Updated Hourly Offers Proposal Overview

GOFSTF

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Concerns with Previous Proposal

The previous proposal linked the price schedule to cost schedule in order to limit the amount by which a price based schedule could be increased and reduce opportunity for market manipulation

- Complex implementation, difficult to articulate to users in advance what an allowable price based schedule increase would be
- Required locking generation owners out of eMKT under a varied set of circumstances which increased complexity
- Did not allow the uncommitted portion of price schedule to be updated in real time

Guiding Principles

- PJM felt it was important to update the proposal with the following guiding principles in mind
  - Keep the implementation as simple as possible (within reason) given the deadline to implement changes prior to winter 2016/17
  - Allow resources to articulate and recover their costs
    - Allow price based schedules to be updated in real time
  - Eliminate foreseeable opportunities for market abuse
  - Minimize schedule switching throughout the day
    - Avoids undesirable dispatch patterns that could impact system cost and control

Updated Proposal Summary

- Schedules can be differentiated hourly (24 individual offer values)
- Both Cost and Price based schedules may be increased or decreased in real time for both committed and uncommitted hours
- Amount of the change is not limited for market-based offers. Cost-based offers are limited by the existing provisions in the cost development guidelines and the resource's approved fuel cost policy
- Operating Reserve deviations are assessed to units that update their offers in RT (with some exceptions)
- TPS test will be run in real time for units which are running on price and increase their price schedules

Cost Based Offer Changes

- Increases to cost based schedule are limited to increases in fuel cost component of offer. This agrees with the IMM.
- Cost based offers must still comply with the rules in Manual 15: Cost Development Guidelines (capped at cost + 10%)
  - Cost based offers must be updated hourly **during uncommitted hours** to reflect a decrease in cost whenever the previously submitted cost based offer exceeds cost + 10%
    - Would only apply to units with a fuel cost policy that is based on a reference price that can change intraday
    - Only applies to hours without a DA or RT commitment so that unit isn't forced to incur deviation charges (see operating reserve deviation updates in package)
    - Not required to raise cost based offers when costs increase

Price Based Offer Change

- Increases to price based schedules will not be limited
  - However, offers that increase by more than 10% from originally committed value or from the previous hour will be flagged for further review.
- Price based schedules can be changed without a corresponding change in the cost based schedule
  - During commitment extensions, increases in the price-based offer beyond 10% without a change in cost will result in forfeiture of make-whole for extended hours.

Allowable Schedule Updates in Real Time

	Committed DA	Committed RT	Committed on	Change cost for committed hrs	Change price for committed hrs	Change cost uncommitted hrs	Change price uncommitted hrs
1	Y	N	Price or Cost	Yes (increase and decrease)	Yes (increase and decrease)	Yes (increase and decrease)	Yes (increase and decrease)
2	N	Y (Comm. RT for min run)	Price or Cost				
3	N	Y (Brought on early or extended)	Price or Cost				
4	N	N	NA	NA	NA		

See slide 12 for summary of make whole implications of increasing and decreasing offer in RT

- Day Ahead (DA) Market
  - Hourly Test
  - Test performed on a generation owner basis
  - Mitigation determined by run segment
  - No change to DA TPS with hourly offer updates except to consider offers that differ by hour

- Real Time
  - Test performed on a generation owner basis
  - Test performed for uncommitted resources called on for transmission

- Real Time (continued)
  - Test performed in the IT SCED engine (look ahead resource commitment tool)
  - Each solution interval (4 total) in the IT SCED case is evaluated
  - No change to TPS test for uncommitted resources with hourly offer updates except to consider offers that differ by hour

Summary of additional TPS test with Introduction of Hourly Offers

- PJM Matrix proposal enhanced to specifically test online resources which increase their price based offer in real time

  - Test to verify increase in Price based offer does not create local market power condition
  - Test will use existing TPS logic (generation owner based)
  - Test to be performed hourly
  - Online resource operating on its Price Schedule which increases its price based offer will be evaluated for potential mitigation
  - No threshold applied to price based offer increase

Summary of additional TPS test with Introduction of Hourly Offers

- If generation owner fails TPS test then the unit(s) operating on their price schedule which increased its price based offer will be mitigated to their cheapest schedule
- Participant notification via eMKT

The updated proposal includes changes on both the charge and credit sides of the uplift equation

