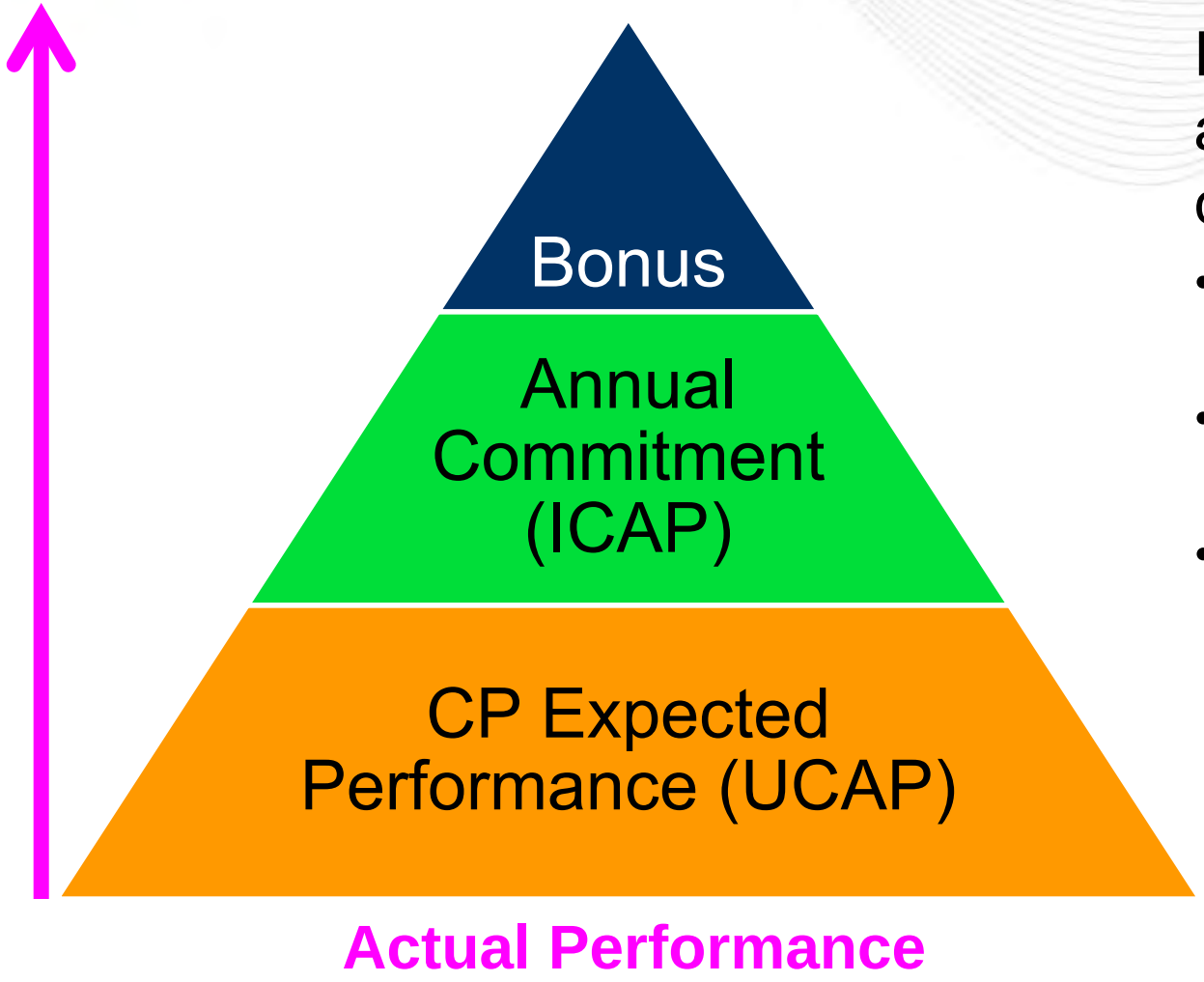
Stop-loss

- 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 Resources: 1.5 * Applicable LDA Net CONE * Max Daily UCAP Commitment during the Delivery Year through the end of the month for which the Non-Performance Charge was assessed
  - Base Capacity Resources: Total capacity revenues due to the resource for the Delivery Year
- The Stop-Loss for the Transition Years:
  - 2016/2017 CP Stop loss = $85,333.70 * the resource's max committed CP UCAP MW
  - 2017/2018 CP Stop loss =$108,910.23 * the resource's max committed CP UCAP MW

Settlements

- Non-Performance Assessment
- **Examples**
- Replacement Transactions
- Billing and Reports

Transition DY Non-Performance Assessment



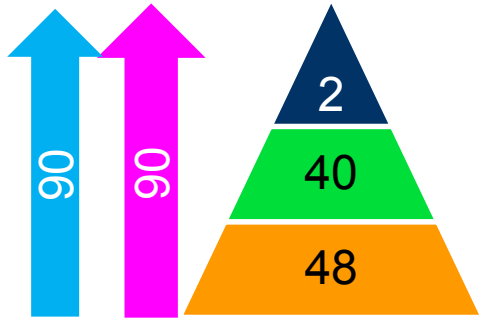
For any generation resource with both an Annual Resource and a CP commitment, Actual Performance will:

