Day-Ahead Market Enhancements

Stakeholder Workshop
2/27/2023

Reminders

- This call is being recorded for informational and convenience purposes only. Any related transcriptions should not be reprinted without ISO permission.
- If you need technical assistance during the meeting, please send a chat to the event producer.

Instructions for raising your hand to ask a question

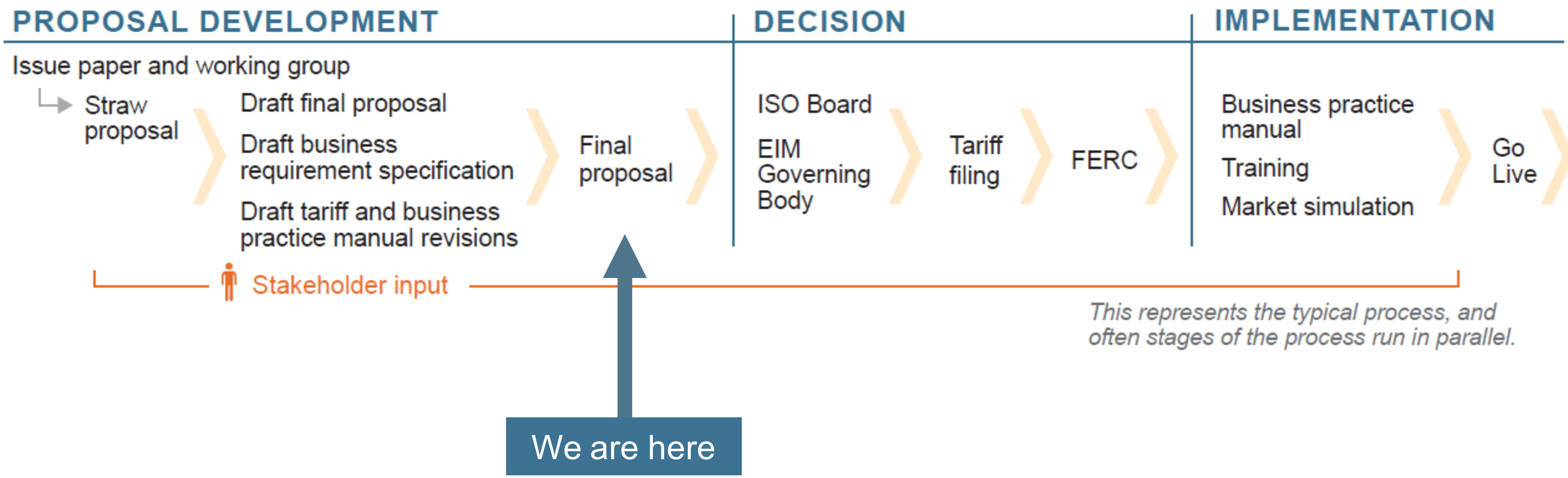
- If you are connected to audio through your computer or used the “call me” option, select the raise hand icon located on the top right above the chat window.
  Note: #2 only works if you dialed into the meeting.
  - Please remember to state your name and affiliation before making your comment.

- You may also send your question via chat to either Isabella Nicosia or to all panelists.

Agenda

Time	Topic	Presenter
1:00 – 1:05	Welcome and introduction	Isabella Nicosia
1:05 – 2:30	• Problem statement/efficiencies gained by an imbalance product/goals of DAME • High-level articulation of nodal approach	CAISO Staff
2:30 – 3:45	• Problem statement and EDAM considerations • Why consider zonal framework	WPTF
3:45 – 4:45	• Problem statement/efficiencies of downward products • Light benchmarking/summary of discussion at FERC technical conference • Summary of zonal proposal	Vistra
4:45 – 5:00	Path forward and evaluation framework recommendation	WPTF
5:00	Next steps	Isabella Nicosia

Stakeholder Process



Day 1 plan

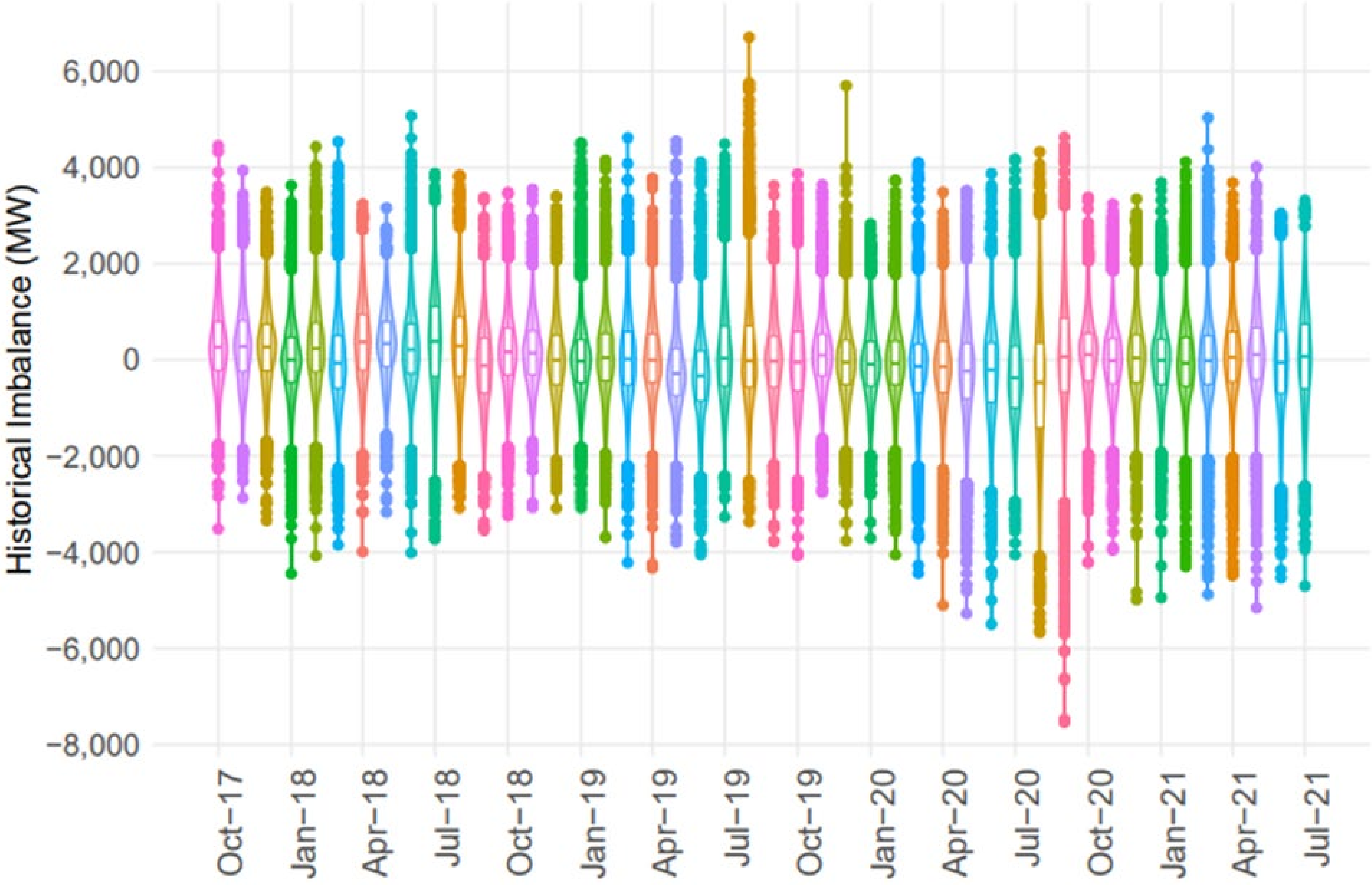
- Problem/opportunity statements (what issues are we trying to solve; what opportunities/benefits are we trying to achieve)
- High-level articulation of nodal approach
  – Calculation of the uncertainty requirements; how and why?
  – Distribution of the uncertainty requirements; how and why?
  – Deployment scenarios; how and why?

