



California ISO

Day-Ahead Market Enhancements - Second Revised Straw Proposal

Stakeholder Meetings

July 28 - 29, 2021

Agenda

Time	Topic	Presenter
1:00 – 1:05	Welcome and introductions	Kristina Osborne
1:05 – 2:00	Overview	James Friedrich
2:00 – 4:50	Proposed design changes	James Friedrich
4:50 – 5:00	Next steps	Kristina Osborne

Stakeholder Process

PROPOSAL DEVELOPMENT

Issue paper and working group

↳ Straw proposal

Draft final proposal

Draft business requirement specification

Draft tariff and business practice manual revisions

Final proposal

DECISION

ISO Board
EIM Governing Body

Tariff filing

FERC

IMPLEMENTATION

Business practice manual
Training
Market simulation

Go Live

Stakeholder input

We are here

This represents the typical process, and often stages of the process run in parallel.

Housekeeping reminders

- This call is being recorded for informational and convenience purposes only. Any related transcriptions should not be reprinted without ISO's permission.
- To ask a question, press #2 on your telephone keypad or send question to meeting host in the chat.
- Calls are structured to stimulate an honest dialogue and engage different perspectives.
- Please keep comments professional and respectful.
- Please try and be brief and refrain from repeating what has already been said so that we can manage the time efficiently.

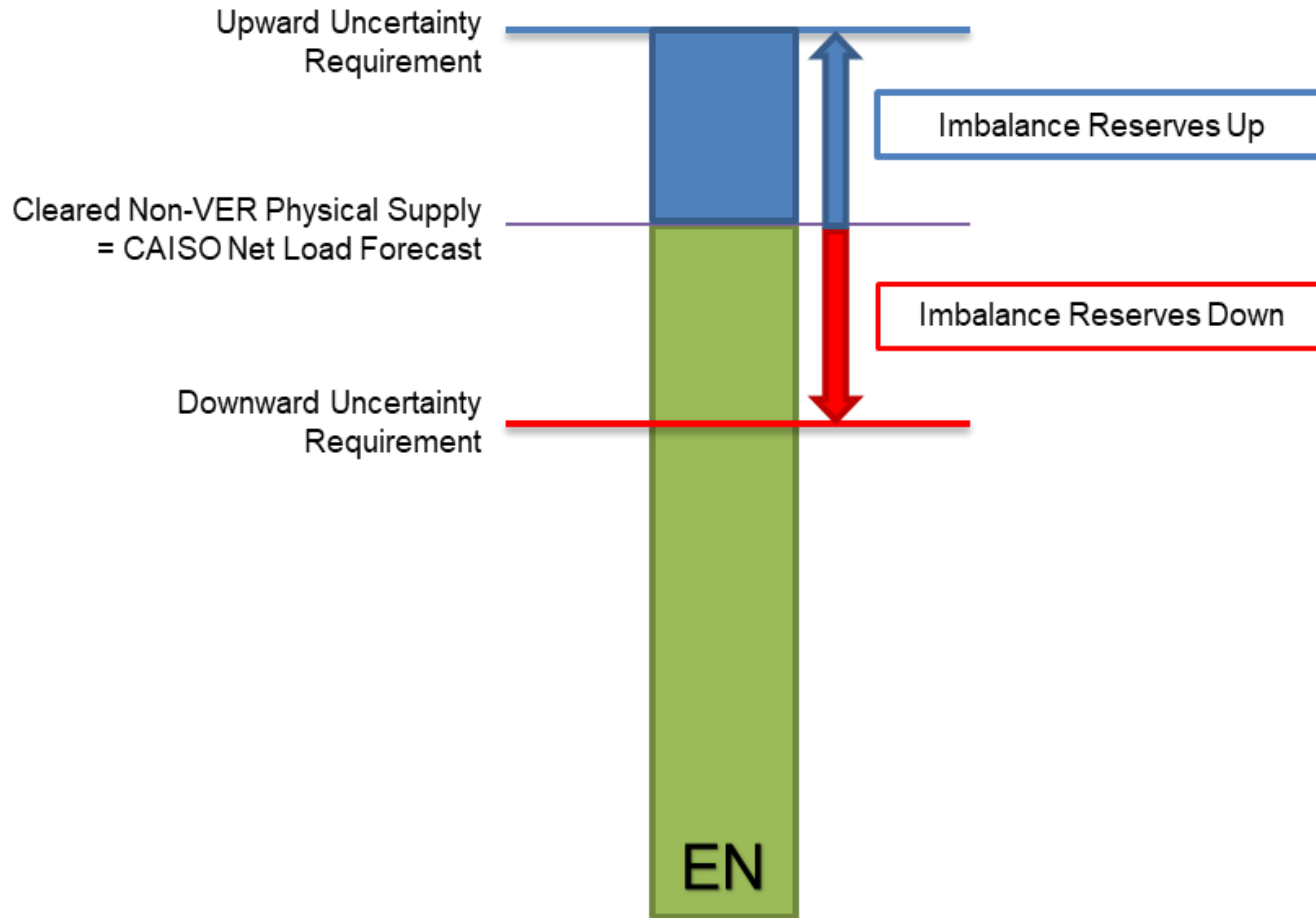
Overview

James Friedrich, Senior Market Design Policy Specialist

New approach is needed to address operations need to bias residual unit commitment (RUC) process