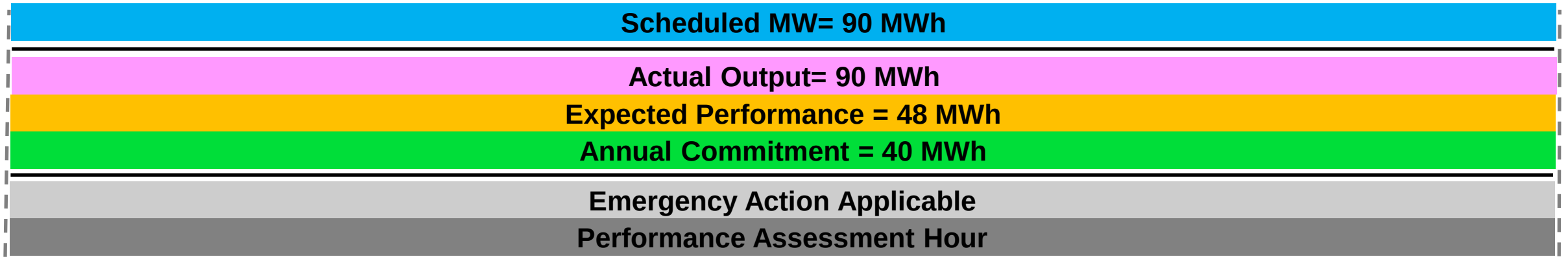
- First be assigned to the resource's Expected Performance as a CP Resource
- Then assigned to the resource's Annual commitment (in ICAP terms)
- Any remaining Actual Performance is used for purposes of determining Bonus Performance

CP and Annual Commitments – Example 1

PAH Effective Start at 0800	Unit UCAP = 100 MW	Balancing Ratio (BR) = 0.80
PAH Applicable Start at 0900	CP Commitment (UCAP) = 60 MW	Expected Performance = CP Commitment * BR
PAH Stop at 1000	Annual Commitment (ICAP) = 40 MW	Performance Shortfall = Expected - Actual

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)

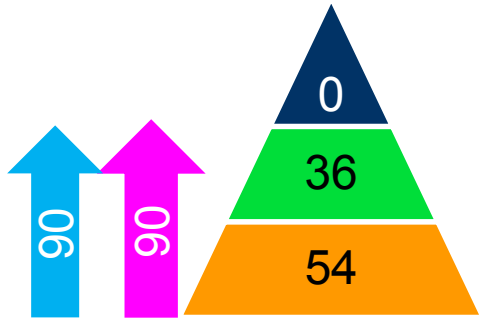


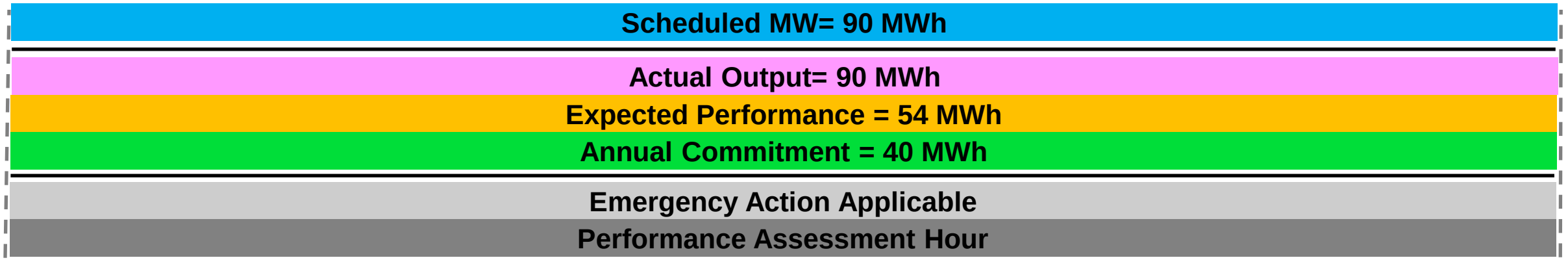


CP and Annual Commitments – Example 2

PAH Effective Start at 0800	Unit UCAP = 100 MW	Balancing Ratio (BR) = 0.90
PAH Applicable Start at 0900	CP Commitment (UCAP) = 60 MW	Expected Performance = CP Commitment * BR
PAH Stop at 1000	Annual Commitment (ICAP) = 40 MW	Performance Shortfall = Expected - Actual

Scheduled/Dispatch = 90 MWh
Actual Performance (PwrMtr) = 90 MWh
Expected Performance = 54 MWh (60 MW * 0.9)
Performance Shortfall = 0 MWh → (54 Expected – 90 Actual = - 36 MWh)
Bonus Performance = 0 MWh → (90 Actual – 54 Expected – 36 Annual)