Problem Statements (1 of 2)

- As our system becomes increasingly reliant on weather-sensitive resources such as solar and wind energy, the uncertainty and variability of net load the system needs to balance increases.

- This creates risk for the real-time market and for grid operators tasked with managing the balance of supply and demand under a growing range of possible outcomes.

Variable load and renewables increase imbalances between day-ahead and real-time market

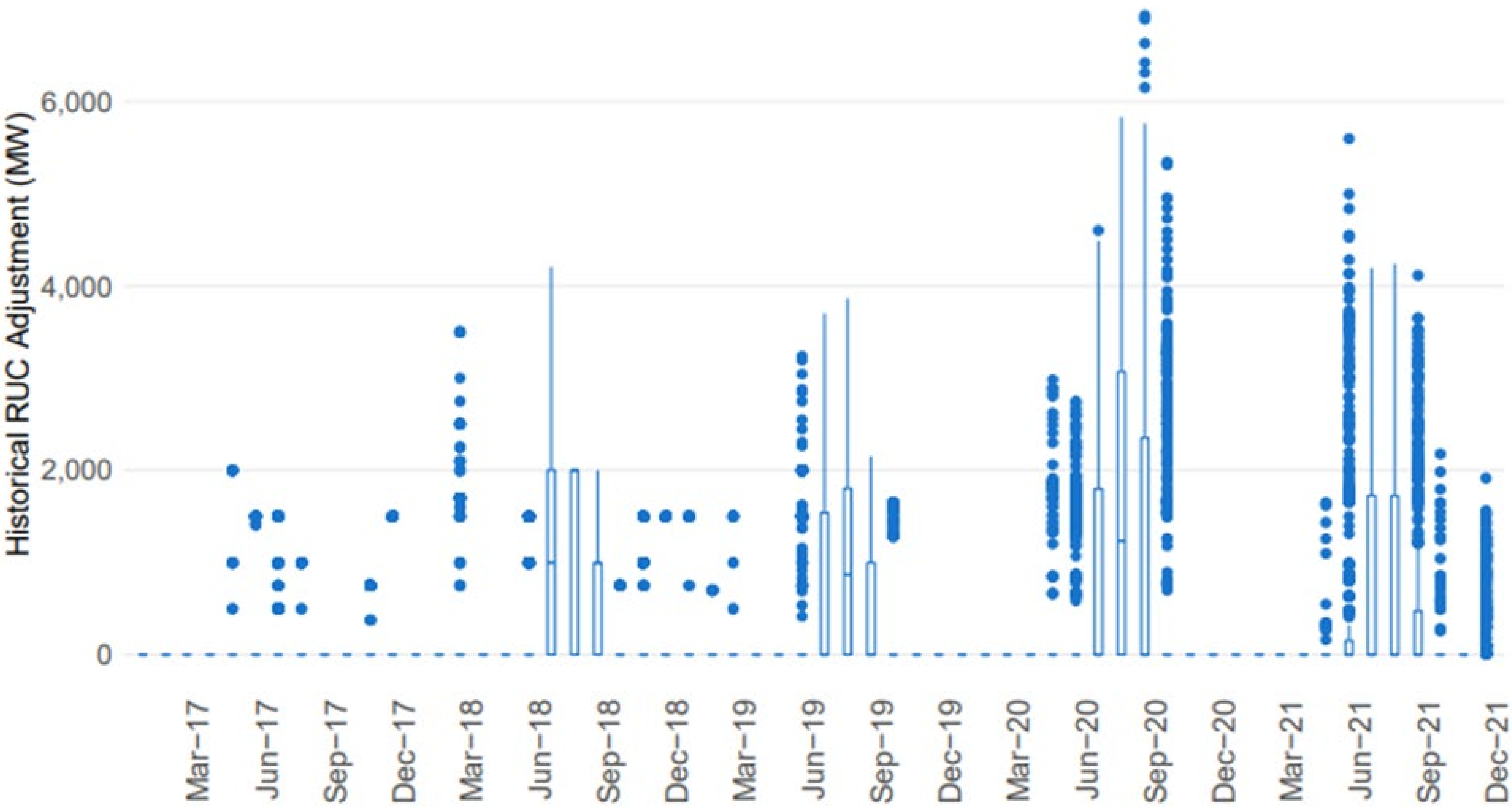


Problem Statements (2 of 2)

- System operators are relying on out-of-market actions to reserve additional supply in the day-ahead market to manage this reliability risk.

- Persistent out-of-market actions signal that there is a gap in our market design that should be addressed with a market-based solution.