- Add imbalance reserve up and down to IFM to provide intra-hour ramp and cover uncertainty
 - Addresses need to bias RUC load forecast
- Return RUC to its original purpose and enhance
 - Procure reliability capacity up and down. Does not shut down resources.
 - Continue to establish export/import energy schedule to be tagged for checkout
 - Establish binding MSG configuration based upon RUC schedule

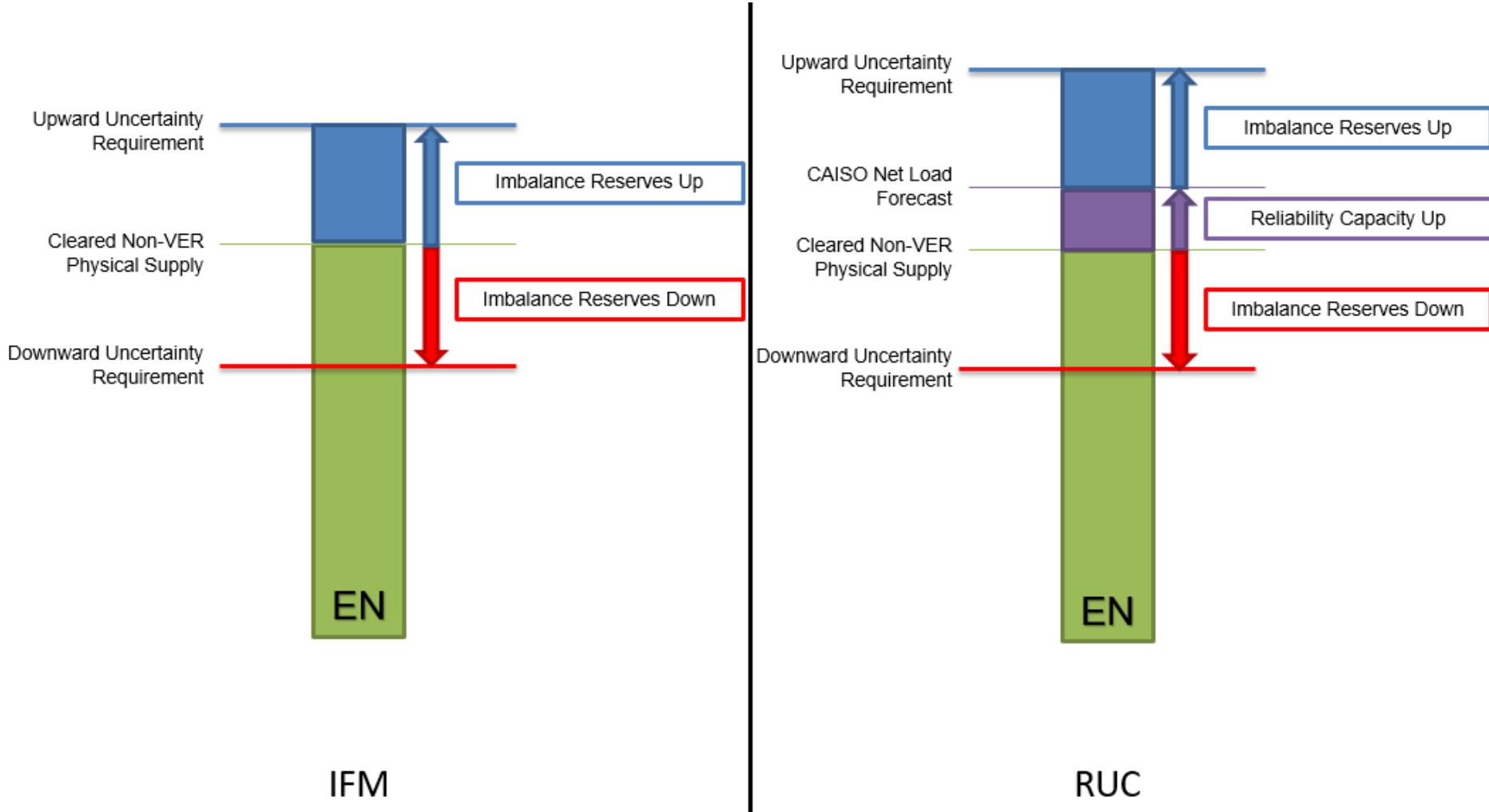
Day-ahead market products when net load forecast is equal to non-VER physical supply



