MARKET SURVEILLANCE COMMITTEE

Mosaic Metrics Discussion

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Topics

- Comparison Metrics
- Benefits
- Cost
- Metric
- DAME and EDAM

Metrics

A fundamental criterion for assessing the value of a method of forecasting uncertainty is whether the methodology is sufficiently accurate that the benefits of using the forecast methodology to commit capacity in RUC exceed the cost.

BENEFITS – COST > 0

- The value of this metric takes account of coverage, requirements, exceedance, closeness and informativeness.
- This metric is not simply a gauge of whether methodology A is better than methodology B, but of whether a method is good enough to be worth using.
- The metric is impacted by both the forecast accuracy and by the cost effectiveness of the RUC design and implementation.

We will first discuss the calculation of benefits, then of costs, then the overall metric.

Benefits

The benefit from applying a forecasting methodology is the value of the reduction in uncovered uncertainty. The benefit involves calculating the amount of increased coverage and valuing this increased coverage.

- Actual realized uncertainty is observed. (ACTUAL)
- Predicted uncertainty is known (PREDICTED)
- The amount of predicted uncertainty covered in RUC is determined when using the methodology in RUC (COVERED).
- The amount of long start capacity, and capacity requiring a RUC payment that is cleared in RUC is determined when using the methodology in RUC (CLEARED)

The amount of uncertainty covered in RUC may be less than predicted uncertainty due to a lack of resources to cover uncertainty or the operation of a demand curve.

PREDICTED ≥ COVERED

The amount of long start capacity cleared in RUC will generally be less than the amount of uncertainty covered because there will generally be capacity on resources committed in the IFM that was not fully scheduled to provide energy or ancillary services in the IFM, and some uncertainty could be covered by short-start units that could be committed in RTPD or STUC.

COVERED ≥ CLEARED.

Benefits

The benefits from a method of modeling uncertainty are:

MIN [Maximum(ACTUAL- (COVERED-CLEARED), 0), Cleared] *VALUE

- If ACTUAL < (COVERED- CLEARED) there is no improvement as the CLEARED capacity was not needed. The actual uncertainty could have been met without committing additional long start or other costly capacity in RUC.
- IF ACTUAL > (COVERED-CLEARED) The improvement is at most equal to CLEARED.

VALUE would be an assessment of the benefit from covering uncertainty in RUC.

Benefits

VALUE is an assessment of the value of covering uncertainty in RUC.

- VALUE could be set as a single value such as $1000/MWh
- VALUE could be set as different values for different levels of under coverage. For example, if:

  MIN [Maximum(ACTUAL- (COVERED-CLEARED), 0), Cleared]< 200MW

  - a lower value might be used to value improved coverage on the basis that operators can manage small levels of uncovered real-time net load uncertainty at a lower cost than higher levels of uncovered real-time uncertainty.
  - The benefit calculation could be elaborated to include several tiers of coverage benefit values.

Costs

Costs would be the costs incurred to commit resources to cover uncertainty in RUC. (RUC COSTS)

- These costs are determined in RUC when the methodology is used in RUC.
- These costs are not perfectly observable as some resources might have been committed to cover underbid load and net virtual supply even if there were no uncertainty. (BASE RUC)
  - One approach would be to simply assume that the cost of covering BASE RUC is small.
  - A more elaborate approach would multiply total RUC costs by the ratio:

    COVERAGE / (COVERAGE + BASE RUC)

Metric

The overall metric would be:

MIN [Maximum(ACTUAL- (COVERED-CLEARED), 0), Cleared] *VALUE– RUC COSTS

An important good feature of this metric is that it can take a negative value if the error in the uncertainty forecast is so large that the value of the improved coverage is low relative to the costs incurred to cover the predicted net load uncertainty.

- This feature can perhaps be thought of as a measure of informativeness. If the forecasting methodology does not provide much useful information, the costs will exceed the benefits.
- However, large errors on days when there is lots of capacity available to cover uncertainty at low or even zero cost will not materially impact the metric because the errors have little cost.