Out-of-market actions increasing in frequency and magnitude



Imbalance reserves would be co-optimized with energy and ancillary services in the IFM

- Co-optimization allows market to determine most efficient use of resource's capacity
- Co-optimization assures resources can bid all of their capacity for all eligible products without risk of losing revenue because market prices ensure opportunity costs are covered
- As a result, day-ahead unit commitment, schedules and prices of all co-optimized products will be more efficient
- More accurate assessment of day-ahead uncertainty improves real-time price formation and schedules

Imbalance reserves increase operational and practical benefits of the EDAM

- Opportunity to extend more efficient market dispatch and pricing to the entire EDAM and downstream to the WEIM

- Opportunity to leverage market transfers to achieve the following operational benefits
  (1) offset uncertainties over a larger footprint through regional diversity
  (2) facilitate purchase of imbalance reserves cheaper than one could provide with their own resources, and sales of imbalance reserves that are in excess of one's individual needs

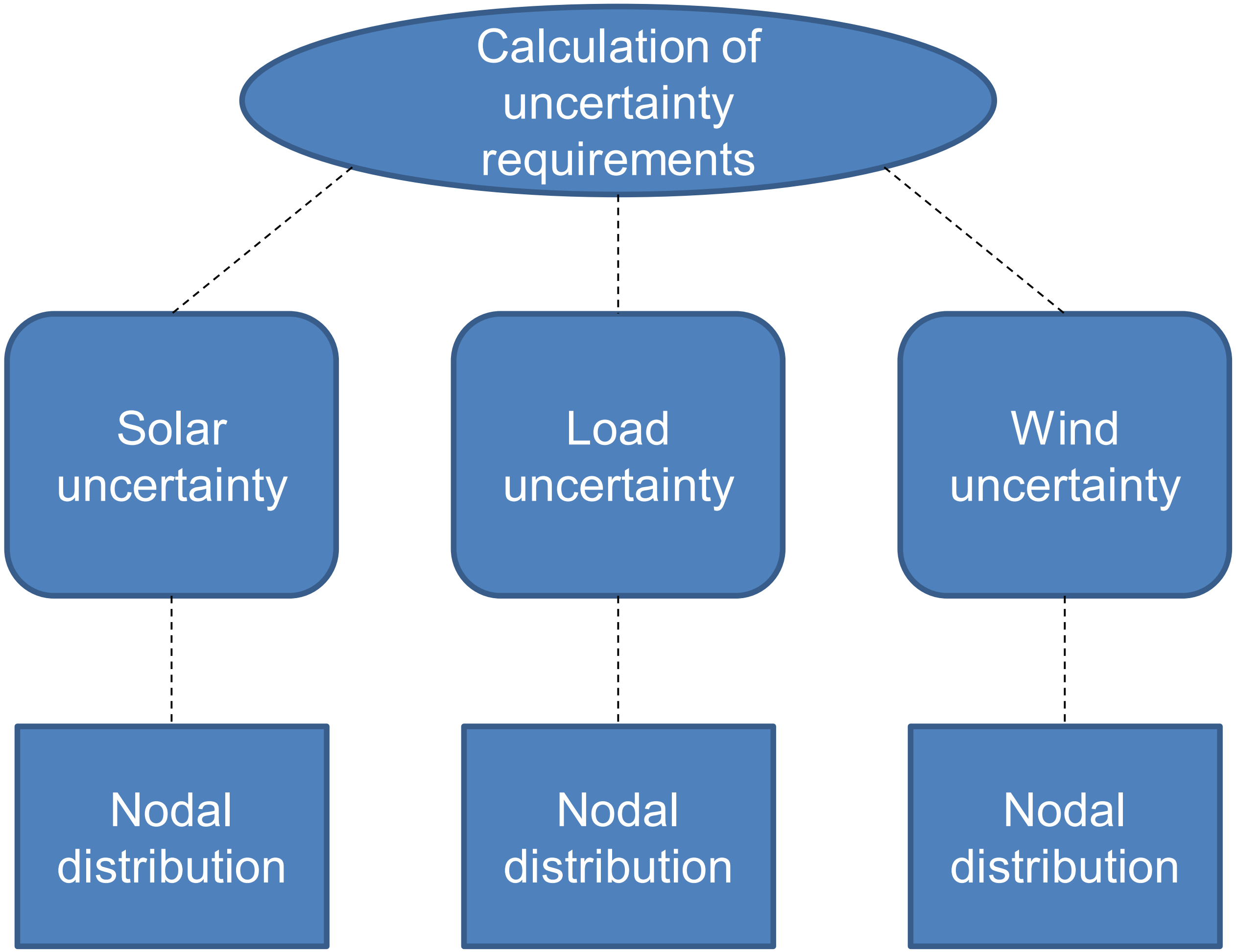
Imbalance reserves increase operational and practical benefits of the EDAM

- Opportunity to create higher confidence in EDAM transfers through deliverability assessment of all optimized products (energy, imbalance reserves, reliability capacity)

- Opportunity to maintain flexibility in real-time through creation and enforcement of real-time bidding obligations that may not be consistent across EDAM participants and in a way that extends beyond the WEIM RSE

- Opportunity to establish a consistent treatment of “flexibility” in the EDAM resource sufficiency evaluation

High-level articulation of nodal design



A few points before we dig deeper

- This is the same construct (using different input data) as what is implemented in real-time market for flexible ramping product

- One motivation of the proposed design is to not repeat mistakes made in initial FRP implementation

Undeliverable reserve products lead to current and future market inefficiencies and operational challenges

EDAM Presentation – Oct 17, 2019

$ Deliverability of RT Flexible Ramping Product (FRP)

Not biddable
+/- 1000MW
50% deliverable

$$$ Deliverability of DAME Imbalance Reserves

Biddable
+/- 4000MW
50% deliverable?