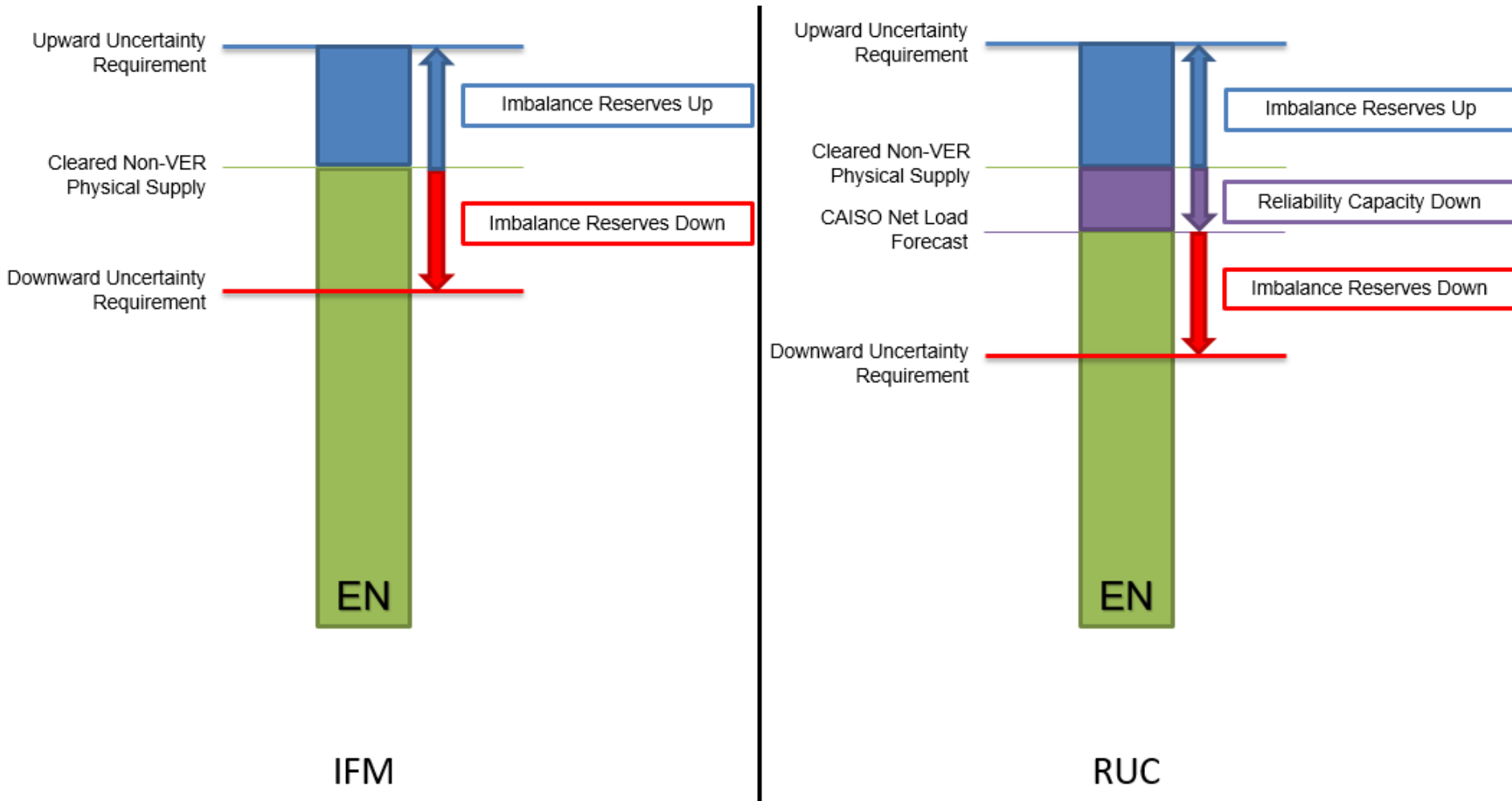
Reliability capacity is needed because cleared non-variable energy resource (VER) physical supply may clear differently when bid-in load, virtual bids, and VER offers are considered

- Drivers of reliability capacity up
 - Bid-in load clears less than CAISO forecast
 - Virtual supply clears market
 - Cleared VERs greater than CAISO forecast
- Drivers of reliability capacity down
 - Bid-in load clears greater than CAISO forecast
 - Virtual demand clears market
 - Cleared VERs less than CAISO forecast