- Balancing Operating Reserve Credits
  - Changes proposed to the version of schedule to which a resource will be made whole
  - Change proposed in the balancing value portion of the calculation
- Balancing Operating Reserve Charges
  - Resources that change their offer for previously committed hours will be subject to additional deviation charges
- Lost Opportunity Cost Credits
  - Changes proposed to the version of the schedule on which a resource will be compensated

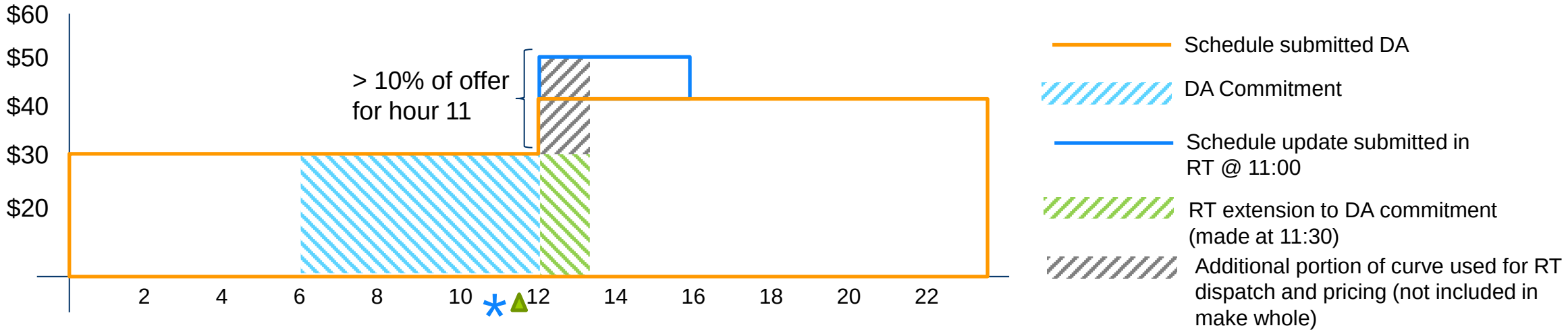
Schedule Version Used for BOR Credits

- Day-Ahead Operating Reserves will be unchanged.

- Resources with a DA commitment will be made whole in real-time to the lesser of:
  - the DA committed offer
  - the RT updated offer

- Resources without a DA commitment will be made whole for the longer of the resource's minimum run time or specified commitment duration to the lesser of:
  - the offer available at the time the RT commitment is made
  - the RT updated offer

- Resources being brought on early or having their commitment extended in real-time will be made whole for the remainder of their run time using the RT offer curve (price or cost) in effect at the time the commitment to extend the unit is made.
  - If a resource increases its **price based** offer by more than 10% in the hours adjacent to a pre-existing commitment without a corresponding increase in the cost based offer, the resource will be made whole using the offer value used for the adjacent committed hour's make whole payment.



Version of Schedule Used for BOR Credits - Summary

	Committed DA	Committed RT	Committed on	Change in Direction for Committed Hours	Version of Schedule Used for Make Whole*
1a	Y	N	Price or Cost	Increase	DA offer
1b				Decrease	RT updated offer
1c				No Change	DA offer
2a	N	Y (Comm. RT for min run)	Price or Cost	Increase	RT offer @ time of commitment
2b				Decrease	RT updated offer
2c				No Change	RT offer @ time of commitment
3a	N	Y (Brought on early or extended)	Price	Increase (change > 10% of offer for adjacent committed hour **without** corresponding increase in cost based offer)**	offer value used for the adjacent committed hour's make whole payment
3b				Increase (change > 10% of offer for adjacent committed hour **with** corresponding increase in cost based offer)**	RT updated offer @ time decision to extend unit is made
3c				Increase (change <= 10% of offer for adjacent committed hour)**	RT updated offer @ time decision to extend unit is made
3d			Cost	Increase	RT updated offer @ time decision to extend unit is made
3e			Price or Cost	Decrease	RT updated offer @ time decision to extend unit is made
3f				No Change	RT updated offer @ time decision to extend unit is made
4	N	N	NA	NA	NA - Unit is not committed

*The schedule version used for make whole is the lesser of the version in place at the time of commitment or the RT updated version. The values in this column reflect the lesser of these two versions.
** These scenarios apply regardless of a RT update

- PJM proposes a change to the calculation of the Balancing Value used in the Balancing Operating Reserve Credit
  - Addresses case for unit committed in DA and increases offer in RT resulting in unit being dispatched down.
  - As a result the unit has to buy back energy in RT.
  - Absent a change, BOR credits would compensate the unit for the buy back due to Balancing Value going negative.