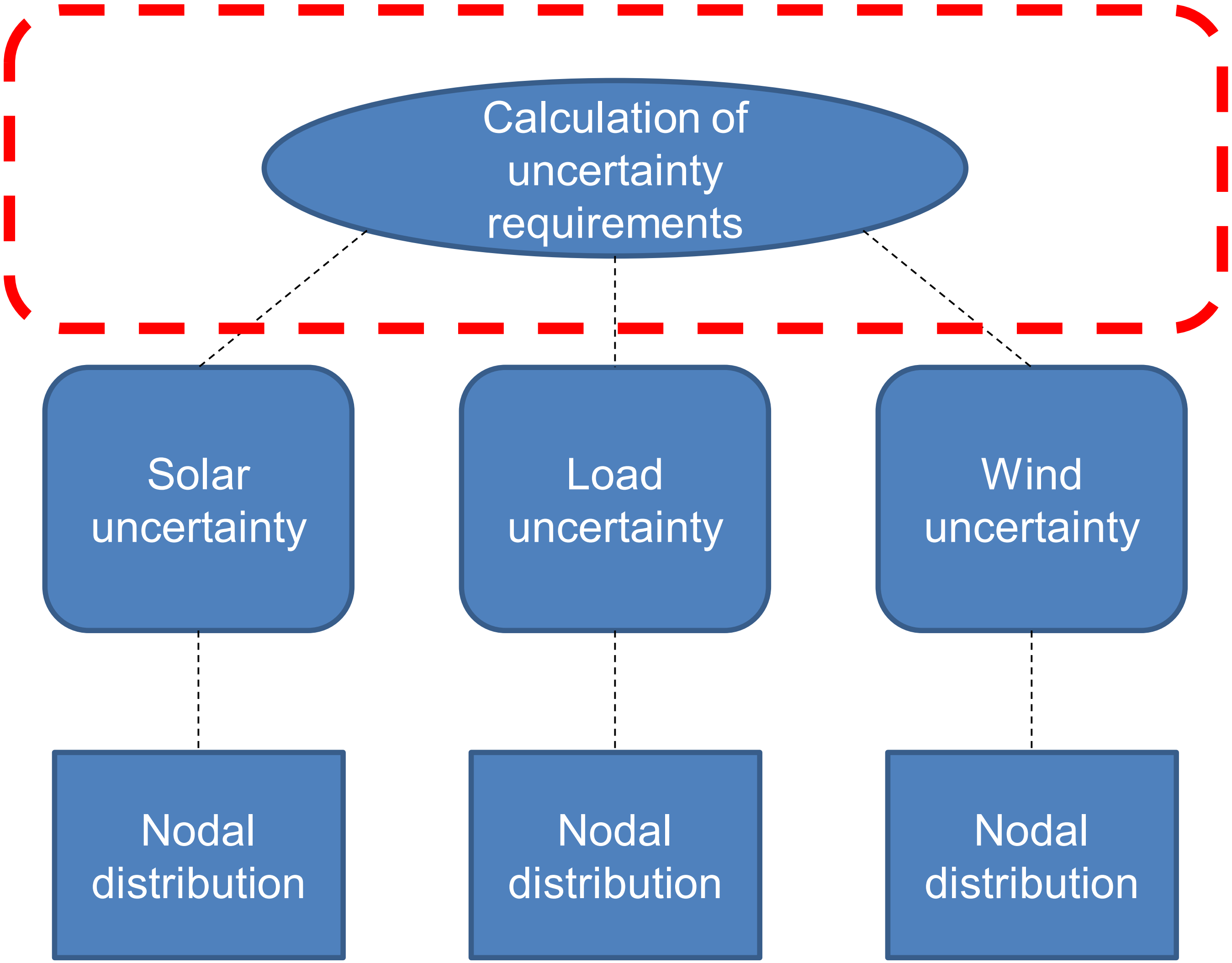
$$$$$$$ EDAM Benefits

Can a BAA rely on imbalance reserves in other BAAs to avoid unit commitment in its BAA?

Price Performance Analysis identified need to improve deliverability of ramping products

http://www.caiso.com/Documents/FinalReport-PricePerformanceAnalysis.pdf

High-level articulation of nodal design

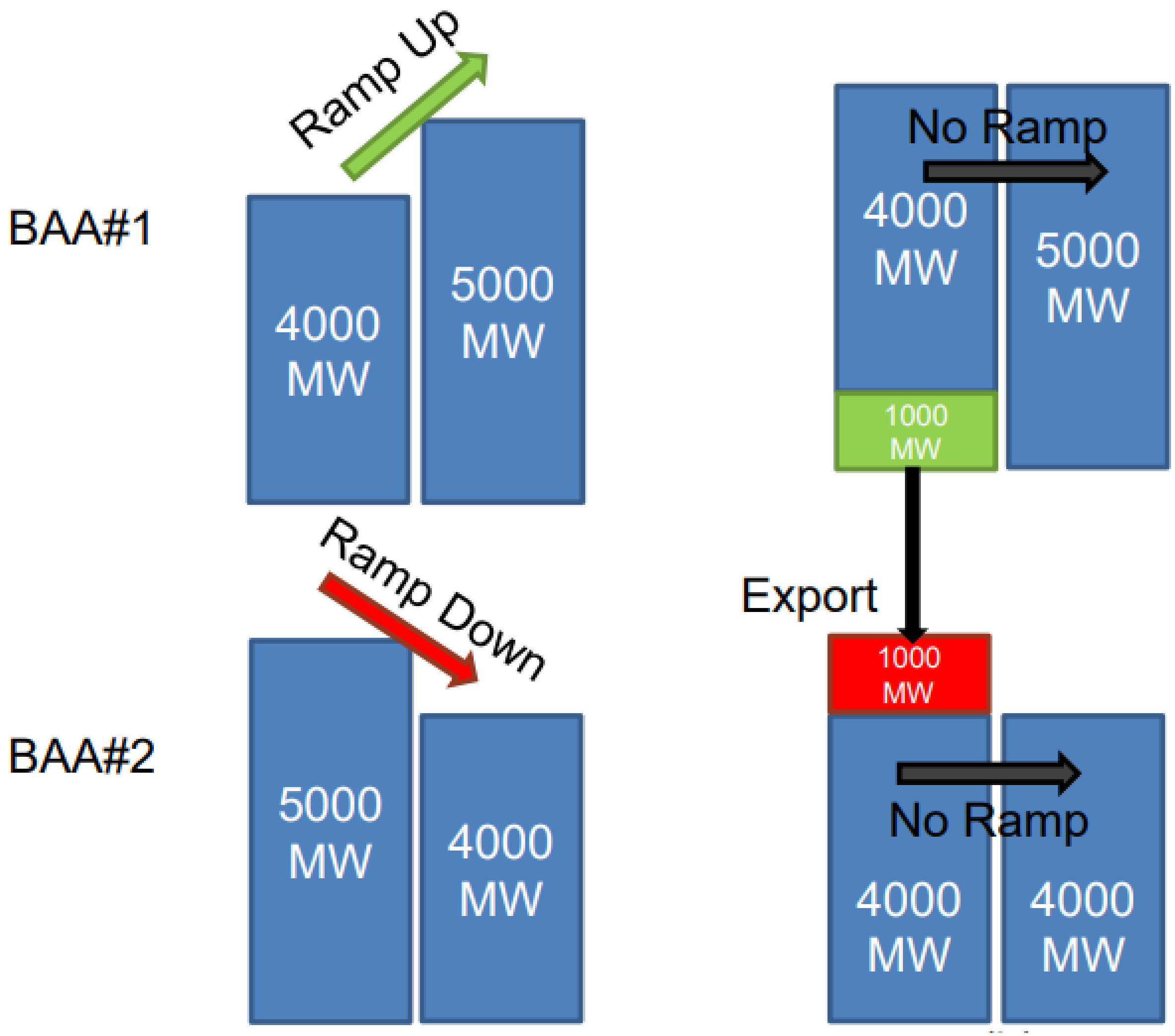


Calculation of uncertainty requirements

- Uncertainty requirements = quantity of imbalance reserve up and down an EDAM BAA must offer to meet its RSE obligations