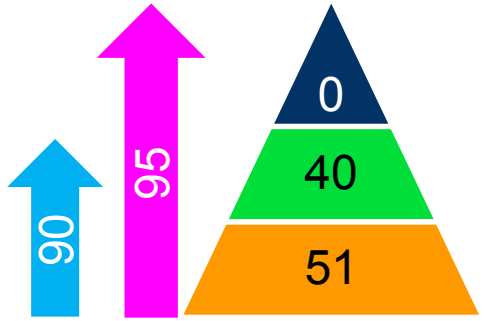


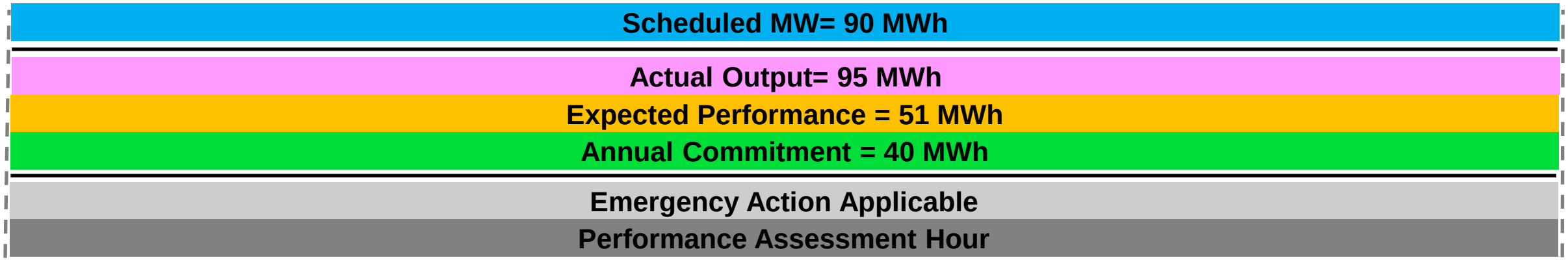


CP and Annual Commitments – Example 3

PAH Effective Start at 0800	Unit UCAP = 100 MW	Balancing Ratio (BR) = 0.85
PAH Applicable Start at 0900	CP Commitment (UCAP) = 60 MW	Expected Performance = CP Commitment * BR
PAH Stop at 1000	Annual Commitment (ICAP) = 40 MW	Performance Shortfall = Expected - Actual

Scheduled/Dispatch = 90 MWh
Actual Performance (PwrMtr) = 95 MWh
Expected Performance = 51 MWh (60 MW * 0.85)
Performance Shortfall = 0 MWh → (51 Expected – 95 Actual = - 44 MWh)
Bonus Performance = 0 MWh → (95 Actual – 51 Expected – 40 Annual)
→ No Bonus Performance since PJM only scheduled resource to 90 MWh

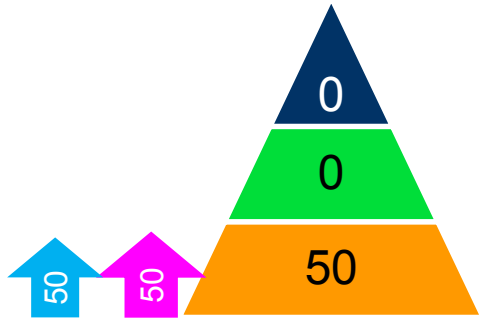


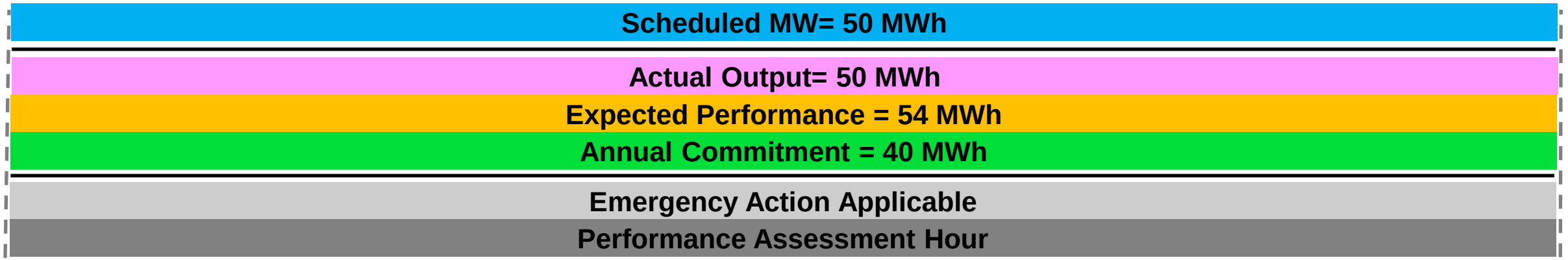


CP and Annual Commitments – Example 4

PAH Effective Start at 0800	Unit UCAP = 100 MW	Balancing Ratio (BR) = 0.90
PAH Applicable Start at 0900	CP Commitment (UCAP) = 60 MW	Expected Performance = CP Commitment * BR
PAH Stop at 1000	Annual Commitment (ICAP) = 40 MW	Performance Shortfall = Expected - Actual

Scheduled/Dispatch = 50 MWh
Actual Performance (PwrMtr) = 50 MWh
Expected Performance = 54 MWh (60 MW * 0.9)
Performance Shortfall = 0 MWh → (54 Expected – 50 Actual = 4 MWh)
→ 4 MWh Shortfall is excused since PJM only schedule unit to 50 MWh
Bonus Performance = 0 MWh → (50 Actual – 54 Expected – 0 Annual)

