



California ISO

Flexible Ramping Product (FRP) Refinements – Deliverability

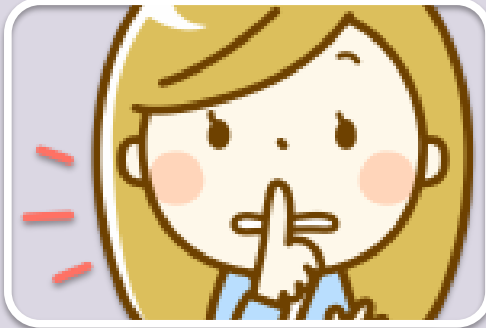
September 7, 2022

Radha Madrigal
Customer Readiness

Updated to include
BAAOP screens;
slides 21-23

Updated: 11/29/2022

Housekeeping



Keep yourself muted to minimize background noise



Unmute to ask verbal questions or write questions in the chat pod



Raise your hand using WebEx interactivity tools

Agenda

- This training will cover the following topics:
 - Background of FRP
 - High-level review of changes
 - Application-specific details
 - Market simulation activities



Objectives: Flexible Ramping Product Refinements

- Enforce transmission constraints and transfer limits in FRP deployment scenarios
- Procure FRP collectively for the group of BAAs that pass the flex test
- Procure FRP separately for BAAs that fail the flex test
- Establish Locational Marginal Capacity Prices (LMCP) for FRP
- Enhance current approach by adopting quantile regression method to adjust current FRP up/down requirement
- Distribute uncertainty requirement in each BAA load and Variable Energy Resource (VER) locations versus just load
- Enhance calculation of demand curve by adopting quantile regression method
- Distribute demand curve surplus variable as a decision variable at load aggregation points (LAP) versus Balancing Authority Areas (BAA)

Acronyms

Abbreviation	Term	Abbreviation	Term
BAA	Balancing Authority Area	MRI-S	Market Results Interface - Settlements
BAAOP	Balancing Authority Area Operations Portal	OASIS	Open Access Same-Time Information System
CLAP	Custom Load Aggregation Point	RSE	Resource Sufficiency Evaluation
CMRI	Customer Market Results Interface	RTD	Real-Time Dispatch
FRD	Flexible Ramping Down	RTM	Real-Time Market
FRP	Flexible Ramping Product	RTPD	Real-Time Pre Dispatch
FRU	Flexible Ramping Up	TAC	Transmission Access Charge
LAP	Load Aggregation Point	VER	Variable Energy Resource
LMCP	Locational Marginal Capacity Price	WEIM	Western Energy Imbalance Market

FRP REFINEMENTS - DELIVERABILITY

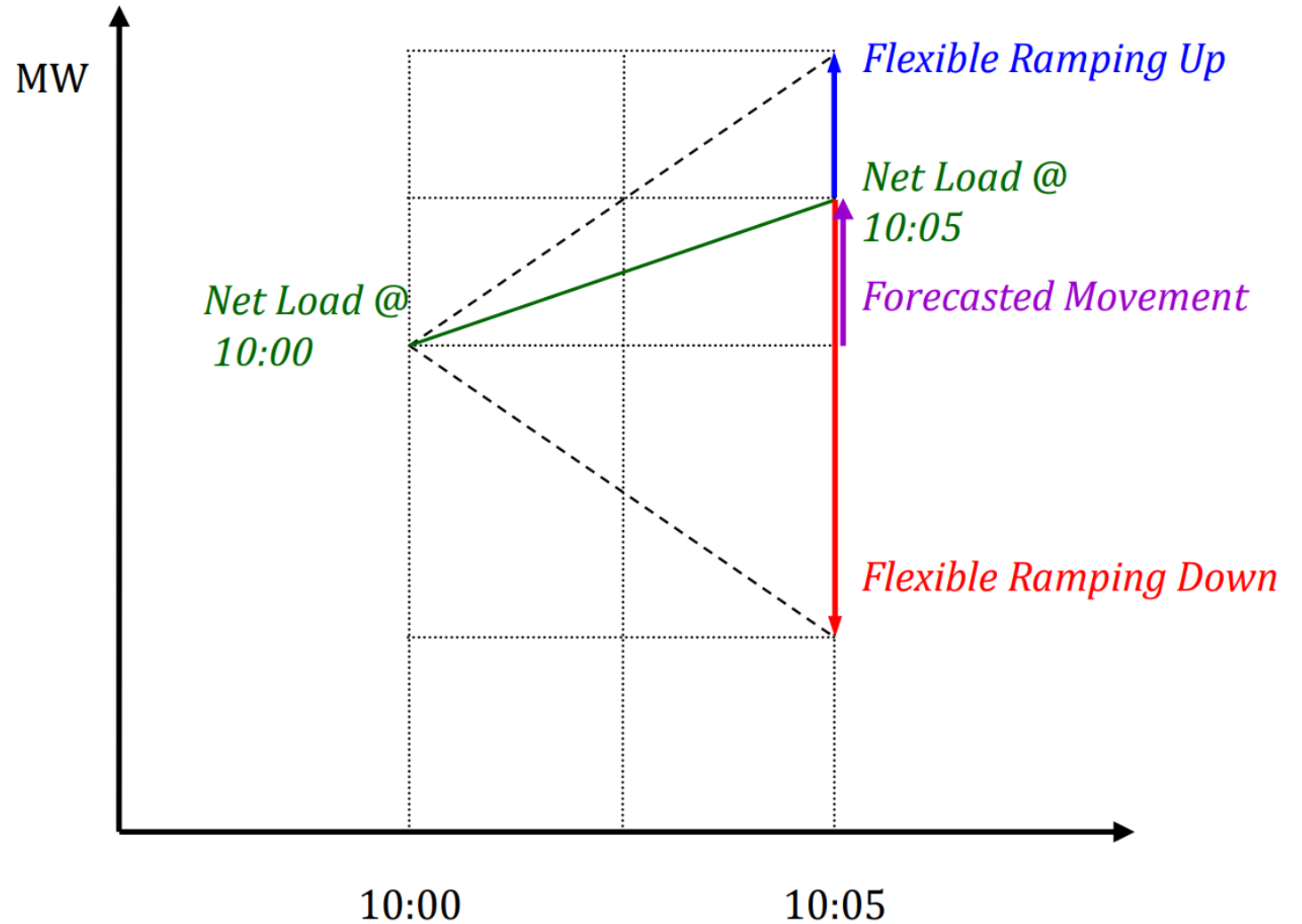
Implementation timeline

- Tariff amendment filed with FERC: August 15, 2022
 - FERC approval requested by October 17, 2022
- Market simulation: September 15 – October 14, 2022
- Production activation date: TBD

BACKGROUND: HIGH-LEVEL REVIEW OF CHANGES

Flexible Ramping Product

Flexible ramping product secures additional ramping capability that can be dispatched in the subsequent market runs to cover uncertainty in forecasted net load



Background: FRP Refinements – Deliverability Initiative

Problem Statement

- Analyses showed energy from a large portion of scheduled FRP capacity is actually not deliverable because of congested transmission
 - Real-time market (RTM) currently does not consider transmission constraints within BAAs when scheduling FRP
- In addition to reducing FRP's effectiveness in addressing load uncertainty, this situation:
 - tends to make flexible ramping prices artificially low
 - is not reflective of the value of capacity that can provide flexible ramping capability



Background: FRP Refinements – Deliverability Initiative Solution

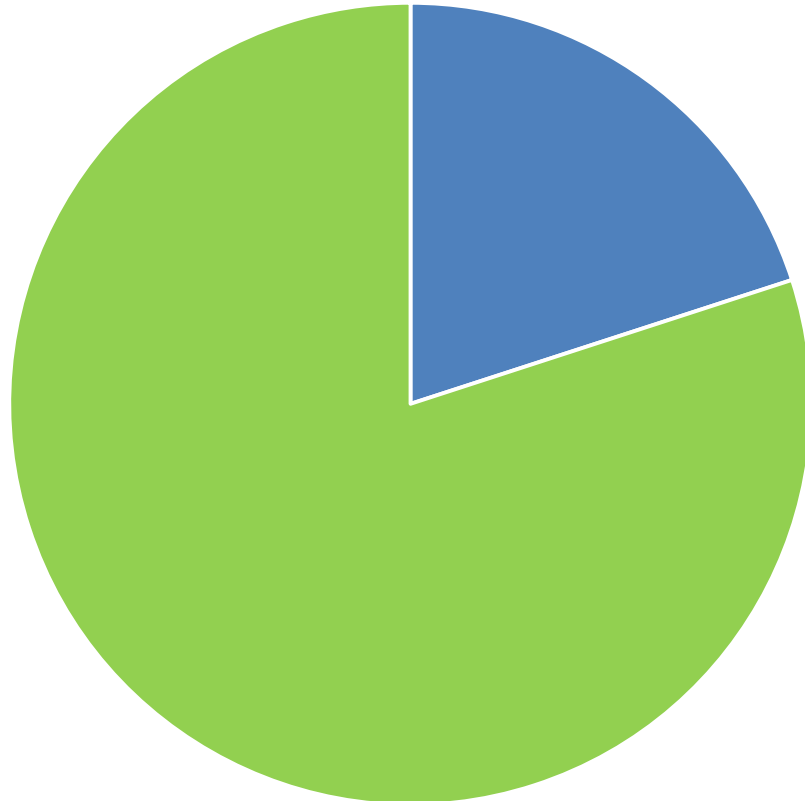
- Most significant enhancement is to **model FRP by location of the nodes** that are in the ISO market's network model
 - Locational modeling consists of:
 - the RTM considering transmission constraints
 - the energy flows that would occur when the RTM dispatches energy from capacity scheduled to provide FRP
 - Ensures FRP awards are *feasible to deliver* and *appropriately priced*