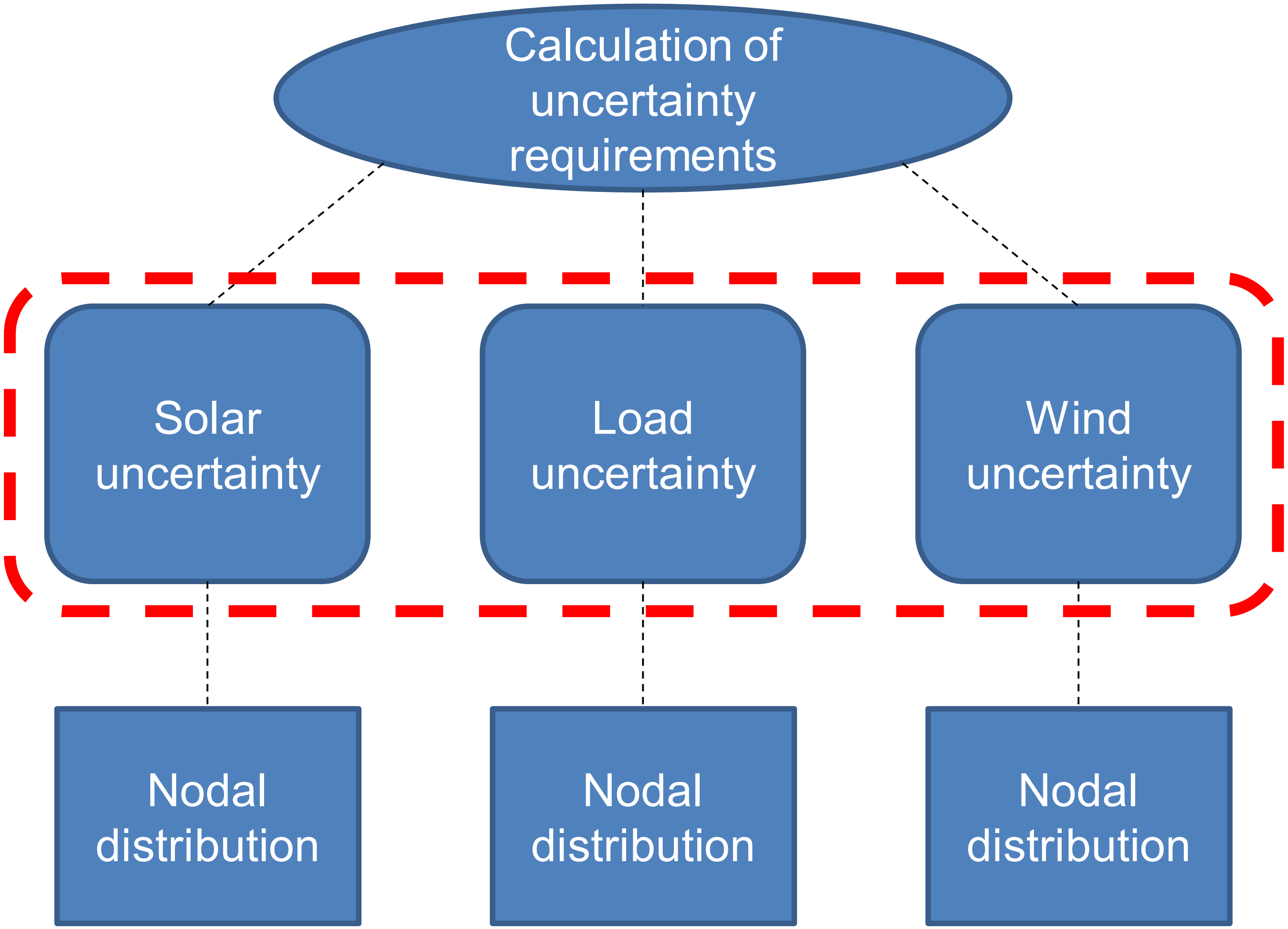
- Uncertainty requirements are calculated at a BAA level
  - Why? Because uncertainties can offset over connected regions
  - That means fewer overall reserves need to be procured for the market footprint
  - The EDAM diversity benefit demonstrates this idea
  - The data is accessible

Example



BAA#1
Ramp Up
4000 MW
5000 MW
BAA#2
Ramp Down
5000 MW
4000 MW
No Ramp
4000 MW
5000 MW
1000 MW
Export
1000 MW
No Ramp
4000 MW
4000 MW