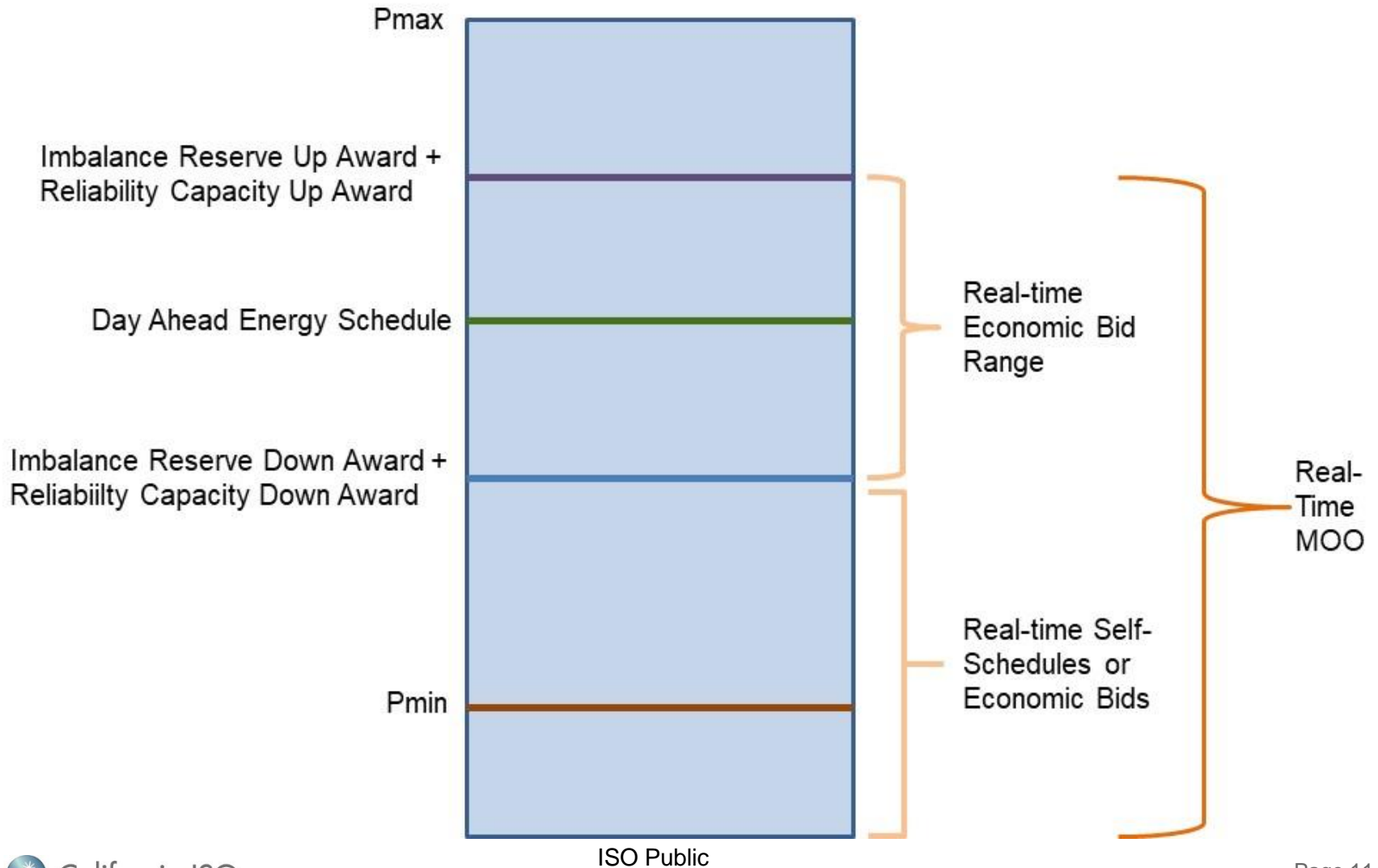
Day-ahead market products when net load forecast is greater than non-VER physical supply



Day-ahead market products when net load forecast is less than non-VER physical supply



Real-time bidding obligations



Topic	Previous Proposal	New Proposal	Rationale
Day-ahead market formulation	Integrated IFM and RUC with multiple passes and a decoupled reliability capacity constraint.	Sequential IFM and RUC.	Testing of the multi-pass formulation revealed several insurmountable issues.
Day-ahead market formulation	A single MPM pass before IFM will mitigate energy, imbalance reserve, and reliability capacity offers.	An MPM pass run before IFM will mitigate energy and imbalance reserve offers and a separate MPM pass run before RUC will mitigate reliability capacity offers.	Using the status quo MPM pass to mitigate reliability capacity offers when imbalance reserve deployment scenarios are uncompetitive is suboptimal compared to using the RUC optimization to determine whether reliability capacity offers are uncompetitive.
Variable Energy Resources (VERs)	VERs are ineligible to provide RCU and IRU.	VERs can provide RCU and IRU if they use the CAISO VER forecast.	Stakeholders desired the ability for VERs to provide upward capacity products.

Topic	Previous Proposal	New Proposal	Rationale
Imbalance reserve procurement	The day-ahead market will procure imbalance reserves based on a demand curve.	The day-ahead market will procure the entire imbalance reserve requirement and set the relaxation penalty price below the power balance constraint but above low-priority (LPT) self-scheduled exports.	Using a demand curve may cause low-priority self-scheduled exports or exports with high economic bids to clear before meeting the full imbalance reserve requirement. This may cause system operators to continue to perform the out-of-market actions that imbalance reserves are intended to prevent.
Imbalance reserve settlement	No ramp deviation settlement proposed.	Deviation settlement between forecasted movement/imbalance reserve awards in the day-ahead market and forecasted movement/flexible ramping product in the real-time market.	Prevents double payment of forecasted movement and energy opportunity costs and incentivizes following day-ahead schedules.

Topic	Previous Proposal	New Proposal	Rationale
Imbalance Reserve Unavailability	No imbalance reserve unavailability no-pay mechanism proposed.	Resources with an upper economic limit that does not support their day-ahead energy + IRU award less the 5-minute portion of their imbalance reserve award in IFM will be charged the higher of the RTPD FRU price, the RTD FRU price, or the IRU price.	A stronger incentive than a simple no-pay is needed to ensure resources follow through on their must-offer obligations.
Accounting for Energy Offer Cost in Upward Capacity Procurement	Implement a real-time energy offer cap for resources awarded RCU and/or IRU. The offer cap would be set at the marginal price of meeting the P97.5 net load forecast using all available day-ahead energy bids.	Implement a rule such that resources would be ineligible for RCU/IRU awards on any capacity segment with an associated energy bid that exceeds the calculated P97.5 price.	Stakeholders were opposed to previous proposal and new proposal solves same objective more directly and simply.