Background: Western Energy Imbalance Market (WEIM) Resource Sufficiency Evaluation (RSE)

- In the original proposal (2020), there was a technical element that would have limited WEIM transfers to zero as a consequence of failing the RSE; That was a proposal to change the status quo of holding transfers constant at the level prior to the hour in which the entity fails the RSE
- Significant stakeholder dialogue since that time concluded that *limiting WEIM transfers to zero in the event of an RSE failure would exacerbate reliability issues* during stressed system conditions and create unacceptable risks to reliability
- ISO modified this element of the original proposal, *effectively retaining the existing consequences for failing the RSE* while the ISO works to establish a framework of financial consequences for RSE failure
 - This modification will allow the ISO to implement this initiative without causing any adverse reliability impacts

Implementation: Western Energy Imbalance Market (WEIM) Resource Sufficiency Evaluation (RSE)

Procurement of FRP



■ Separate for BAAs that fail flex test

■ Procured for entire group of BAAs among those that pass flex test

- ISO will maintain current RSE rules that limit WEIM energy transfers, when a BAA fails the RSE, to the amount scheduled in the market interval preceding the failure
- The RTM will only procure FRP from a failing BAA's own resources
- Procurement target will be the amount calculated to meet the BAA's individual uncertainty and forecasted ramping needs and would be feasible to deliver
- Target would not include the benefit of pooling uncertainty of all BAAs across the WEIM footprint; *This prevents a BAA with insufficient resources to meet its FRP needs from leaning on the capacity of other BAAs*
- When WEIM BAA is in contingency, the BAA will be removed from FLEX UP and FLEX DOWN passing group definition; *There will be no FRU/FRD procurement for that BAA*

Key Points: Flexible Ramping Up (FRU) & Flexible Ramping Down (FRD)

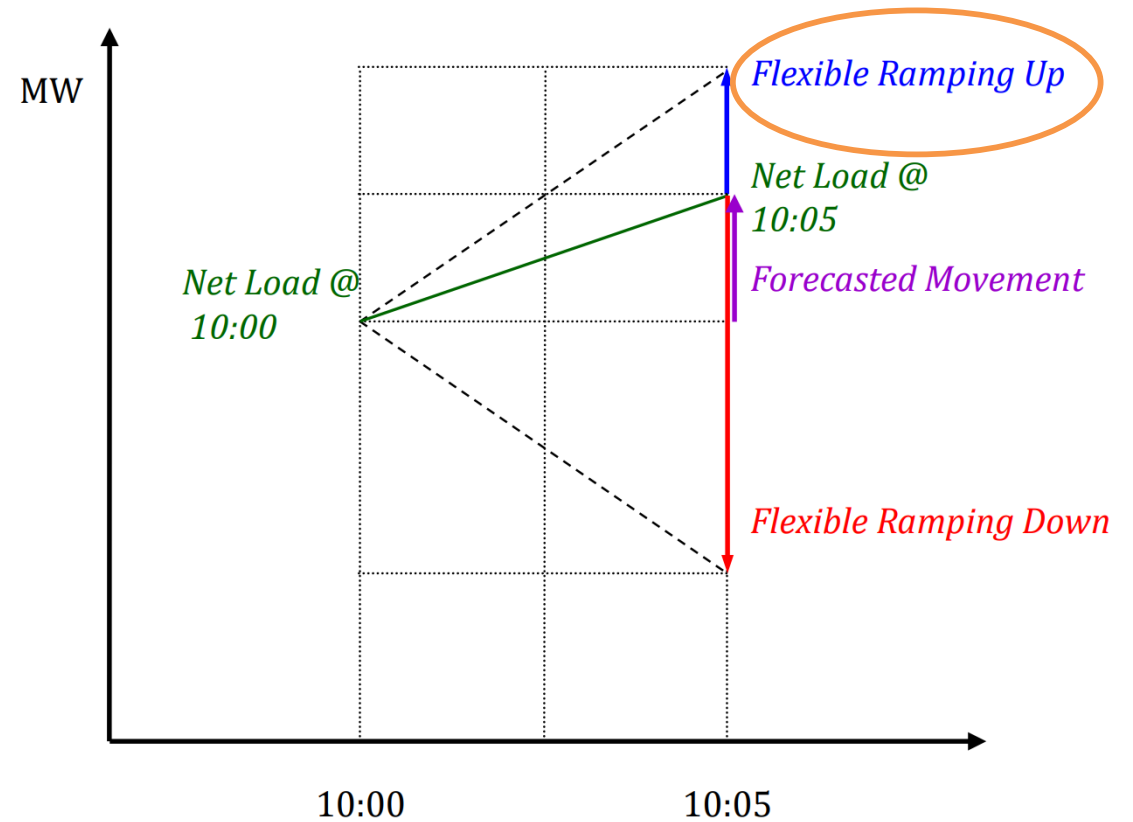
- There are **no** capacity bids for FRU/FRD; they are **priced at opportunity costs**
- Only 5-min dispatchable resources are eligible for FRU/FRD awards
- Variable Energy Resources (VERs) are scheduled up to their forecast and they may be awarded FRU/FRD; VER FRU/FRD awards are deployed in the FRU/FRD deployment scenarios
- All physical transmission/transfer constraints that are enforced in the original market calculation (including base case and contingency constraints) are also enforced in the FRU/FRD deployment scenarios

Key Points: Flexible Ramping Up (FRU) & Flexible Ramping Down (FRD)

- Distribution of FRU/FRD requirements in FRU/FRD deployment scenarios in each BAA is divided among load, solar, and wind resources
 - Allocation factors are derived from historical data that reflect the relative contributions of these resource classes to the overall uncertainty
- FRU/FRD demand elasticity is achieved with FRU/FRD surplus variables with cost curves that reflect the expected cost of foregoing FRU/FRD procurement
 - Ensures that FRU/FRD is not procured at a higher cost than the benefit it provides
- FRU/FRD surplus variables are modeled as independent controls in each FRP surplus zone, effectively relaxing the distributed FRU/FRD requirements in the respective zone

