Business Requirements Specification

Day-Ahead Market Enhancements

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Revision History

Date	Version	Description
7/25/2023	1.0	Initial Document Release.

Disclaimer and Understanding

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1 Introduction

1.1 Purpose

The purpose of this document is to capture and record a description of what the Users and Business Stakeholders of the project wish to obtain, by providing high level business requirements. This document establishes the basis for the agreement between the initiators and implementers of the project. The information in this document serves as input to determine the scope of projects and all Business Process Modeling and System Requirements Specifications efforts.

Business requirements are what must be delivered to provide value for the Users and Business Stakeholders. Systems, software, and processes are the ways (how) to deliver, satisfy or meet the business requirements (what).

The objective of this initiative is to enhance the California ISO's (CAISO's) day-ahead market by: (BOG: May 2023, In production: Fall 2024)

- Introducing an imbalance reserve (IRU/IRD) product to provide flexible capacity to account for real-time ramping needs that are greater than accounted for in hourly day-ahead market schedules and to account for real-time net load uncertainty:
- Enhancing the residual unit commitment process to also ensure there is sufficient downward dispatch capability (RCU/RCD) in the event real-time load is less than scheduled in the integrated forward market.

The CAISO proposes to preserve the sequential integrated forward market and residual unit commitment process (IFM, RUC)

1.2 Conventions

- None

1.3 Scope

High level Impact analysis:

- **Market products IRU/IRD, RCU/RCD:** Suppliers will provide price and quantity bids for capacity availability in both the upward and downward direction that the market will use to award both imbalance reserves (IRU/IRD, 15-minute ramp dispatchable in IFM) and reliability capacity (RCU/RCD, hourly dispatchable in RUC). Set resource eligibility of IRU/IRD, RCU/RCD in MF.
- **IRU/IRD requirement:** An imbalance reserves up and down product to the integrated forward market with a requirement based on historical uncertainty between the day-ahead and real-time markets using quantile regression (Internal ISO System, DAM)

- **Co-optimization IRU/IRD** products with energy and ancillary services to schedule resources (MPM, IFM, SIBR)
    - o Set up IRU/IRD procurement constraints
    - o Apply market power mitigation to IRU in the same manner for energy
    - o An imbalance reserve award will obligate a supplier to provide economic energy bids in the real-time market (RTM, SIBR)
    - o Ensure imbalance reserves are deliverable using IRU/IRD deployment scenario.
    - o Modeling these transmission constraints including IRU/IRD, using same DF as energy of the resource, no incremental transmission losses, have MP for IRU/IRD (MPM,IFM)
    - o Publish IRU/IRD (CMRI, OASIS)
- **Optimize RCU/RCD** products in RUC with energy, IRU/IRD and ancillary services award/schedule from IFM (RUC)
    - o Apply market power mitigation to RCU
    - o RCU/RCD will obligate to provide economic energy bids in the real-time market (RTM, SIBR)
    - o Modeling these transmission constraints , have MP for RCU/RCD (MPM/RUC)
    - o Publish RCU/RCD (CMRI, OASIS)
- Enhance the residual unit commitment (RUC) process to establish the binding configuration for multi-stage generating (MSG) resources. (RUC, CMRI)
- RTM run with IRU/IRD, RCU/RCD awards must offer obligation and price bid cap.

- **Settlement for IRU/IRD, RCU/RCD payment, cost allocation, Unavailability No Pay, BCR and GMC**
    - o Resources awarded IRU/IRD, RCU/RCD will be paid a day-ahead payment at the marginal price for the relevant product.
    - o Ramping provided by imbalance reserve awards and forecasted movement in the day-ahead market will be settled against forecasted movement and flexible ramping product in the real-time market.
    - o Resource economic limit not support IRU/IRD, exclude 5 minute uncertainty, subject to No Pay,
    - o Resource economic limit not support RCU/RCD subject to No Pay
    - o The market will recover the costs of these products through a cost allocation that collects payments from entities based on their contribution to the need to procure the product.
    - o BCR: IRU/IRD for DAM BCR, RCU/RCD for RTM BCR
    - o GMC: GMC market service charge apply to IRU/IRD, RCU/RCD
- **CMRI/OASIS**: report IRU/IRD, RCU/RCD

1.4 Acronym and Terms Definitions

Refer to **Appendix-A – Acronym Definition**

2 Intellectual Property Ownership

Intellectual Property covers a broad array of information and materials, including written works, computer programs, software, business manuals, processes, symbols, logos and other work products. Determining ownership of Intellectual Property is very important in preserving the rights of the California ISO, and helps to avoid Intellectual Property infringement issues. In considering the business requirements or service requirements to be performed, the business owner of the project must determine Intellectual Property Ownership.

2.1 Checklist

All information in this document is the Intellectual Property (copyright, trademark, patent, and/or trade secret) of the California ISO.