Topic	Previous Proposal	New Proposal	Rationale
Market Power Mitigation	Mitigate availability bids to maximum of \$30 or \$30 plus the resource's default energy bid minus the real-time energy offer cap. \$30 represents the 90 th percentile spin price, which represents a competitive availability price.	The CAISO proposes to calculate a "competitive availability price" for imbalance reserves that excludes non-competitive congestion prices similar to the competitive locational marginal price used in energy offer mitigation. The CAISO seeks stakeholder input on the appropriate spinning reserve price percentile that approximates actual availability costs.	Aligns mitigation of imbalance reserve bids with energy bids and responds to stakeholder feedback that 90 th percentile spin price was too high and objections to a single mitigation price.
Contingency Modeling Enhancements (CME)	Previous straw proposals added a bidding component to CME (i.e., corrective capacity up and corrective capacity down).	This component has been removed from implementation.	FERC agreed to release the CAISO from its commitment to implement Contingency Modeling Enhancements.

Proposed design changes

James Friedrich, Senior Market Design Policy Specialist

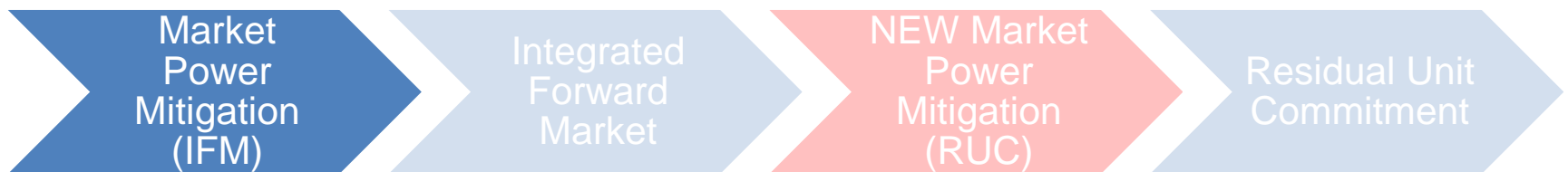
Discussion topics

- Market power mitigation for IFM
- Integrated forward market (IFM) process
- Market power mitigation for RUC
- Residual unit commitment (RUC) process
- Settlement of ramp deviations
- Other design considerations

DAY-AHEAD MARKET PROCESSES

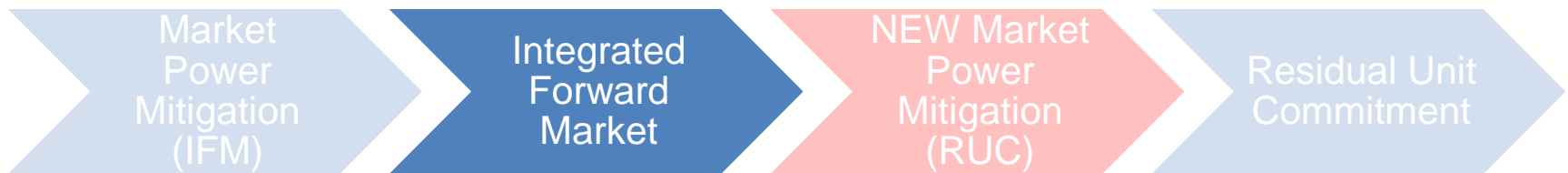
Market power mitigation for IFM

- Use unmitigated bids to clear bid-in load, bid-in supply, imports, exports, ancillary services requirements, and the imbalance reserve requirements
- Resources with a net positive marginal congestion contribution from uncompetitive constraints will have their energy and/or imbalance reserve bids mitigated
- Mitigate energy offers to the greater of “default energy bids” or competitive locational marginal price
- Mitigate imbalance reserve offers to the greater of “default availability bid” or “competitive availability price”



Integrated forward market

- IFM clears bid-in load, bid-in supply, imports, exports, and ancillary services requirements using mitigated bids
- New imbalance reserves product co-optimized and procured
 - Requirement based on quantile regression of 2.5/97.5 percentiles of historical net load uncertainty
 - Imbalance reserve scheduling run penalty price set above low-priority self-scheduled exports but below self-scheduled load
 - Utilizes deployment scenarios to consider transmission constraints



Imbalance reserves no longer proposed to be procured based on a demand curve

- Relaxation of demand curve could result in insufficient capacity to meet real-time ramping needs and net load uncertainty
- Could allow low-priority, self-scheduled (LPT) exports and high-priced economic exports to clear before imbalance reserve requirement is met
- Not procuring full requirement may continue to result in out-of-market actions that imbalance reserves are intended to prevent