High-level articulation of nodal design

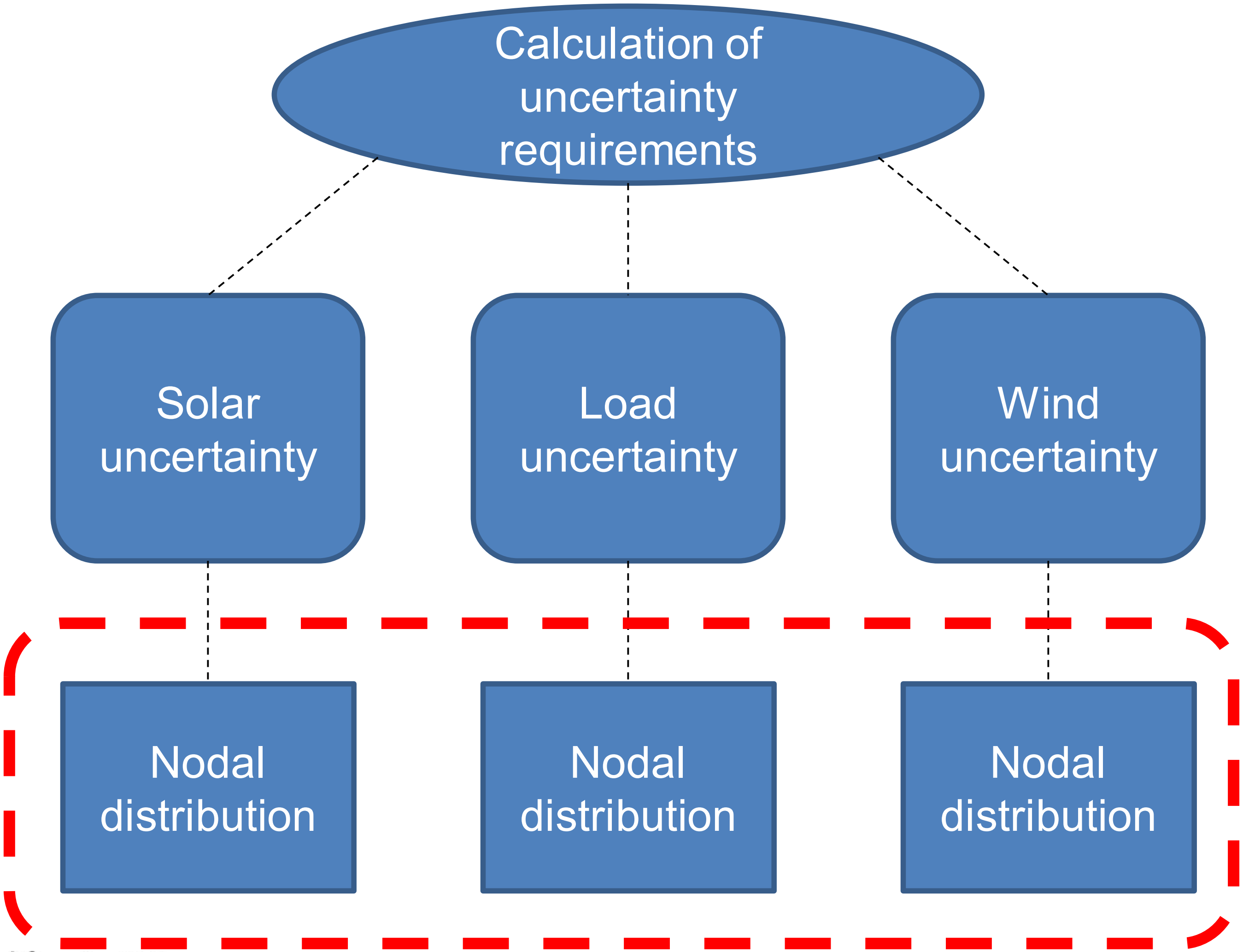


Uncertainty requirements are divided among load, wind, and solar categories

- The Imbalance Reserve Up and Down requirements are divided among load, solar, and wind resources that reflect the relative contributions of these resource classes to the total requirements.

Imbalance Reserve Up	***2000 MW***
Load	*1000 MW*
Solar	*500 MW*
Wind	*500 MW*

High-level articulation of nodal design



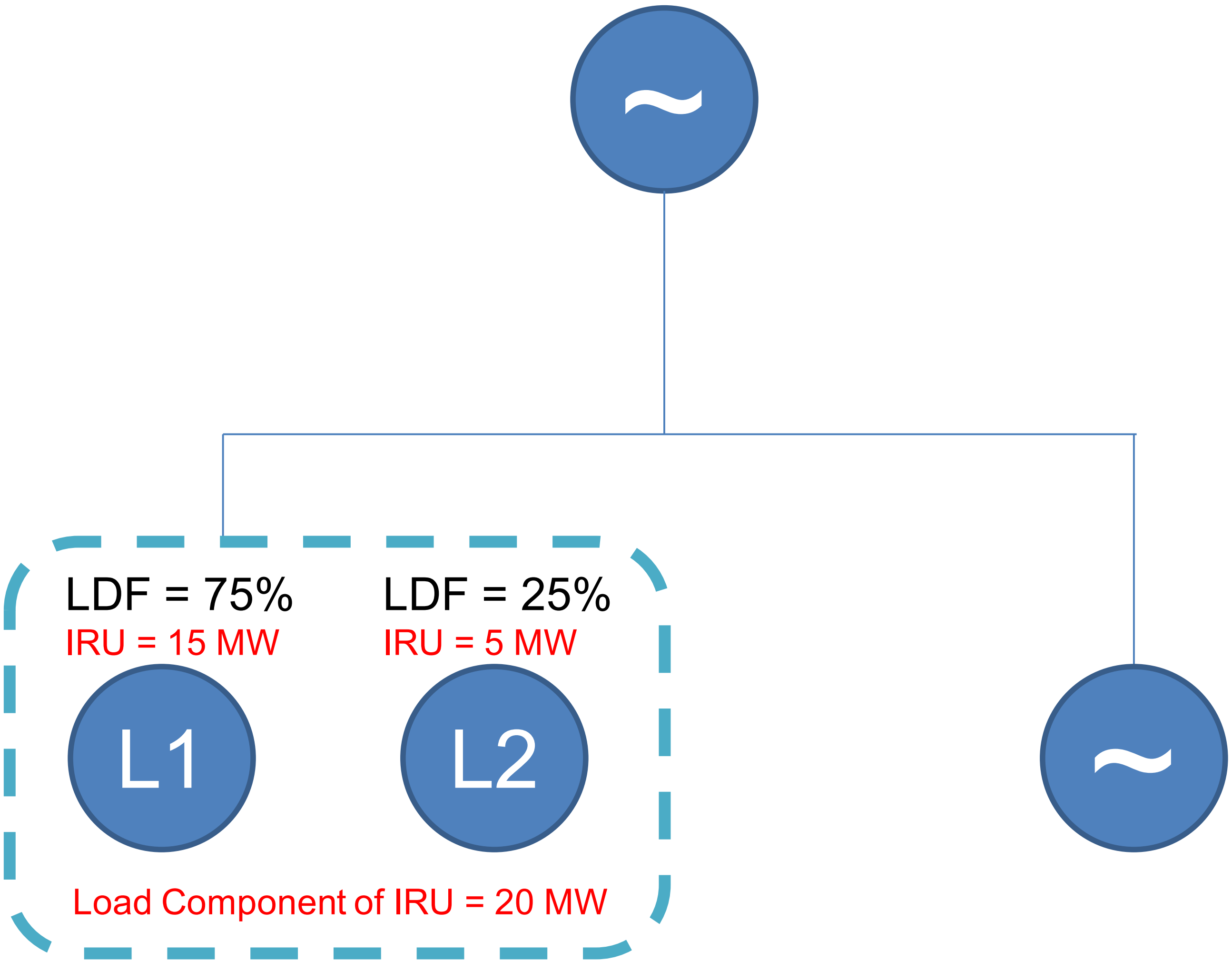
Nodal distribution for load

- The load component of the Imbalance Reserve Up requirement is distributed to load nodes as a positive load change in the upward deployment scenario

- The load component of the Imbalance Reserve Down requirement is distributed as a negative load change in the downward deployment scenario.

- The same load distribution factors used in RUC are used to distribute these components.