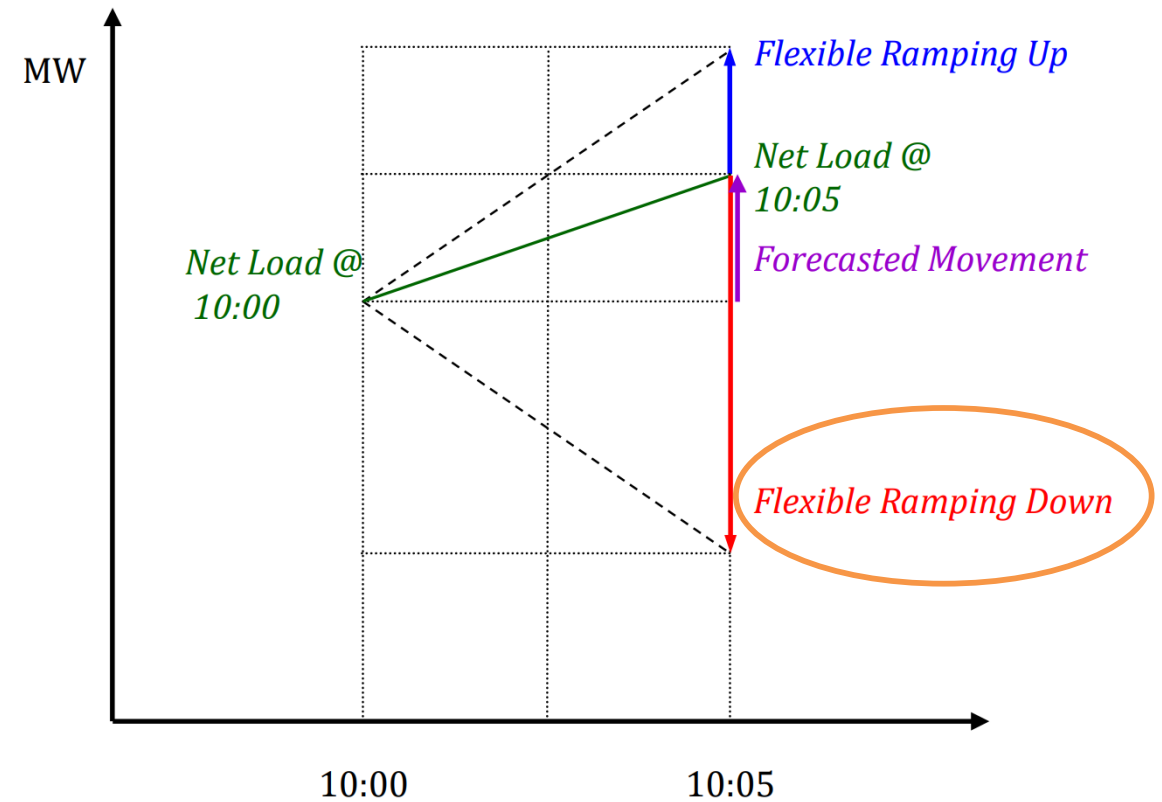
Flexible Ramping Up Deployment Scenario

- All FRU awards are deployed
- Demand/wind/solar forecast for each BAA that failed FRU sufficiency test is adjusted by FRU requirement for that BAA
- Demand/wind/solar forecast for group of BAAs that passed FRU sufficiency test is adjusted by FRU requirement for BAA group
- FRU surplus in each BAA that failed FRU sufficiency test is fully deployed
- FRU surplus in group of BAAs that passed FRU sufficiency test is fully deployed



Flexible Ramping Down Deployment Scenario

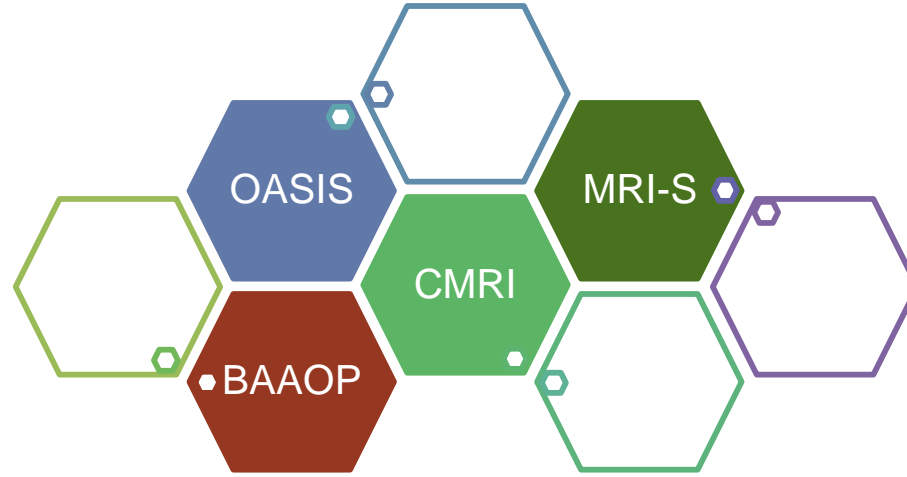
- All FRD awards are deployed
- Demand/wind/solar forecast for each BAA that failed FRD sufficiency test is adjusted by FRD requirement for that BAA
- Demand/wind/solar forecast for group of BAAs that passed FRD sufficiency test is adjusted by FRD requirement for BAA group
- FRD surplus in each BAA that failed FRD sufficiency test is fully deployed
- FRD surplus in group of BAAs that passed FRD sufficiency test is fully deployed



Configuration of FRP Surplus Zones

- Define and maintain FRP surplus zones in each BAA in the WEIM area
- FRP surplus zones shall include generation and load nodes so that every generation and load in a BAA shall belong to only **one** FRP surplus zone
 - In the case of CAISO, this will include CAISO scheduling points
- FRP surplus zones shall be used in the market to distribute FRP surplus variables
 - Four FRP surplus zones for CAISO align with the four TAC areas
 - For WEIM BAAs, one FRP surplus zone for the entire BAA, except for BAAs with CLAPs (e.g., BANC, PSCO) where the FRP surplus zones shall align with the CLAPs

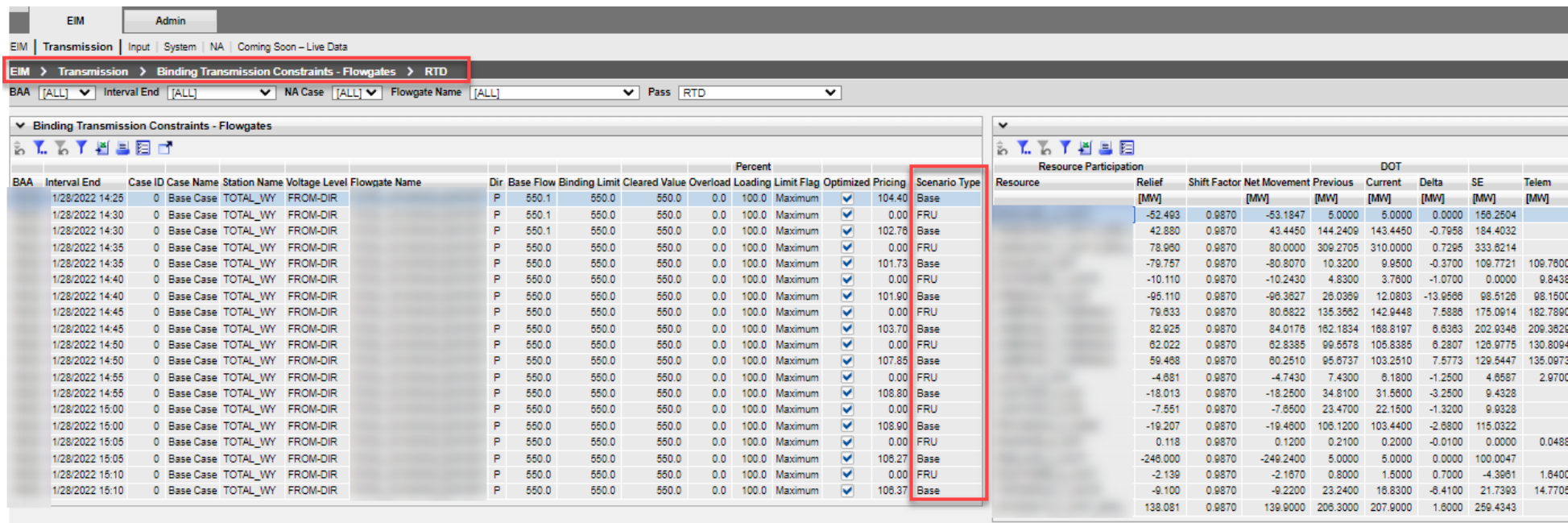
Questions



REVIEW APPLICATION-SPECIFIC DETAILS

Change to existing display – Market: Real-time

- Path: EIM > Transmission > Binding Transmission Constraints - Flowgates > RTD/RTPD/STUC
- Existing UI has a slight change; there is an additional column to indicate the constraint is binding and in which scenarios (BASE, FRU is FRU deployment scenario, FRD is for FRD deployment scenario)



The screenshot shows the EIM interface for Binding Transmission Constraints - Flowgates in Real-time (RTD) mode. The breadcrumb path is EIM > Transmission > Binding Transmission Constraints - Flowgates > RTD. The main table displays flowgate data with a new 'Scenario Type' column highlighted in red. The table includes columns for Interval End, Case ID, Case Name, Station Name, Voltage Level, Flowgate Name, Dir, Base Flow, Binding Limit, Cleared Value, Overload, Loading, Limit Flag, Optimized Pricing, and Scenario Type. The Scenario Type column shows values like 'Base', 'FRU', and 'FRD'.