3 Details of Business Need/Problem

3.1   Description

Business Opportunity/Problem Statement:	
What:	The objective of this initiative is to enhance the California ISO's (CAISO's) day-ahead market by: ∗ Introducing an imbalance reserve (IRU/IRD) product to provide flexible capacity to account for real-time ramping needs ∗ Enhancing the residual unit commitment process to also ensure there is sufficient downward dispatch capability (RCU/RCD) ∗ Enhancing the day-ahead market to maximize benefits of greater West-wide diversity in the day-ahead optimization for Western Energy Imbalance Market participants
When:	Fall 2024
Why do we have this opportunity/problem:	Imbalance reserves will ensure the day-ahead market schedules sufficient real-time dispatch capability to meet net load imbalances and ramping needs that materialize between the day-ahead and real-time markets. These imbalances have increased in recent years because of increasing amounts of weather- dependent supply and load resources on the CAISO grid.
Who does this opportunity/problem impact:	• Real-Time Operations • MAF • Market Services • Market Participants • Customer Service • Policy • Legal

4 Business Impacts

4.1 Business Practice Manual (BPM)

BPM	Description of Impact(s)
Definitions and Acronyms	*Yes*
Market Instruments	Yes
Market Operations	Yes
Settlements and Billing	Yes

4.2   Other

Impact	Description (optional)
Market Simulation	Yes
Market Participant Impact	Yes
External Bid Publication	*Yes*
User Acceptance Testing (UAT)	*Yes*
Operational Procedures	*Yes*
Customer Readiness Impact	
1. **External Communication Needed**	*Yes*
2. **External Onboarding and Maintenance**	*No*
• **External Training**	*Yes*
• **External Computer Based Training**	*Yes*
Policy Initiative	*Yes*

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5 Business Requirements

The sections below describe the Business processes and the associated business requirements involved in the project. These may represent high-level functional, non-functional, reporting, and/or infrastructure requirements. These business requirements directly relate to the high-level scope items determined for the project.

5.1 Business Process: Resource Management (Master File)

- Define Resource IRU and IRD eligibility
- Define Resource RCU and RCD eligibility
- Define and Consume IR and RC DAB Ranking Options
- Define and Retrieve LSE RA True-Up Flag (retrieve via CIDI)

5.1.1 Business Requirements

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted

DAME-BRQ-01000	**Define Imbalance Reserve Up (IRU) and Imbalance Reserve Down (IRD) eligibility for the resource in DAM**:
	
	 - Define resource and intertie eligibility for Imbalance reserve product (IR):
	    o Separate flag for upper (IRU), down (IRD) for all upper eligible registered resources
	    o Register max quantity (MW) for IRU and IRD, *calculated based on 30-minute ramp, capped by Pmax/Pmin*
	    o For NGR, the IRU eligibility and max quantity are limited to positive (discharging) range, and the IRD eligibility and max quantity are limited to the negative (charging) range.
	
	 - Pass the IRU, IRD flags and MW to the downstream systems
	
	 Note:
	
	 Res provide the capacity product must register in MF
	
	 The IRU/IRD eligibility flags and corresponding MW quantities should be added to GRDT as read-only.
		Core	Master File
			
			 RDT

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	Note: • Refer to **Resource Eligibility Table** in **Appendix-B: Formulas, Calculation Details, and Examples**		

DAME-BRQ-01010	**Define Reliability Capacity Up (RCU) and Reliability Capacity Down (RCD) eligibility:**
	
	• Define physical market resource eligibility for Reliability Capacity (RC):
	   ○ Separate flag for upper (RCU), down (RCD)
	   ○ Register max quantity for RCU and RCD, calculated based on 60-minute ramp, capped by Pmax
	   ○ For NGR, the RCU eligibility and max quantity are limited to positive (discharging) range, and the RCD eligibility and max quantity are limited to the negative (charging) range
	• Pass the RCU, RCD flags and MW to the downstream systems
	
	Note: *The RCU/RCD eligibility flags and corresponding MW quantities should be added to GRDT as read-only*
	
	Note:
	
	• Resources/MSG configurations will only get awarded RCU or RCD, not both.
	
	• Refer to **Resource Eligibility Table** in **Appendix-B: Formulas, Calculation Details, and Examples**
		Core	Master File
			
			RDT

DAME-BRQ-01040	**Define IR and RC DAB Ranking Options**
	
	• System shall define the following <u>separate</u> resource-specific fields, for all resources, including NGRs:
	   ○ IRU DAB Options Ranking
	   ○ IRD DAB Options Ranking
	   ○ RCU DAB Options Ranking
	   ○ RCD DAB Options Ranking
	• Supported possible numeric rankings are for:
	   ○ Null (for IR/RC non-eligible resources)
	   ○ (1 or 2) Calculated (for IR/RC eligible resources)
		Core	• MF

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	o (1 or 2) Negotiated Rate (for IR/RC eligible resources)		
DAME-BRQ-01060	**Consume IR and RC DAB Ranking Options from Resources' SCs** • System shall consume the following separate resource-specific fields from resources' SCs, respectively, for all resources, including NGRs: o IRU DAB Options Ranking o IRD DAB Options Ranking o RCU DAB Options Ranking o RCD DAB Options Ranking • Supported possible numeric rankings are for: o Null (for IR/RC non-eligible resources) o (1 or 2) Calculated (for IR/RC eligible resources) o (1 or 2) Negotiated Rate (for IR/RC eligible resources) **Notes** • If Negotiated Rate Option is ranked as 1, but no Negotiated Rate process was in place, CAISO will revert to the next ranking option, which is the Calculated option. • For the first year from Go-Live, the Negotiated Rate option for IRU/IRD and RCU/RCD will not be supported, until CAISO gains more operational experience with associated bid and costs. • Rankings should be consistent across up and down products; i.e. if Calculated is ranked 1 for IRU, it should also be ranked 1 for IRD.	Core	• MF • RDT
DAME-BRQ-01080	**Default IR and RC DAB Ranking Options** System shall use the following default numeric values for resource-specific IRU/IRD and RCU/RCD DAB Options Ranking, for all resources, including NGRs: • Null (for non-eligible resources) • (1) Calculated (for eligible resources) • (2) Negotiated Rate (for eligible resources)	Core	• MF
DAME-BRQ-01100	**Define LSE RA True-Up Flag** • System shall define the following LSE-specific fields: o LSE RA True-Up Flag • Supported possible values are: o Opt-In o Opt-Out • Default values for first implementation shall be set to:	Core	• MF