Balancing Value = (RT Generation MWh – DA Scheduled MWh) x RT Generator LMP

Where RT Generation MWh is greater of

[RT Generation MWh

Or

Lesser of (Greater of (RT Dispatch Desired MWh and Original Schedule Desired MWh using the committed offer schedule) and DA Scheduled MWh)]

Bal Op Res Credit = RT Offer – Balancing Value – DA Value – DA Operating Reserve Credit – Any Sync/Non Sync/Reactive/DASR revenue

Existing Balancing Value Calculation Example

Original Offer - DA

Segment	MW	Price
1	50	5
2	100	10

Updated Offer - RT

Segment	MW	Price
1	50	10
2	100	15

In DA, LMP = $10 and unit clears at 100 MW

In RT, LMP = $10 and unit is dispatched at 50 MW

Applying the existing Balancing Value equation:

RT Generation MWh is greater of
[RT Generation MWh (50 MW)
Or
Lesser of (RT Dispatch Desired MWh (50 MW) and DA Scheduled MWh (100 MW))]

RT Generation MWh = 50 MW

Balancing Value = (RT Generation MWh (50 MW) – DA Scheduled MWh (100 MW)) x RT Generator LMP ($10) = -$500

A negative balancing value results in an increased Balancing Operating Reserve Credit

Proposed Balancing Value Calculation Example

Original Offer - DA

Segment	MW	Price
1	50	5
2	100	10

Updated Offer - RT

Segment	MW	Price
1	50	10
2	100	15

In DA, LMP = $10 and unit clears at 100 MW

In RT, LMP = $10 and unit is dispatched at 50 MW

Applying the proposed Balancing Value equation:

RT Generation MWh is greater of
[RT Generation MWh (50 MW)
Or
Lesser of (Greater of (RT Dispatch Desired MWh (50 MW) and Original Schedule
Desired MWh (100 MW) using the committed offer schedule) and DA Scheduled MWh (100 MW))]

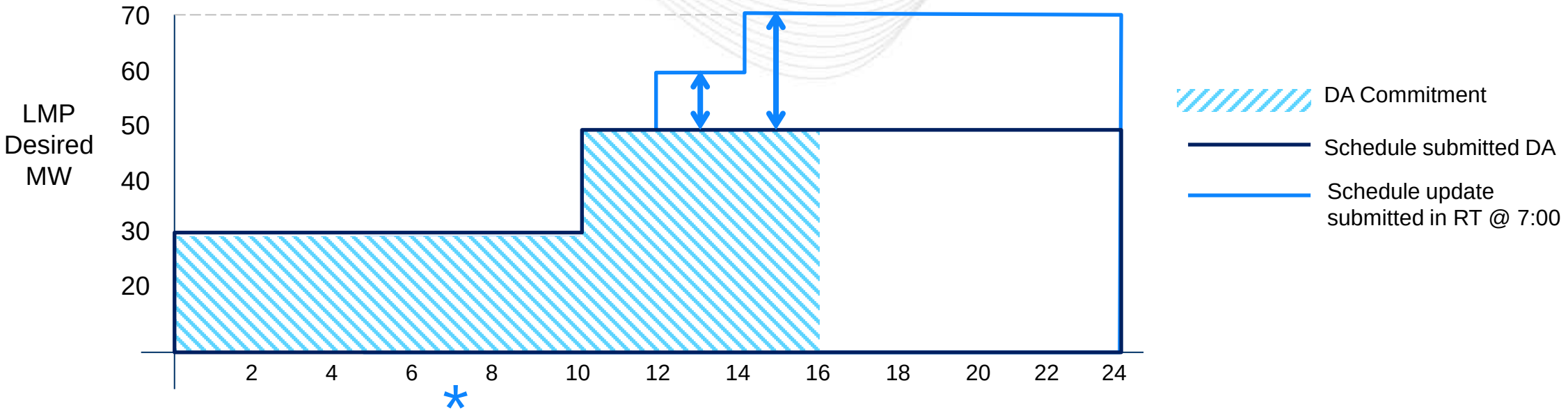
RT Generation MWh = 100 MW

Balancing Value = (RT Generation MWh (100 MW) – DA Scheduled MWh (100 MW)) x RT Generator LMP ($10) = $0