BAA	Interval End	Case ID	Case Name	Station Name	Voltage Level	Flowgate Name	Dir	Base Flow	Binding Limit	Cleared Value	Overload	Loading	Limit Flag	Optimized Pricing	Scenario Type
	1/28/2022 14:25	0	Base Case	TOTAL_WY	FROM-DIR		P	550.1	550.0	550.0	0.0	100.0	Maximum	104.40	Base
	1/28/2022 14:30	0	Base Case	TOTAL_WY	FROM-DIR		P	550.1	550.0	550.0	0.0	100.0	Maximum	102.76	FRU
	1/28/2022 14:30	0	Base Case	TOTAL_WY	FROM-DIR		P	550.1	550.0	550.0	0.0	100.0	Maximum	102.76	Base
	1/28/2022 14:35	0	Base Case	TOTAL_WY	FROM-DIR		P	550.0	550.0	550.0	0.0	100.0	Maximum	0.00	FRU
	1/28/2022 14:35	0	Base Case	TOTAL_WY	FROM-DIR		P	550.0	550.0	550.0	0.0	100.0	Maximum	101.73	Base
	1/28/2022 14:40	0	Base Case	TOTAL_WY	FROM-DIR		P	550.0	550.0	550.0	0.0	100.0	Maximum	0.00	FRU
	1/28/2022 14:40	0	Base Case	TOTAL_WY	FROM-DIR		P	550.0	550.0	550.0	0.0	100.0	Maximum	101.90	Base
	1/28/2022 14:45	0	Base Case	TOTAL_WY	FROM-DIR		P	550.0	550.0	550.0	0.0	100.0	Maximum	0.00	FRU
	1/28/2022 14:45	0	Base Case	TOTAL_WY	FROM-DIR		P	550.0	550.0	550.0	0.0	100.0	Maximum	103.70	Base
	1/28/2022 14:50	0	Base Case	TOTAL_WY	FROM-DIR		P	550.0	550.0	550.0	0.0	100.0	Maximum	0.00	FRU
	1/28/2022 14:50	0	Base Case	TOTAL_WY	FROM-DIR		P	550.0	550.0	550.0	0.0	100.0	Maximum	107.85	Base
	1/28/2022 14:55	0	Base Case	TOTAL_WY	FROM-DIR		P	550.0	550.0	550.0	0.0	100.0	Maximum	0.00	FRU
	1/28/2022 14:55	0	Base Case	TOTAL_WY	FROM-DIR		P	550.0	550.0	550.0	0.0	100.0	Maximum	108.80	Base
	1/28/2022 15:00	0	Base Case	TOTAL_WY	FROM-DIR		P	550.0	550.0	550.0	0.0	100.0	Maximum	0.00	FRU
	1/28/2022 15:00	0	Base Case	TOTAL_WY	FROM-DIR		P	550.0	550.0	550.0	0.0	100.0	Maximum	108.90	Base
	1/28/2022 15:05	0	Base Case	TOTAL_WY	FROM-DIR		P	550.0	550.0	550.0	0.0	100.0	Maximum	0.00	FRU
	1/28/2022 15:05	0	Base Case	TOTAL_WY	FROM-DIR		P	550.0	550.0	550.0	0.0	100.0	Maximum	108.27	Base
	1/28/2022 15:10	0	Base Case	TOTAL_WY	FROM-DIR		P	550.0	550.0	550.0	0.0	100.0	Maximum	0.00	FRU
	1/28/2022 15:10	0	Base Case	TOTAL_WY	FROM-DIR		P	550.0	550.0	550.0	0.0	100.0	Maximum	108.37	Base

New display – Market: Real-time BAAOP Flex Ramp Sufficiency Schedules, BAA Factors

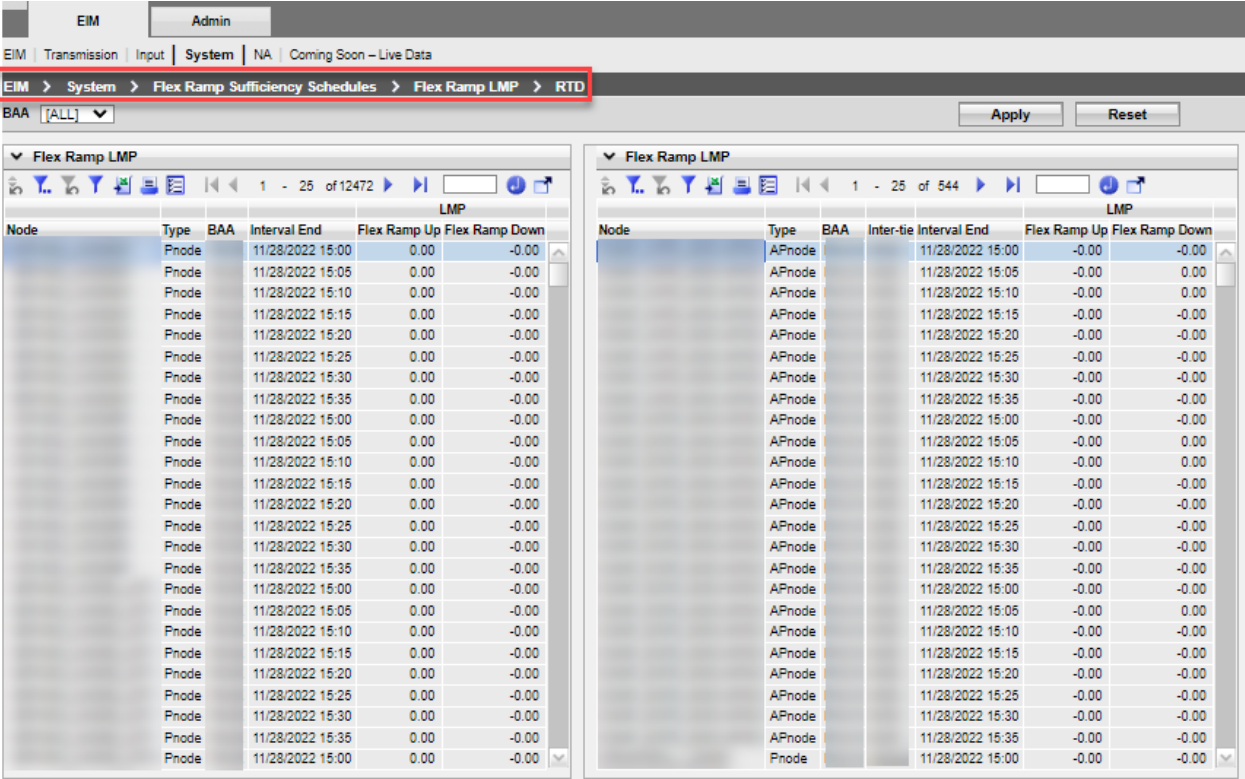
- Path: EIM > System > Flex Ramp Sufficiency Schedules > BAA Factors > RTD/RTPD/STUC
- New UI to show the FRP requirement for individual BAA's requirement (when they fail the test in that direction) and FRU/FRD_pass group requirement for the remaining BAAs which pass the test in that direction

The screenshot shows the EIM Admin interface. The breadcrumb path is highlighted: EIM > System > Flex Ramp Sufficiency Schedules > Flex Ramp BAA Factors > RTD. Below the breadcrumb is a table titled 'Flex Ramp - BAA Factors and Forecast'. The table has columns for BAA / Group, Interval End, Direction, Flex Ramp Req, Demand, Wind, and Solar. The first 15 rows are for 'FRD Pass Group' with 'DN' direction, and the last 10 rows are for 'FRU Pass Group' with 'UP' direction. To the right of the table is a 'Demand Curve' chart with 'MW' on the x-axis, which is currently blank.