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	o Opt-Out **Notes** • This flag is used for LSE RA true-up settlements to compensate LSEs for IRU/IRD and RCU/RCD awards that overlap with RA capacity with IRU/IRD awards for transitional three years period starting from Go-Live.		
DAME-BRQ-01120	**Consume LSE RA True-Up Flag from LSE' SCs** • System shall consume the following LSE-specific fields from LSE' SCs: o LSE RA True-Up Flag. • System shall support the capability for LSEs's SCs to Opt-in for one time within 30-days of Go-Live. After 30-days of Go-Live, no changes shall be made to this flag. • After 3-years from Go-Live, System shall set this flag to always Opt-Out for all LSEs. Implementation **Note** • LSE SCs shall use CIDI to send this data to ISO for being entered by MCI users in MF.	Core	• MF • CIDI

5.2 Business Process: Manage the Balancing Authority Requirements Calculator

For IRU/IRD requirement forecast parameters estimation use quantile regression model:

- Calculate (DA-RTPD) forecast up/down extreme variation

- Calculate the second-order polynomial coefficients of the High/Low Percentile quadratic quantile regression for uncertainty of demand, solar, wind and MOSAIC

- Calculate High/Low Percentile forecast uncertainty histogram for Load, wind, Solar, net load *and maximum boundary for IRU/IRD*

- *Calculate IRU/IRD demand price curve*

5.2.1 Business Requirements

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
DAME-BRQ-02000	**General statement:** Extend FRP requirements forecast quantile regression model to Imbalance Reserve requirement forecast and demand price curve The system stores the historical data and estimate the parameters of the statistic forecast model.	Process	Internal ISO System

DAME-BRQ-02010	**Set the configurable parameters for the quantile regression for IR**
	
	The system shall have a set of system-wide **configurable** initialization parameters (separate set for FRP and IR) for Imbalance Requirement (IR) :
	
	    o the High Percentile, initially set to 97.5% (0.975)
	
	    o the Low Percentile, initially set to 2.5% (0.025)
	
	    o for the High Percentile Threshold, initially set to 99% (0.99)
	
	    o the Low Percentile Threshold, initially set to 1% (0.01)
	
	    o the Data Retention Period, initially set to 365 days Configurable parameter to select Sampling Scheme:
	
	        o Rolling sampling (current)
		Core	Internal ISO System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	○ Symmetrical sampling (backward/forward) for matching day and month (default option) ○ Set configurable sample days (if Symmetrical sampling option is selected, default this parameter to 90 days backward and 90 days forward) ○ Use the same definition for Day Type as for FRP for Weekday or Weekend/Holiday, similar to FRP functionality where holidays/weekend definitions are in MF.		
DAME-BRQ-02012	**Access EDAM BAAs** • Access DAM BAA definition from MF • Access the EDAM_AREA definition from MF	Core	Internal ISO System (from MF)
DAME-BRQ-02020	**Consume and store the trading day DAM forecast data of demand(d) /solar(s)/wind(w) for each BAA and aggregate for the entire DAM area** At the end of each DAM, the system shall consume the following data for each Trading Hour in that Trading Day for each BAA in the DAM Area and then aggregate for the entire DAM Area: • DAM binding total demand forecast(d) • DAM binding total solar forecast(s) for each 60min interval • DAM binding total wind forecast(w) for each 60min interval The system shall store this hourly forecast for demand/solar/wind for the Data Retention Period by BAA and entire DAM Area, Trading Day, Day Type, Trading Hour and market DAM. **Notes** • lowercase (d, s, w) is for independent forecast data • uppercase (D,S,W) is the dependent uncertainty data • Refer to **DAME-BRQ-02010** for data retention business requirement.	Core	Internal ISO System (from IFM)