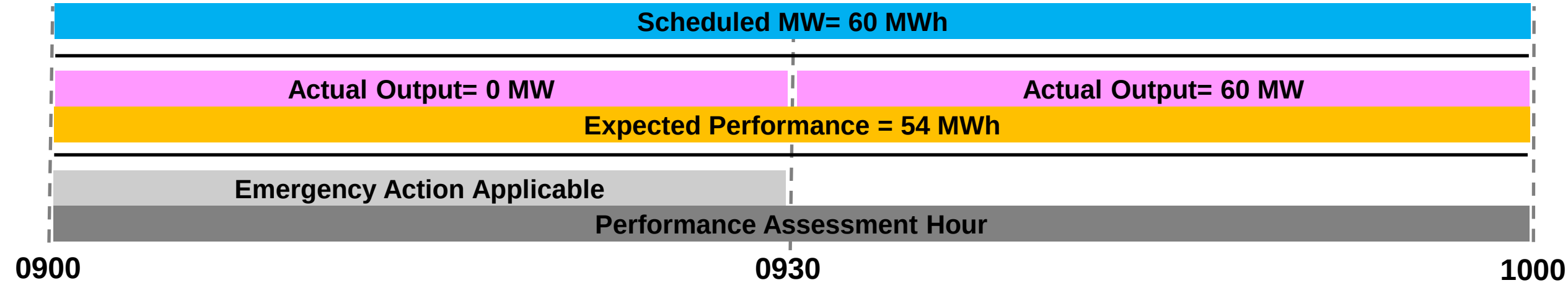




CP Commitment and Partial Hour – Example 1

PAH Effective Start at 0800	Unit UCAP = 60 MW	Balancing Ratio (BR) = 0.90
PAH Applicable Start at 0900	CP Commitment (UCAP) = 60 MW	Expected Performance = CP Commitment * BR
PAH Stop at 930		Performance Shortfall = Expected - Actual

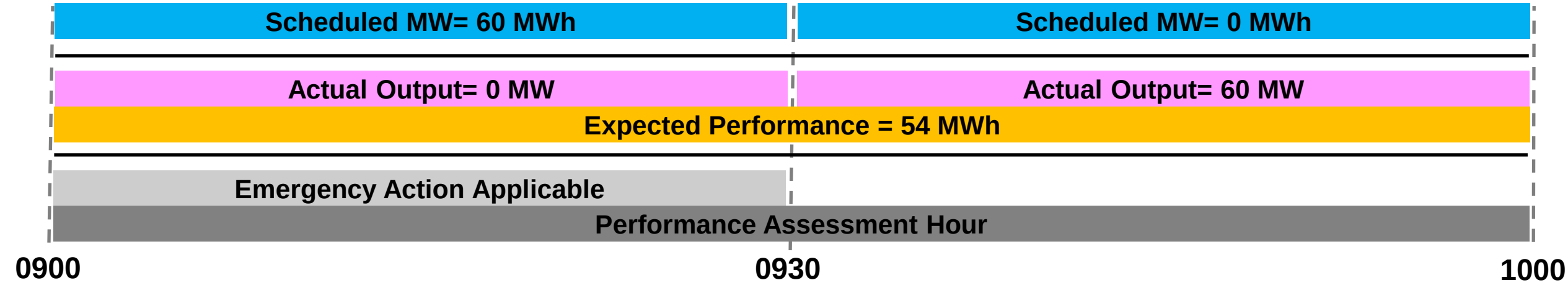
Scheduled/Dispatch = 60 MWh
Actual Performance (PwrMtr) = 30 MWh
Expected Performance = 54 MWh (60 MW * 0.9)
Performance Shortfall = 24 MWh → (54 Expected – 30 Actual = 24 MWh)
Bonus Performance = 0 MWh → (30 Actual – 54 Expected)



CP Commitment and Partial Hour – Example 2

PAH Effective Start at 0800	Unit UCAP = 60 MW	Balancing Ratio (BR) = 0.90
PAH Applicable Start at 0900	CP Commitment (UCAP) = 60 MW	Expected Performance = CP Commitment * BR
PAH Stop at 930		Performance Shortfall = Expected - Actual

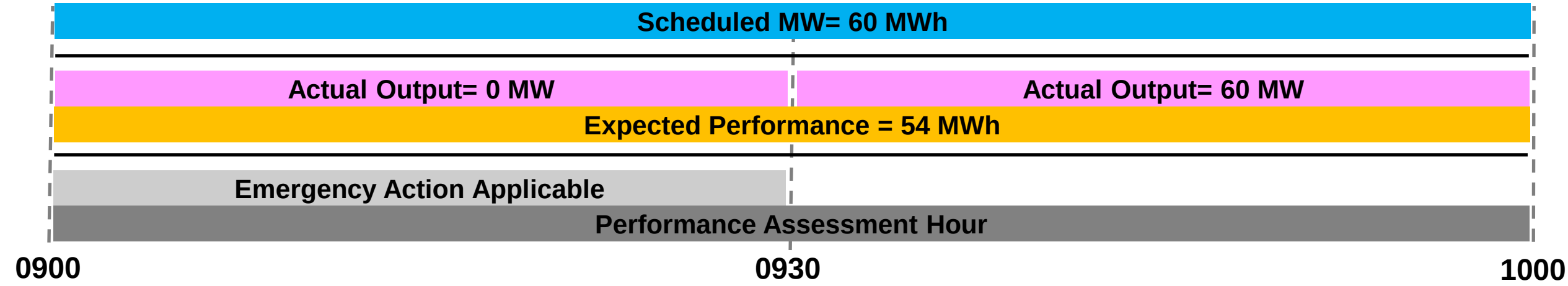
Scheduled/Dispatch = 30 MWh
Actual Performance (PwrMtr) = 30 MWh
Expected Performance = 54 MWh (60 MW * 0.9)
Performance Shortfall = 0 MWh → (54 Expected – 30 Actual = 24 MWh)
→ 24 MWh Shortfall is excused since PJM only schedule unit to 30 MWh
Bonus Performance = 0 MWh → (30 Actual – 54 Expected)



