



# Day Ahead Market Enhancements: Issue Paper/Straw Proposal

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Megan Poage

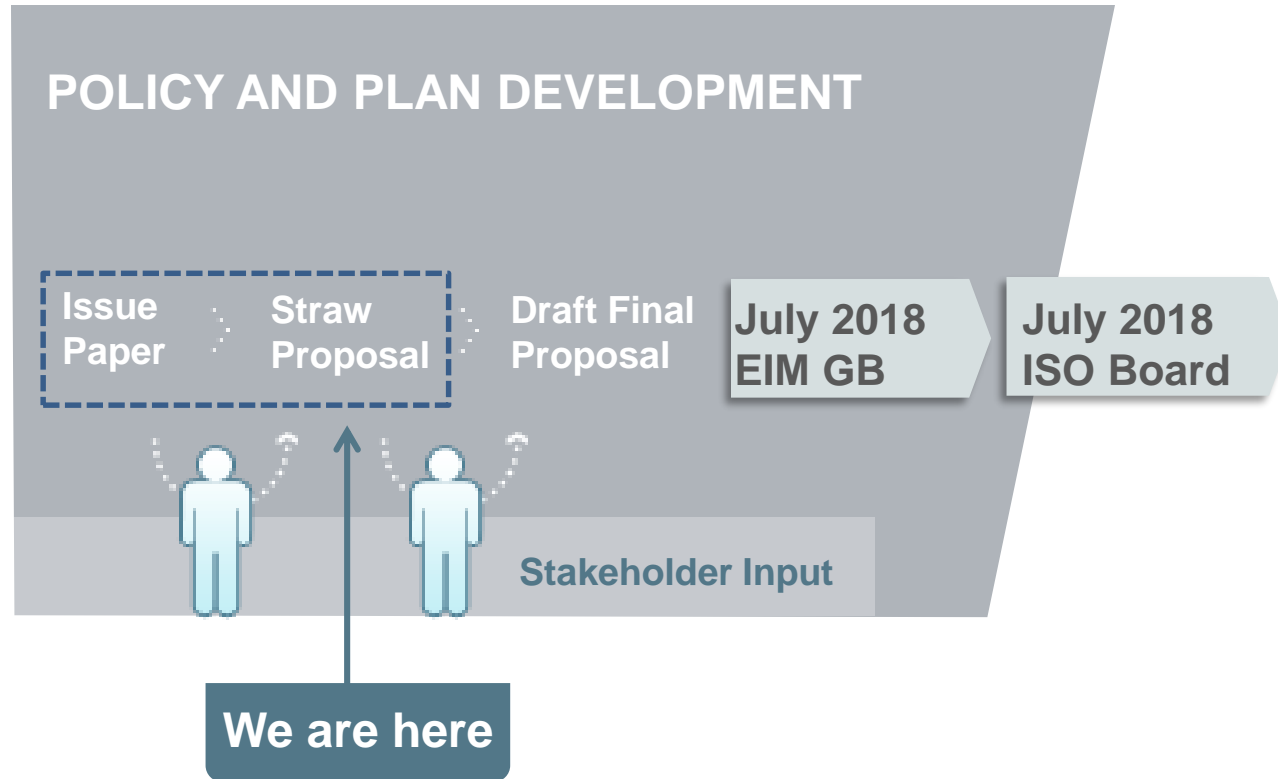
Senior Market Design & Regulatory Policy Developer

March 7, 2018

# Agenda

Time	Topic	Presenter
10:00 – 10:10	Welcome and Introductions	Kristina Osborne
10:10 – 12:00	Issue Paper: Limitations of the current day-ahead market	Don Tretheway
12:00 – 1:00	LUNCH	
1:00 – 3:00	Straw Proposal: Imbalance reserves	Megan Poage
3:00 – 3:50	Extending to EIM Entities	Don Tretheway
3:50 – 4:00	EIM Categorization & Next Steps	Kristina Osborne

# ISO Policy Initiative Stakeholder Process



Day-Ahead Market Enhancements

# **ISSUE PAPER: LIMITATIONS OF THE CURRENT DAM**

Don Tretheway  
Senior Advisor, Market Design Policy

## The CAISO's current DAM is limited due to subsequent runs of the IFM and RUC

- IFM runs based on bid-in demand to clear energy for the next trade day
- RUC procures incremental capacity to ensure additional resources will be available in real-time
- Resources with a RUC award have a must offer obligation to submit economic bids into the real-time market

Currently, RUC procures additional capacity to address shortfall between IFM and ISO net load forecast.