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
DAME-BRQ-02030	**Consume and store the demand(d)/solar(s)/wind(w) trading day RTPD forecast data** At the end of each Trading Day, the system shall consume the following data for each Trading Hour in that Trading Day for each BAA in the DAM area and for the entire DAM area: • FMM binding demand forecast for each 15 min interval • FMM binding solar forecast for each 15 min interval • FMM binding wind forecast for each 15 min interval The system shall store this information for the Data Retention Period by Trading Day, Day Type, Trading Hour, and DAM/FMM Trading Interval.	**Existing System Functionality**	Internal ISO System
DAME-BRQ-02040	**Calculate and store uncertainty as hourly maximum and minimum differences (two samples) between RTPD and DAM for the demand/solar/wind binding forecasts** After each Trading Day, the system shall calculate the uncertainty for each 60min period of each Trading Hour in that Trading Day, for each BAA in the DAM Area, for the entire DAM Area: • the algebraic difference between the *maximum/minimum* **demand** forecast of the four binding 15 minute RTPD intervals in that 60min period and the corresponding DAM hourly forecast in that 60min period • the algebraic difference between the *maximum/minimum* **solar** forecast of the four binding 15 minute RTPD intervals in that 60min period and the corresponding DAM hourly forecast in that 60min period • the algebraic difference between the *maximum/minimum* **wind** forecast of the four binding 15 minute RTPD intervals in that 60min period and the corresponding DAM hourly forecast in that 60min period • The system shall store hourly maximum and minimum difference values of demand, solar and wind for the Data Retention Period by Trading Day, Day Type, Trading Hour of DAM horizon.	Core	Internal ISO System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
DAME-BRQ-02050	**Manage rolling day of retention period for DAM:** The system shall roll the Data Retention Period at the end of each Trading Day by one Trading Day, deleting the data for the first Trading Day in the Data Retention Period.	Core	Internal ISO System
DAME-BRQ-02060	**Retrieve the total maximum capacity of solar/wind for each BAA and aggregate for the entire DAM area** After rolling the Data Retention Period, the system shall • Retrieve the maximum capacity of VER resources by solar/wind at any given Trading Day for each BAA and then aggregate for the entire DAM Area. • Store this information for the Data Retention Period by Trading Day and Day Type.	Existing	Internal ISO System (from MF)
DAME-BRQ-02070	**Adjust solar/wind forecast and uncertainty for each day in retention period:** After rolling the Data Retention Period, For each trading day in the Data Retention Period for the Day Type of the next Trading Day, for each BAA and DAM Area system shall calculate • The solar/wind capacity factor as the ratio of the total solar/wind capacity in the next Trading Day over the total solar/wind capacity in the Trading Day in the Data Retention Period. • Adjust the solar/wind forecast and uncertainty data by multiplying the data with the solar/wind capacity factor of the Trading Day in the Data Retention Period.	Core	Internal ISO System
DAME-BRQ-02080	**Calculate and store net demand uncertainty as maximum/minimum net demand difference between RTPD and DAM for retention period** After rolling the Data Retention Period, For each Trading Hour in each Trading Day in the Data Retention Period for the Day Type of the next Trading Day, for each BAA and the DAM Area	Core	Internal ISO System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	• Calculate the net demand forecast (nd) as the demand forecast minus the adjusted solar forecast minus the adjusted wind forecast for each hour in DAM and each binding 15 minute intervals in RTPD • Calculate the hourly net demand forecast uncertainty (ND) as the algebraic difference between the *maximum/minimum* net demand forecast of the 4 binding RTPD intervals and DAM in the corresponding hour (two samples).		
DAME-BRQ-02090	**Calculate and store the Hourly High/lower percentile of histogram(H) for uncertainty of Demand(D) /Solar(S) /Wind(W) /Net demand(ND)** After rolling the Data Retention Period, for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA and DAM Area Calculate and store: • the High/Low Percentile demand forecast uncertainty histogram ($D_{60}^{H97.5}$) /($D_{60}^{H2.5}$) • the High/Low Percentile adjusted solar forecast uncertainty histogram ($S_{60}^{H97.5}$) /($S_{60}^{H2.5}$) • the High/Low Percentile adjusted wind forecast uncertainty histogram ($W_{60}^{H97.5}$) /($W_{60}^{H2.5}$) • the High/Low Percentile net demand forecast uncertainty histogram ($ND_{60}^{H97.5}$) /($ND_{60}^{H2.5}$)	Core	Internal ISO System
DAME-BRQ-02100	**Calculate and store the hourly second-order polynomial coefficients of the High /Low Percentile quadratic quantile regression for uncertainty of Demand(D)/Solar(S)/Wind(W)** After rolling the Data Retention Period, for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA and DAM Area Calculate and store the second-order polynomial coefficients of the High/low Percentile quadratic quantile regression of uncertainty of forecast of:	Core	Internal ISO System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	• Demand: $(A_{60}^{D97.5}, B_{60}^{D97.5}, C_{60}^{D97.5})/(A_{60}^{D2.5}, B_{60}^{D2.5}, C_{60}^{D2.5})$ through regression $$D_{60}^{P97.5}(d) \equiv A_{60}^{D97.5}\, d^2 + B_{60}^{D97.5}\, d + C_{60}^{D97.5}$$ $$D_{60}^{P2.5}(d) \equiv A_{60}^{D2.5}\, d^2 + B_{60}^{D2.5}\, d + C_{60}^{D2.5}$$ • Solar: $(A_{60}^{S97.5}, B_{60}^{S97.5}, C_{60}^{S97.5})/(A_{60}^{S2.5}, B_{60}^{S2.5}, C_{60}^{S2.5})$ through regression $$S_{60}^{P97.5}(s) \equiv A_{60}^{S97.5}\, s^2 + B_{60}^{S97.5}\, s + C_{60}^{S97.5}$$ $$S_{60}^{P2.5}(s) \equiv A_{60}^{S2.5}\, s^2 + B_{60}^{S2.5}\, s + C_{60}^{S2.5}$$ • Wind: $(A_{60}^{W97.5}, B_{60}^{W97.5}, C_{60}^{W97.5})/(A_{60}^{W2.5}, B_{60}^{W2.5}, C_{60}^{W2.5})$ through regression $$W_{60}^{P97.5}(w) \equiv A_{60}^{W97.5}\, w^2 + B_{60}^{W97.5}\, w + C_{60}^{W97.5}$$ $$W_{60}^{P2.5}(w) \equiv A_{60}^{W2.5}\, w^2 + B_{60}^{W2.5}\, w + C_{60}^{W2.5}$$ *Note:* *lowercase (d, s, w) is for independent variables for forecasts* *uppercase (D,S,W) is the dependent variables for calculated uncertainty data, difference between DAM and RTPD* *to estimate A,B,C, use historical forecast and uncertainty data (historical uncertainty data will have 2 samples for each hour with max/min)* *2 samples of uncertainty will be used in both high/low percentile regression, meaning same sample set for High/low percentile parameter estimation.*		
DAME-BRQ-02110	**Construct input of mosaic for high/low percentile mosaic regression** After rolling the Data Retention Period, for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA and DAM Area	Core	Internal ISO System