CP Commitment and Partial Hour – Example 3

PAH Effective Start at 0800	Unit UCAP = 60 MW	Balancing Ratio (BR) = 0.90
PAH Applicable Start at 0900	CP Commitment (UCAP) = 60 MW	Expected Performance = CP Commitment * BR
PAH Stop at 930		Performance Shortfall = Expected - Actual

Scheduled/Dispatch = 60 MWh
Actual Performance (PwrMtr) = 30 MWh
Expected Performance = 54 MWh (60 MW * 0.9)
Performance Shortfall = 24 MWh → (54 Expected – 30 Actual = 24 MWh)
Bonus Performance = 0 MWh → (30 Actual – 54 Expected)

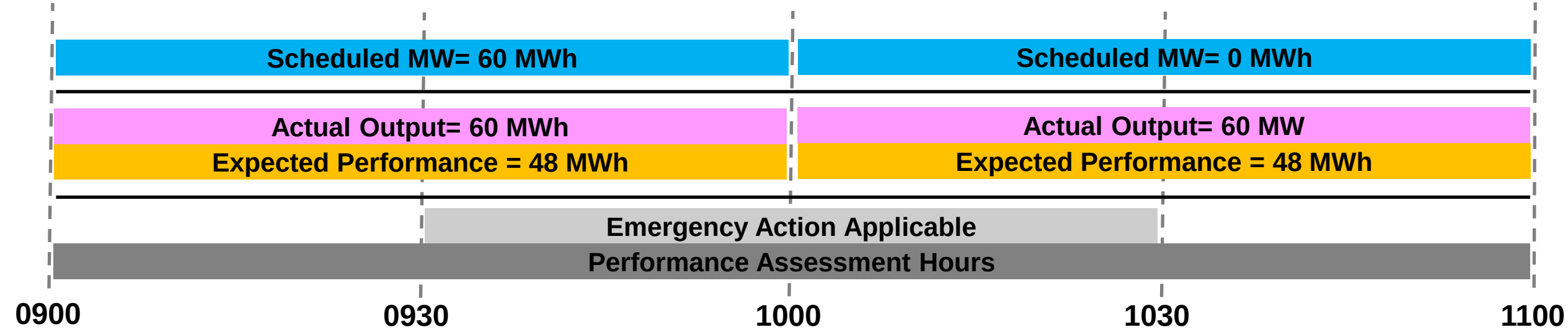


CP Commitment and Partial Hour – Example 3

PAH Effective Start at 0800	Unit UCAP = 60 MW	Balancing Ratio (BR) = 0.80
PAH Applicable Start at 0930	CP Commitment (UCAP) = 60 MW	Expected Performance = CP Commitment * BR
PAH Stop at 1030		Performance Shortfall = Expected - Actual

Scheduled/Dispatch = 60 MWh
Actual Performance (PwrMtr) = 60 MWh
Expected Performance = 48 MWh (60 MW * 0.80)
Performance Shortfall = 0 MWh (48 Expected – 60 Actual)
Bonus Performance = 12 MWh (60 Actual – 48 Expected)

Scheduled/Dispatch = 0 MWh
Actual Performance (PwrMtr) = 60 MWh
Expected Performance = 48 MWh (60 MW * 0.80)
Performance Shortfall = 0 MWh (PJM did not schedule unit)
Bonus Performance = 0 MWh (PJM did not schedule unit)



Load Management Partial Dispatch Clock Hour (FSL)

M&V Type	FSL	Lead time	60
Dispatch Start	13:20	Notify time	12:20
Dispatch End	17:20		