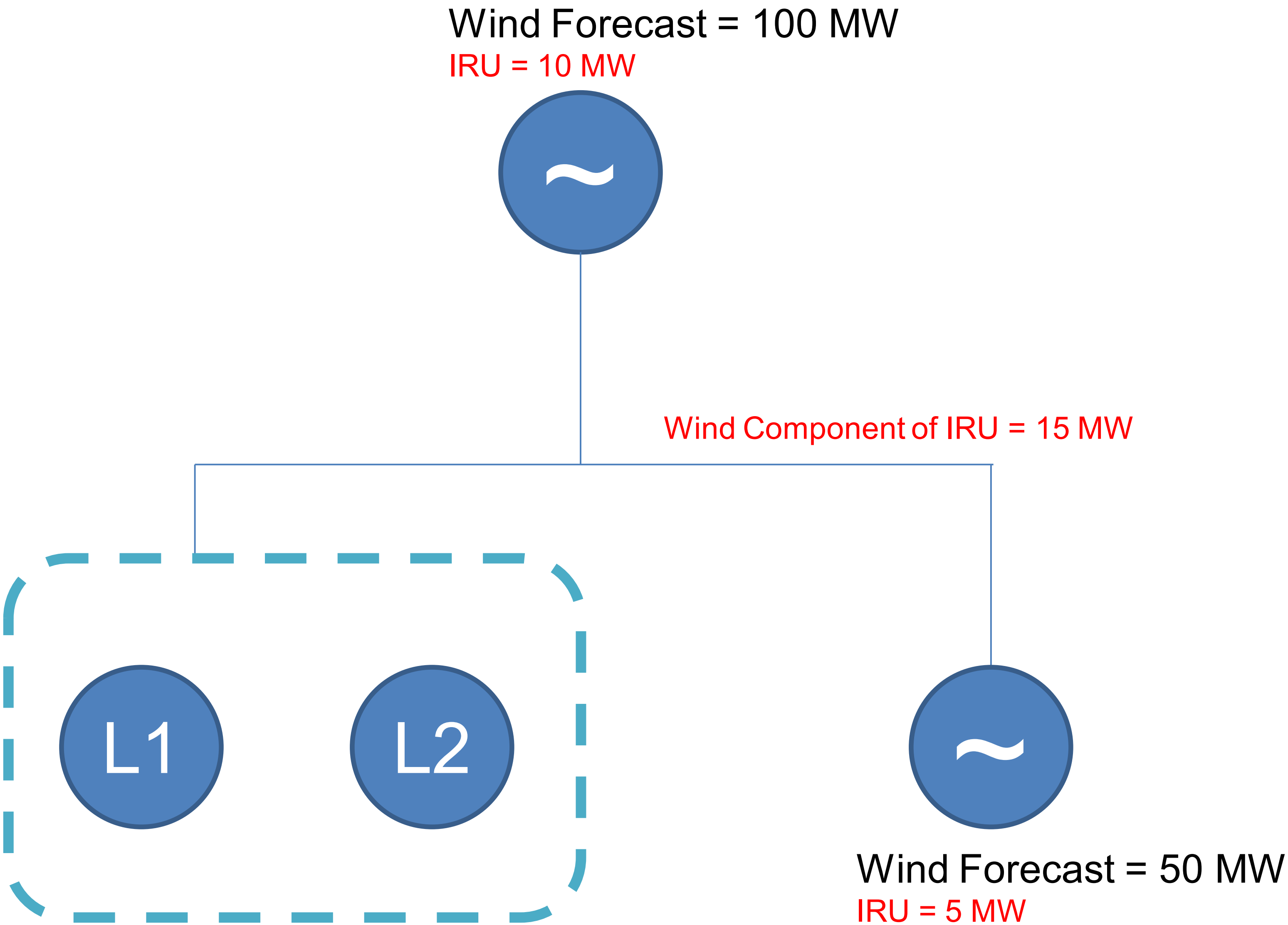
Nodal distribution for load



Nodal distribution for wind/solar

- The solar/wind component of the Imbalance Reserve Up requirement is distributed to solar/wind nodes as a positive load change in the upward deployment scenario
- The solar/wind component of the Imbalance Reserve Down requirement is distributed as a negative load change in the downward deployment scenario.
- The distribution of the solar/wind component to solar/wind nodes is in proportion to the wind/solar resource forecast

Nodal distribution for wind/solar



Upward uncertainty by load, wind, and solar
FRP Refinements Final Proposal – page 12

Hour	Load	Wind	Solar	Load	Wind	Solar	Load	VER
1	188	272	1	41%	59%	0%	41%	59%
2	143	322	1	31%	69%	0%	31%	69%
3	97	302	1	24%	76%	0%	24%	76%
4	81	285	1	22%	78%	0%	22%	78%
5	140	293	1	32%	68%	0%	32%	68%
6	209	322	10	39%	59%	2%	39%	61%
7	239	278	214	33%	38%	29%	33%	67%
8	205	270	697	18%	23%	59%	18%	82%
9	253	277	678	21%	23%	56%	21%	79%
10	214	246	475	23%	26%	51%	23%	77%
11	228	232	480	24%	25%	51%	24%	76%
12	258	227	483	27%	23%	50%	27%	73%
13	228	201	501	25%	22%	54%	25%	75%
14	243	204	638	22%	19%	59%	22%	78%
15	277	215	635	25%	19%	56%	25%	75%
16	390	255	680	29%	19%	51%	29%	71%
17	384	262	572	32%	22%	47%	32%	68%
18	353	303	465	32%	27%	41%	32%	68%
19	311	303	269	35%	34%	30%	35%	65%
20	284	343	62	41%	50%	9%	41%	59%
21	190	320	5	37%	62%	1%	37%	63%
22	253	306	1	45%	55%	0%	45%	55%
23	276	325	1	46%	54%	0%	46%	54%
24	228	306	1	43%	57%	0%	43%	57%

Deployment scenarios

- Base, upward, and downward deployment scenarios are simultaneously optimized to respect transmission constraints
- Upward deployment scenario → supply is added to system assuming all imbalance reserve up awards deploy as energy; demand is added to system based on distribution of upward requirements described previously
- Downward deployment scenario → supply is removed from system assuming all imbalance reserve down awards reduce energy; demand is subtracted from the system based on distribution of downward requirements described previously

Why is this important?

- Nodal procurement ensures that both energy and imbalance reserve awards are transmission feasible at the time they are procured

- The nodal approach does not assure real-time deliverability; the goal is not to knowingly procure reserves behind constraints
  - Operational concern that would take extensive out-of-market actions to manage and less confidence in EDAM transfers
  - Financial concern that market participants may be paying to procure for reserves from resources that are constrained and paying to re-dispatch around them in real-time

- Nodal approach produces more accurate prices for imbalance reserves AND energy

Ancillary Service Deliverability and Real-Time Re-optimization
CAISO Draft 2023 Policy Initiatives Catalog – Item 6.1.1

- Ancillary services are procured based upon system and zonal requirements
  - Zonal approach does not guarantee that the ancillary services are deliverable; manageable but not optimal
  - Operators perform studies to identify day-ahead awards that are not accessible and block these resources from being awarded ancillary services

- This initiative will look at implementing nodal ancillary services
  - This functionality will also support the re-optimization ancillary services in real-time because operators will be assured the capacity awards are deliverable. This is a long-term scarcity pricing goal as part of a phased approach to price formation enhancements.

