Balancing Operating Reserve Credit Matrix Updates

Brian Weathers, Sr. Lead Consultant
Market Settlements Development
September 10, 2024

Today's Presentation and Examples

Goal: Describe proposed changes to the following areas that work in conjunction with the proposed Balancing Operating Reserve (BOR) credit calculation methodology previously discussed.

- Balancing Operating Reserve Credit Eligibility
- Start time and End time of Tracking Desired MW calculation
- Offers used in the BOR Credit methodology calculations
- Treatment of Day-ahead Buy Back for Day-Ahead Commitment periods

The effect of all changes together is that resources are made whole to their costs, however the make whole is limited to the amount of uplift the resource *would have been entitled to* if the resource followed dispatch.

Balancing Operating Reserve Credit Eligibility Review

What does it mean for a resource to be “eligible for BOR credits”?

- It means the Balancing Operating Reserve credit calculations will be performed for eligible intervals
- It does NOT guarantee the resource will be made whole for every MW provided.
- The amount of make whole is determined by the outcome of the proposed BOR credit calculation methodology:
  - Step 1: Calculate make whole credit for the segment using ***Tracking Desired MW***.
  - Step 2: Calculate make whole credit for the segment using ***Actual RT MW.***
  - Step 3: Compare and set the resource’s credit equal to the ***lesser*** of the two values.

Which Resources are Eligible for BOR Credits?

Resources that are committed by PJM** are eligible for BOR credits

- The current tariff language uses the term “operating as requested by PJM” when referring to pool-scheduled resources eligible for uplift.
- **Status Quo:** This term has been historically interpreted as coming online and offline consistent with PJM’s request. Eligibility is based on the duration of the PJM commitment/min run periods and being online.
- **Proposal:** Eligibility is based on PJM commitments/min run periods and is not limited to a resource coming online/offline. This change in tandem with the proposed BOR credit methodology and the calculation of a Tracking Desired MW metric determines the uplift compensation for operating as requested by PJM.

** Committed by PJM means pool-scheduled by PJM in real-time for at least 1 interval of the DA commitment or min-run time

Eligibility Design Components

The proposal aims to clarify BOR eligibility as it relates to the following time periods:

- Prior to the start time of the commitment (Matrix Item 1a)
- During the commitment period (Matrix Item 1b) – *focus of today's examples*
- Once released from the commitment (Matrix Item 1c)

BOR Eligibility prior to start of Commitment

Design Component 1a	Status Quo - Conceptual Description	Proposal
Eligibility During Ramp Up	Resources with a soak process are not eligible prior to start of commitment. All intervals from synchronization to the start of the commitment, which are used for initial ramping and soaking to meet the commitment, are excluded from both make whole segments. Resources without a soak process are Eligible for ramping intervals prior to the start of the commitment (limited to 30 minutes).	Status Quo plus Resources without a soak process are eligible up to 30 minutes prior to start of commitment only if incremental energy offer price mw pairs remain less than or equal to the first hour of PJM commitment. If deemed to be ineligible, incremental and no load costs will be ineligible for make whole however, start up costs will still be eligible for make whole payments in the first hour/interval of commitment based on the committed schedule. Implement an objective check to determine if resource is ramping in 30 min prior to the start of the commitment and therefore eligible for these 30 minutes.

BOR Eligibility once released from Commitment

(no change from prior meetings)

Design Components 1c	Status Quo - Conceptual Description	Proposal
Eligibility During Ramp Down	Eligible from the time PJM releases the unit to breaker open, or 3 hours, whichever is less. However, if unit is taken over to run for company, eligibility terminates when the unit is released from PJM dispatch.	Remove universal 3 hour limit and replace with resource type-specific limit based on 90th percentile evaluation of historical shut down times. -Coal Resources/Solid Fuel NUG/OIL/GAS Steam Resource = **120** Minutes, -CT Resources = 30 Minutes, -Combined Cycle Resources = 45 Minutes -Wind/Solar/Pump Storage/Run of River - as specified as self scheduling notification times as documented in M11 Section 2.3.3 and Battery = 20 Minutes -Nuclear = Not eligible PJM and the IMM will perform analysis every two years utilizing historical shut down time data only for PJM or pool scheduled commitments. From this sample population, the 90th percentile shall be used to determine eligibility thresholds to be agreed upon by PJM and the IMM. This process shall be documented in manual 28. Analysis results will be shared with stakeholders prior to new thresholds becoming effective.

BOR Eligibility During Commitment

Design Component 1b	Status Quo - Conceptual Description	Proposal
Eligibility During Commitment Period	Eligible from the start of the PJM commitment through the time when PJM releases the unit For this purpose, the start of the commitment of a resource is the later of 1) the first interval of the commitment or 2) the time at which the resource reaches its economic minimum.	Eligibility begins at the first interval of PJM commitment for the run. Once a resource is committed by PJM, it is eligible for BOR credits from the first interval of the PJM commitment until the later of the expiration of its DA commitment/min run time or when PJM releases it. One exception: If a unit trips, its eligibility will end at the later of when it trips or the end of its DA commitment/min run time Three differences from today's eligibility window: - If unit self-schedules in middle of DA commitment/min run, the unit will remain eligible for those hours This allows any revenues earned in this period to offset the startup costs that the unit will be made whole for. - If PJM releases unit prior to end of DA commitment, it will remain eligible beyond release through end of the DA commitment This will ensure the resource is eligible to be made whole for any buy out of day ahead position. - Units with soak time will be eligible at start of commitment rather than later of first interval of commitment or when unit hits eco min; Prevention of double counting of ramping and soak costs will occur by modifying when Tracking Desired starts to calculate and the inputs to the BOR calculation rather than by modifying the start of the commitment period as is done today

BOR Eligibility during Commitment Period Proposal

Proposal General Rule: Eligibility begins the first interval a resource is committed by PJM and ends at the later of the expiration of its DA Commitment/min run time or when PJM releases the resource.

- No longer restricted to unit being on-line (Status Quo)

Exceptions:

- If a unit trips, eligibility ends at the later of when it trips or the end of its DA commitment/min run time.
- If a resource self-schedules during the DA commitment or RT min run period, eligibility will continue through the end of the DA commitment/min run period. Resource becomes ineligible thereafter.
  - The above two exceptions ensure any profits gained during the entirety of the DA commitment/min run time (via the MW produced or buying out of the DA market) offset the start-up costs for the segment thus reducing potential uplift. Additionally, if Tracking Desired MWh is below DA MWh, the Step 1 calculation will at least include the buy back MWh desired by PJM.
- If PJM releases a resource prior to end of DA commitment, eligibility will continue until the end of its DA commitment.
  - This ensures the resource is eligible to be made whole for any buy out of its DA position as a result of operating as requested by PJM.

BOR Eligibility: Resources with a Soak Process

Resources with a Soak Process have startup costs that include the costs from PJM notification to dispatchable output and from last breaker open to shutdown.

- **Status Quo:** BOR commitment period eligibility does not begin until the later of the start of commitment or when the resource reaches dispatchable output (economic minimum).
  - This rule exists to prevent double recovery of the ramping and soaking costs included in start costs.
- **Proposal:** BOR commitment period eligibility follows the general eligibility rule and begins the first interval the resource is committed by PJM.
  - Exceptions to the Tracking Desired MW and BOR credit calculation methodology (Step 1 and Step 2), rather than delaying the start time of eligibility, will prevent double recovery of costs.

BOR Eligibility: Resources without a Soak Process

Resources without a Soak Process have startup costs that include costs from PJM notification to first breaker close and from last breaker open to shutdown

- **Status Quo:** Eligible for ramping intervals prior to the start of the commitment, however ramping intervals are limited to 30 minutes.
- **Proposal:** Status Quo with additional clarifications on 30 minute ramping validations
  - Create an objective metric based on MWh output to determine if unit is ramping within the 30 min prior to the commitment start time and therefore eligible for the ramp up period.
  - Any flat profiled units according to M28 Section 1A, Revenue Data for Settlements, are excluded from the ramp up eligibility period due to the fact that PJM is unable to determine if the unit is in ramp up mode.
  - Resource is only eligible during the ramping intervals if the incremental energy offer price mw pairs remain less than or equal to that of the first hour of PJM commitment

Tracking Desired Calculation

- There are two Tracking Desired (TRLD) calculations:
  1. TRLD MW: calculates the desired MW output (in power).
  2. TRLD MWh: calculates the desired MWh output (in energy). TRLD MWh equals the average between the TRLD MW desired at the start of the 5-minute interval and the TRLD MW desired at the end of the 5-minute interval (i.e., start of the next 5-minute interval).
- TRLD MWh is the metric used in balancing operating reserve credits and deviation charges.
  - TRLD MW will not be used (other than as an input to the TRLD MWh calculation) as compensation and measures of following dispatch are based on energy (MWh) and not power (MW)
  - TRLD MWh is set to Actual RT MWh when TRLD MW is not calculated (e.g., prior to the start and after the end time of the Tracking Desired Calculation.

Refer to IMM 6/10/2024 presentation for additional details on power vs. energy

TRLD Starting Point

- The purpose of Tracking Desired MW is to more accurately measure how closely a resource is following dispatch over a period of time compared to status quo.
- TRLD will be calculated starting at a defined time (t0 or time zero) and it will end at a defined time. The proposal must also define what MW value should be calculated at t0.
- T0 represents when the resource *should be* online or dispatchable based on energy logging, while honoring soak time differences.

Start of Tracking Definition

- The start and end of the TRLD calculation will be triggered by the effective time of the first energy dispatch logs after the unit has been offline (regardless of whether it is a pool or self-scheduled energy log).
  - Subsequent logs, after the unit is online, will not trigger a restart of the TRLD calculation.
  - If the first energy log is a non-dispatchable log reason representing a units soak time, the TRLD calculation start will instead be triggered off of the next dispatchable energy log.
- The exact interval in which the TRLD calculation start will occur will depend on the type of log and whether the unit has a soak process or not.

Log Types

Log Type	Expectation
Now	PJM requests the unit running as soon as possible
Future	PJM requests the unit dispatchable at a specified future point in time

Now logs vs. Future logs are distinguished based on when the commitment starts in relation to when the commitment was made

- All day-ahead and RAC commitments are considered ‘future’ logs
- ‘Now’ logs are generally logs with the creation time and commitment start time close together

- The start of TRLD will be the effective time of the log that brought the unit online, unless the unit comes online / becomes dispatchable early and PJM requested the unit ASAP (it is a Now log).