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ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	Based on Histogram and quadratic Quantile Regression estimates uncertainty of load, wind, and solar *Calculate:* ○ *Input (m=uncertainty of net load) for High percentile mosaic regression:* $m_{60}^{P97.5}(nd, d, s, w)$ $\equiv ND_{60}^{H97.5} - \left(D_{60}^{H97.5} - S_{60}^{H2.5} - W_{60}^{H2.5}\right) + (D_{60}^{P97.5}(d)$ $- S_{60}^{P2.5}(s) - W_{60}^{P2.5}(w))$ ○ *Input (m) for Low percentile mosaic regression:* $m_{60}^{P2.5}(nd, d, s, w)$ $\equiv ND_{60}^{H2.5} - (D_{60}^{H2.5} - S_{60}^{H97.5} - W_{60}^{H97.5}) + (D_{60}^{P2.5}(d)$ $- S_{60}^{P97.5}(s) - W_{60}^{P97.5}(w))$ Note: *There will be 2 samples of variable m created for each hour.*		
DAME-BRQ-02120	**Calculate and store the hourly second-order polynomial coefficients of the High /Low Percentile quadratic quantile regression for mosaic (M)** After rolling the Data Retention Period, for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA and DAM Area Calculate and store the second-order polynomial coefficients of the High/low Percentile quadratic quantile regression of uncertainty of forecast of: • Mosaic (Net Demand): $(A_{60}^{M97.5}, B_{60}^{M97.5}, C_{60}^{M97.5})/(A_{60}^{M2.5}, B_{60}^{M2.5}, C_{60}^{M2.5})$ through regression $M_{60}^{P97.5}(m) \equiv A_{60}^{M97.5} m^2 + B_{60}^{M97.5} m + C_{60}^{M97.5}$ $M_{60}^{P2.5}(m) \equiv A_{60}^{M2.5} m^2 + B_{60}^{M2.5} m + C_{60}^{M2.5}$ *Note:*	Core	Internal ISO System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	In Quantile regression for Mosaic • *m include* $m_{60}^{P97.5}$ *and* $m_{60}^{P2.5}$ *for each hour calculated for historical data according to BRQ1110* • *M include calculation of Net Load uncertainty max/min for historical data according to BRQ1080* • *2 samples of m and 2 samples of M will be used in both high/low percentile regression for parameter A,B,C estimation for M*		
DAME-BRQ-02130	**Calculate High/low percentile threshold for uncertainty of net demand (ND)** After rolling the Data Retention Period, the system shall calculate and store the hourly High/low Percentile Threshold net demand forecast uncertainty histogram (ND_{60}^{H99})/ (ND_{60}^{H1}) for each Trading Hour in the Data Retention Period for the Day Type of the next Trading Day, for each BAA and DAM Area.	Core	Internal ISO System

DAME-BRQ-02140	**By 6:00am of DAM each Trading Day, the system shall broadcast the following hourly data**
	
	 For each Trading Hour in the next Trading Day for the Day Type of that Trading Day, for each BAA and DAM Area:
	
	 • the High/low Percentile hourly forecast uncertainty histogram for:
	
	 • net demand: $(ND_{60}^{H97.5})$/$(ND_{60}^{H2.5})$
	
	 • demand: $(D_{60}^{H97.5})$/$(D_{60}^{H2.5})$
	
	 • adjusted solar: $(S_{60}^{H97.5})$/$(S_{60}^{H2.5})$
	
	 • adjusted wind: $(W_{60}^{H97.5})$/$(W_{60}^{H2.5})$
	
	 • the second-order polynomial coefficients of the High/low Percentile quadratic quantile regression of hourly forecast uncertainty
	
	     ○ demand: $(A_{60}^{D97.5}, B_{60}^{D97.5}, C_{60}^{D97.5})$ /$(A_{60}^{D2.5}, B_{60}^{D2.5}, C_{60}^{D2.5})$
	
	     ○ Solar: $(A_{60}^{S97.5}, B_{60}^{S97.5}, C_{60}^{S97.5})$ /$(A_{60}^{S2.5}, B_{60}^{S2.5}, C_{60}^{S2.5})$
	
	     ○ Wind: $(A_{60}^{W97.5}, B_{60}^{W97.5}, C_{60}^{W97.5})$ /$(A_{60}^{W2.5}, B_{60}^{W2.5}, C_{60}^{W2.5})$
	
	     ○ Mosaic (net load) $(A_{60}^{M97.5}, B_{60}^{M97.5}, C_{60}^{M97.5})$ /$(A_{60}^{M2.5}, B_{60}^{M2.5}, C_{60}^{M2.5})$
		Core	Internal ISO System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	• the hourly High/low Percentile Threshold forecast uncertainty histogram ○ net demand (ND_{60}^{H99})/ (ND_{60}^{H1}) Note: Market DAM will consume data to forecast the IRU and IRD requirements (IRUR/IRDR). CMRI or OASIS will report the data		

DAME-BRQ-02150	**Set, Store and broadcast threshold IRU/IRD requirements:**
	
	• Set and store configurable threshold to allow settings of the max/min IRU/IRD requirement for each BAA and DAM_AREA. If the threshold value is not provided, then 9999/0 is assumed.
	
