Day-Ahead Market Enhancement Settlement discussion

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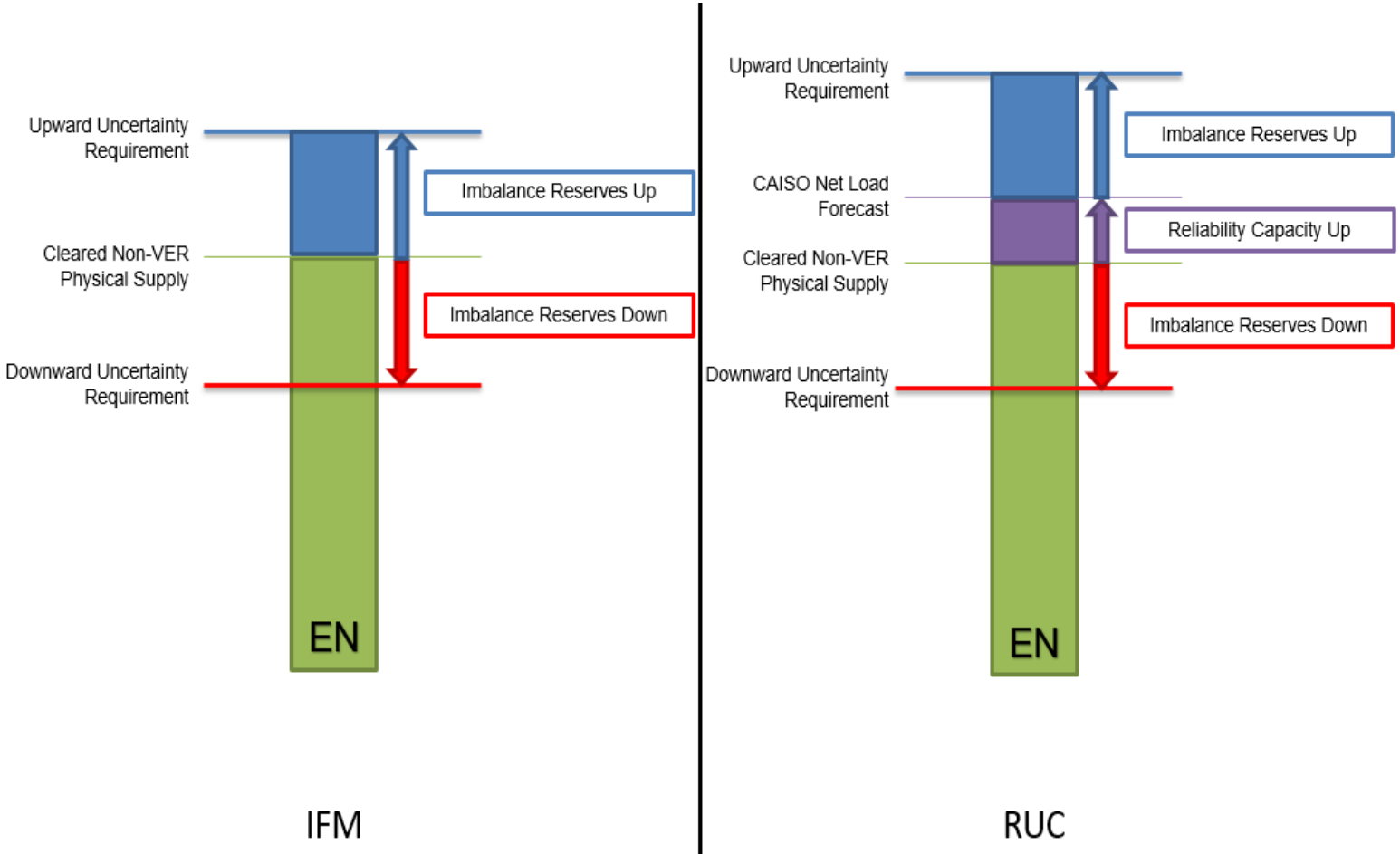
Sequential approach to commit additional resources if physical supply clears IFM less than ISO net load forecast



Reliability capacity up and down settlement very similar to RUC today

- No deviation settlement with real-time products
- No pay provision if unable to meet must offer allocation
  - Charged the higher of RC or FMM FRP
- Two tier cost allocation
  - Tier 1 to load, SC-forecasted VER deviations and SC net virtual positon
  - Tier 2 to metered load