Start time of Tracking Desired MW Calculation When Unit Called on Now

Log Type	Unit with Soak Time	TRLD Start Time (t0 time)	Calculation for MW at Start of Tracking (t0 MW)	Description
Now	Soak	min(t0 log effective time + Notification Time + Start Time, time unit reaches Eco Min)	TRLD MW_{t0} = MAX [MIN (LMP Desired, SCED Basepoint), Eco Min]	Start Time: If the unit is dispatchable early, TRLD will begin as soon as it becomes dispatchable; otherwise it starts when expected to be dispatchable. MW: The first TRLD to be calculated will be between Eco Min and SCED Basepoint (capped at LMP Desired in case the unit is overgenerating). After t0, TRLD will ramp the unit up, down or remain equal based on the LMP.
Now	No Soak	min(t0 log effective time + Notification Time + Start Time, time unit comes online)	TRLD MW_{t0} = 0 MW	Start Time: If the unit is online early, TRLD will begin as soon as it comes online; otherwise it starts when expected to be online. MW: After t0, TRLD will ramp the unit up until it reaches eco min. After TRLD reaches eco min, TRLD will ramp the unit up, down or remain equal based on the LMP.

Start time of Tracking Desired MW Calculation When Unit Called on for a Time in the Future

Log Type	Unit with Soak Time	TRLD Start Time (t0 time)	Calculation for MW at Start of Tracking (t0 MW)	Description
Future	Soak/No Soak	t0 log effective time	TRLD MW_{t0} = MAX [MIN (LMP Desired, SCED Basepoint), Eco Min]	Start Time: TRLD will begin when the unit is expected to be dispatchable. MW: The first TRLD to be calculated will be between Eco Min and SCED Basepoint (capped at LMP Desired in case the unit is overgenerating). After t0, TRLD will ramp the unit up, down or remain equal based on the LMP.

Key Takeaway on Tracking Start Time: Tracking Start Time represents when resource ***should be*** online or dispatchable, with respect to an energy log, while honoring soak time differences. Refer to IMM 6/10/2024 presentation for additional details.

End time of TRLD MW Calculation

- When a unit is released from commitment, TRLD MW will ramp the resource to economic minimum. Once at and below economic minimum, TRLD MWh will reflect the RT MWh output of the resource down to 0 MWh.
  - This assists with the make whole calculation during ramp down intervals.
- If a unit never goes offline after a release from commitment and is subsequently logged for energy, this will not trigger the end (or ramp down) of TRLD MW. TRLD MW will continue to calculate until the next energy log.
- If a unit trips, TRLD MW ends immediately at the later of the end of the DA commitment or the end of the min run time. It does not follow a ramp down profile beyond that point.
  - A ramp down profile is not needed after the unit trips since eligibility immediately terminates after the end of the DA commitment or min run time.

Offers used in BOR Credit calculation methodology – Startup Cost

Status Quo: Startup cost using **lesser of committed or final offer**. Full startup cost is applied to the first interval of the PJM Commitment.

Proposal:

Component	Step 1 Tracking Desired MW	Step 2 Actual MW	Applied Intervals
Startup Cost	Start up cost using **lesser of committed or final offer**	Start up cost using **final offer**	If it was PJM's commitment decision to startup the unit, startup is included at the beginning of the PJM commitment

Key Takeaway: The proposal does not change the status quo regarding the use of the lesser of the committed or final offer in determining costs to be made whole or the hour from which the start costs are used. Additionally a resource continues to be made whole to their startup cost incurred from a PJM commitment and following dispatch.

Offers used in BOR Credit calculation methodology – Incremental Offer and No Load

Status Quo: Total Offer cost is determined using the lesser of Operating Reserve Desired MW or Actual MW* and the **lesser of committed or final offer.**

Proposal:

Component	Step 1 Tracking Desired MW	Step 2 Actual MW
Incremental Offer and No Load Cost	Total Offer cost determined using TRLD MWh and the **lesser of the committed or final offer.**	Total Offer cost determined using Actual RT MWh and the **final offer.**

Key Takeaway: The proposal does not change the status quo regarding the use of the lesser of the committed or final offer in determining costs to be made whole. The incorporation of the Step 1 and Step 2 methodology results in a resource being made whole to its costs, but the make whole is limited to the amount of uplift the resource *would have been entitled* to if the resource followed dispatch.

Treatment of DA Buy Back (When RT MW < DA MW)

Status Quo	Proposal Step 1 (TRLD MWh)	Proposal Step 2 (Actual MWh)
Unit is made whole for the DA Buy Back based on the Min (DA MW, Max (Operating Reserve Desired MW, Committed Offer Desired MW). There are scenarios when the DA Buy Back does not adequately represent how well a resource is following PJM dispatch.	Unit is made whole for any DA Buy Back based on the TRLD MWh. TRLD MWh reflects the PJM directed dispatch MWh. As a result, the make whole calculation includes any DA buy back resulting from a PJM dispatch instruction.	Unit is made whole for any DA Buy Back based on the Actual RT MWh.

Key Takeaway: The DA buy back continues to be included in the make whole calculation. The BOR Credit methodology (Step 1 and Step 2) will reflect the make whole necessary for buying out of a DA commitment, but the make whole is limited to the amount of uplift the resource *would have been entitled* to if the resource followed dispatch.

Adjustment to Costs and Revenues during Soak Period

Proposal:

- When a unit is soaking during hours it was scheduled to be dispatchable and is eligible for uplift, the costs incurred and revenues received must be removed from the calculation since they are included in the startup cost. The costs are removed by making the incremental energy offer and no load costs zero. The revenues are removed by subtracting the value received from those MW.
  - When the unit clears DA, the value is equal to RT MW x DA LMP.
  - When the unit is committed in RT, the value is equal to RT MW x RT LMP.
- This additional adjustment is necessary since eligibility will now start at the beginning of the commitment rather than when the unit hits Eco Min. This prevents double counting of revenues and costs.
- This applies to step 1 anytime the TRLD MWh indicate that the unit is not dispatchable.
- This applies to step 2 anytime the Actual MWh indicate that the unit is not dispatchable.

Uplift Eligibility Examples

- Uplift eligibility details
- Early (PJM/company) w/ and without soak
- Late (PJM/company) w/ and without soak
- Early release (PJM/company) and Trip
- Taken over by company

Uplift Eligibility Start Time: Another Look at Status Quo

Status Quo Eligibility Start

- Interval of PJM-requested time to be dispatchable
  - Unit must be online
  - Soak unit must have reached eco min (Included in Startup Cost)
  - Start time for non-soak units is the interval the unit comes online, unless the unit is online too early.

Uplift Eligibility Start Time: Proposal

Similar to the start time of the tracking calculation, the proposed start time of eligibility for BOR credits hinges on the log type and characteristics of the resource

- **Log Type (PJM Requested)**
  - **Future Log**: PJM requests the unit dispatchable at a specified future point in time
  - **Now Log**: PJM requests the unit running as soon as possible
- **Characteristics**
  - **Soak – Future Log**
    - Resource is eligible at the time it is expected to follow cost
  - **No Soak – Future Log**
    - Resource may be eligible up to 30 minutes prior to the expected time to follow cost
  - **No Soak – Now Log**
    - Resource is eligible the earlier of (a) the log time plus notification plus startup time and (b) breaker close

End of BOR Credit Eligibility: Status Quo

The interval in which eligibility for BOR credits ends is dependent upon the log reason that triggers the end of eligibility.

Log Type	Status Quo End of Eligibility
PJM Release	Earlier of breaker open and 3 hours after release
Taken Over by Company	Interval of request
Trip	Interval of breaker open
Company Requested Release	Interval of request

End of BOR Credit Eligibility: Proposal

The interval in which eligibility for BOR credits ends will continue to be dependent upon the log reason that triggers the end of eligibility.

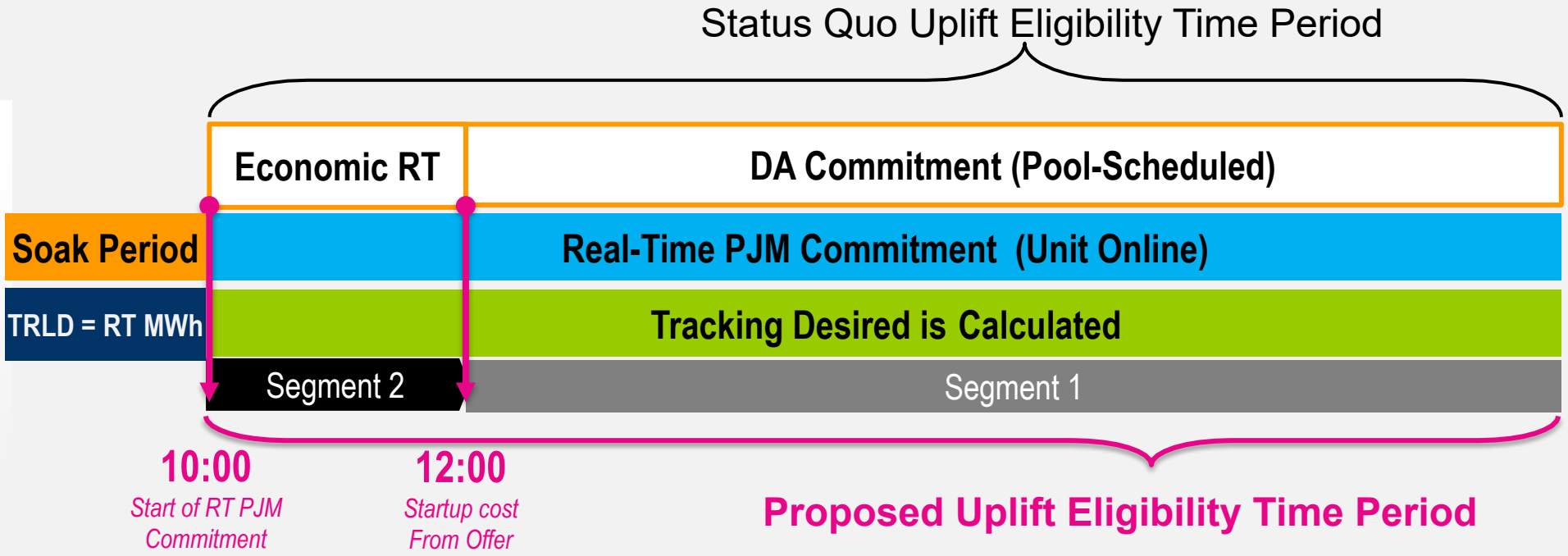
Log Type	Proposed End of Eligibility
PJM Release	Interval of the earlier of breaker open and the technology- specific expected ramp down time (see matrix item 1c)
Taken Over by Company	If log is effective before the end of the PJM Day-ahead Commitment or min run, then it ends at the end of the DA commitment/min run time.
Trip	
Company Requested Release	Else, eligibility ends at the interval of the request (effective time of the log)