HE12



- RUC addresses forecast difference but does not address upward uncertainty

# RUC will not de-commit resources if IFM clears above the net load forecast

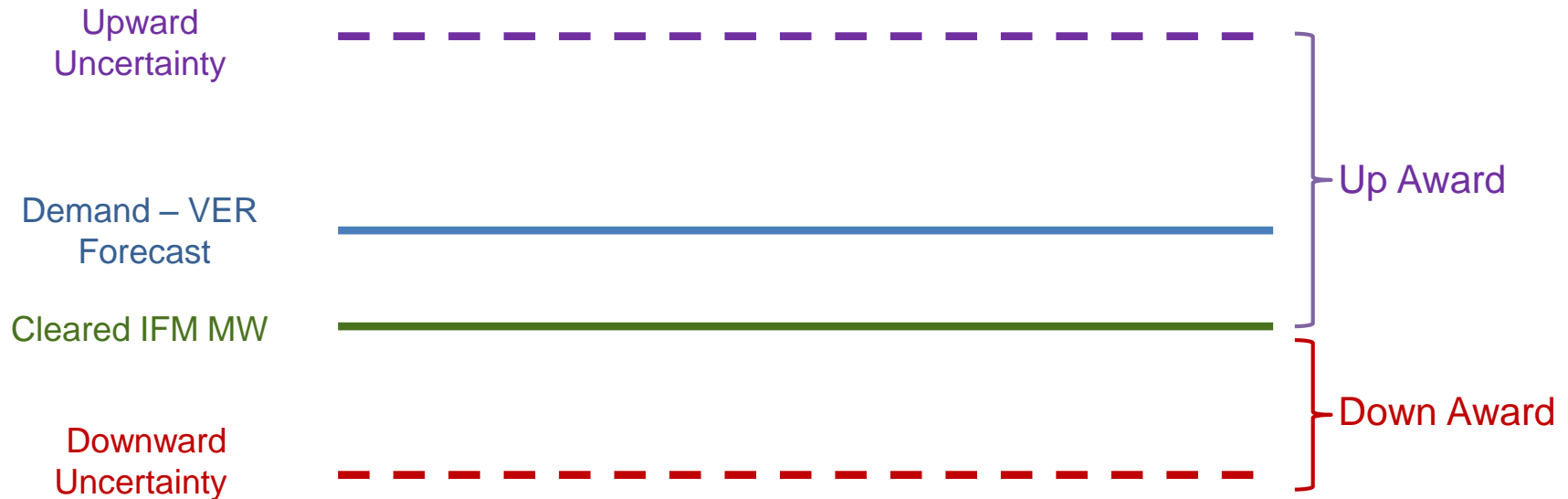
## Current Design - HE 10



- RUC does not address forecast difference OR downward uncertainty

# Up and down awards can be used to address upward and downward uncertainty (1 of 3)

HE 12, Interval 2\*



- IFM clears below net load forecast. Uncertainty is accounted for with up and down awards



# Up and down awards can be used to address upward and downward uncertainty (2 of 3)

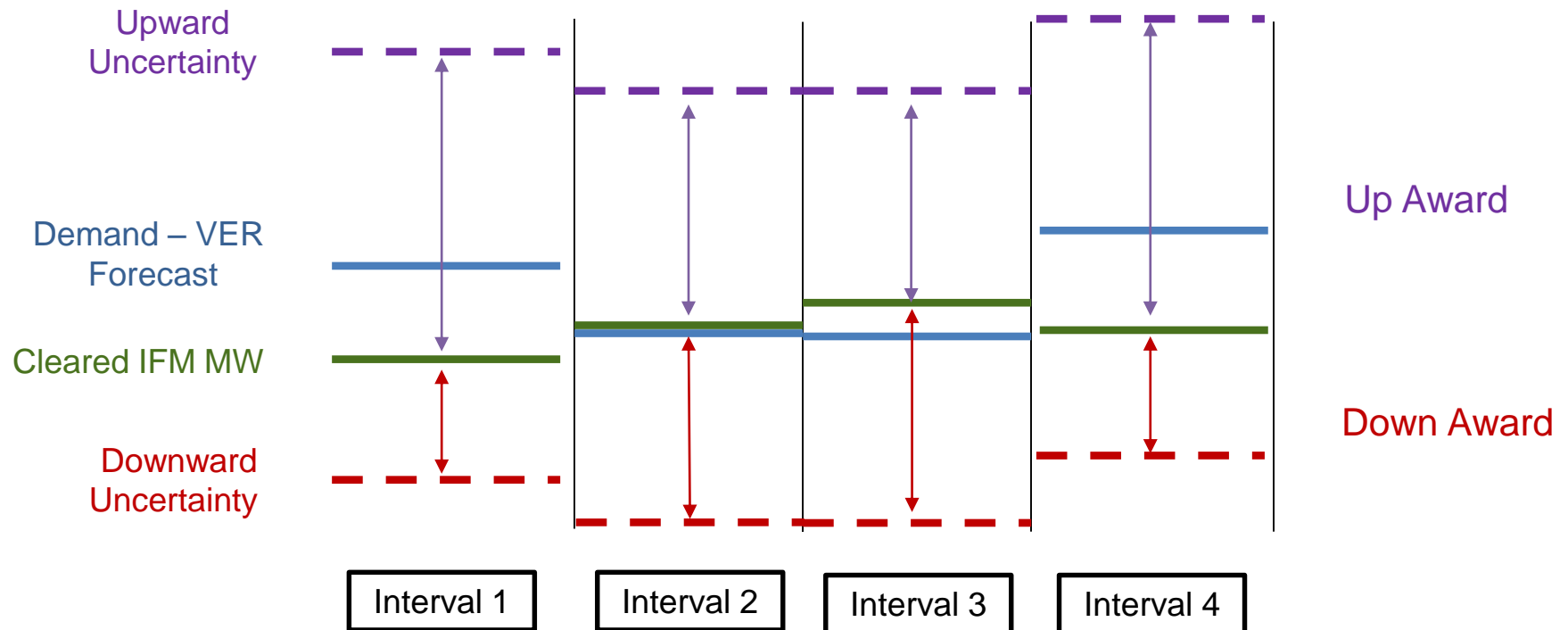
HE 10, Interval 1\*



- IFM clears above net load forecast. Uncertainty is accounted for with up and down awards.