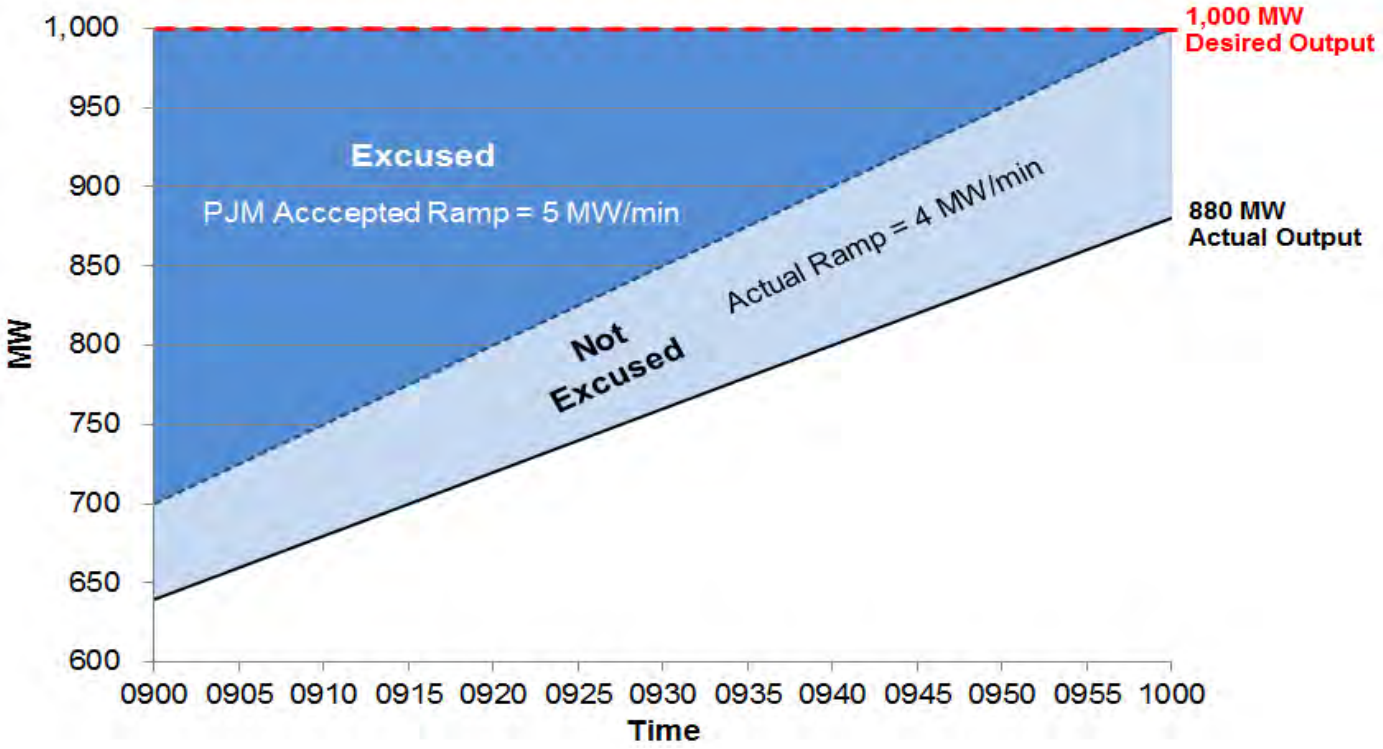
Hourly compliance calculation

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

*Additional Notes are located in the Appendix section

PJM Acceptable Ramp Rate

PAH Effective Start	0800	Unit UCAP	1,000 MW
PAH Applicable Start	0900	CP Committed UCAP	1,000 MW
PAH Stop	1000	Ramp Rate	5 MW / Min
Balancing Ratio	1.00		



Time	Desired (MW)	Output (Desired)	Output (Actual)	Excused MW	Not Excused MW
0900	1,000	700	640	300	60
0901	1,000	705	644	295	61
0902	1,000	710	648	290	62
0903	1,000	715	652	285	63
0904	1,000	720	656	280	64

Settlements

- Non-Performance Assessment
- Examples
- **Replacement Transactions**
- Billing and Reports

Replacement Capacity Transactions

- Replacement Capacity Transactions allows a Capacity Market Seller (CMS) to reduce or remove the commitment on a committed Capacity Resource .
- The CMS may specify available capacity, Locational UCAP, or Cleared Buy Bid as the source of replacement as detailed in the next slide.
- When using available capacity as a replacement resource, the commitment and associated performance obligations are shifted to the specified replacement resource.

Illustration of Replacement Transaction

Replace 10 MW of Committed Capacity on Cap Resource 1 with Available Capacity on Cap Resource 2

Before:

Unit	Owned Capacity (UCAP MW)	Commitment Capacity (UCAP MW)	Available Capacity (UCAP MW)
Cap Resource 1	100	100	0
Cap Resource 2	150	100	50

After:

Unit	Owned Capacity (UCAP MW)	Commitment Capacity (UCAP MW)	Available Capacity (UCAP MW)
Cap Resource 1	100	90	10
Cap Resource 2	150	110	40

Replacement Transaction Rules

	Replacement Rules	Retroactive Replacement Rules
Eligible Sources of Replacement Capacity		
Available Capacity from another resource	x	x
Locational UCAP	x	
Cleared Buy Bid	x	
Requirements of Replacement Capacity		
Must be in the same sub-account as resource being replaced for the transaction's effective time period	x	x
Must have same or better temporal availability as resource being replaced	x	x
Must be located in same LDA (or child LDA) as resource being replaced	x	x
Must be included in the same Non-Performance Assessment as resource being replaced		x
Timing Restrictions		
Must be submitted prior to the effective start date of the transaction	x	
Must be submitted within 3 business days following the effective start date of the transaction		x

Replacement Capacity vs Bonus Performance

- Capacity Replacements can only be made using available capacity
  - Available capacity is shown in eRPM in the resource position tab
  - Available capacity = Daily ICAP Owned – Daily Unoffered ICAP - (Daily RPM Resource Commitments/(1-Effective EFORd)) – Daily FRR Capacity Plan 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

Resource	Location	Owned Capacity (UCAP MW)	Commitment Capacity (UCAP MW)	Available Capacity (UCAP MW)
Cap Resource 1	AE	100	100	0
Cap Resource 2	JCPL	150	100	50
Cap Resource 3	PECO	200	200	0
Energy Resource 1	AE	0	0	0

Cap Resource 2 has Available Capacity on Delivery Day and may be used as a replacement resource for Delivery Day.