Examples of resources online early (prior to original commitment)

Example 1:
Unit online Early due to PJM

SCENARIO:

- PJM schedules the unit in DA
- **PJM calls the unit to come on early in RT**
- This represents a change in the commitment period



TAKEAWAYS

Status Quo

*Eligibility is adjusted to 10:00 due to PJM calling on the resource early, **however** the startup costs used are still those for 12:00 because PJM assigns the startup cost with the original Day-ahead commitment. The lesser of the Committed and Final offer is used when determining the appropriate 12:00 startup cost to use.*

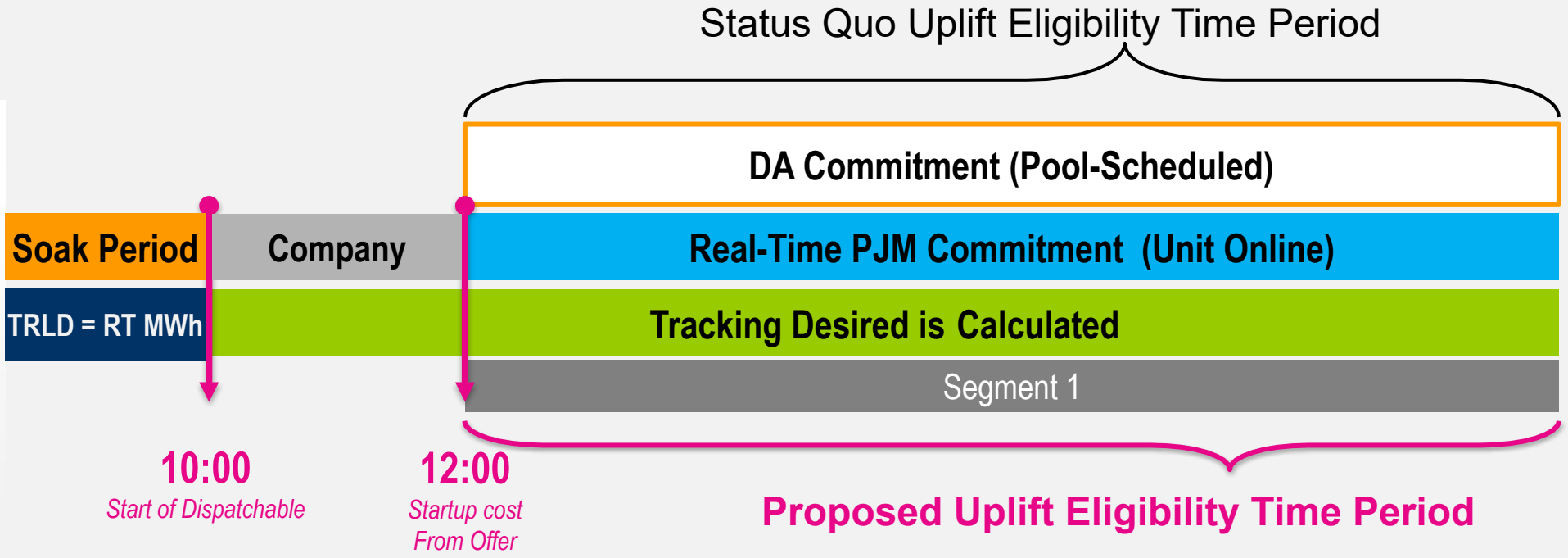
Proposal Solution

- **Step 1** – Startup Status Quo, Eligibility Status Quo, **Uses TRLD MWh**, Lesser of Committed and Final Offer
- **Step 2** – Startup Status Quo, Eligibility Status Quo, **Uses Actual MWh, Final Offer**

Example 2:
Unit online Early for DA Commitment (w/ Soak)

SCENARIO:

- PJM schedules the unit in DA
- **Unit is early meeting DA Commitment; logged as running for company** when ready to follow dispatch @ 10:00



TAKEAWAYS

Status Quo

Unit is not eligible after soak period, because the unit is available to follow dispatch prior to DA/Real-Time Commitment. This was not at the request of PJM. The unit is online early for Company. The Startup is still provided at the start of the DA/Real-Time Commitment.

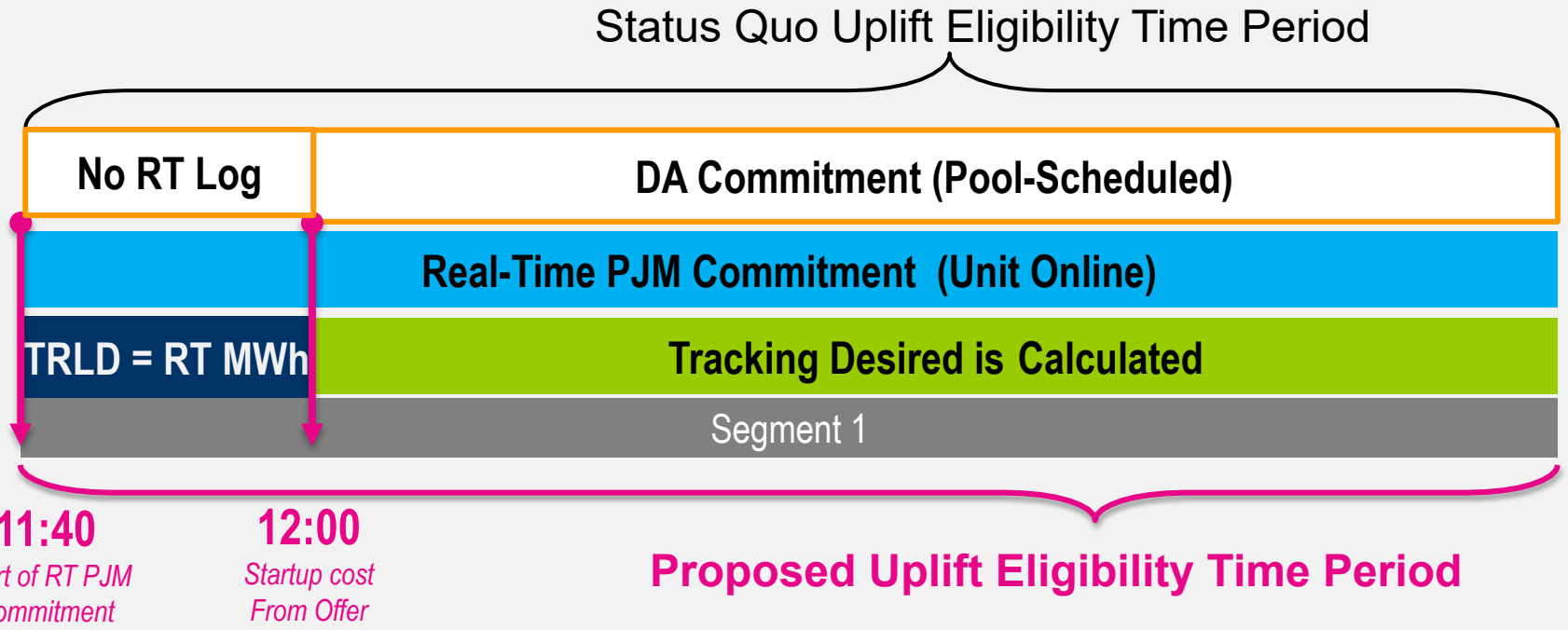
Proposal Solution

- **Step 1** – Startup Status Quo, Eligibility Status Quo, **Uses TRLD MWh**, Lesser of Committed and Final Offer
- **Step 2** – Startup Status Quo, Eligibility Status Quo, **Uses Actual MWh, Final Offer**

Example 3:
Unit online Early for DA Commitment (within 30 min)

SCENARIO:

- PJM schedules the unit in DA
- **Unit is 20 minutes early for DA Commitment** (no energy log for these intervals)
- Unit does not have a soak period



TAKEAWAYS

Status Quo

Early eligibility for uplift is a subjective review to determine unit online too early, within approximately 30 minutes of DA commitment is used as a guideline.

Proposal Solution

- If the unit is in startup/ramp up within 30 minutes prior of the PJM commitment, the unit remains eligible for ramp up period:
  - An objective metric based on MWh output will be used to determine if the unit is ramping and therefore eligible.
  - Any Flat profiled units according to M28 (section 1a Revenue Data for Settlements) are excluded from the ramp up eligibility period due to the fact that PJM is unable to determine if the unit is in ramp up mode