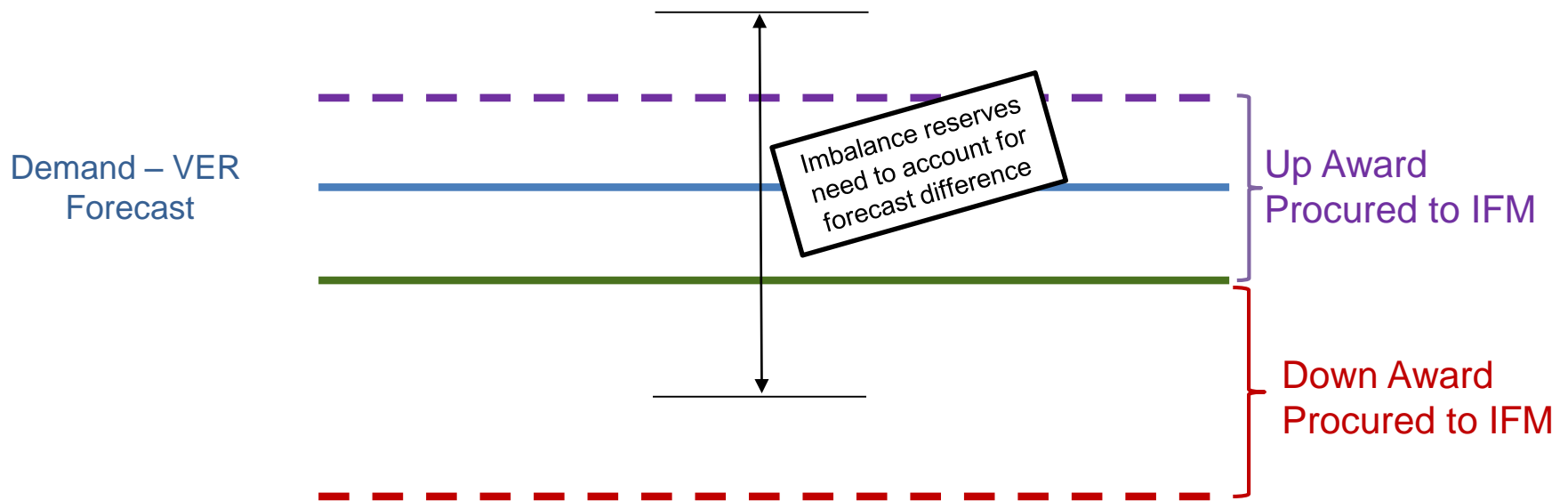
# Up and down awards can be used to address upward and downward uncertainty (3 of 3)

## Proposed Design - HE 12, Intervals 1-4



# Up and down awards must be procured based on net load forecast instead of cleared IFM

HE 12, Interval 2\*



- Must integrate IFM and RUC to address forecast differences

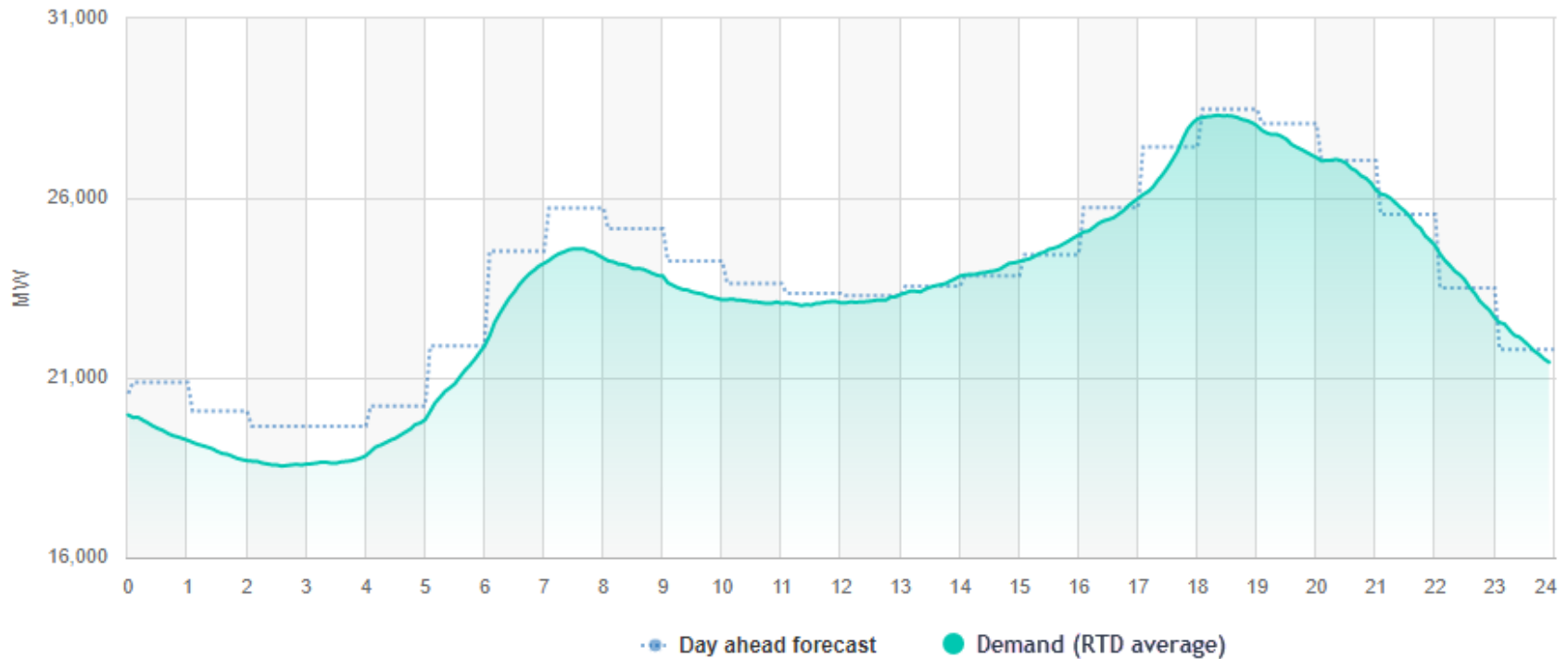
## Day-ahead market enhancements address net load curve and uncertainty previously left to real-time market