Imbalance reserve cost allocation

Imbalance Reserves Up

Tier 1

- **Generation:** $\text{MAX}(0, \text{Day-ahead energy schedule} - \text{FMM upper economic limit as affected by de-rates})$
- **Load:** Negative uninstructed imbalance energy
- **Imports:** $\text{MAX}(0, \text{Day-ahead energy schedule} - \text{FMM upper economic limit as affected by e-Tag transmission profile})$
- **Exports:** $\text{MIN}(0, \text{FMM self-schedule} - \text{Day-ahead energy schedule})$

Tier 2

- Metered demand

Imbalance Reserves Down

Tier 1

- **Generation:** $\text{MAX}(0, \text{FMM lower economic limit as affected by rerates} - \text{Day-ahead energy schedule})$
- **Load:** Positive uninstructed imbalance energy
- **Imports:** $\text{MIN}(0, \text{MAX}(\text{e-Tag transmission profile}, \text{FMM self-schedule}) - \text{Day-ahead energy schedule})$
- **Exports:** $\text{MAX}(0, \text{Day-ahead energy schedule} - \text{e-Tag transmission profile})$

Tier 2

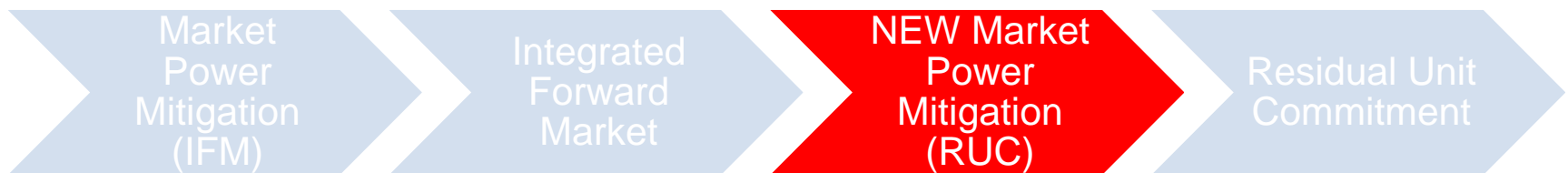
- Metered demand

Imbalance Reserve No Pay

- **Imbalance reserves up:** Resources with an upper economic limit that does not support their day-ahead energy + IRU award less the 5-minute uncertainty award in FMM will be charged the higher of the RTPD FRU price, the RTD FRU price, or the IRU price.
- **Imbalance reserves down:** Resources with a lower economic limit that does not support their day-ahead energy - IRD award plus the 5-minute uncertainty award in FMM will be charged the higher of the RTPD FRD price, the RTD FRD price, or the IRD price.

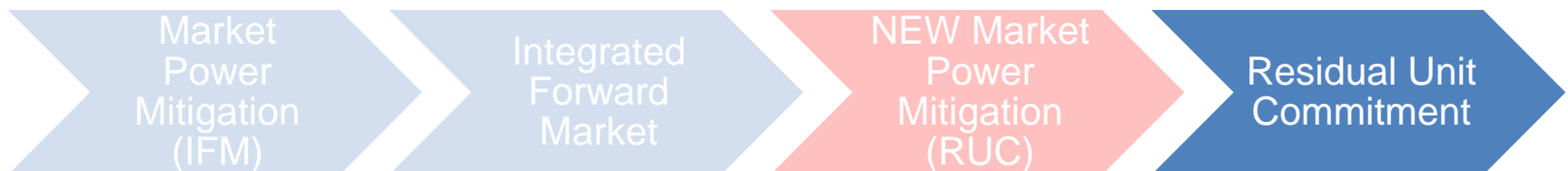
Market power mitigation for RUC

- New proposed pass to mitigate reliability capacity up and down offers
- Hold IFM schedules fixed and use unmitigated reliability capacity bids to procure reliability capacity to meet CAISO net demand forecast
- Resources with a net positive marginal congestion contribution from uncompetitive constraints will have their reliability capacity bids mitigated
- Mitigate reliability capacity offers to the greater of “default availability bid” or “competitive availability price”
- CAISO to evaluate feasibility in terms of run time and market performance. To that end, RUC MPM pass will be limited to a 24-hour horizon. Any mitigated bid in the 24-hour RUC MPM pass will apply across the 72-hour RUC optimization.



Residual unit commitment

- Holds IFM schedules fixed and procures incremental capacity (reliability capacity up) or decremental capacity (reliability capacity down) based on IFM energy schedules compared to CAISO net load forecast
- Continue to establish export/import energy schedule to be tagged for checkout
- Transition MSG resources in the downward direction (but not turn them off completely) and establish their binding configuration



Reliability capacity cost allocation

Reliability Capacity Up

Tier 1

- **Net virtual supply:** Max of (a) zero or (b) scheduling coordinator net virtual supply awards
- **Under-scheduled load:** Net negative metered demand
- **Over-scheduled (non-CAISO forecasted) VERs:** Max of (a) zero or (b) sum of non-forecasted VER day-ahead schedule less their CAISO day-ahead VER forecast

Tier 2

- Metered demand

Reliability Capacity Down

Tier 1

- **Net virtual demand:** Max of (a) zero or (b) scheduling coordinator net virtual demand awards
- **Over-scheduled load:** Net positive metered demand

Tier 2

- Metered demand

*Under-scheduled VERs are not part of the RCD cost allocation

Reliability Capacity No Pay

- **Reliability capacity up:** Resources with an upper economic limit that does not support their day-ahead energy + RCU award will be charged the higher of the RTPD FRU price or the RCU price.
- **Reliability capacity down:** Resources with a lower economic limit that does not support their day-ahead energy - RCD award will be charged the higher of the RTPD FRD price or the RCD price.