Cap Resource 2 has Available ICAP on Delivery Day and may be used as a replacement resource for Delivery Day.

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

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

**Negative Performance Shortfall represents over performance (Bonus Performance).*

Cap Resource 3 and Energy Resource 1 have bonus MW on Delivery Day, but no Available Capacity and CANNOT be used as a replacement resource for Delivery Day.

Example - After Retroactive Replacement

eRPM Resource Position: July 1

Resource	Location	Owned Capacity (UCAP MW)	Commitment Capacity (UCAP MW)	Available Capacity (UCAP MW)
Cap Resource 1	AE	100	**90**	**10**
Cap Resource 2	JCPL	150	**110**	**40**
Cap Resource 3	PECO	200	200	0
Energy Resource 1	AE	0	0	0

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

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

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

Due to reduced commitment, Cap Resource 1 no longer subject to Charge

Cap Resource 2's Credit has been reduced due to increased commitment

**Negative Performance Shortfall represents over performance (Bonus Performance).*

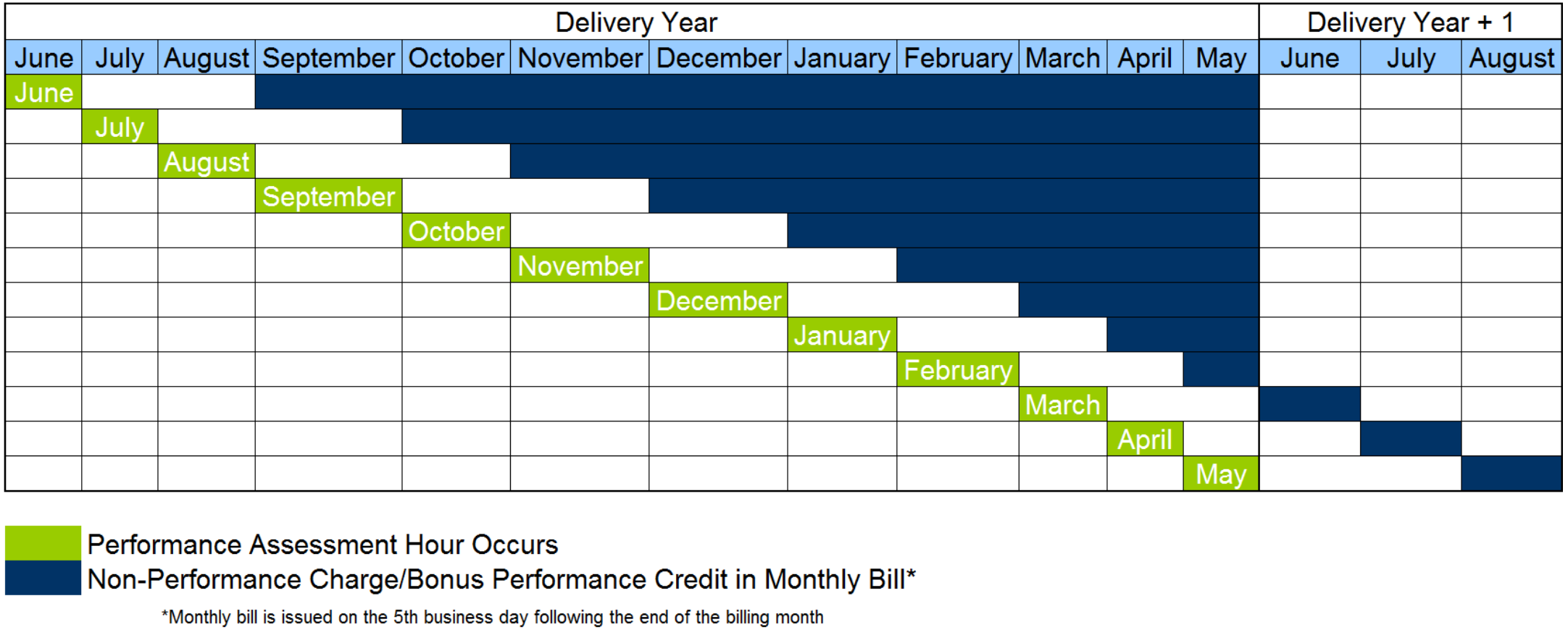
- Non-Performance Assessment
- Examples
- Replacement Transactions
- **Billing and Reports**

Timing of Non Performance Assessments

- 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 Assessment Timing

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



Non Performance Assessment Timing Example

June 5 PAH occurance

Resource A
Total Non-Performance Charge= $1,350
Per Month billed = $150 ($1,350 / 9)

Resource B
Total Bonus Credit = $720
Per Month billed = $80 ($720 / 9)

Resource C
Total Bonus Credit = $630
Per Month billed = $70 ($630 / 9)

August 7 PAH occurance

Resource A
Total Non-Performance Charge= $1,225
Per Month billed = $175 ($1,225 / 7)

Resource B
Total Bonus Credit = $525
Per Month billed = $75 ($525 / 7)