- 15-minute scheduling granularity in IFM
- Day-ahead imbalance reserve product
- Combined Integrated Forward Market and Residual Unit Commitment

# Why these three elements are dependent on each other?

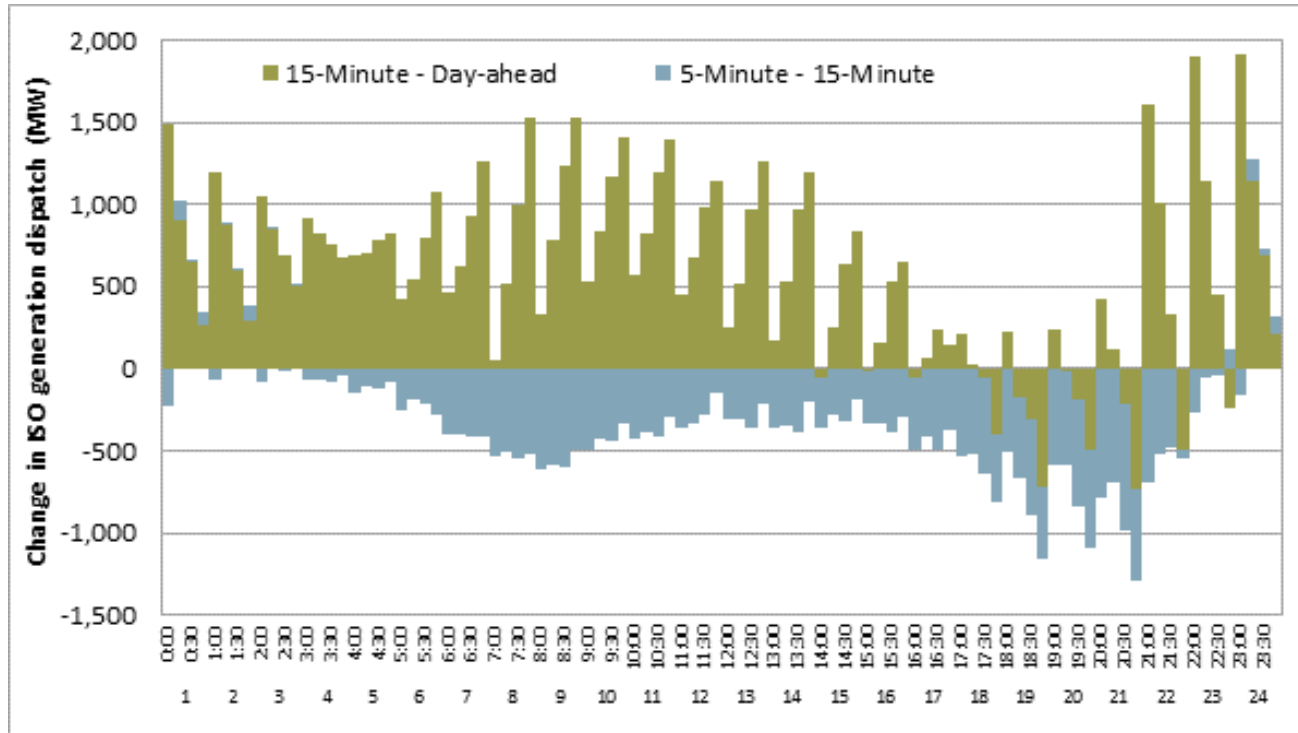
- 15 minute scheduling addresses granularity issues between day-ahead market and FMM
- DA imbalance reserves ensure sufficient real-time bids to meet imbalances that materializes in RTM
- Integrated IFM/RUC allows the DA imbalance reserve to be procured relative to ISO net load forecast, not bid in demand

# The CAISO's current DAM is limited due to day-ahead hourly scheduling



- Downward uncertainty occurs HE01 – HE12
- Granularity difference occurs HE20 – HE24