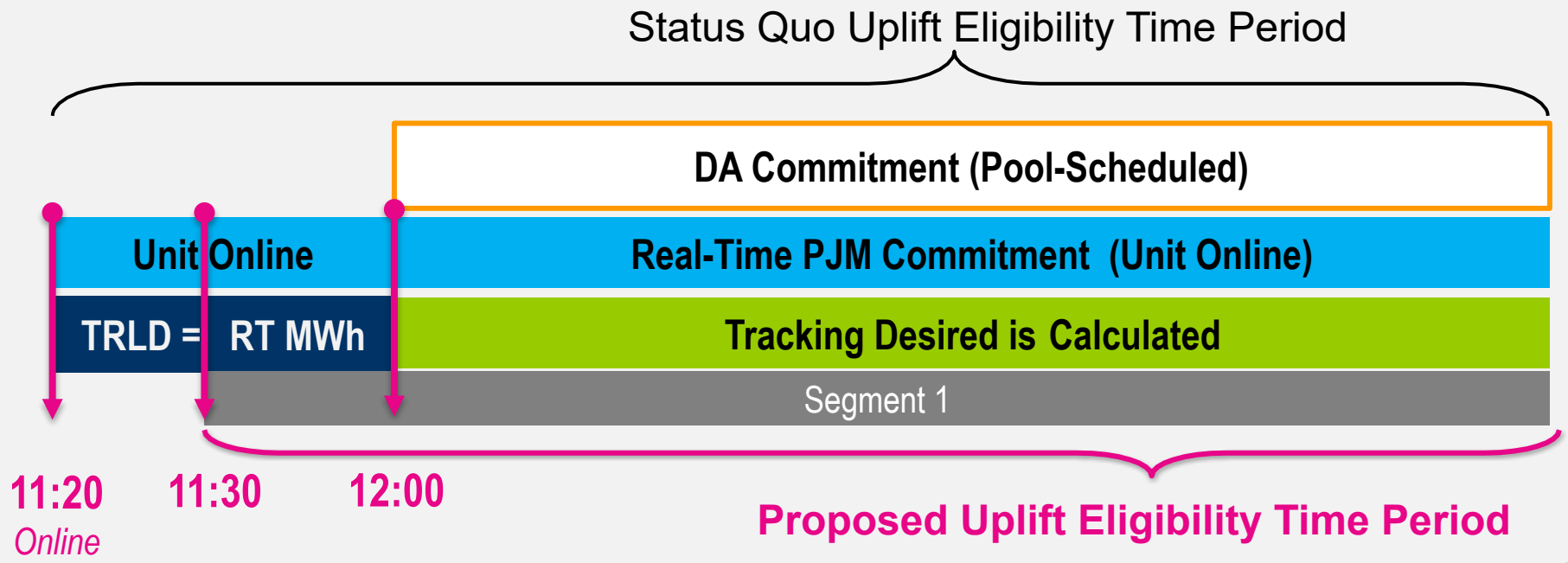
- **Step 1 –** reflect the expected revenue/losses following PJM dispatch
  - Within 30 minutes of DA commitment TRLD MWh will equal RTMWh

- **Step 2 –** reflect revenue/losses from **actual performance** of following the PJM dispatch instructions
  - MW will equal 0 anytime unit is not online during the uplift eligibility period

Example 4:
Unit online Early for DA Commitment (greater than 30 min)

SCENARIO:

- PJM schedules the unit in DA
- **Unit is more than 30 minutes early for DA commitment (no energy log)**
- Unit does not have a soak period



TAKEAWAYS

Status Quo

Early eligibility for uplift is a subjective review to determine unit online too early, within approximately 30 minutes of DA commitment is used as a guideline.

Proposal Solution

- If the unit is in startup/ramp up within 30 minutes prior of the PJM commitment:
  - An objective metric based on MWh output will be used to determine if the unit is ramping and therefore eligible.
  - Any Flat profiled units according to M28 (section 1a Revenue Data for Settlements) are excluded from the ramp up eligibility period due to the fact that PJM is unable to determine, if the unit is in ramp up mode
- **Step 1 –** reflect the expected revenue/losses following PJM dispatch instructions
  - Within 30 minutes of DA commitment TRLD MWh will equal RTMWh
- **Step 2 –** reflect revenue/losses from **actual performance** of following the PJM dispatch instructions
  - MW will equal 0 anytime unit is not online during the uplift eligibility period

Key Changes from status quo:

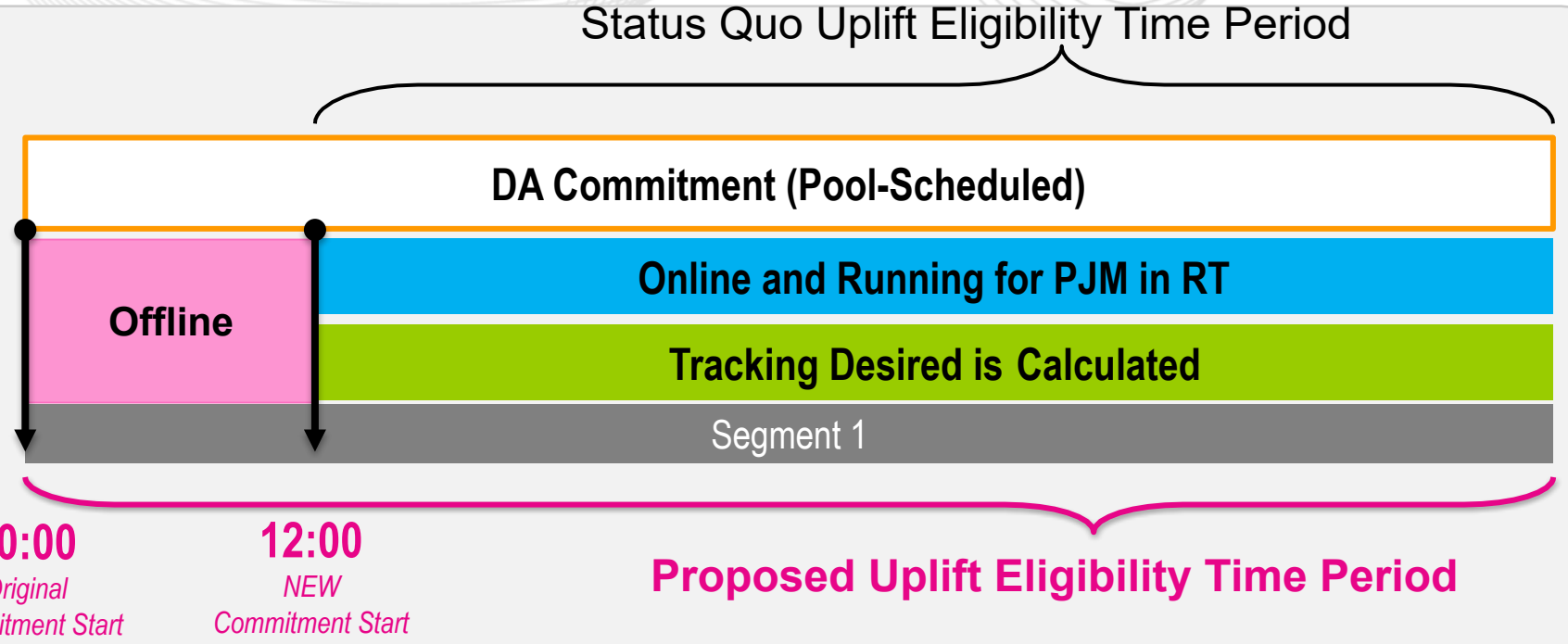
- PJM will move to two calculations from a single calculation that used the lesser of Actual MW or Desired for the Energy offer and the Greater of Actual MW or Desired for the Balancing Value calculation.
  - Step 1 will only use the Tracking Desired MW and **the lesser of Committed or Final Offer**
  - Step 2 will only use Actual MW and **the final offer**.
- In all of the examples above, the unit retained their startup costs, since the reason for coming online was due to a PJM commitment.
- Startup costs will be allocated across the commitment period that it is applied to (the Day-Ahead Commitment or Minimum Run Time).
- Example 4 the proposal will allow eligibility for a non-soak resource to ramp a maximum of 30 minutes prior to a time that the resource has a future log where it is expected to be online and dispatchable for PJM.
- Objective criteria will be applied to ensure resource is ramping within 30 minutes in order to determine eligibility.

Examples of resources coming online late (after original commitment start time)

Example 5:
Due to PJM, Unit Starts Late for its DA Commitment (No Soak)

SCENARIO:

- PJM schedules the unit in DA
- **Unit is late due to PJM Actions** (late release from prior commitment)
- RT unit commitment is shifted to 12:00
- **Unit does not have a soak**



TAKEAWAYS

Status Quo

Eligibility starts when unit is online. Unit is not eligible from 10 to 12, so is not made whole for DA buy back costs. Only DA revenue is included in uplift calculation.

Proposal

- Extend the uplift eligibility to the start of the DA commitment.
- TRLD begins at the start of the new RT Commitment at 12:00
- Eligibility begins at start of DA commitment, which allows any DA buy back between 10 and 12 to be made whole

- **Step 1** – reflects the expected revenue/losses using the TRLD MWh during the proposed uplift eligibility time period
  - TRLD MWh = RT MWh (0 MWh) prior to the start of the commitment, which ensures the DA buy back is included.

- **Step 2** – reflect revenue/losses from **actual performance** during the proposed uplift eligibility time period
  - MW will equal 0 anytime unit is not online during the uplift eligibility period. The full DA buy back will be included in the calculation.

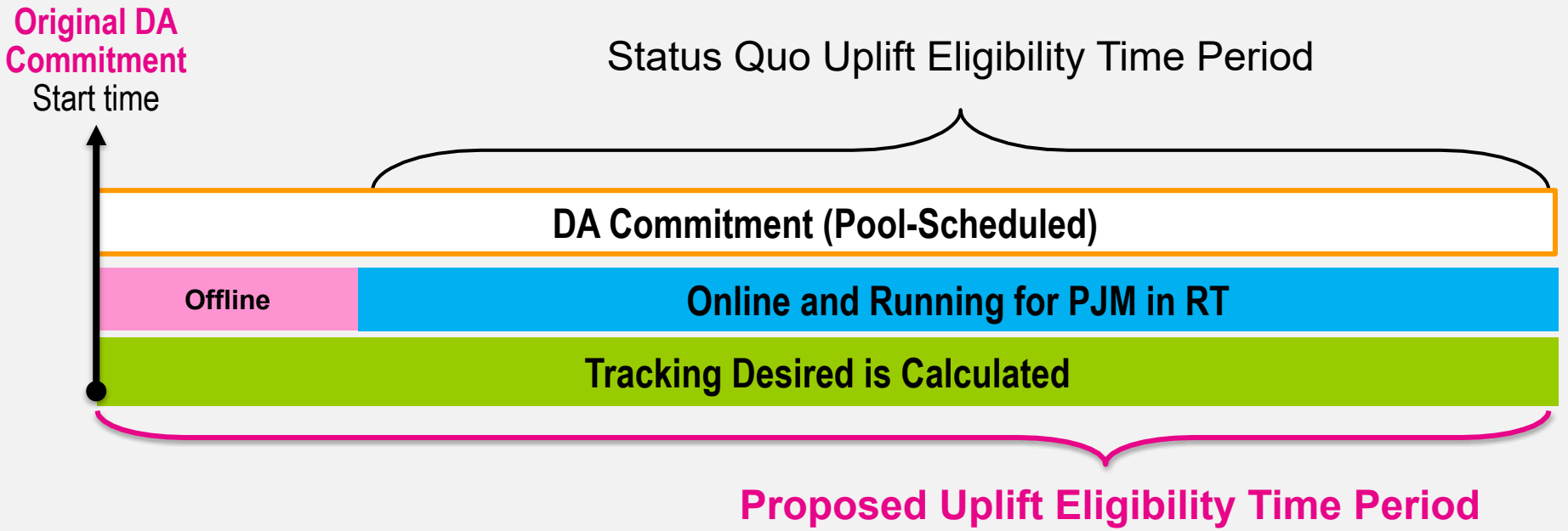
Example 5

- Why the change to eligibility?
  - Currently, when a unit is committed in DA but does not run in RT, the full DA revenue from the intervals where the unit wasn't running is included in the BOR calculation for the remainder of the DA commitment where the unit is eligible for BOR. However, the balancing revenue (or the DA buy back) from the intervals where the unit didn't run is not included. This can lead to an overstatement of the revenues available to offset costs in other intervals.
  - By keeping the unit eligible for BOR for the entire DA commitment, it will take into account the balancing revenue (DA buy back) for the resource. This will reduce the revenue amount used in the uplift calculation. When the unit is offline due to a PJM request, the losses due to the buy out of the Day-ahead Market will now be included in the uplift calculation.
  - This calculation is used in Step 1 and Step 2

Example 6:
Due to Participant, Unit Starts Late for its DA Commitment (No soak)

SCENARIO:

- PJM schedules the unit in DA
- **Unit is late due Market Participant Actions**
- Resource has **No Soak Time**



TAKEAWAYS

Status Quo
Eligibility starts when unit comes online

Proposal

Extend the uplift eligibility to the start of the DA commitment.