	• Broadcast max/min IRU/IRD requirement thresholds
	
	    $(IRUR_{60}^{max})$/$(IRUR_{60}^{min})$; $IRDR_{60}^{max}$/$(IRDR_{60}^{min})$
	
	    for each BAA and DAM area
	
	Note:
	
	• The threshold value will be used by DAM to cap the IRU/IRD requirement.
	
	• The threshold values should be positive.
		Core	Internal ISO System

DAME-BRQ-02300	**Set configurable IRU and IRD price cap for the DAM** Set configurable parameters for capping IRU and IRD demand curve respectively apply to every BAA. These parameters are subject to be scaled just like other penalty prices. Default parameters for • IRU price cap is $55 • IRD price cap is $55	Core	Internal ISO System
DAME-BRQ-02310	**Consume DAM hourly forecast for demand, solar and wind for each BAA after 9 am** Consume the hourly demand, solar and wind forecast for DAM time horizon, aggregated for each BAA.	Core	Internal ISO System (from IFM [Pre-DAM])

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
DAME-BRQ-02320	**Calculate hourly demand price curve for IRU and IRD for each BAA using latest forecast following the completion of [IFM pre-DAM] run, with avoidance cost of $247 for IRU and -$150 for IRD, and an administration cap of $55 for both IRU/IRD** AT 10 am, calculate hourly demand price curve for IRU/IRD by BAA based on the latest hourly forecast data: Monotonically decreasing stepwise price curve with N segments. Equidistant percentile selection from P_0 to $P_N^{(-)}$ (0.025) and from P_0 to $P_N^{(+)}$ (0.975): $\left\{P_n^{(-)} = P_{n-1}^{(-)} - \frac{P_0 - P_N^{(-)}}{N}, n = 1,2,\dots,N\right\}$ and $\left\{P_n^{(+)} = P_{n-1}^{(+)} + \frac{P_N^{(+)} - P_0}{N}, n = 1,2,\dots,N\right\}$, where $P_0 = P_0^{(-)} = P_0^{(+)}$. The price curve quantities are the quantiles of the selected percentiles: $Q\left(P_0 = P_0^{(-)} = P_0^{(+)}\right) \equiv 0, \left\{Q\left(P_n^{(-)}\right), n = 1,2,\dots,N\right\}$, and $\left\{Q\left(P_n^{(+)}\right), n = 1,2,\dots,N\right\}$. These can be determined from the MOSAIC polynomial evaluation grid via linear interpolation. The price curve segment prices are the products of the probability of uncertainty materializing beyond the start of each segment and the relevant energy price cap: $\left\{P_n^{(-)} ENPF, n = 0,1,\dots,N-1\right\}$ and $\left\{\left(1 - P_n^{(+)}\right) ENPC, n = 0,1,\dots,N-1\right\}$, where $ENPF$ is the avoidance cost floor ($-$150/MWh) and $ENPC$ is the avoidance cost ceiling [$247 for IRU and -$150 for IRD]). • For IRU demand price curve for each hour interval for each BAA in the EDAM Area:	Core	Internal ISO System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	$\left\{ \begin{array}{c} Q\left(P_n^{(+)}\right), \left(1 - P_n^{(+)}\right) ENPC, \\ n = 0, 1, 2, \ldots, N-1 \end{array} \right\}$ Where: N is the Price Curve Segment Count $ENPC$ is the avoidance cost ceiling P_0 is the percentile with zero quantile P_N^+ is the high percentile $Q\left(P_n^{(+)}\right) = A_{60}^{MP_n^+} \left(M_{60}^{PP_n^+}\right)^2 + B_{60}^{MP_n^+} M_{60}^{PP_n^+} + C_{60}^{MP_n^+}$ Where: $M_{60}^{PP_n^+} \equiv ND_{60}^{HP_n^+} - \left(D_{60}^{HP_n^+} - S_{60}^{H\left(1-P_n^+\right)} - W_{60}^{H\left(1-P_n^+\right)}\right) +$ $\left(D_{60}^{PP_n^+}(d) - S_{60}^{P\left(1-P_n^+\right)}(s) - W_{60}^{P\left(1-P_n^+\right)}(w)\right)$ • For IRD demand price curve for each hour interval for each BAA in the EDAM Area: $\left\{ \begin{array}{c} Q\left(P_n^{(-)}\right), P_n^{(-)} ENPF, \\ n = 0, 1, 2, \ldots, N-1 \end{array} \right\}$ Where: ENPF is the avoidance cost floor P_0 is the percentile with zero quantile $P_N^{(-)}$ is the low percentile • no steps of the demand curve will exceed the administrative ceiling of \$55/MWh for the imbalance reserve product Note $d -$ latest demand forecast for each BAA $w -$ latest wind forecast for each BAA $s -$ latest solar forecast for each BAA		

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
DAME-BRQ-02340	**Broadcast IRU and IRD demand price curve before 10 am** Broadcast demand price curve for • IRU each hour each EDAM BAA for the DAM horizon before 10 am $$\left\{ \begin{array}{c} Q\left(P_n^{(+)}\right), \left(1 - P_n^{(+)}\right) ENPC, \\ n = 0, 1, 2, \ldots, N-1 \end{array} \right\}$$ • IRD each hour each EDAM BAA for the DAM horizon before 10 am $$\left\{ \begin{array}{c} Q\left(P_n^{(-)}\right), P_n^{(-)} ENPF, \\ n = 0, 1, 2, \ldots, N-1 \end{array} \right\}$$	Core	Internal ISO System