# The day-ahead market hourly scheduling is leaving too much imbalance for the RTM to resolve



Q3 2017 DMM Report – Average change in internal generators

- Shaping imports can address ISO ramping needs
- Internal generators available to meet real-time imbalance

# Imbalance reserves can be used for all services in the real-time market

<b>Day-Ahead Market</b>	Bid-in Demand	ISO Net-Load Forecast	Contingency Reserves	Regulation	Corrective Capacity	<b>Imbalance Reserves</b>	
	Financial	Reliability	6.3% of the load forecast	Forecast error between RTD and Actual	System able to meet line limits after contingency	Forecast difference between IFM and RTM for all day-ahead market products	
<b>Real-Time Market</b>	Bid-in Demand	ISO Net - Load Forecast	Contingency Reserves	Regulation	Corrective Capacity	FRP Forecasted Movement	FRP Uncertainty Awards
	Not Applicable	Imbalance energy	Incremental	Incremental	Re-dispatch, if necessary	Ramp between market intervals in the same run	Forecast difference between binding and advisory intervals between runs



# QUESTIONS?

If you have any questions, please contact Kristina Osborne at [kosborne@caiso.com](mailto:kosborne@caiso.com) or send text to 916-802-7631.

Day-Ahead Market Enhancements

**LUNCH BREAK**

**12:00PM – 1:00PM**

Day-Ahead Market Enhancements

# **STRAW PROPOSAL: IMBALANCE RESERVES**

Megan Poage

Senior Market Design & Regulatory Policy Developer

# CAISO looks forward to stakeholder engagement and comments regarding the imbalance reserve proposal

- Review of proposed market design rules is intended to create discussion and identify additional design elements
- Next paper will be informed by discussion at this meeting and written comments

# CAISO proposes day-ahead fifteen-minute scheduling granularity.

- Bid submission will remain hourly for both day-ahead and real-time market.
- Scheduling coordinators can elect hourly block scheduling for resources.
- Resources can now be committed intra-hour at the beginning of any fifteen-minute interval.

## Allow bid-in load and VERs to shape their economic bids based upon relative forecast.

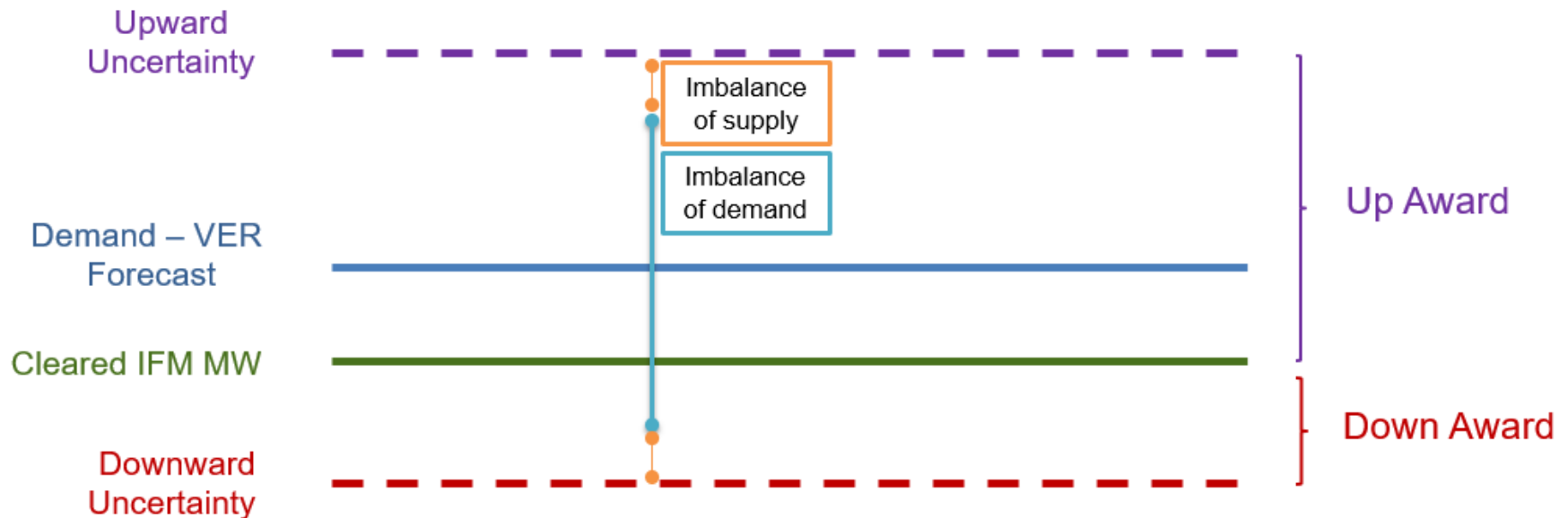
- Scheduling coordinators provide fifteen-minute upper economic limit (UEL) for bid-in load.
- Scheduling coordinators provide fifteen-minute upper economic limit for VERS.
  - IFM will use CAISO forecast or SC submitted UEL (determined by SC)
  - If SC uses their own forecast in IFM, they can still use the ISO forecast in the RTM.
  - RTM will use CAISO forecast to clear the market, but SC can submit UEL for settlements

# Imbalance reserves can be used for all services in the real-time market

<b>Day-Ahead Market</b>	Bid-in Demand	ISO Net-Load Forecast	Contingency Reserves	Regulation	Corrective Capacity	<b>Imbalance Reserves</b>	
	Financial	Reliability	6.3% of the load forecast	Forecast error between RTD and Actual	System able to meet line limits after contingency	Forecast difference between IFM and RTM for all real-time market products	
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	Not Applicable	Imbalance energy	Incremental	Incremental	Re-dispatch, if necessary	Ramp between market intervals in the same run	Forecast difference between binding and advisory intervals between runs

# Total imbalance is supply and demand driven

- Imbalance reserves should cover uncertainty resulting from imbalance of supply and demand





Upward imbalance reserves are used when the real-time market must accommodate an inflexible schedule change.