Start Tracking Desired at the time the Unit was expected to be online and following dispatch. (DA Commitment start time)

- **Step 1 –** reflect the expected revenue/losses following PJM dispatch instructions when PJM committed, **using the Tracking desired which started calculating from the start of the DA Commitment Period.**
- **Step 2 –** reflect revenue/losses from actual performance of following the PJM dispatch instructions
  - RT MWh will equal 0 anytime unit is not online during the uplift eligibility period

Example 6

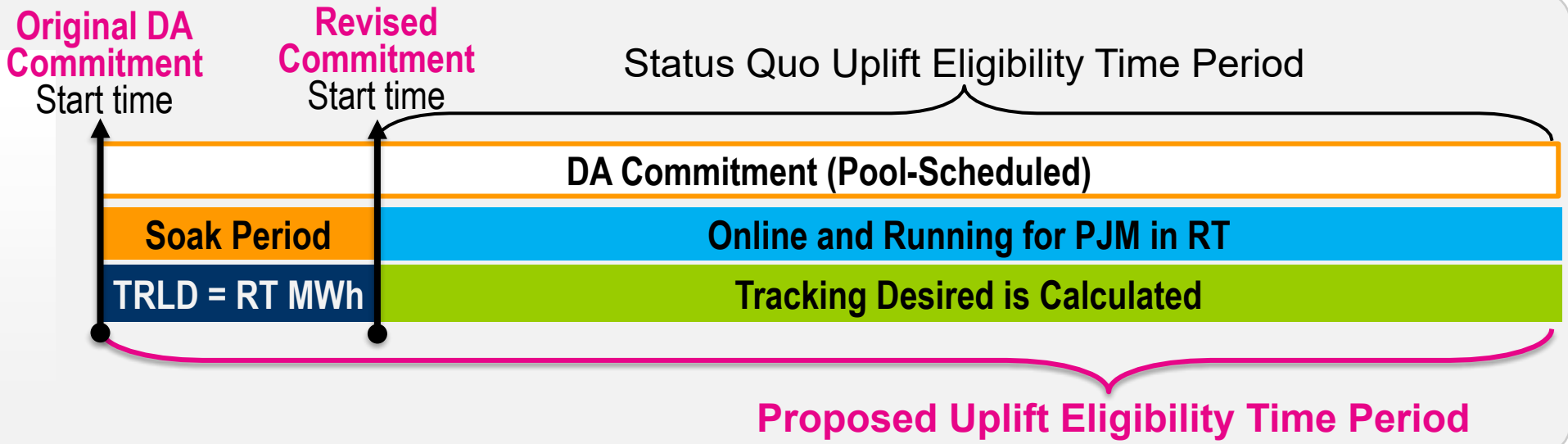
Why does tracking start at the Day-Ahead commitment and why is the eligibility extended to the start of the Day-Ahead commitment?

- Tracking desired begins calculating at the start of the Day-Ahead commitment, because the unit was expected to be online and following cost at that point in time.
- Step 1 calculation will use the tracking desired to start calculating the uplift amount that would have been paid if the unit followed dispatch. **That is, the uplift that would have been paid if the unit was online and following cost at the expected time.**
- Step 2 calculation will be based off of the actual MW. In some intervals, the actual MW will be zero. This will result in the DA Revenue and Balancing Revenue being used in the uplift calculation for intervals where the unit is offline.

Example 7:
Due to PJM, Unit Starts Late for its DA Commitment (Soak)

SCENARIO:

- PJM schedules the unit in DA
- **Unit is late due PJM Actions** (late release from prior commitment)
- Resource has a **Soak Time**



TAKEAWAYS

Status Quo

Eligibility will start at the new time the resource is expected to start following cost.

Proposal: Extend the uplift eligibility to the start of the DA commitment.

- TRLD begins when the unit is expected to be dispatchable based on the revised commitment.
- Costs and Revenues associated with the MW's produced during the soak period are excluded from the BOR credit calculations due to those cost/revenues already included in startup costs. (status quo)
- When unit is soaking, only the revenues/losses from the DA buy back for MW not produced over and above the DA revenues for those same MWs are included in the calculation.

- **Step 1** – reflect the expected revenue/losses using the TRLD MWh during proposed uplift eligibility time period
  - TRLD MWh be equal to RTMW MWh at the start of the uplift eligibility period before the unit is online
  - Any DA buy back associated with MW's not produced during Soak period based on TRLD MWh are included (full DA buy back in this case because TRLD MWh = RT MWh)

- **Step 2** – reflect revenue/losses from the **actual performance** of the unit during the proposed uplift eligibility time period
  - Any DA buy back associated with MW's not produced during Soak period based on RT MWh are included

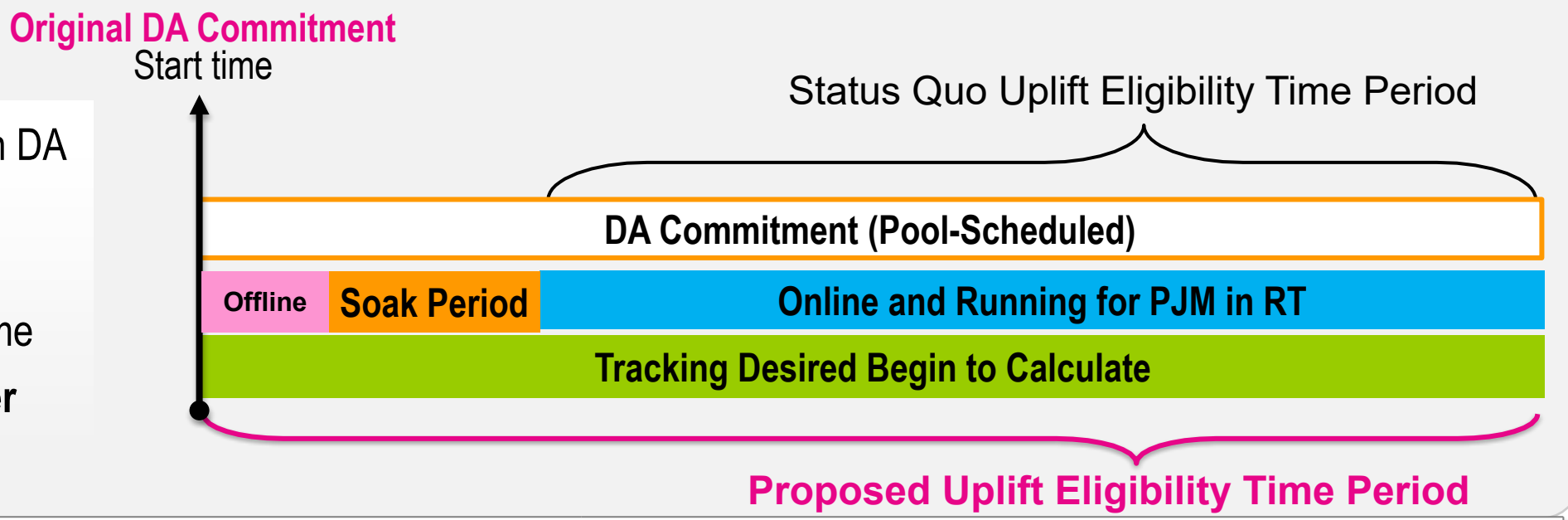
Example 7

- Why the new calculation when the resource is within it's Day-ahead commitment, while soaking due to PJM actions?
  - The net soak costs (costs minus expected revenues) are included in the startup cost of the resource
    - Because of this, Step 1 and Step 2 will not include any no load and incremental energy costs from MWh produced during the soak period
  - However, there may be additional profit/losses from the buyout (DA MW > RT MW) of the Day-ahead market that were not included within the estimate of the net soak costs. The net DA and Balancing revenues/losses for these buy out MWh will be included in the uplift calculation for both Step 1 and Step 2 to ensure all revenues and losses are fully captured.

Example 8:
Due to Participant, Unit starts late for its DA commitment (With Soak)

SCENARIO:

- PJM schedules the unit in DA
- **Unit is late due Market Participant Actions**
- Resource **has** a Soak Time
- **Soak period begins after DA commitment start**



TAKEAWAYS

Status Quo

Eligible at the time the resource is dispatchable

Proposal

Extend the uplift eligibility to the start of the DA commitment.

Start Tracking desired at the time the Unit was expected to be online and dispatch (DA Commitment) even if the unit is offline.

- **Step 1** – reflect the expected revenue/losses using the Tracking Desired when PJM committed
  - TRLD will have the unit at Eco Min MW at the start of the uplift eligibility period.
  - Based on TRLD, unit is not soaking so no special logic to exclude costs or revenues and prevent double counting is needed
- **Step 2** – reflect revenue/losses from **actual performance** during uplift eligibility period
  - Costs and Revenues associated with the MW's produced during the soak period are excluded from BOR credit calculations due those cost/revenues already included in startup costs
  - Any DA buy back associated with MW's not produced during Soak period are included
  - Partial DA buy back when unit is in the soak process, Full DA buyback when unit is not online

Example 8

Why does tracking start at the Day-Ahead commitment and why is the eligibility extended to the start of the Day-Ahead commitment?