5.3 Business Process: Calculate & Monitor Energy Costs & Indices

- Setting IR/RC DAB for Calculated Ranking Option

- Negotiated Rate IR/RC DAB (NDAB)

- Setting IR/RC DAB for Negotiated Option (NDAB)

5.3.1 Business Requirements

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
DAME-BRQ-03040	**Setting IR/RC DAB for Calculated Ranking Option** • For resources (including NGRs) that have market product DAB Options Ranking set to "Calculated" as first option, System shall automatically set the DAB for these resources for that market product to a configurable values (initially set as below): 	Market Product	DAB
---	---
IRU	$55/MWh
IRD	$55/MWh
RCU	$55/MWh
RCD	$55/MWh | • There shall be separate DAB for IRU, IRD, RCU and RCD. • The IRU/IRD and RCU/RCD DAB shall have single segment. • The x-axis of all DABs shall be set to the entire Registered MW Capacity of the eligible resource, specifically calculated as: o Registered Max Capacity (Pmax) minus Registered Min Capacity (Pmin). • The IRU/IRD and RCU/RCD DAB shall be resource-specific daily granularity.	Core	• Internal ISO System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	• The DAB value shall be applied to all the EDAM resources, include CASIO and EDAM BAAs. **Note:** • The resource-specific daily DAB for IRU and RCU market products are needed for market power mitigation of IRU and RCU bids, respectively, as well as IRU and RCU bid insertion/creation in SIBR, respectively. • The resource-specific daily DAB for IRD and RCD market products are needed for IRD and RCD bid insertion/creation in SIBR, respectively. • Registered Pmin is negative for NGRs.		
DAME-BRQ-03060	**Negotiated Rate IR/RC DAB (NDAB)** System shall process IRU, IRD, RCU, and RCD DAB if their resources elect Negotiated Rate DAB (NDAB) (for IRU, IRD, RCU, and RCD, respectively) as rank "1". **Note:** • Resources' SCs shall be responsible of negotiating the IRU/IRD and RCU/RCD NDAB if that option is applicable and will initiate the negotiation process. • For the first year from Go-Live, the Negotiated Rate option for IRU/IRD and RCU/RCD will not be supported, until CAISO gains more operational experience with associated bid and costs.	Core	• Internal ISO System
DAME-BRQ-03080	**Setting IR/RC DAB for Negotiated Option (NDAB)** For resources (including NGRs) that have market product DAB Options Ranking set to "Negotiated" as first option, System shall automatically set the NDAB for these resources based on the value or formulation that was negotiated with the SC. • There shall be separate NDAB for IRU, IRD, RCU and RCD. • The IRU/IRD and RCU/RCD NDAB shall have single segment. • The IRU/IRD and RCU/RCD NDAB shall be resource-specific daily granularity.	Core	• Internal ISO System

5.4 Business Process: Manage DAM – IFM

- Setup the configurable set of transmission constraints activate in IRU/IRD deployment scenarios

- Set up the configurable parameter for specify the IRU/IRD deployment scenarios percentage of contribution towards the transmission constraint

- Accept and validate IRU/IRD bids, MOO apply to Flex RA

- Accept and validate RCU/RCD bids, MOO apply to RA

- Consume hourly Histogram and second-order polynomial coefficients for IRU/IRD

- Calculate 6&9 am hourly IRU/IRD requirements

- Set IRU demand price curve

- Distribute IRUR/IRDR to load and VER nodes

- Include IRU/IRD deployment scenarios, use same SF as case cases

- Apply LMPM for energy bid by Including IRU and IRD deployment scenario in DCPA counter flow calculation and Energy LMP calculation

- Apply LMPM for IRU bid by including IRU deployment scenario in DCPA counter flow calculation and IRU nodal price calculation
- Procure IRU/IRD through co-optimization with energy and AS
- Calculate LMP for energy and IRU/IRD

5.4.1 Business Requirements

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted

DAME-BRQ-04004	**Specify the set of transmission constraints for IRU/IRD deployment scenarios**
	
	- Setup the configurable set of transmission constraints activate in IRU or IRD deployment scenarios
	    o By individual constraint: enable or disable the constraints in IRU/IRD deployment scenarios, provide ability to group the constraints
	    o The changes should persistent , default is to enforce all critical constraints
	    o A constraint can't be activated for deployment scenarios only; if the constraint is not activated in base scenario, the activation in deployment scenario won't be in effect.
	- Build Operator display for control the activate transmission constraint in deployment scenarios
		Core	DAM

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	• The same set of constraints in deployment scenarios apply to all the IFM passes, in MPM,GHG pass, IFM		
DAME-BRQ-04005	**Specify configurable IRU and IRD deployment factors (DIRU/DIRD) configure portion of power flow related the IRU and IRD deployment scenarios** • Set up the configurable deployment factors between 0 to 1 for specify the IRU/IRD deployment scenarios percentage of contribution on power flow towards the transmission constraint. Default value is 1 **Note:** • The deployment factors (DIRU/DIRD) will affect IR MCC, consider the deployment factor in MPM, CRR 1B • The product of DIRU/DIRD and shift factor should be higher than Shift Factor tolerance • Transformed shift factors for IRU/IRD shall be used in IRUMP/IRDMP formulations.	Core	DAM