- Drivers of upward imbalance reserves include:
  - Load that is higher than IFM schedule
  - Virtual supply
  - Conventional generators that are unable to meet their IFM schedule
  - VERs that are unable to meet their IFM schedule
  - Imports that don't tag their IFM schedule
  - Exports that self-schedule above their IFM schedule

# Imbalance reserves address uncertainty between the day-ahead and real-time markets

- Ensure sufficient real-time economic bids are available to resolve net upward deviations that occur

Reason for Deviation	Difference between IFM and real-time
<b>Bid in demand is lower than actual load increase</b>	+ 100 MW
<b>Generator self-schedule increase from IFM</b>	- 40 MW
<b>VER unable to meet day-ahead forecast by 15 MW</b>	+15 MW
<b>Import under tags 20 MW</b>	+ 20 MW
<b>Export self-schedule increase from IFM</b>	+ 10 MW
<b>TOTAL IMBALANCE</b>	<b>105 MW</b>

Downward imbalance reserves are used when the real-time market must accommodate an inflexible schedule change.

- Drivers of downward imbalance reserves include:
  - Load that is lower than IFM schedule
  - Virtual demand
  - Conventional generators that self-schedule above their IFM schedule
  - VERs that self-schedule above their IFM schedule
  - Imports that self-schedule above their IFM schedule
  - Exports that don't tag their IFM schedule

# Imbalance reserves address uncertainty between the day-ahead and real-time markets

- Ensure sufficient real-time economic bids are available to resolve net downward deviations that occur

Reason for Deviation	Difference between IFM and real-time
<b>Bid in demand is higher than actual load increase</b>	- 50 MW
<b>Generator is unable to meet IFM schedule by 30 MW</b>	+ 40 MW
<b>VER self-schedules above forecast by 15 MW</b>	-15 MW
<b>Import self-schedule increase from IFM by 50 MW</b>	- 50 MW
<b>Export unable to tag IFM schedule</b>	- 10 MW
<b>TOTAL IMBALANCE</b>	<b>- 85 MW</b>

# The CAISO proposes the following design features for imbalance reserves (1 of 3):

- Imbalance reserve requirement based on potential imbalance between IFM and real-time
  - Can be split between 5-minute and 15-minute resources
  - Will be posted on OASIS
  - IFM will procure 100% of requirement
  - Can be procured in sub-regional zones

## The CAISO proposes the following design features for imbalance reserves (2 of 3):

- If there are inadequate imbalance reserve bids, a penalty price will be used to allow the market to reach a solution
  - Penalty price will be based on the real-time flexible reserve product penalty price
- Resources without imbalance reserve awards can elect not to bid into the real-time market
  - Can still be exceptionally dispatched
- CAISO will consider testing and qualification of imbalance reserve resources

## The CAISO proposes the following design features for imbalance reserves (3 of 3):

- Imbalance reserves can be used in the RTM for energy, certified AS, flexible ramping product, forecasted movement/uncertainty awards, or corrective capacity.
- RTM must account for ramp deliverability of imbalance reserve resources.

# The CAISO proposes the following operational characteristics for imbalance reserves:

- **Fast Start Units:**
  - Maximum MW Quantity = Ramp Rate \* 15-minute
  - If committed in IFM, eligible for up award to max quantity
  - If committed in IFM, eligible for down award of:  
MIN (IFM – PMin, max quantity)
- **Long Start & Medium Start Units:**
  - Maximum MW Quantity = Dispatchable Ramp Rate \* 15-minute
  - If committed in IFM, eligible for up award to max quantity
  - If committed in IFM, eligible for down award of:  
MIN (IFM – PMin, max quantity)



## The CAISO proposes the following design features related to bidding for imbalance reserves:

- Bids for up and down imbalance reserves will replace the current RUC availability bids
- RA will not be required to bid at \$0.00
- Resources awarded imbalance reserves must submit economic bids for energy and certified AS
- There will be no self-provision of imbalance reserves

## The CAISO proposes the following design features related to settlement of imbalance reserves (1 of 2):

- Resource with an imbalance reserve award will be paid at the day-ahead imbalance reserve marginal price
  - Included in IFM bid cost recovery (BCR)
- Resource meets its MOO but is not dispatched:
  - Keeps day-ahead payment
- Resource meets its MOO and is dispatched for energy/AS:
  - Keeps day-ahead payment and energy/AS payment

## The CAISO proposes the following design features related to settlement of imbalance reserves (2 of 2):

- Resource does not meet its MOO:
  - No pay provisions
- Resource meets its MOO but deviates from dispatch:
  - Charged for costs associated with flexible ramping product (uncertainty movement)
  - No rescission of imbalance reserve payments