Next week's meetings

- More detailed examples to illustrate different approaches
- Potential empirical analysis
- Discuss potential improvements to Final Proposal

Next week's meetings

- DAME workshops:
  - February 27, 2023 from 1 p.m. – 5 p.m. (virtual)
  - March 7, 2023 from 9 a.m. – 4 p.m. (hybrid)
  - March 8, 2023 from 9 a.m. – 12 p.m. (hybrid)

- Market Surveillance Committee meeting:
  - March 10, 2023 from 9 a.m. – 12 p.m. (virtual)

Comments

- Please submit comments on the DAME workshop discussions by end of day March 24 using the template provided on the initiative webpage.

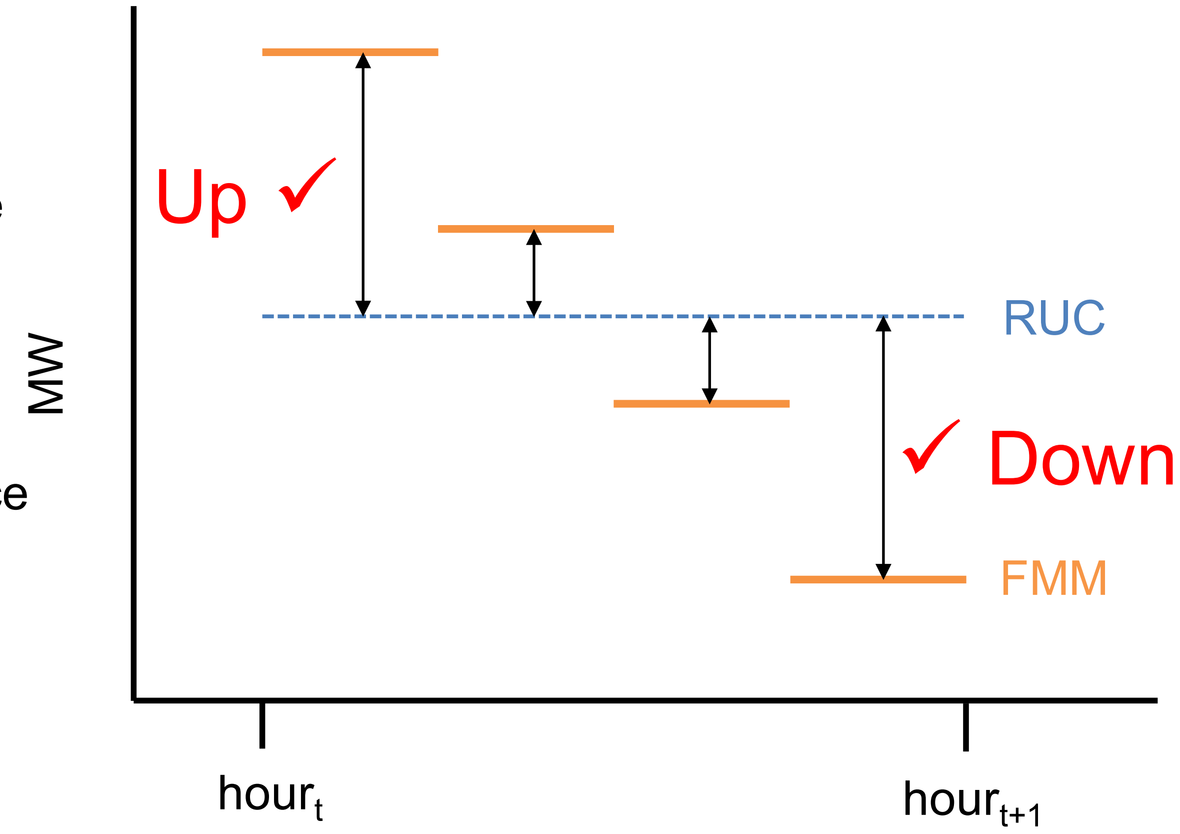
APPENDIX

Calculation of uncertainty requirements

Step 1: Collect imbalance data

For every hour, compare the day-ahead forecast (RUC) with the series of four real-time FMM forecasts.

Record the highest difference (residual) for the upward requirement and the lowest difference for the downward requirement. For example, we might collect data points 500MW and -500MW from this chart.



Calculation of uncertainty requirements

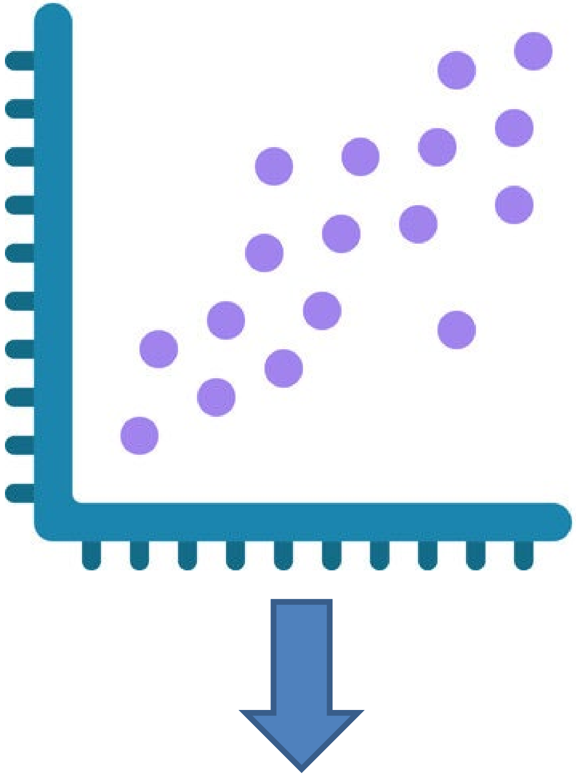
Step 2: Use dataset as input into regression model

The model estimates the 97.5 and 2.5 percentile forecast error for load, solar, and wind separately, then aggregates them using the identity

$IRU = Load_{97.5} – Wind_{2.5} – Solar_{2.5}$

And

$IRD = Load_{2.5} – Wind_{97.5} – Solar_{97.5}$



$$Q(Y|X) = X\beta(q)$$

Quantile Regression Model

http://www.caiso.com/InitiativeDocuments/AppendixC-QuantileRegressionApproach-FlexibleRampingProductRequirements.pdf