Imbalance reserves settlement introduces some new concepts

- 5-minute ramp deviation settlement with flexible ramping product
  - Both for forecasted movement and uncertainty awards
- No pay provision if unable to meet remaining 15-minute must offer obligation in FMM
  - Charged the higher of IR or FMM FRP
- Two tier cost allocation
  - Tier 1 to deviations that require dispatch of other resource due to uncertainty materializing
  - Tier 2 to metered load

Bid cost recover changes to incorporate new products

- Imbalance reserve revenue and cost will be considered in IFM bid cost recovery over the day
- Reliability capacity revenue and cost will be consider in the RTM bid cost recovery over the day
- Flexible ramping product revenue and cost remains in the RTM bid cost recovery over the day

Settlement of ramp deviations between IFM, FMM and RTD (1 of 2)

- Ramp is composed of …
  1. *Forecasted movement* is the change in energy schedules between intervals in same market run
  2. *Uncertainty awards* are additional ramp capability held back to meet changes in net load between market runs

- Marginal value of ramp is the same for both types

- Objective, if the ramp capability is the same as IFM in FMM and RTD, then the ramp deviation settlement should be zero

Settlement of ramp deviations between IFM, FMM and RTD (2 of 2)

- Complications to address in design
  - Forecasted movement compensation can occur through energy price (IFM*) or a side payment (FMM & RTD)
    - Side payment if moving up is paid FRU and charged FRD
  - Forecasted movement is included in EIM base schedule changes to calculate forecasted movement deviations in FMM
  - No imbalance reserve awards are included in EIM base schedules to meet uncertainty in FMM
  - Uncertainty granularity difference between 15-min imbalance reserves and 5-min flexible ramping products
  - Ramp for imbalance reserves comes from unloaded capability and energy schedule changes in opposite direction
  - Ramp for FRP uncertainty awards comes from unloaded capability and energy schedule changes in opposite direction

Ramp deviation settlement between IFM and FMM

- $\Delta FRU(t) = FRU(t) - \min\begin{pmatrix} RR \times 5 - \min\big(0, \big(IFM(h) - IFM(h-1)\big)/12\big), \\ \max\big(0, IRU(h) - \max\big(0, \big(IFM(h) - IFM(h-1)\big)/12\big)\big) \end{pmatrix}$

  opposite IFM movement

  concurrent IFM movement

- $\Delta FRD(t) = FRD(t) - \min\begin{pmatrix} RR \times 5 + \max\big(0, \big(IFM(h) - IFM(h-1)\big)/12\big), \\ \max\big(0, IRD(h) + \min\big(0, \big(IFM(h) - IFM(h-1)\big)/12\big)\big) \end{pmatrix}$

  opposite IFM movement

  concurrent IFM movement

- $\Delta FM(t) = \big(FMM(t) - FMM(t-1)\big)/3 - \big(IFM(h) - IFM(h-1)\big)/12$

  FMM movement

  IFM movement

* RR is IFM ramp rate

Imbalance reserve no-pay settlement rules

- $$IRUNP(t-1) = \max\left(0, IFM(h) + IRU(h) - \min\left(\begin{matrix} RR \times 5 - \min\left(0, \left(IFM(h) - IFM(h-1)\right)/12\right), \\ \max\left(0, IRU(h) - \max\left(0, \left(IFM(h) - IFM(h-1)\right)/12\right)\right) \end{matrix}\right) - UOL(t-1)\right)$$

  opposite IFM movement

  concurrent IFM movement

- $$IRDNP(t-1) = \max\left(0, LOL(t-1) - IFM(h) + IRD(h) - \min\left(\begin{matrix} RR \times 5 + \max\left(0, \left(IFM(h) - IFM(h-1)\right)/12\right), \\ \max\left(0, IRD(h) + \min\left(0, \left(IFM(h) - IFM(h-1)\right)/12\right)\right) \end{matrix}\right)\right)$$

  opposite IFM movement

  concurrent IFM movement

Review spreadsheet example

- http://www.caiso.com/InitiativeDocuments/FMM-RTDSettlementExample-Day-AheadMarketEnhancements.xlsx

Observations from proposed ramp deviation settlement rules

- No net deviation settlement if full ramp capability is available
  - Forecast movement deviation offset FRU/FRD deviations

- Ramp deviation settlement occurs when …
  - Ramp capability used for energy/capacity is different between IFM and FMM
  - Ramp rate changes between IFM and RTM
  - A resource's schedule reaches its upper/lower economic limit or limited by outages
  - Congestion differences between IFM and RTM requiring re-dispatch