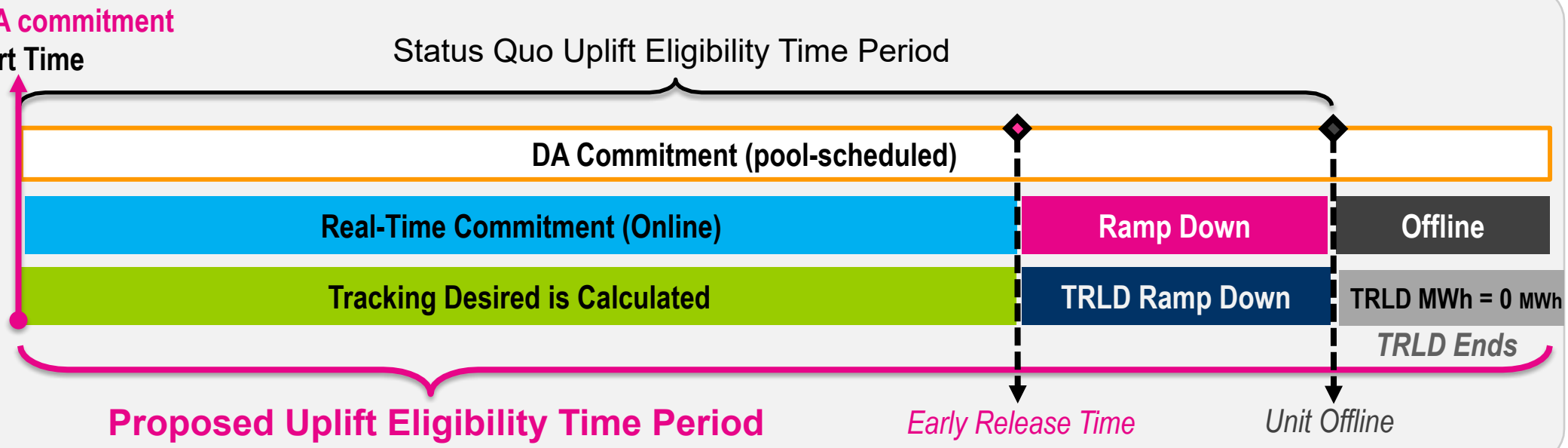
- Tracking desired begins calculating at the start of the Day-Ahead commitment, because the unit was expected to be online and following cost at that point in time.
- Step 1 calculation will use the tracking desired to start calculating the uplift amount that would have been paid if the unit following dispatch. **That is, the uplift that would have been paid if the unit was online and following cost at the expected time.**
- **Step 2** will not include any no load and incremental energy costs during the soak period in order to prevent double recovery of the costs already included in startup cost.
- The additional profit/loss of the deviations from the buyout will be used in Step 2 during the soak period.
- Step 2 calculation will be based off of the actual MW. In some intervals, the actual MW will be zero. This will result in the DA Revenue and Balancing Revenue being used in the uplift calculation for intervals where the unit is offline.

Examples of early release (before end of DA commitment / min run time) and unit trips

Example 9:
Due to PJM, Unit Released Early

SCENARIO:

- PJM schedules the unit in DA
- **Unit released early by PJM**



TAKEAWAYS

Status Quo

If a resource is released early by PJM, eligibility terminates once the resource is offline. The resource is responsible for the buy out of the DA position for the remainder of their DA commitment. This eligibility rule provides an ***incorrect*** incentive for following PJM instruction

Proposal

- Extend the uplift eligibility to End of DA commitment.
- Any DA buy back associated with MW's not produced after PJM release are now included in both Step 1 and Step 2
- **Step 1 –** reflect the expected revenue/losses using the Tracking Desired when PJM committed
  - Costs and Revenues associated with the TRLD MWh produced during the ramp down period are included in BOR credit calculations
  - TRLD will begin ramping the unit down to economic minimum when the unit is released by PJM. Once the unit output is below economic minimum, TRLD MWh will equal RTMWh output including when unit is offline
  - ~~Any DA buy back associated with MW's not produced after PJM release are now included~~
- **Step 2 –** reflect revenue/losses from ***actual performance*** during the uplift eligibility time period
  - Costs and Revenues associated with the RT MWh produced during the ramp down period are included in BOR credit calculations

Example 9
Early Release

Why change the eligibility rules for a unit released early prior to the end of its Day-ahead Commitment? What does it impact?

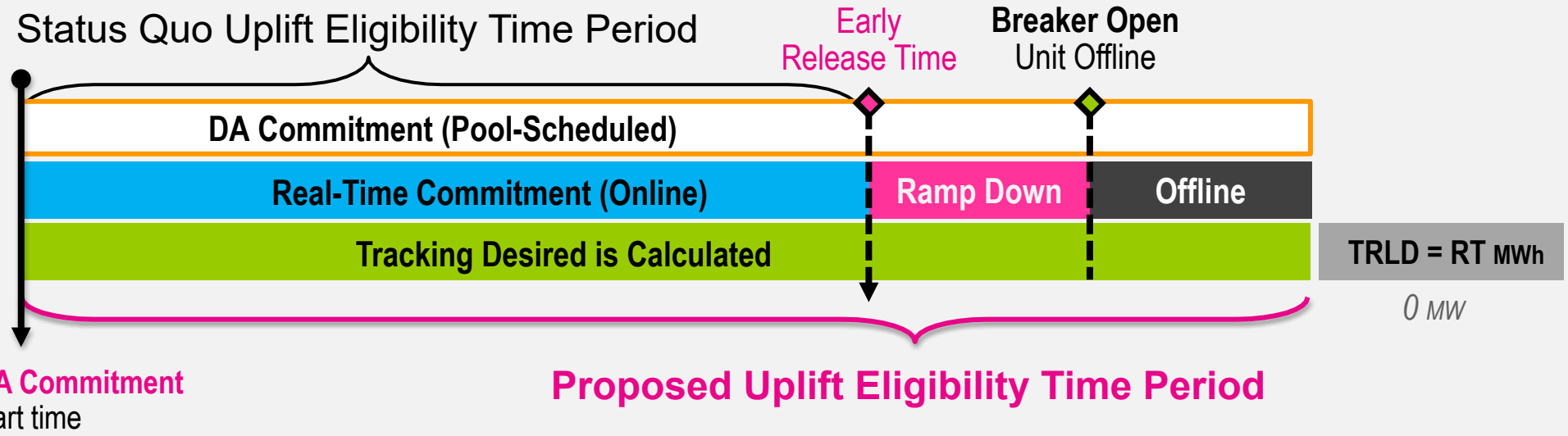
- Currently, eligibility ends once the unit ramps offline when a unit is released early by PJM.
  - This results in the unit being responsible for any buy out of their Day-ahead position, while the uplift calculation uses all of the Day-ahead revenue from the offline intervals. This means the net revenues for that time period are overstated and reduces the likelihood the resource will be made whole for costs it incurred while following dispatch directives.
  - This creates a disincentive to follow PJM dispatch and increases the likelihood the resource will be taken over to run for company once released by PJM in order to minimize losses due to the DA buy back.
- The proposed change would keep the unit eligible until the end of the Day-ahead commitment. The impact is on the revenue side of the calculation. It will use the DA revenue and the Balancing revenue (DA buy back) in the uplift calculation. This will result in the use of the correct profit/loss in the uplift calculation for following a PJM instruction.

Example 10:
Due to Company action, Unit Released Early (Economic De-commitment)

SCENARIO:

- PJM schedules the unit in DA
- **Unit released** early by Company

** *This looks like a unit trip from a logging perspective as it immediately terminates eligibility. today*



TAKEAWAYS

Status Quo

If a resource is released early by company, eligibility terminates at the time of release. The resource is responsible for the cost of buying out of the DA position for the remainder of their DA commitment (or retains possession of revenue from it).

Proposal

- Extend uplift eligibility until the end of the DA ahead commitment
- **Step 1** – reflect the expected revenue/losses using tracking desired when PJM committed
  - TRLD will continue to be calculated until the end of the DA commitment. TRLD MWh = RT MWh beyond end of DA.
- **Step 2 –** reflect revenue/losses from **actual performance** during the uplift eligibility time period

TRLD = RTMW: *Tracking Value Equals Real-Time MW*

Example 10

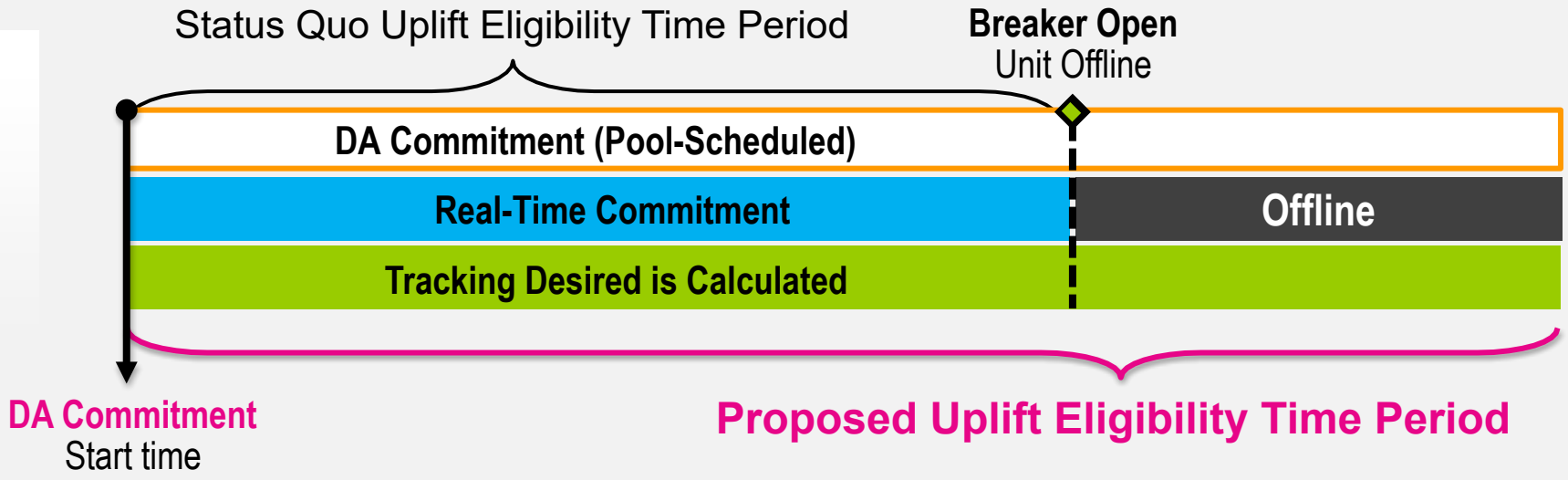
The company requested the unit be taken offline prior to the end of its Day-ahead commitment. How is this different from the scenario where PJM releases the unit early?