BAA / Group	Interval End	Direction	Flex Ramp Req	Demand	Wind	Solar
FRD Pass Group	11/28/2022 14:45	DN	156.37	0.23	0.33	0.43
FRD Pass Group	11/28/2022 14:50	DN	142.88	0.23	0.33	0.44
FRD Pass Group	11/28/2022 14:55	DN	130.25	0.23	0.33	0.44
FRD Pass Group	11/28/2022 15:00	DN	117.88	0.23	0.33	0.44
FRD Pass Group	11/28/2022 15:05	DN	357.93	0.26	0.43	0.31
FRD Pass Group	11/28/2022 15:10	DN	352.27	0.27	0.43	0.30
FRD Pass Group	11/28/2022 15:15	DN	344.91	0.27	0.43	0.30
FRD Pass Group	11/28/2022 15:20	DN	337.30	0.27	0.44	0.29
FRD Pass Group	11/28/2022 15:25	DN	327.75	0.28	0.45	0.28
FRD Pass Group	11/28/2022 15:30	DN	318.45	0.28	0.45	0.28
FRU Pass Group	11/28/2022 14:45	UP	357.05	0.25	0.21	0.54
FRU Pass Group	11/28/2022 14:50	UP	357.05	0.25	0.21	0.54
FRU Pass Group	11/28/2022 14:55	UP	357.05	0.25	0.21	0.54
FRU Pass Group	11/28/2022 15:00	UP	357.05	0.25	0.21	0.54
FRU Pass Group	11/28/2022 15:05	UP	428.57	0.26	0.23	0.51
FRU Pass Group	11/28/2022 15:10	UP	428.57	0.26	0.23	0.51
FRU Pass Group	11/28/2022 15:15	UP	428.57	0.26	0.23	0.50
FRU Pass Group	11/28/2022 15:20	UP	428.57	0.26	0.24	0.50
FRU Pass Group	11/28/2022 15:25	UP	413.80	0.27	0.24	0.49
FRU Pass Group	11/28/2022 15:30	UP	398.83	0.28	0.25	0.48

New display – Market: Real-time BAAOP Flex Ramp Sufficiency Schedules, Flex Ramp LMP

- PATH: EIM > System > Flex Ramp Sufficiency Schedules > Flex Ramp LMP > RTD/RTPD/STUC
- New UI to show nodal FRP prices



The screenshot shows the EIM Admin interface with the navigation path: EIM > System > Flex Ramp Sufficiency Schedules > Flex Ramp LMP > RTD. The interface displays two side-by-side tables for Flex Ramp LMP data.

Table 1 (Left): Shows data for 25 of 12472 records. The columns are Node, Type, BAA, Interval End, Flex Ramp Up, and Flex Ramp Down. All values for Flex Ramp Up and Flex Ramp Down are 0.00.

Node	Type	BAA	Interval End	Flex Ramp Up	Flex Ramp Down
Pnode			11/28/2022 15:00	0.00	-0.00
Pnode			11/28/2022 15:05	0.00	-0.00
Pnode			11/28/2022 15:10	0.00	-0.00
Pnode			11/28/2022 15:15	0.00	-0.00
Pnode			11/28/2022 15:20	0.00	-0.00
Pnode			11/28/2022 15:25	0.00	-0.00
Pnode			11/28/2022 15:30	0.00	-0.00
Pnode			11/28/2022 15:35	0.00	-0.00
Pnode			11/28/2022 15:00	0.00	-0.00
Pnode			11/28/2022 15:05	0.00	-0.00
Pnode			11/28/2022 15:10	0.00	-0.00
Pnode			11/28/2022 15:15	0.00	-0.00
Pnode			11/28/2022 15:20	0.00	-0.00
Pnode			11/28/2022 15:25	0.00	-0.00
Pnode			11/28/2022 15:30	0.00	-0.00
Pnode			11/28/2022 15:35	0.00	-0.00
Pnode			11/28/2022 15:00	0.00	-0.00
Pnode			11/28/2022 15:05	0.00	-0.00
Pnode			11/28/2022 15:10	0.00	-0.00
Pnode			11/28/2022 15:15	0.00	-0.00
Pnode			11/28/2022 15:20	0.00	-0.00
Pnode			11/28/2022 15:25	0.00	-0.00
Pnode			11/28/2022 15:30	0.00	-0.00
Pnode			11/28/2022 15:35	0.00	-0.00
Pnode			11/28/2022 15:00	0.00	-0.00

Table 2 (Right): Shows data for 25 of 544 records. The columns are Node, Type, BAA, Inter-tie, Interval End, Flex Ramp Up, and Flex Ramp Down. All values for Flex Ramp Up and Flex Ramp Down are 0.00.

Node	Type	BAA	Inter-tie	Interval End	Flex Ramp Up	Flex Ramp Down
APnode				11/28/2022 15:00	-0.00	-0.00
APnode				11/28/2022 15:05	-0.00	0.00
APnode				11/28/2022 15:10	-0.00	0.00
APnode				11/28/2022 15:15	-0.00	-0.00
APnode				11/28/2022 15:20	-0.00	-0.00
APnode				11/28/2022 15:25	-0.00	-0.00
APnode				11/28/2022 15:30	-0.00	-0.00
APnode				11/28/2022 15:35	-0.00	-0.00
APnode				11/28/2022 15:00	-0.00	-0.00
APnode				11/28/2022 15:05	-0.00	-0.00
APnode				11/28/2022 15:10	-0.00	0.00
APnode				11/28/2022 15:15	-0.00	-0.00
APnode				11/28/2022 15:20	-0.00	-0.00
APnode				11/28/2022 15:25	-0.00	-0.00
APnode				11/28/2022 15:30	-0.00	-0.00
APnode				11/28/2022 15:35	-0.00	-0.00
APnode				11/28/2022 15:00	-0.00	-0.00
APnode				11/28/2022 15:05	-0.00	0.00
APnode				11/28/2022 15:10	-0.00	-0.00
APnode				11/28/2022 15:15	-0.00	-0.00
APnode				11/28/2022 15:20	-0.00	-0.00
APnode				11/28/2022 15:25	-0.00	-0.00
APnode				11/28/2022 15:30	-0.00	-0.00
APnode				11/28/2022 15:35	-0.00	-0.00
APnode				11/28/2022 15:00	-0.00	-0.00

Existing CMRI reports will contain updated FRP data



California ISO Customer Market Results Interface

Day-Ahead Real-Time Post-Market Default Bids Convergence Bidding Forecast Reference LSE Energy

Start Date: Hour-Ahead Scheduling Process (HASP) Schedule Prices

End Date: Hour-Ahead Scheduling Process (HASP) Schedules

Day-Ahead: Hour-Ahead Scheduling Process (HASP) Market Power Mitigation (MPM) Results

Trade Date: Fifteen-Minute Market (FMM) Flexible Ramp Price Breakdown

Report Generated: Fifteen-Minute Market (FMM) Schedules

Real-Time Dispatch (RTD) Schedule Prices

Real-Time Dispatch (RTD) Flexible Ramp Price Breakdown


Real-Time Dispatch (RTD) Schedules

Additional FRP awards data will be incorporated into these existing reports

New OASIS Report Accessible From Prices Menu



The screenshot shows the OASIS web application interface. At the top, the California ISO logo and 'OASIS' text are visible. Below the navigation tabs (ATLAS REFERENCE, REPORT DEFINITION, PRICES, TRANSMISSION, SYSTEM DEMAND, ENERGY, ANCILLARY SERVICES, CONGESTION REVENUE RIGHTS, PUBL), the 'PRICES' menu is expanded. The 'Energy Prices' sub-menu is highlighted, and 'Flexible Ramping Nodal Prices' is selected and highlighted with an orange box. The main content area shows a report header for 'Flexible Ramping Nodal Prices' with columns for Market, Opr Date, Node, Ramp Type, and Interval. A message states 'No Data found'. The report generation timestamp is '09/07/2022 17:39:24'.



ATLAS REFERENCE REPORT DEFINITION **PRICES** TRANSMISSION SYSTEM DEMAND ENERGY ANCILLARY SERVICES CONGESTION REVENUE RIGHTS PUBL

Date: 09/07/2022 Market: RTD Group: SELECT_NODE Node: 0096WD_7_N001 Apply

Download XML Download CSV


Flexible Ramping Nodal Prices

Market	Opr Date	Node	Ramp Type	Interval	HE01	HE02	HE03	HE04	HE05	HE06	HE07	HE08	HE09	HE10	HE11	HE12	HE13	HE14	HE15	HE16
No Data found																				



Flexible Ramping Nodal Prices

FRU/FRD Nodal prices at the Pnode level for all P-nodes, SP-ties and AP-nodes calculated by the RTD and RTPD binding market run



ATLAS REFERENCE REPORT DEFINITION **PRICES** TRANSMISSION SYSTEM DEMAND ENERGY ANCILLARY SERVICES CONGESTION RE

Date: 09/07/2022 Market: RTD Group: SELECT_NODE Node: 0096WD_7_N001

Download XML Download CSV

Flexible Ramping Nodal Prices

Market	Opr Date	Node	Ramp Type	Interval	HE01	HE02	HE03	HE04	HE05	HE06	HE07	HE08	HE09	HE10	HE11	HE12	HE13	HE14	HE15	HE16
No Data found																				