# Cost allocation will be consistent with CAISO guiding principles

- Allocate costs to resources that create the need for imbalance reserves to be utilized
- Allocate costs to resources with schedules less than or greater than their IFM schedules (unless the resource schedule change is the result of an economic dispatch)

# Proposed Cost Allocation – Imbalance Reserves, Up

- Metered load at the resource level that is higher than the IFM schedule
- Generating resources, VERs, NGR and PDR/DDR that have real-time schedules less than their IFM schedule (unless economically dispatched down).
  - For VERs, the forecast will be used as the UEL
  - For import resources, the bid will be used as the UEL
- Exports that self-schedule with a lower economic limit (LEL) than their IFM schedule
- Virtual supply

# Cost Allocation – Imbalance Reserves, Down

- Metered load at the resource level that is lower than the IFM schedule
- Generating resources, VERs, NGR and PDR/DDR that have real-time schedules greater than their IFM schedule (unless economically dispatched up).
  - For VERs, the forecast will be used as the LEL
  - For export resources, the bid will be used as the LEL
- Exports that self-schedule below their IFM schedule or are unable to tag to their IFM schedule
- Imports that self-schedule above their IFM schedule
- Virtual demand

# Proposed cost allocation will be based on net deviations by Scheduling Coordinator

- Based on net deviations by scheduling coordinator
- Assuming the same SC for the following deviations, the cost of 105 MW would be allocated to the SC

Reason for Deviation	Difference between IFM and real-time
Bid in demand is lower than actual load increase	+ 100 MW
Generator self-schedule increase from IFM	- 40 MW
VER unable to meet day-ahead forecast by 15 MW	+15 MW
Import under tags 20 MW	+ 20 MW
Export self-schedule increase from IFM	+ 10 MW
<b>TOTAL IMBALANCE</b>	<b>105 MW</b>

# The CAISO proposes a two-tier cost allocation

- The allocation for upward imbalance reserves will be:
  - Up Tier 1 =  $\text{Min}(\text{Up price, Net negative imbalance reserve deviation price}) * \text{net negative imbalance reserve deviation}$
  - Up Tier 2 = Measured demand (metered load and exports)
- The allocation for downward imbalance reserves will be:
  - Down Tier 1 =  $\text{Min}(\text{Down price, Net positive imbalance reserve deviation price}) * \text{net positive imbalance reserve deviation}$
  - Down Tier 2 = Measured demand (metered load and exports)



## The CAISO requests input from stakeholders regarding additional design considerations (1 of 2):

- HASP reversal rule will still apply
  - Pricing rules associated with HASP are intended to address implicit virtual bidding and are not addressed with proposed cost allocation
- RA resources will no longer have a real-time MOO unless awarded a day-ahead schedule, RUC, AS, or imbalance reserve award.
  - This simplifies RAAIM

## The CAISO requests input from stakeholders regarding additional design considerations (2 of 2):

- Will existing policies for exceptional dispatches or capacity procurement mechanism need to change?
  - No CPM payment for RA resources that are exceptionally dispatched in real-time
- Congestion revenue rights will now be settled based on 15-minute IFM schedules instead of hourly schedules.
  - Does CRR settlement rule need to be reviewed?
- How will intertie deviations be fully addressed?
- How will D2, D3 and 72 hour RUC be impacted? When will extra long start resources be committed?

Additional information/data analysis will be provided in the next policy paper:

- **Appendix A: Historical Analysis of Imbalance**
  - Imbalance calculations would be consistent between DAM Enhancements and FRACMOO (i.e. will rely on same data set)
- **Appendix B: Imbalance Reserve Requirement**
  - Use of historical analysis and regression testing to develop a forward-looking requirement
- **Appendix C: Mathematic Formulations**
  - Combining IFM & RUC

# QUESTIONS?

Day-Ahead Market Enhancements

# EXTENDING TO EIM ENTITIES

# Extending DAM to EIM Entities provides additional regional benefits

- Key benefits:
  - Allows EIM participants to take advantage of day-ahead market enhancements
  - Day-ahead unit commitment and scheduling across larger footprint improves market efficiency and more effectively integrates renewables
- Key principles:
  - Each balancing authority retains reliability responsibilities
  - States maintain control over integrated resource planning
    - Resource adequacy procurement decisions remain with local regulatory authority
    - Transmission planning and investment decisions remain with each balancing authority and local regulatory authority