Resource C
Total Bonus Credit = $700
Per Month billed = $100 ($700 / 7)

Bills	Resource A		Resource B		Resource C	
Sep	$150		$80		$70	
Oct	$150		$80		$70	
Nov	$150	$175	$80	$75	$70	$100
Dec	$150	$175	$80	$75	$70	$100
Jan	$150	$175	$80	$75	$70	$100
Feb	$150	$175	$80	$75	$70	$100
Mar	$150	$175	$80	$75	$70	$100
Apr	$150	$175	$80	$75	$70	$100
May	$150	$175	$80	$75	$70	$100
	$1,350	$1,225	$720	$525	$630	$700

- New Billing Line Items and MSRS reports will be available to provide details of Capacity Performance Billing
- New Billing Line Items:
  - CP Transitional Locational Reliability Charge*
  - Capacity Performance Resource Deficiency Charge*
  - Non-Performance Charge**
  - Bonus Performance Credit**

*New Line Items Starting 6/1/2016, will first appear on the Weekly Bill issued on June 7

**New Line Items will appear in Monthly Bill issued 3 months following first PAH

DY 2016/17 Billing Line Items for Capacity Commitment

	Annual Commitment*	Capacity Performance Commitment
Generation	• Capacity Resource Deficiency Charge • Generation Resource Rating Test Failure Charge • Peak-Hour Period Availability Charge • Peak Season Maintenance Compliance Penalty Charge	• Capacity Performance Resource Deficiency Charge • Generation Resource Rating Test Failure Charge • Non-Performance Charge • Bonus Performance Credit
Load Management	• Capacity Resource Deficiency Charge • Load Management Test Failure Charge • Load Management Event Compliance Charge • Load Management Event Compliance Credit	• Capacity Performance Resource Deficiency Charge • Load Management Test Failure Charge • Non-Performance Charge • Bonus Performance Credit

* Annual Commitment section also includes Limited and Extended Summer Load Management capacity commitments

MSRS Reports

- Updated MSRS Reports:
  - Locational Reliability Charge Summary
  - Deficiency Credit Summary
- New MSRS Reports:
  - MSRS reports that provide supporting documentation for the Non-Performance Charge and Bonus Performance Credit are still being designed.
- Supporting Details for the new and revised MSRS reports will be communicated via:
  - Discussion at the Market Settlements Subcommittee
  - Email to the MSS distribution list highlighting the report description
  - Updated Guide to Billing
  - Updated MSRS Report Dictionary

Data Reporting

- PJM is actively working to create a standardized report that will be published ~ 3 business days after each PAH occurs
- Report will provide data, not reasons and 'why'
  - PAH trigger
  - Load Forecast
  - Generation
  - Load Management
  - Transmission outages
  - Shortage
- Details of communication and posting location are TBD

References

Topic	Email
General Capacity Performance	capacityperformance@pjm.com
Unit Specific Parameters / Real Time Values	unitspecificpls@pjm.com
Settlements and Billing	capacityperformance@pjm.com
Emergency Procedures	EPAdmin@pjm.com
General Questions	custsvc@pjm.com

Appendix

Load Management Partial Dispatch Clock Hour (FSL)

Notes:

A	*Compliance hour - if dispatched for =>30 but less than 60 then "partial", if less than 30 = "na", 60 = "full"*
B	*Registration hourly Load Reduction cannot be negative*
C	*Capacity commitment ICAP (MW) = final capacity commitment prorated to registration for day*
D	*Hourly Compliance (MW) - Negative = shorfall, Positive = overcomply*
E	*Numbers in Icap - Ucap conversation includes DR Factor and FPR factor where applicable*
F	*na - not applicable*
G	*GLD done same way except Load Reduction (MW) is lessor of FSL Reduction and reported reduction*
H	*Start time for dispatch is notification time plus lead time unless PJM shorten for reduced/no notice event*

Performance Shortfall

- PJM will perform Performance Shortfall Calculations according to Tariff, Attachment DD, Section 10A (d)
  - Notwithstanding subsection (c) above, a Capacity Resource or Locational UCAP of a Capacity Market Seller or Locational UCAP Seller shall not be considered in the calculation of a Performance Shortfall for a Performance Assessment Hour to the extent such Capacity Resource or Locational UCAP was unavailable during such Performance Assessment Hour solely because the resource on which such Capacity Resource or Locational UCAP is based (a) was on a Generator Planned Outage or Generator Maintenance Outage approved by the Office of the Interconnection; (b) was not scheduled to operate by the Office of the Interconnection; (c) was online but was scheduled down, by the Office of the Interconnection, based on a determination by the Office of the Interconnection that such scheduling action was appropriate to the security constrained economic dispatch of the PJM Region; or (d) was operating within its dispatchable range (i.e. at or above its Economic Minimum) while Following PJM dispatch instructions received in accordance with a PJM acceptable ramp rate. Subject to the foregoing, such resource shall be considered in the calculation of a Performance Shortfall if it would otherwise have been scheduled by the Office of the Interconnection to perform, but was not scheduled to operate, or was scheduled down, solely due to: (i) any operating parameter limitations submitted in the resource's offer, or (ii) the seller's submission of a market-based offer higher than its cost-based.

    - Blue highlighted language is pending at FERC in Docket No. ER16-1336