Report Generated: 09/07/2022 17:39:24

- 0096WD_7_N001
- 0096WD_7_N002
- 106THSO_LNODED1
- 10TH_STW_1_1LNODE
- 10TH_STW_1_2LNODE
- 118THSO_LNODER1
- 119TH_BP_LNODEXF1
- 126THSO_LNODE_LDT1
- 126THSO_LNODE_LDT2
- 12STREET_LNODEEET1
- 12STREET_LNODEEET2
- 12TH_S_LNODENMZ
- 12TH_S_LNODEXWQ
- 13THSO_LNODE-3
- 13THSO_LNODED2
- 1501WDC2_7_ND001
- 22ND_ST_LNODEDIST
- 23RDST_LNODED1
- 23RDST_LNODED2
- 23RDST_LNODED3

New OASIS Reports Accessible From Energy Menu



The screenshot shows the OASIS website header with the California ISO logo and navigation tabs: ATLAS REFERENCE, REPORT DEFINITION, PRICES, TRANSMISSION, SYSTEM DEMAND, ENERGY, ANCILLARY SERVICES, CONGESTION REVENUE RIGHTS, PUBLIC BIDS, and REFERENCE. The ENERGY tab is selected, and its dropdown menu is open, listing: Schedule, System, Flexible Ramping, Convergence Bidding, Energy Imbalance Market, and Uplift. A secondary dropdown menu is open under Flexible Ramping, listing: Flexible Ramp Requirements, Uncertainty Movement by Category, Flexible Ramp Aggregate Awards, Flexible Ramp Surplus Demand Curves, Flexible Ramp Requirements Inputs and Outputs, Flexible Ramp Test Results Groups, Flexible Ramp Forecasts, Flexible Ramp Requirement Thresholds, Flexible Ramp Requirements Input Polynomials, and Flexible Ramp Requirements Uncertainty Histograms. An orange box highlights the last five items in this secondary menu. The main content area on the left contains a welcome message and sections for Standards Information and Transmission Information.

California ISO | OASIS

ATLAS REFERENCE REPORT DEFINITION PRICES TRANSMISSION SYSTEM DEMAND ENERGY ANCILLARY SERVICES CONGESTION REVENUE RIGHTS PUBLIC BIDS REFERENCE

Welcome to the California ISO Open Access Same-time Information site. On OASIS you will find real-time data related to the ISO transmission and its Market, such as system demand forecasts, transmission outages status, market prices and market result data.

Standards Information
[North American Energy Standards Board \(NAESB\)](#)
[ISO Business Practice Manuals](#)
[Available Transfer Capability Information](#)

Transmission Information
[Base Case Data](#)

Schedule
System
Flexible Ramping
Convergence Bidding
Energy Imbalance Market
Uplift

Flexible Ramp Requirements
Uncertainty Movement by Category
Flexible Ramp Aggregate Awards
Flexible Ramp Surplus Demand Curves
Flexible Ramp Requirements Inputs and Outputs
Flexible Ramp Test Results Groups
Flexible Ramp Forecasts
Flexible Ramp Requirement Thresholds
Flexible Ramp Requirements Input Polynomials
Flexible Ramp Requirements Uncertainty Histograms



ATLAS REFERENCE REPORT DEFINITION PRICES TRANSMISSION SYSTEM DEMAND ENERGY ANCILLARY SERVICES CONGESTION

Date: 09/02/2022 Market: RTD BAA: [ALL] BAA Group ID: [ALL] Ramp Type: [ALL]

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Flexible Ramp Test Results Groups

1 - 20 of 2128

Market	Trade Date	BAA Group Id	BAA	Interval Start Time	Interval End Time	Hour Ending	Ramp Type
RTD	09/02/2022			09/02/2022 00:00:00	09/02/2022 00:15:00	1	DOWN
RTD	09/02/2022			09/02/2022 00:00:00	09/02/2022 00:15:00	1	UP
RTD	09/02/2022			09/02/2022 00:15:00	09/02/2022 00:30:00	1	DOWN
RTD	09/02/2022			09/02/2022 00:15:00	09/02/2022 00:30:00	1	UP

Flexible Ramp Test Results Groups

RTPD/RTD passing group ID & failing entities; Report provides the ability to determine which entities are part of the WEIM area requirement

Date: 09/02/2022 Market: RTD BAA: [ALL] BAA Group ID: [ALL] Ramp Type: [ALL]

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Flexible Ramp Test Results Groups

No Data found

Report Generated: 09/02/2022 17:06:19

- RTD
- RTPD
- AVA
- AVRN
- AZPS
- BAA-TEST
- BANC
- BANCSMUD
- BCHA
- BPAT
- CISO
- EPE
- IPCO
- LADWP
- NEVP
- NWMT
- PACE
- PACW
- PGE
- PNM
- PSEI

- [ALL]
- FRU_PASS_GRP
- FRD_PASS_GRP
- AVA
- AVRN
- AZPS
- BAA-TEST
- BANC
- BANCSMUD
- BCHA
- BPAT
- CISO
- EPE
- IPCO
- LADWP
- NEVP
- NWMT
- PACE
- PACW
- PGE

- [ALL]
- UP
- DOWN



Flexible Ramp Forecasts

California ISO OASIS

ATLAS REFERENCE REPORT DEFINITION PRICES TRANSMISSION SYSTEM DEMAND ENERGY ANCILLARY SERVICES CONGESTION

Date From: 09/02/2022 Market/Process: RTD BAA ID: [ALL] Data Type: [ALL] Run Type: [ALL]

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Flexible Ramp Forecasts

1 - 20 of 2838

Market	Opr Date	Balancing Authority Area ID	Run Type	Data Type	Interval	HE01	HE02	HE03	HE04	HE05	HE06
RTD	09/02/2022		Advisory	Demand	1			8,694.25	8,707.50		
RTD	09/02/2022		Binding	Demand	1			8,694.25	8,707.50		
RTD	09/02/2022		Advisory	Solar	1			8,570.50	8,579.25		
RTD	09/02/2022		Binding	Solar	1			8,570.50	8,579.25		
RTD	09/02/2022		Advisory	Wind	1			8,570.50	8,579.25		
RTD	09/02/2022		Binding	Wind	1			8,570.50	8,579.25		

- Total RTD/RTPD binding & advisory resource forecast grouped by WEIM entity by tech type for solar/wind
- Report will also have a demand forecast component

California ISO OASIS

ATLAS REFERENCE REPORT DEFINITION PRICES TRANSMISSION SYSTEM DEMAND ENERGY ANCILLARY SERVICES CONGESTION

Date From: 09/02/2022 Market/Process: RTD BAA ID: [ALL] Data Type: [ALL] Run Type: [ALL]

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Flexible Ramp Forecasts

No Data found

Report Generated: 09/02/2022 17:45:08

Market: [ALL] BAA ID: [ALL] Data Type: [ALL] Run Type: [ALL]

Interval: [ALL] HE01 HE02 HE03 HE04 HE05 HE06



Date: 09/02/2022 Market/Process: RTD BAA ID: [ALL] Apply Reset

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Flexible Ramp Requirement Thresholds

1 - 20 of 82

Market	Opr Date	Balancing Authority Area ID	Ramp Type	Percentile	Data Type	Interval	HE01	HE02	HE03	HE04	HE05	HE06
RTD	09/02/2022		UP	HIGH	Histogram	1	32.95	0.00	0.00	0.00	0.00	0.00
RTD	09/02/2022		UP	LOW	Histogram	1	0.00	0.00	0.00	0.00	0.00	0.00
RTD	09/02/2022		UP	HIGH	Histogram	1	17.12	15.22	15.90	12.48	13.76	21.18
RTD	09/02/2022		UP	LOW	Histogram	1	-17.26	-17.42	-15.22	-16.26	-16.72	-25.46

Flexible Ramp Requirement Thresholds

Threshold value for FRU/FRD requirement for each BAA/WEIM area

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ATLAS REFERENCE REPORT DEFINITION PRICES TRANSMISSION SYSTEM DEMAND ENERGY ANCILLARY SERVICES CONGESTION REVENUE RIGHTS

Date: 09/02/2022 Market/Process: RTD BAA ID: [ALL] Apply Reset

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Flexible Ramp Requirement Thresholds

Market Opr Date Balancing Authority Area ID Ramp Type Percentile Data Type Interval HE01 HE02 HE03

No Data found

Report Generated: 09/02/2022 20:31:03

- [ALL]
- AVA
- AVRN
- AZPS
- BAA-TEST
- BANC
- BANCSMUD
- BCHA
- BPAT
- CISO
- EPE
- IPCO
- LADWP



Date: 09/02/2022 Market/Process: RTD BAA Group: [ALL] Apply Reset

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Flexible Ramp Requirement Input Polynomials