- Resources will continue to incur deviations caused by not following DA schedule or RT dispatch, as per existing rules
- Resources will now also be subject to additional deviation charges for updating their offer for a previously committed hour
  - Additional deviations = difference between LMP desired MW based on offer at the time of the commitment (DA or RT) and LMP desired MW based on the RT updated offer
    - Deviation charge applies to any hourly difference regardless of amount
      - The 5 MW and 5% bandwidth applies only to the status quo deviation charge
    - Supplier netting will not be applied

Example 1: Committed DA – 1 Update to Offer in RT

Assume unit follows PJM dispatch



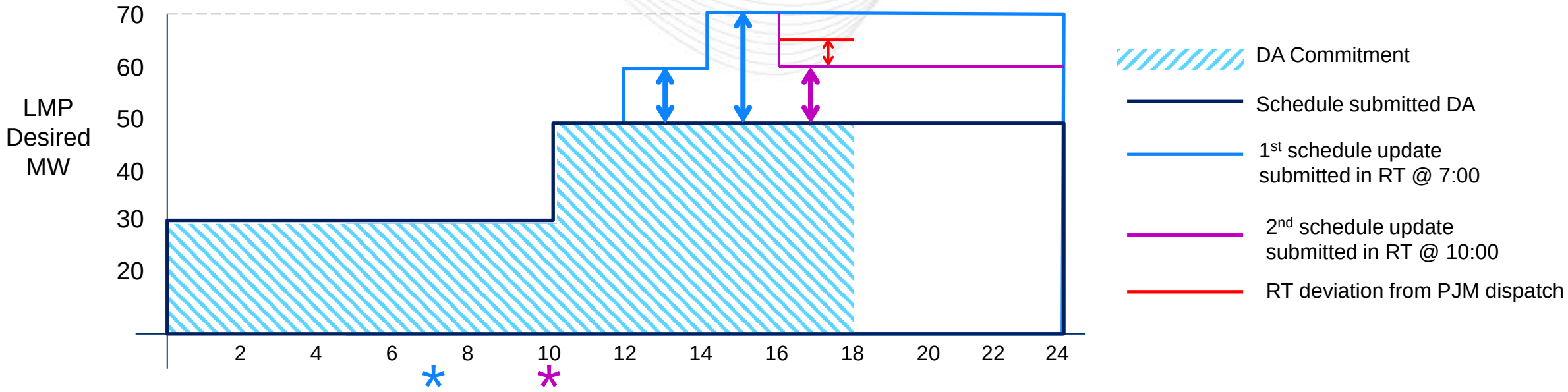
Two sets of deviations due to updated offer:

1) HB 12 – 14 for 10 MW

2) HB 14 – 16 for 20 MW

Example 2: Committed DA – 2 Updates to Offer in RT

Assume unit follows PJM dispatch, except for hours 16-18



Three sets of deviations due to updated offers:

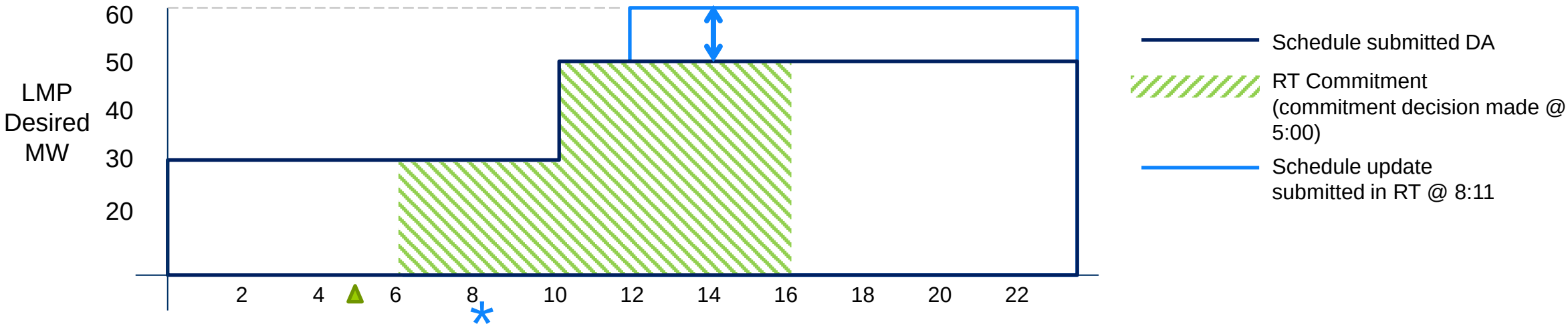
1) HB 12 – 14 for 10 MW
2) HB 14 – 16 for 20 MW
3) HB 16 – 18 for 10 MW

Status quo deviation charge:

1) HB 16 – 18 for 5 MW

Example 3: Committed in RT (for min run) – Increase to offer for committed hours

Unit has a min run time of 10 hours. Assume cost increases for hours 12 and beyond subsequent to DA offer submission and offer was not updated prior to RT commitment. Unit follows PJM dispatch and fulfills its min run time.