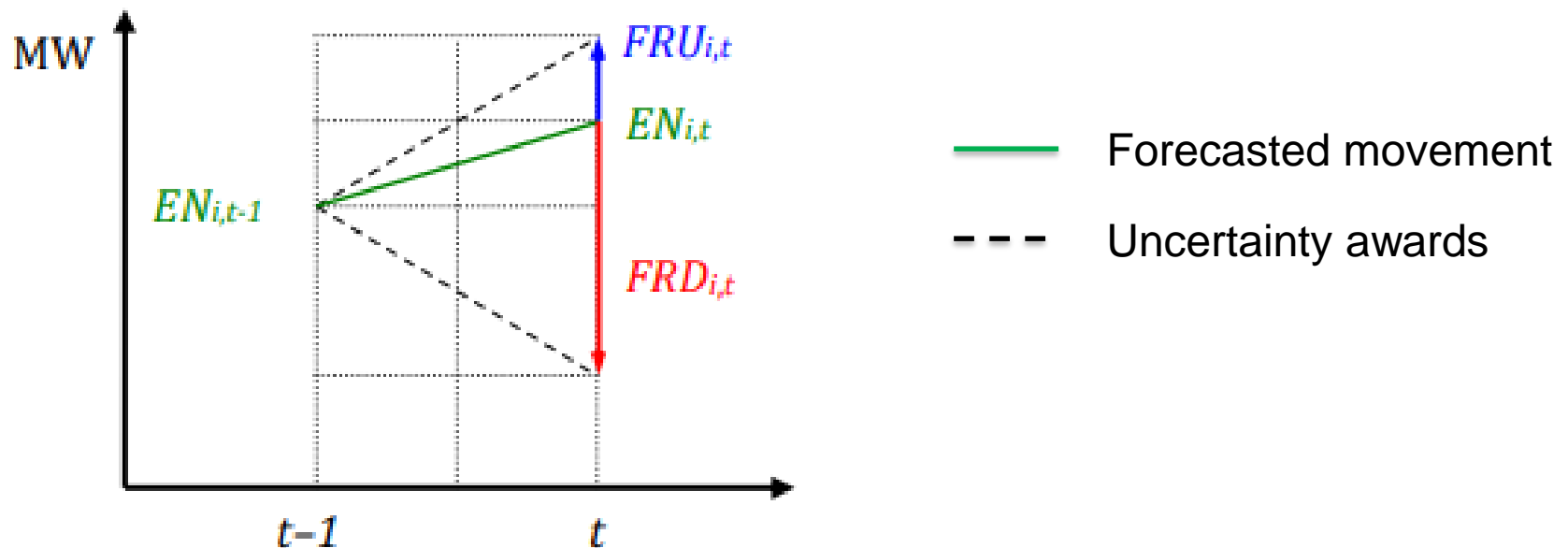
Bid cost recovery changes to incorporate new products

- 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

DEVIATION SETTLEMENT

Settlement of ramp deviations between IFM, FMM and RTD

- 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



Complications to address in design of deviation settlement

- 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

Problems that can occur without a ramp deviation settlement for imbalance reserves

- Capacity that is not available in real time reduces the available supply of ramp and drives up its price
 - Resources that do not provide the availability they are obligated to based on their imbalances reserves awards should settle those imbalances at prices reflecting real time conditions
- Energy opportunity cost double payment
 - Opportunity cost is part of marginal price of both IRP and FRP
- Forecasted movement double payment
 - Forecasted movement is embedded in IFM energy LMP but is a side payment in RTM

Summary of ramp deviation settlement of forecasted movement and uncertainty awards

	Ramp Settlement
IFM Forecasted Movement	No side payment, paid energy price
IFM Imbalance Reserve Award	Pay award
FMM Forecasted Movement	Settle deviation from IFM 15-minute forecasted movement
FMM FRP Uncertainty Award	Settle deviation from embedded 5-minute ramp within IR award
RTD Forecasted Movement	Settle deviation from FMM 5-minute forecasted movement
RTD FRP Uncertainty Award	Settle deviation from FMM
Imbalance Reserve No Pay	Charge if 15-minute ramp above 5-minute deviations is unavailable

Ramp deviation settlement spreadsheet discussed at May 21, 2021 Market Surveillance Committee meeting

- Audio recording of MSC discussion
 - <https://www.youtube.com/watch?v=bxVTMhnMB9Q>
- Spreadsheet
 - <http://www.caiso.com/InitiativeDocuments/FMM-RTDSettlementExample-Day-AheadMarketEnhancements.xlsx>