Market	Opr Date	Balancing Authority Area Group	Ramp Type	Percentile	Data Type	Interval	HE01			HE02		
							A Value	B Value	C Value	A Value	B Value	C Value
RTD	09/02/2022		UP	HIGH	DEMAND	1	-0.00	0.03	-5.80	-0.00	0.07	-22.50
RTD	09/02/2022		UP	HIGH	MOSAIC	1	0.02	0.33	5.75	0.01	0.39	5.04
RTD	09/02/2022		UP	HIGH	SOLAR	1	0.00	0.00	0.00	0.00	0.00	0.00
RTD	09/02/2022		UP	HIGH	WIND	1	-0.00	0.20	2.11	-0.00	0.18	4.24
RTD	09/02/2022		UP	LOW	DEMAND	1	-0.00	0.00	-5.80	0.00	-0.10	42.93
RTD	09/02/2022		UP	LOW	MOSAIC	1	-0.02	0.39	-4.03	-0.01	0.74	-1.18
RTD	09/02/2022		UP	LOW	SOLAR	1	0.00	0.00	0.00	0.00	0.00	0.00
RTD	09/02/2022		UP	LOW	WIND	1	0.00	-0.17	-1.35	0.00	-0.11	-2.31

Flexible Ramp Requirement Input Polynomials

5 & 15 min. polynomial coefficients for both low/high for Mosaic, wind, solar, and demand forecast by WEIM entity/area

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ATLAS REFERENCE REPORT DEFINITION PRICES TRANSMISSION SYSTEM DEMAND ENERGY ANCILLARY SERVICES

Date: 09/02/2022 Market/Process: RTD BAA Group: [ALL] Apply Reset

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Flexible Ramp Requirement Input Polynomials

Market Opr Date Balancing Authority Area Group Ramp Type

No Data found

HE01 HE02

A Value B Value C Value A Value B Value C Value



Date: 09/02/2022 Market/Process: RTD BAA Group: [ALL] Apply Reset

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Flexible Ramp Requirements Input Uncertainty Histograms

1 - 20 of 328

Market	Opr Date	Balancing Authority Area Group	Ramp Type	Percentile	Data Type	Interval	HE01	HE02	HE03	HE04
RTD	09/02/2022		UP	HIGH	DEMAND	1	32.95	0.00	0.00	0.00
RTD	09/02/2022		UP	HIGH	NET-DEMAND	1	32.95	0.00	0.00	0.00
RTD	09/02/2022		UP	HIGH	SOLAR	1	0.00	0.00	0.00	0.00
RTD	09/02/2022		UP	HIGH	WIND	1	0.00	0.00	0.00	0.00
RTD	09/02/2022		UP	LOW	DEMAND	1	0.00	0.00	0.00	0.00
RTD	09/02/2022		UP	LOW	NET-DEMAND	1	0.00	0.00	0.00	0.00
RTD	09/02/2022		UP	LOW	SOLAR	1	0.00	0.00	0.00	0.00
RTD	09/02/2022		UP	LOW	WIND	1	0.00	0.00	0.00	0.00

Flexible Ramp Requirements Input Uncertainty Histograms

5 & 15 min. uncertainty histogram values for both low/ high percentile for wind, solar, net demand, and demand forecast by WEIM entity/area

California ISO OASIS

ATLAS REFERENCE REPORT DEFINITION PRICES TRANSMISSION SYSTEM DEMAND ENERGY A

Date: 09/02/2022 Market/Process: RTD BAA Group: [ALL] Apply

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Flexible Ramp Requirements Input Uncertainty

Market Opr Date Balancing Authority Area Group Ramp Type Data Type Interval

No Data found

Report Generated: 09/02/2022 21:58:38

- [ALL]
- AVA
- AVRN
- AZPS
- BAA-TEST
- BANC
- BANCSMUD
- BCHA
- BPAT
- CISO
- EIM_AREA
- EPE

New OASIS Reports Accessible From Prices Menu



California ISO | OASIS

ATLAS REFERENCE REPORT DEFINITION PRICES TRANSMISSION SYSTEM DEMAND ENERGY ANCILLARY SERVICES CONGESTION

Welcome to the California ISO OASIS site. On OASIS you will find real-time data and its Market, such as system status, market prices and market clearing results.

Standards Information
North American Energy Standards Board (NAESB)
ISO Business Practice Manuals
Available Transfer Capability Information


Transmission Information
Base Case Data
Interconnection Study Statistics

Energy Prices ▶
Shadow Prices ▶
Ancillary Services Prices ▶
Index Prices ▶
Market Power Mitigation ▶

Nomogram/Branch Shadow Prices
Intertie Constraint Shadow Prices
Interval Intertie Constraint Shadow Prices
Interval Nomogram/Branch Shadow Prices
Nodal Group Constraints
Flexible Ramping Constraint Results
Contingency Dispatch Intertie Constraint Shadow Prices
Contingency Dispatch Nomogram/Branch Shadow Prices
EIM Green House Gas (GHG) Shadow Prices
Scheduling Constraint Shadow Prices
Flexible Ramping Constraint Shadow Prices
Flexible Ramping Scheduling Constraint Shadow Prices
Aggregate Capability Constraint Shadow Prices

Existing report

New reports



ATLAS REFERENCE REPORT DEFINITION PRICES TRANSMISSION SYSTEM DEMAND ENERGY ANCILLARY SERVICES CONGESTION REVENUE RIGHTS PUBLIC BIDS

Date: 09/06/2022 Market: RTD Time Period: CURRENT BAA Group: [ALL] Apply Reset

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Flexible Ramping Constraint Results

Balancing Authority Area Group	Market	Hour Ending	Market Run Date Time	Market Interval Start Date Time	HE	Ramp Up Capacity (MW)	Ramp Up Shadow Price (\$)	Ramp Down Capacity (MW)	Ramp Down Shadow Price (\$)
	RTD	16	09/06/2022 15:10:00	09/06/2022 15:10	16	30.66000	0.00000	34.77000	0.00000
	RTD	16	09/06/2022 15:10:00	09/06/2022 15:10	16	36.46000	0.00000	46.23000	0.00000
	RTD	16	09/06/2022 15:10:00	09/06/2022 15:10	16	72.97000	0.00000	77.25000	0.00000
	RTD	16	09/06/2022 15:10:00	09/06/2022 15:10	16	100.00000	0.00000		
	RTD	16	09/06/2022 15:10:00	09/06/2022 15:10	16	8.70000	0.00000		
	RTD	16	09/06/2022 15:10:00	09/06/2022 15:10	16	12.95000	0.00000		
	RTD	16	09/06/2022 15:10:00	09/06/2022 15:10	16	0.00000	0.00000		
	RTD	16	09/06/2022 15:10:00	09/06/2022 15:10	16	0.00000	0.00000		



Flexible Ramping Constraint Results (Existing Report)

FRU/FRD shadow price and requirement for BAAs that fail the RSE and for the FRU/FRD passing group calculated by market runs



ATLAS REFERENCE REPORT DEFINITION PRICES TRANSMISSION SYSTEM DEMAND ENERGY ANCILLARY SERVICES

Date: 09/06/2022 Market: RTD Time Period: CURRENT BAA Group: [ALL]

Download XML Download CSV

Flexible Ramping Constraint Results

No Data found

- AVA
- AVRN
- AZPS
- BAA-TEST
- BANC
- BANCSMUD
- BCHA
- BPAT
- CISO
- FIM AREA



ATLAS REFERENCE REPORT DEFINITION **PRICES** TRANSMISSION SYSTEM DEMAND ENERGY ANCILLARY SERVICES CONGESTION REVE

Date: 09/04/2022 Market: RTD Constraint Name [ALL] Apply

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Flexible Ramping Constraint Shadow Prices

1 - 20 of 28

Market	Opr Date	Constraint Name	Direction	Ramp Type	Interval	HE01	HE02	HE03	HE04	HE05	HE06	HE07
RTD	09/04/2022			FRU	4							0.00000
RTD	09/04/2022			FRU	5							0.00000
RTD	09/04/2022			FRU	6							0.00000
RTD	09/04/2022			FRU	1	-37.46524	-42.37288	-311.54809				
RTD	09/04/2022			FRU	2	-37.46524		-447.61322				
RTD	09/04/2022			FRU	3	-83.11475		-600.00000				
RTD	09/04/2022			FRU	4	-389.86486	-206.63533	-446.53884				

Flexible Ramping Constraint Shadow Prices

ATLAS REFERENCE REPORT DEFINITION **PRICES** TRANSMISSION SYSTEM DEMAND ENERGY ANCILLARY SERVICES CONGESTION

Date: 09/06/2022 Market: RTD Constraint Name [ALL] Apply

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Flexible Ramping Constraint Shadow Prices