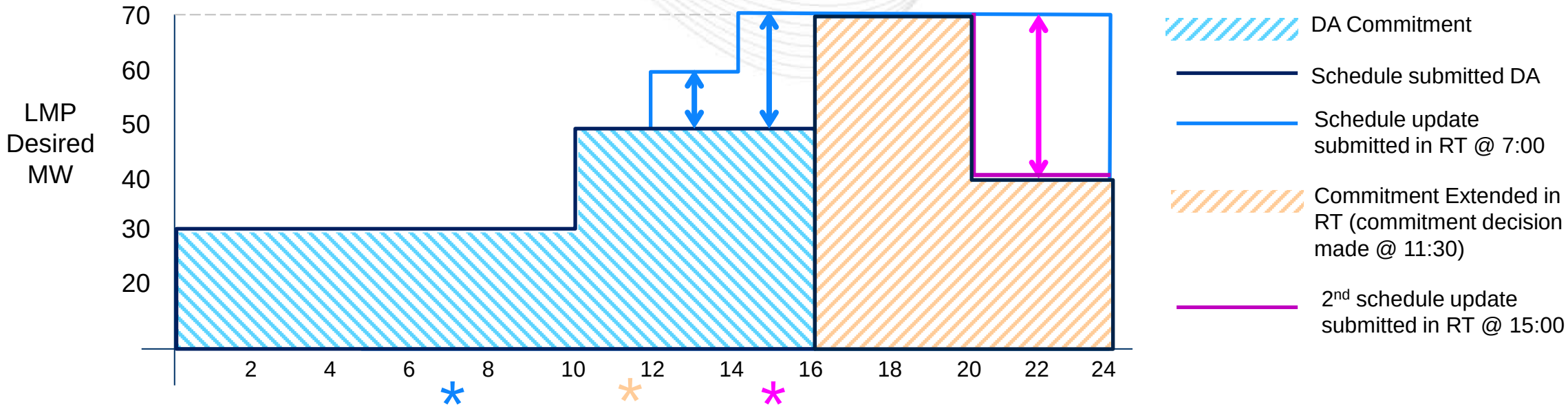


One set of deviations due to updated offer:

1) HB 12 – 16 for 10 MW

Example 4: Committed DA, Extended in RT – 1 Update to Offer in RT

Assume unit follows PJM dispatch



Three sets of deviations due to updated offer and extended RT commitment :

1) HB 12 – 14 for 10 MW

2) HB 14 – 16 for 20 MW

3) HB 20 – 24 for 30 MW

- CT LOC will be calculated using the higher of:
  - the DA committed offer
  - the RT updated offer
- LOC for reliability reduction
  - Pool scheduled resources will be compensated using the *higher* of:
    - the DA committed offer
    - the RT updated offer
  - Self-scheduled resources* will be compensated using the *higher* of:
    - All DA available price or cost offers (regardless of which schedule the resource is currently committed on)
    - All RT available price or cost offers (regardless of which schedule the resource is currently committed on)
    - *Consistent with existing rules, PJM will not provide an LOC credit for self-scheduled units that PJM dispatch does not allow to come online in RT

LOC for units providing reactive support

- Unit *reduced* to provide reactive support: calculation will be the same as for a reliability reduction (previous slide)
- *Pool scheduled* resources whose output has been *increased* will use the *lesser* of:
  - The DA committed offer
  - The RT updated offer
- *Self-scheduled* resources whose output has been *increased* will use the *lesser* of:
  - All DA submitted price or cost offers (regardless of which schedule the resource is currently committed on)
  - All RT available price or cost offers (regardless of which schedule the resource is currently committed on)

Several of the proposed changes combine to provide a strong disincentive for speculative offer changes

- New Schedule Deviations (on top of existing generator deviations)
- If dispatched down due to increased offer, not made whole for buy back in RT (change to balancing value calculation)
- Make whole is limited in hours in which a unit is extended if price offer increases more than 10% without corresponding change in cost
- Capacity Performance Penalties ($~4000/MWh) for being dispatched down in a performance hour and price based offer is greater than cost offer
  - Section 10A(d) of Attachment DD of the OATT