Reliability capacity up and down settlement very similar to RUC today

- No deviation settlement with real-time products

Settlement of convergence bids

- Virtual supply is paid the day-ahead price
- Virtual demand is charged the day-ahead price

- Forecasted movement is settled in the IFM energy price
- Forecasted movement is a side payment in FMM

- Virtual supply is charged the FMM price and forecasted movement
- Virtual demand is paid the FMM price and forecasted movement

Settlement of deviations from EIM base schedules

- Forecasted movement is included in EIM base schedule changes similar to CAISO day-ahead schedules
 - Deviation settlement of forecasted movement between base schedule and FMM schedule
- No imbalance reserve awards are included in EIM base schedules to meet uncertainty in FMM
 - No deviation settlement for uncertainty, all FRP uncertainty awards are incremental

OTHER DESIGN ELEMENTS

Ideally, IRU/RCU awarded to unloaded capacity with the lowest energy cost assuming same availability bid

- Prior to day-ahead market, CAISO will calculate and publish a max energy bid by estimating the clearing price if P97.5 uncertainty materialized in real-time
- Resources whose underlying energy bid segment exceed the max energy bid will not be awarded IRU or RCU that overlaps those segments of bid curve
- Example
 - Max Energy Bid = \$400
 - Resource's Bid Curve
 - 0-50MW @ \$100, 50-100MW @ \$250, 100-150MW @ \$450, 150-175MW = \$500
 - $IRU + RCU \leq \text{MAX}(0, 100\text{MW} - EN)$
 - If energy schedule is 75MW, then IRU cannot exceed 25MW

Seeking stakeholder feedback on appropriate level for a default availability bid

- Default availability bid needed for imbalance reserves and reliability capacity
 - Mitigated to higher of default availability bid or competitive price
- Difficulty in determining a formulaic approach to calculate the default availability bid for each resource
- Can historical spinning reserves prices serve as a proxy for a standard default availability bid?

Percentile	Bid Price		Percentile	Cleared Price
50	\$ 24.18		50	\$ 4.69
55	\$ 25.09		55	\$ 5.34
60	\$ 26.11		60	\$ 6.33
65	\$ 26.98		65	\$ 7.57
70	\$ 27.92		70	\$ 8.77
75	\$ 28.83		75	\$ 10.00
80	\$ 29.84		80	\$ 11.41
85	\$ 31.45		85	\$ 13.49
90	\$ 33.39		90	\$ 16.60

- Negotiated option if standard default availability bid is too low*

Variable energy resources can elect in Masterfile to use the CAISO forecast as their upper economic limit in IFM

- Non CAISO forecasted VERs in IFM
 - Difference between VERs forecast and CAISO forecast is treated as virtual supply/demand
 - Eligible for RCD or IRD awards
 - Not eligible for RCU or IRU awards
 - Subject to cost allocation of reliability capacity up
 - Subject to cost allocation of imbalance reserves
- CAISO forecasted VERs in IFM
 - Eligible for RCD, IRD, RCU, IRU awards
 - Not subject to cost allocation of reliability capacity up
 - Subject to cost allocation of imbalance reserves
 - Considering requirement to provide High Sustainable Limit (HSL) and seeking stakeholder feedback*

CAISO is proposing a transition period for the day-ahead market enhancements

- RA resources must bid \$0 for imbalance reserves and reliability capacity
- RA resources have a real-time must offer obligation with or without an imbalance reserves or reliability capacity award
- All resources will be paid the marginal price for imbalance reserves and reliability capacity awards
- Transition period will end
 1. At the start of the calendar year in which EIM entities will onboard into the extended day-ahead market, or
 2. CAISO seeks stakeholder feedback on appropriate length independent of EDAM implementation

Purpose of the transition period

- Observe how the new market performs
- Make any necessary adjustments to certain market design elements such as the imbalance reserve requirement
- Provide time for load serving entities to transition contracts to a paradigm of non-zero RUC availability bids for resource adequacy capacity
- Analyze the existing resource adequacy real-time must-offer obligation paradigm
- Inform further flexible resource adequacy analysis and refinement
- Evaluate using historical spin prices to establish a default availability bid
- Evaluate setting of the price threshold for imbalance reserve up and reliability capacity up eligibility

NEXT STEPS

EIM Governing Body Classification

- The CAISO proposes the EIM Governing Body have an **advisory role** in the approval of the day-ahead market enhancements initiative
- Stakeholders encouraged to submit responses to the EIM classification within written comments

Technical Appendix

- Draft technical appendix will be posted before stakeholder comments are due

Next Steps

Milestone	Date
2 nd Revised Straw Proposal	July 21, 2021
Stakeholder Meetings	July 28 - 29, 2021
Comments Due	August 18, 2021
Draft Final Proposal	September 15, 2021
EIM Governing Body	October 20, 2021
CAISO Board of Governors	November 3-4, 2021

Submit comments using the comment template linked on the initiative webpage

<https://stakeholdercenter.caiso.com/StakeholderInitiatives/External-load-forward-scheduling-rights-process>

Please contact Kristina Osborne at kosborne@caiso.com or isostakeholderaffairs@caiso.com