Metric

This metric could be directly calculated for the actual methodology being used in RUC. Some approximations would be needed for comparisons with an alternative method (alt).

- If PREDICTEDalt > PREDICTEDactual, and PREDICTEDactual = COVERAGEactual, we would not know for sure how much additional capacity could have been committed
  - If PREDICTEDactual > COVERAGEactual we would know no additional capacity would have been committed
  - If PREDICTEDactual = COVERAGEactual, we could assume the full amount of additional capacity would have been committed
- If PREDICTEDalt > PREDICTEDactual and CLEAREDactual =0, we would not know for sure if an alternative method would have cleared additional costly capacity.
  - We could assume no additional costly capacity would be committed

Metric

This metric could be directly calculated for the actual methodology being used in RUC. Some approximations would be needed for comparisons with an alternative method (Continued)

- If PREDICTEDalt > PREDICTEDactual, PREDICTEDactual = COVERAGEactual and CLEAREDactual >0, we know that the alternative method would have tried to clear additional costly capacity but we do not know exactly what that would have cost.
  - We could assume that the cost increase would be the average cost of CLEAREDactual
- If PREDICTEDalt < PREDICTEDactual and CLEAREDactual >0, we know that the alternative method would have cleared less costly capacity but we do not know exactly what the change in costs would have been.
  - If PREDICTEDactual – PREDICTEDalt ≥ CLEAREDactual, then all RUC costs would have been avoided
  - If PREDICTEDactual – PREDICTEDalt < CLEAREDactual, we could assume that the cost savings would be the average cost of CLEAREDactual

The use of the average cost of CLEAREDactual would tend to understate the cost of higher than actual levels of CLEARED and to understate the cost savings from lower than actual levels of CLEARED. A sensitivity test could be run using 1.5 the average cost of CLEARED actual.

Metric

A relevant feature of this metric is that it takes account of the economic efficiency of the RUC commitment process.

- The value of the metric will be reduced by flaws in the RUC design, flaws in the RUC implementation, or impacts on market participant bidding behavior that result in excess RUC procurement costs.
- However, the metric does not evaluate the locational efficiency of the RUC commitment. It does not test whether capacity scheduled in RUC could be dispatched to meet the actual realization of net load uncertainty.
- The metric also does not test whether the “CLEARED” RUC capacity was actually available and performed in real-time.

DAME and EDAM

A similar metric could be applied in DAME and EDAM with a few changes.

Minimum (ACTUAL, CLEARED) *VALUE – Imbalance Reserve Costs

- The benefit calculation would be based on “ACTUAL” and “CLEARED” imbalance reserves without the consideration of covered as covered equals cleared in the DAME design. It would be complex at best to back out what “COVERED” – “CLEARED” would have been without the DAME model.
- The cost calculation would be the cost of procuring imbalance reserves. Because the cost of procuring reserves to cover the uncertainty forecast could vary by location the most accurate imbalance reserve calculation would be:

$\sum_{\text{over locations } i} \text{Price}_i * \text{Quantity}_I$

Where location i is the location at which the uncertainty is modeled and covered.

A simpler calculation would simply sum payments to imbalance reserve providers. This calculation would not be completely accurate if there was congestion impacting imbalance reserve flows in the nodal dispatch, but this metric might be good enough.

DAME and EDAM

With the evolution of DAME into EDAM, thought could be given to calculating both an overall metric and perhaps several regional metrics, such as one for CAISO and the southwest, one for the Pacific Northwest and one for the Rockies.

- There would be complexity to such a calculation because the total EDAM imbalance reserve procurement will reflect the diversity benefit and imbalance reserves procured to meet net load uncertainty in one region might actually be used to balance net load uncertainty in another region.
- Nevertheless, the CAISO could calculate the diversity benefit adjusted procurement for each region (based on the location of the uncertainty, not the resource) and calculate the imbalance reserve price at each location within these three regions to calculate regional metrics.