- Eligibility is extended to the end of the DA commitment in both scenarios. This means the both the DA and Balancing revenue will be used in the BOR calculation after the unit is released.
  - If the unit makes a profit from buying out of the DA commitment, those profits will now be available to offset costs in the remainder of the DA commitment. If the unit loses money from buying out of the DA commitment, the unit has an opportunity to recover those costs, but the buy back will be limited to the amount that would have resulted from following PJM dispatch.
- However, when the company requests the unit to be released early, Tracking Desired will continue to be calculated until the end of the Day-Ahead Commitment rather than ending when the unit comes offline. This represents the amount of MW the unit should have been producing if it operated consistent with the PJM commitment.
  - Step 1 will continue to use the tracking desired as if the unit was operating through the end of the DA commitment. This represents the unit following dispatch, since PJM did not release the unit. This will establish the amount of uplift that PJM is willing to pay.
  - Step 2 will use the actual MW. This includes the intervals that the unit ramped down and was offline. This will account for the actual performance of the unit.
  - The unit will be paid the uplift of the lesser of Step1 and Step 2.

Example 11:
Unit Trip

SCENARIO:

- PJM schedules the unit in DA
- **Unit Trips prior to end of DA commitment**



TAKEAWAYS

Status Quo

Eligibility terminates at the time the unit comes offline. If a resource Trips before the end of the DA commitment, the resource is responsible for the buy out of the DA position for the remainder of their DA commitment.

Proposal

- Extend uplift eligibility until the end of the DA ahead commitment.
- **Step 1** – reflect the expected revenue/losses using tracking desired when PJM committed
  - TRLD will continue to be calculated until the end of the DA commitment.
- **Step 2** – reflect revenue/losses from the actual performance

Example 11

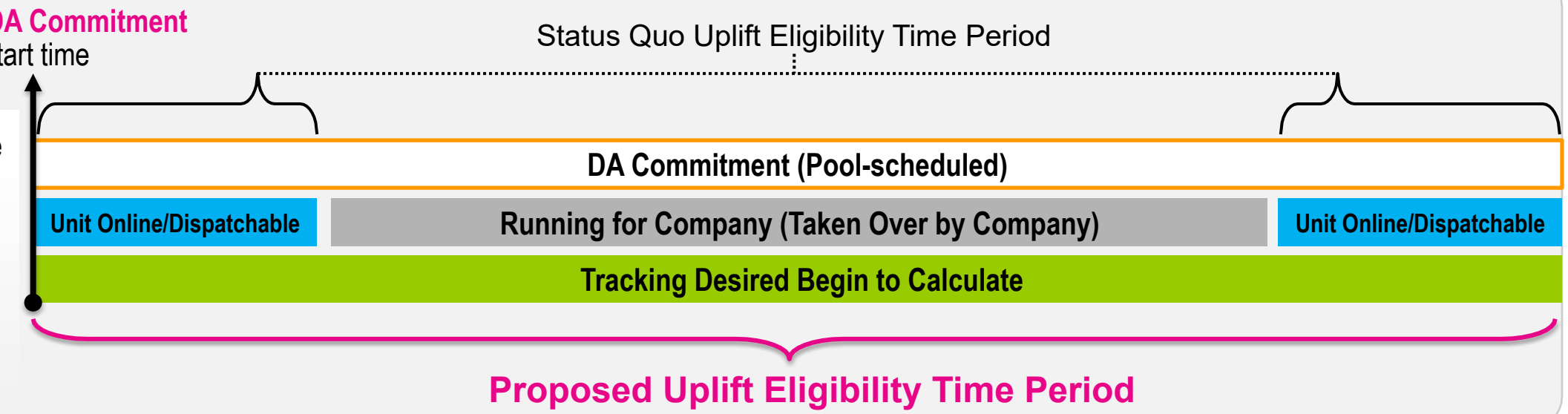
- Unit Trips offline. This is treated the same as if the company had requested the unit be released prior to the end of the Day-ahead Commitment.
- If the unit makes a profit from buying out of the DA commitment, those profits will now be available to offset costs in the remainder of the DA commitment. If the unit loses money from buying out of the DA commitment, the unit has an opportunity to recover those costs, but the buy back will be limited to the amount that would have resulted from following PJM dispatch.
- Step 1 will continue to use the tracking desired as if the unit was operating through the end of the DA commitment. This represents the unit following dispatch, since PJM did not release the unit. This will calculate the amount of uplift that PJM is willing to pay.
- Step 2 will use the actual MW. This includes the intervals that the unit ramped down and was offline. This will account for the actual performance of the unit.
- The unit will be paid the uplift of the lesser of Step1 and Step 2.

Examples of unit taken over to run for company

Example 12:
Unit Taken Over for Company in the Middle of DA Commitment

SCENARIO:

- PJM schedules the unit in DA
- Runs for PJM in RT, then t**aken over by company,** then turned back over to PJM



TAKEAWAYS

Status Quo

- A resource is ineligible for BOR credits in any interval it is running for company. The resource is responsible any losses in those intervals, and any profits earned do not offset other costs during the PJM commitment period.
- All of the DA revenue is used in the "Dispatchable" (blue boxes) and none of the balancing revenue is used in the "Running for company" period (gray box)

Proposal:

- Extend eligibility to the entire DA Commitment period (including self-scheduled intervals)
- Any profits gained during the entirety of the resource operations will offset the start-up expenses throughout the entire first segment thus reducing potential uplift.
- There are no differences between the Step 1 and Step 2 calculations other than the MW utilized. The TRLD MW calculated while the unit is self-scheduled will assume the unit was following dispatch throughout that period

Example 12

Why change the eligibility rules for a unit taken over by company in the middle of the Day-ahead Commitment? What does it impact?

- Currently, eligibility ends during the periods the unit taken over by company.
  - This results in the unit being responsible for any buy out of their Day-ahead position, while the uplift calculation uses all of the Day-ahead revenue from the taken over by company intervals. This means the net revenues for that time period are overstated and reduces the likelihood the resource will be made whole for costs it incurred.
- The proposed change would keep the unit eligible until the end of the Day-ahead commitment.
- Step 1 calculation will use the tracking desired which reflects where PJM would have dispatched the unit. This will include all costs and revenue of that dispatch period and will eliminate the overestimation of revenue from only including the day ahead revenue. This will result in the use of the correct profit/loss in the uplift calculation.
- Step 2 calculation will use actual mw.

Example 13:
Unit Taken Over for Company All of Day

SCENARIO:

- PJM schedules the unit in DA
- **Taken over to run for company in RT for the entire day**

TAKEAWAYS

Status Quo

- Resource is not eligible for BOR credits

Proposal

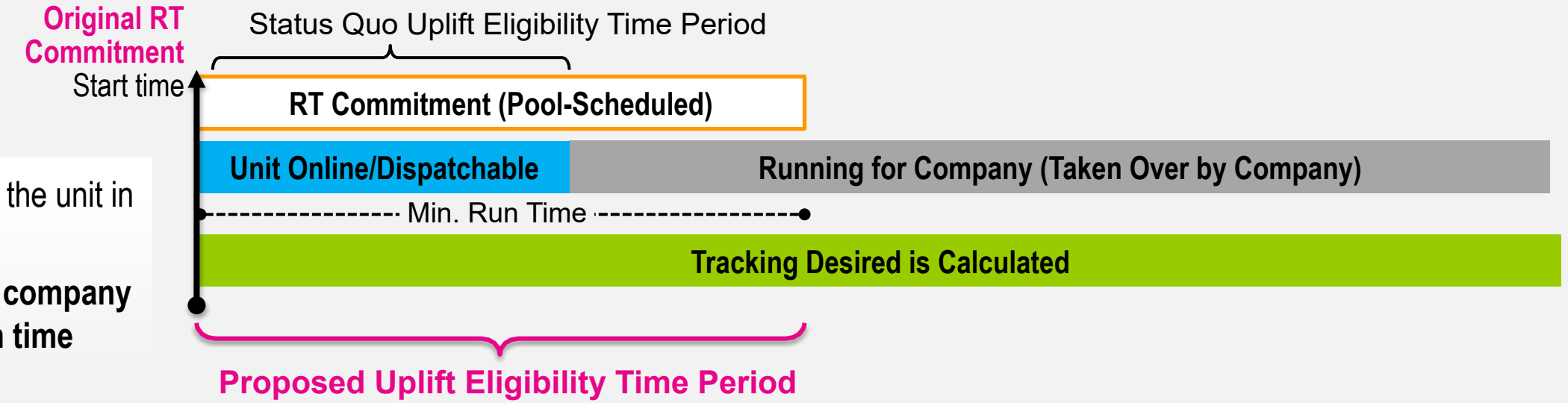
- Status quo, no change to eligibility
- Unit must be running for PJM for at least 1 interval in Real-Time in order to be eligible for BOR credits.