## Scope of stakeholder initiative to extend day-ahead market to EIM Entities (1 of 2):

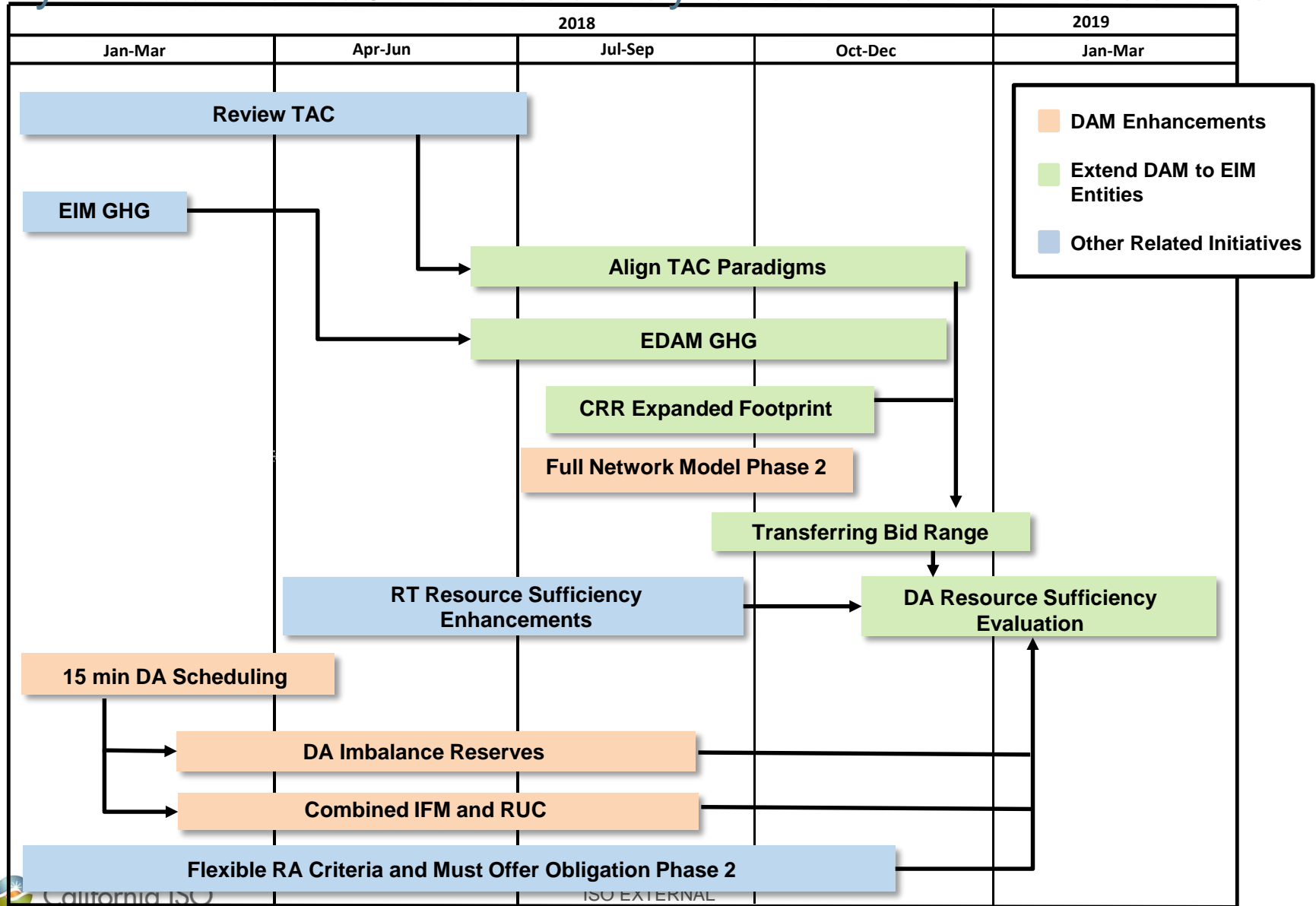
- **Aligning transmission access charge (TAC) paradigms**
  - Ensure EIM Entities recover transmission costs consistent with existing bilateral transmission framework
  - Consistent billing determinants across day-ahead market footprint for market efficiency
- **Congestion revenue rights over expanded footprint**
  - Congestion hedging similar to CAISO balancing area
  - Address long-term bilateral transactions within expanded day-ahead market footprint
- **Day-ahead resource sufficiency evaluation**
  - Ensure balancing areas not leaning on others for capacity, flexibility or transmission

# Scope of stakeholder initiative to extend day-ahead market to EIM Entities (2 of 2):

- Transferring bid range
  - Facilitate monthly/daily/hourly bilateral transactions across expanded day-ahead market footprint
  - Used to help meet resource sufficiency evaluation using resources outside a balancing area
- Day-ahead GHG attribution
  - Extend EIM real-time market approach to day-ahead



# Day-ahead market/Extended Day-ahead Market Interactions



# QUESTIONS?

Day-Ahead Market Enhancements

# **EIM CATEGORIZATION & NEXT STEPS**

# Proposed EIM Governing Body Classification

- The CAISO proposes to give the EIM Governing Body an **advisory** role on all aspects of this initiative
- Stakeholders are encouraged to submit a response to the EIM categorization

# Proposed Initiative Schedule



Milestone	Date
<i>Post Issue Paper/Straw Proposal</i>	<i>February 28, 2018</i>
<i>Stakeholder Meeting</i>	<i>March 7, 2018</i>
<i>Stakeholder Written Comments Due</i>	<i>March 21, 2018</i>
Post Straw Proposal	April 11, 2018
Stakeholder Meeting	April 18, 2018
Stakeholder Written Comments Due	May 2, 2018
Post Revised Straw Proposal (tentative)	May 16, 2018
Stakeholder Meeting	May 23, 2018
Stakeholder Written Comments Due	May 30, 2018
Post Draft Final Proposal	June 12, 2018
Stakeholder Call	June 19, 2018
Stakeholder Written Comments Due	June 26, 2018
EIM Governing Body Meeting	July 12, 2018
Board of Governors Meeting	July 25-26, 2018

# THANK YOU

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