1 - 20 of 28

Market Opr Date Constraint Name Direction Ramp

No Data found

Report Generated: 09/06/2022 22:39:53

- 22040_BARRETT_69.0_22104_CAMERON_69.0_BR_1_1
- 22192_DOUBLTTP_138_22300_FRIARS_138_BR_1_1
- 22192_DOUBLTTP_138_22648_PENSQTOS_138_BR_1_1
- 22300_FRIARS_138_22500_MISSION_138_BR_1_1
- 22356_IMPRLVLY_230_21025_ELCENTRO_230_BR_1_1
- 22357_IV PFC1_230_22358_IV PFC_230_PS_1
- 22831_SYCAMORE_138_22124_CHCARITA_138_BR_1_1
- 30005_ROUND MT_500_30015_TABLE MT_500_BR_2_2
- 30060_MIDWAY_500_24156_VINCENT_500_BR_2_3
- 30105_COTTNWD_230_30245_ROUND MT_230_BR_3_1
- 30500_BELLOTA_230_30515_WARNERVL_230_BR_1_1

Transmission constraint shadow prices for FRU/FRD deployment scenarios in RTPD/RTD



Date: 09/06/2022 Market: RTD Constraint Type: [ALL] Apply Reset

Download XML Download CSV

Flexible Ramping Scheduling Constraint Shadow Prices

Market	Opr Date	Scheduling Constraint Name	Constraint Type	Direction	Ramp Type	Interval	HE01	HE02	HE03
RTD	09/06/2022	BAA POWER BALANCE		UP	1		-1,150.00000	-1,008.00000	-1,008.00000
RTD	09/06/2022	BAA TRANSFER DISTRIBUTION		UP	1		-2,738.65378	-2,134.94824	-2,217.29400
RTD	09/06/2022	BAA TRANSFER UPPER LIMIT		UP	1		0.00000	0.00000	0.00000
RTD	09/06/2022	BAA POWER BALANCE		UP	2		-1,140.00000	-1,008.00000	-1,008.00000
RTD	09/06/2022	BAA TRANSFER DISTRIBUTION		UP	2		-2,692.91535	-2,189.32424	-2,055.26480
RTD	09/06/2022	BAA TRANSFER UPPER LIMIT		UP	2		0.00000	0.00000	0.00000
RTD	09/06/2022	BAA POWER BALANCE		UP	3		-242.26685	-1,007.00000	-1,008.00000
RTD	09/06/2022	BAA TRANSFER DISTRIBUTION		UP	3		-2,087.27045	-2,188.32480	-2,041.92480
RTD	09/06/2022	BAA TRANSFER UPPER LIMIT		UP	3		0.00000	0.00000	0.00000

Flexible Ramping Scheduling Constraint Shadow Prices

Scheduling constraint shadow prices for FRU/FRD deployment scenarios in RTPD/RTD

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Date: 09/06/2022 Market: RTD Constraint Type: [ALL]

Download XML Download CSV

Flexible Ramping Scheduling Constraint S

Market Opr Date Scheduling Constraint Name Constraint Type

No Data found

Report Generated: 09/06/2022 22:46:00

- [ALL]
- BAA POWER BALANCE
- BAA TRANSFER DISTRIBUTION
- BAA TRANSFER LOWER LIMIT
- BAA TRANSFER UPPER LIMIT
- Base Case
- DC TRANSFER DEFINITION
- ETSR LOWER LIMIT
- ETSR TRANSMISSION COST
- ETSR UPPER LIMIT
- ROC_DOWN
- ROC_UP

FRP Settlements Changes

MRI-S

- FRP prices are nodal therefore mechanics for cost allocation pricing will change
- For all WEIM entities that pass either FRU or FRD settlements will derive the total quantity of each category
- For movement award costs associated with BAAs that pass the sufficiency test, those costs will be allocated to the metered demand of all BAAs that belong to the pass group
- For movement award costs associated with BAAs that fail the sufficiency test, those costs will be allocated to the metered demand of the respective BAA
- For the WEIM area host control area ID for flex ramp uncertainty allocations, Settlements shall allocate the costs to the BAAs that pass the sufficiency test based on FRU/FRD categories
- For the uncertainty award cost associated with the BAA that did not pass the sufficiency test, those costs will be allocated to the BAA based on its categories and any residual unallocated balance to the metered demand of that BAA

Changes to Settlements Configuration Guides

The following settlements configuration guides will be impacted:

- BPM CG PC Flexible Ramp Product_5.0
- BPM CG CC 7070 Flexible Ramp Forecasted Movement Settlement_5.3
- BPM CG CC 7071 Flexible Ramp Up Uncertainty Capacity Settlement_5.2
- BPM CG CC 7076 Flexible Ramp Forecast Movement Allocation_5.1
- BPM CG CC 7077 Daily Flexible Ramp Up Uncertainty Award Allocation_5.4
- BPM CG CC 7078 Monthly Flexible Ramp Up Uncertainty Award Allocation_5.1
- BPM CG CC 7081 Flexible Ramp Down Uncertainty Capacity Settlement_5.2
- BPM CG CC 7087 Daily Flexible Ramp Down Uncertainty Award Allocation_5.4
- BPM CG CC 7088 Monthly Flexible Ramp Down Uncertainty Award Allocation_5.1

Questions

Market Simulation

READINESS ACTIVITIES

Setup for Market Simulation Activities

- Market participants should have registered their request to participate in this simulation via the MarketSim@caiso.com mailbox by August 12, 2022
- Users must be provisioned for access in order to participate in Market Simulation
- Attend the Market Simulation calls to stay informed on the timing of activities for this and other Fall 2022 release initiatives

Market Simulation Scenario #1

Scenario Number	Unstructured guided scenario	
1	Description	Demonstrate the variability of locational pricing for FRU/ FRD.
	ISO Actions	N/A
	EIM Market Participant Actions	Market Participants should input economic energy bids to observe results
	ISO Market Participant Actions	N/A
	Expected Outcome	Verify the results in OASIS
	Anticipated Settlement Outcome	Flex Ramp Prices used in settlements will reflect the new locational pricing for FRD
	Expected Settlement Outcome	CC 7070, CC 7071, CC 7076, CC 7077, CC 7078

Market Simulation Scenario #2

Scenario Number	Scenario Execution Trade Date: TBD	
2	Description	Demonstrate the Settlements processing for FRP PASS/FAIL.
	ISO Actions	N/A
	EIM Market Participant Actions	Market Participants should input less than optimal flexible ramping requirements to fail the sufficiency test.
	ISO Market Participant Actions	N/A
	Expected Outcome	FRP Sufficiency test Failed: FRU/FRD is still procured separately for the respective FRU/FRD requirement, but the latter is only reduced by the FRU/FRD demand elasticity in that BAA, without any FRU/FRD credit.
	Anticipated Settlement Outcome	Allocation for both Movement and Uncertainty will be driven by the Pass Group, If a BAA Passes their Sufficiency test, the allocation amount will be a prorated between the BAA over EIM Area (All BAAs that belong to Pass Group). If a BAA Fails their Sufficiency test, the allocation amount will be directly allocated/isolated to the individual BAA.
	Expected Settlement Outcome	CC 7070, CC 7071, CC 7076, CC 7077, CC 7078, PC Flexible Ramp Product

Final Questions



Thank you for your participation!

For more detailed information on anything presented, please
visit our website at:

www.caiso.com

Or send an email to:
CustomerReadiness@caiso.com

REFERENCE MATERIAL

Reference Material

- Business Practice Manual changes:
 - [BPM Change Management](#) – look for changes to Market Instruments and Market Operations BPMs
- Business Requirements Specification:
 - <https://www.caiso.com/Documents/BusinessRequirementsSpecifications12-FlexibleRampingProduct-Deliverability.pdf>
 - <https://www.caiso.com/Documents/BusinessRequirementsSpecifications12-FlexibleRampProduct-RequirementsEnhancements.pdf>
- Initiative webpage:
 - <https://stakeholdercenter.caiso.com/StakeholderInitiatives/Flexible-ramping-product-refinements>

Reference Material

- Market Simulation Structured Scenarios:
 - <https://www.caiso.com/Documents/Market-Simulation-Structured-Scenarios-Flexible-Ramping-Product.pdf>
- Tariff amendment to refine FRP:
 - <https://www.caiso.com/Documents/Aug15-2022-TariffAmendment-FlexibleRampingProductRefinements-ER22-2661.pdf>
- Technical Specifications – located on the [ISO's Developer Site](#) which provides detailed descriptions of the API changes for:
 - OASIS