Examples of Units dispatched in Real-Time Only

Example 14:
Resource taken over for company in the middle of RT commitment

SCENARIO:

- PJM schedules the unit in RT
- **Taken over by company before min run time elapses**



TAKEAWAYS

Status Quo

The uplift eligibility time period ends at the time the unit was taken over by company

Proposal

Eligibility is extended until the end of the minimum run time of the unit

- STEP 1 - reflect the expected revenue/losses using the **TRLD MWh** when PJM committed**. The PJM commitment is considered to be the entire minimum run time, since PJM called the unit online.**
- STEP 1 - reflect the **revenue/losses** from actual performance **during the uplift eligibility time period. The uplift eligibility time period is for the entire minimum run time, since PJM called the unit online.**

Example 14

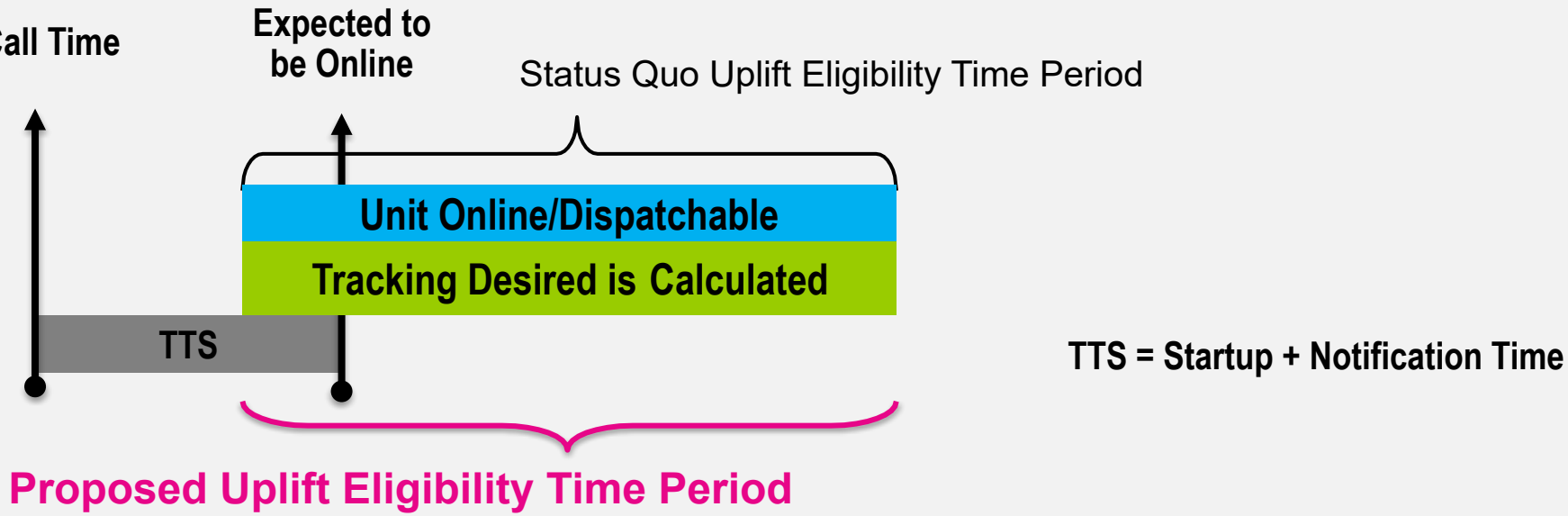
Why change the eligibility rule for a company taking over a unit during the minimum run time, when the commitment is real-time only (no DA commitment)?

- The current rule terminates the eligibility for uplift at the interval the unit is taken over by company. This could result in uplift payments for the startup cost, as the calculation would not use any profits from the remaining intervals of the minimum run time to help offset those startup costs.
- When evaluating the unit to be called online, PJM uses the minimum run time during that evaluation to determine if the unit will be economic. When the decision is made, the expectation is that the unit will be online for at least the minimum run time. The proposed change would keep the unit eligible until the end of that original commitment period (the end of the unit's minimum run time).
- Step 1 will use the tracking desired. The BOR calculation will use any net revenues that would have been available to the resource if it remained PJM-scheduled through the end of the min run time and followed dispatch. This will ensure that the uplift that PJM is willing to pay will only be based on the MW quantity that is consistent with following dispatch.
- Step 2 will use actual MW. This is the uplift that will be needed to make the unit whole based on how it operated.
- **Even though this uplift calculation includes intervals where the unit was self-scheduled, and may make a unit whole for losses in self-scheduled intervals, the uplift paid to the unit will be no greater than what is calculated under Step 1, which is the uplift that would have been owed if the resource had remained running for PJM and followed dispatch.**

Example 15:
Real-Time Commitment (Now Log); online within TTS

SCENARIO:

- PJM schedules the unit in RT to come on as soon as possible
- Resource online prior to TTS elapsing



TAKEAWAYS

Status Quo

- Eligibility begins when resource is online

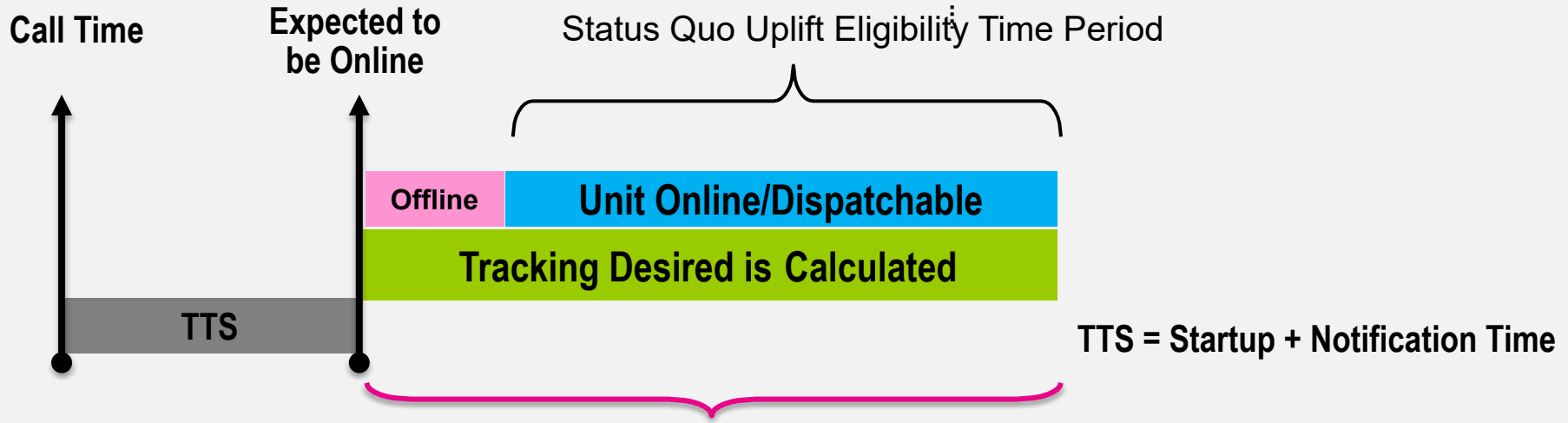
Proposal:

- Tracking begins the earlier of (t0 log effective time + Notification Time + Start Time, time unit comes online) – in this case, when the unit comes online
- Eligibility begins when resource is online
- Except for the use of tracking desired, this is the same as Status Quo

Example 16:
Real-Time Commitment (Now Log): online beyond TTS

SCENARIO:

- PJM schedules the unit in RT to come on as soon as possible (now log)
- Resource online after TTS elapses



TAKEAWAYS

Status Quo

- Eligibility begins when resource is online

Proposal:

- Tracking begins when the unit was expected to be online (based on log time + Startup Time + Notification Time)
- Eligibility begins when TRLD begins

Example 15 and 16

Why change the eligibility rule for a RT committed unit that is online before or after it's TTS?

- Example 15 - The Status quo for eligibility will remain today therefore a unit will continue to be eligible when coming online before it's TTS
- Example 16 - When evaluating the unit to be called online, PJM uses the TTS to determine the expected time the unit is to be online. The proposed change will honor the TTS and make the unit eligible at the time the unit was expected to be online. In addition, the evaluation process for committed the unit determined this was the most economical decision.
- Step 1 will use the tracking desired. The BOR calculation will use any net revenues that would have been available to the resource if it had come online within the TTS. This will ensure that the uplift that PJM is willing to pay will only be based on the MW quantity that is consistent with following dispatch. **That is, the uplift that would have been paid if the unit was online and following cost at the expected time.**
- Step 2 will use actual MW. This is the uplift that will be needed to make the unit whole based on how it operated. Zero mw will be utilized in the period in which the unit is offline.

Next Steps

- Present remaining solution options
  - Special exceptions to proposed rules in this presentation to handle flexible resources
  - Remaining design components 7-9 (use of desired MW in BOR deviations)
- Narrow down options
- Develop formalized packages

Appendix

Acronyms

Acronym	Term & Definition
TRLD	**Tracking Ramp Limit Desired** is the new ramp limited metric utilized to determine if a resource is following dispatch instructions for uplift payments exclusively used in Step 1 of the proposed BOR credit calculation.
SCED	**Real-Time Security Constrained Economic Dispatch** is the application responsible for dispatching resources in real-time for a target five minute interval as a result of a co-optimization of Energy and Reserves for the forecasted system conditions..
MW	A **Megawatt** is a unit of power equaling one million watts (1 MW = 1,000,000 watts) or one thousand kilowatts (1 MW = 1,000 KW). To put it in perspective, under non-severe weather conditions, one MW could power roughly 800 to 1,000 average-sized American homes.
T0 or t0	Time at which the TRLD MW calculation begins.

PJM Glossary

Acronyms

Acronym/Abreviation	Term & Definition
Step 1	**Step 1** an uplift payment calculated using the Tracking Desired Metric, and representative of the uplift owed if the resource followed dispatch instructions
Step 2	**Step 2** is an uplift payment calculated based on the real-time output of the resource
Soak	**Soak** is defined as the soak period or warmup period in which a resource is not dispatchable.

PJM Glossary

Acronyms

Acronym	Term & Definition
Flat Profiled	**Flat Profiled is defined in** M28 Section 1A.1 is term that applies when real-time five minute Settlement Intervals of the hour will be flat-profiled and thus set equal to the Hourly Revenue Meter MWh.
TTS	**TTS or Total Time to Start** is defined as startup time plus notification time

PJM Glossary

Contact

Operating Reserve Clarifications

Facilitator:
Nick Disciullo,

Nicholas.disciullo@pjm.com

Facilitator:
Joey Tutino,

Joseph.Tutino@pjm.com

SME/Presenter:
Brian Weathers,

Brian.Weathers@pjm.com

Operating Reserve Clarifications

Potential Solution Options - Balancing Operating Reserve Credit Matrix Updates

Member Hotline

(610) 666 – 8980

(866) 400 – 8980

custsvc@pjm.com

PROTECT THE POWER GRID

THINK BEFORE YOU CLICK!

pjm

BE ALERT TO MALICIOUS PHISHING EMAILS

Report suspicious email activity to PJM.

Call (610) 666-2244 or email it_ops_ctr_shift@pjm.com