DAME-BRQ-04008	**Allow eligible resource to submit one-segment bid for Imbalance Reserve capacity upward and downward: IRU, IRD**
	
	• Consume MF defined resource eligibility for IR, each flag for each corresponding product: IRU,IRD,
	• Consume MF defined resource eligible limit MW for IRU and IRD
	• Allow the eligible resource, include intertie resource, with resource ID defined in MF to submit one-segment bid of the IRU and/or IRD for the resource associated eligible flag
	• Transaction ID (not pre-registered in MF) are not allowed to bid for IRU/IRD
	• Not allow the following resource type to bid for IRU/IRD.
	    o The non-participating load
	    o Virtual supply/demand
	    o Hourly block import/export
	    o 60-minute PDR
	    o 60-minute RDRR
	
	Note:
	
	• Refer to **Resource Eligibility Table** in **Appendix-B: Formulas, Calculation Details, and Examples**
		Core	SIBR
			
			(from MF)

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
DAME-BRQ-04010	**Set up configurable value for ramp intervals eligible for IRU/IRD , initial 30 minute** • System shall allow the market engineer to configure the ramp intervals eligible for IRU/IRD, initial value is 30 minute. • System shall use the latest configured the ramp interval in DAM.	Core	DAM

DAME-BRQ-04020	**Allow eligible resource to submit one-segment bid for Reliability Capacity (RC) upward and downward: RCU, RCD**
	
	    • Consume MF defined resource eligibility in RUC each flag for each corresponding product: RCU, RCD
	    • Allow the resource with resource ID defined, include intertie resource in MF to submit one-segment bid of the RCU and/or RCD product that is associated eligible flag
	• Not allow 15 minute and 60 minute dispatch-able intertie import/export resources with transaction ID (not pre-registered in MF) to bid for RCU/RCD
	• Not allow the following resource type to bid for RCU/RCD.
	    ○ The non-participating load
	    ○ Virtual supply/demand
	
	Note:
	
	• Refer to **Resource Eligibility Table** in **Appendix-B: Formulas, Calculation Details, and Examples**
		Core	SIBR
			
			(from MF)

DAME-BRQ-04030	**Allow eligible VER to bid for IRU, IRD, RCU, RCD** • Allow VERs with relevant IR and RC eligibility flags to bid IRU and/or IRD same as other resources • Allow VERs with eligible flags to bid RCU and RCD, ○ VER can bid any price for RCU/RCD, same as other resource • If VER is RA, RA resource SIBR rule apply Note: • Restrict all VERs upper economic limit in IFM/RUC to their VER forecast • Extending the RCU/RCD bid up to VER forecast	Core	SIBR

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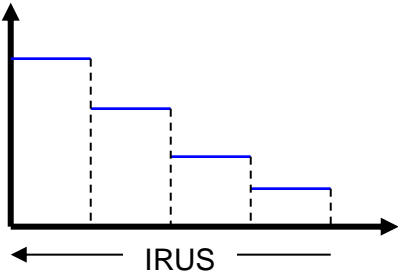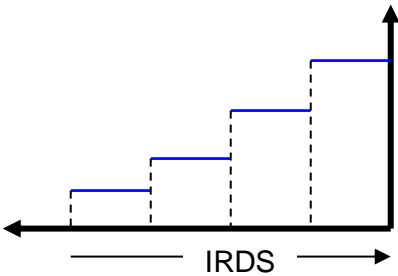| ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	• In settlement remove VERs from RCU/RCD cost allocation		
DAME-BRQ-04031	**Apply VER bid obligation for RCU/RCD up to certified capacity** • Inserting a RCU/RCD bid using DAB for VERS up to their certified RCU/RCD capacity if they do not bid • Extending a submitted RCU/RCD bid for VERs up to their certified RCU/RCD capacity if bid not cover the applicable capacity.	Core	SIBR

DAME-BRQ-04040	**Enforce Flex RA resource Must Offer Obligation (MOO) for Energy**
	
	• Only allow Flex RA to submit self-schedule energy at Pmin
	
	• For Flex RA capacity, MOO and bid insertion for energy:
	
	    o resource shall submit both economic energy bids for full flex RA capacity in DAM
	
	    o Insert DEB for energy for the flex RA capacity without economic bids
	
	    o Extend the last bid segment for energy if the economic bids not cover the full flex RA capacity
	
	Note:
	
	Any resources that are awarded IRU/IRD shall be subject to MOO in RTM.
		Core	SIBR
			
			(from CIRA)

DAME-BRQ-04060	**All the RA resources have MOO for RCU, optional for /RCD and allow non-zero bid** • Resource adequacy resources (Generic and Flex) will be able to bid non-zero prices for reliability capacity RCU/RCD. • For all RA capacity, MOO and bid insertion for RCU apply up to UEL, • Resource can optional bid for RCD : • If RA capacity has no economic RCU/RCD bids, system shall insert RCU DABs for RCU, respectively, in DAM o If RA capacity has no energy bids or self-schedule insert default energy bid (DEB)	Core	SIBR

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ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
DAME-BRQ-04070	**Supporting resource bid for Reliability up RCU for PT-Export or LPT** Incorporate Summer readiness 2021 rule for supporting the PT-export for RCU • Non-RA resources designated to support a PT export shall bid for RCU to the quantity being used to support the PT export, resource is allowed to bid non-zero prices • If the supporting resource has no RCU bid, system shall insert DAB to cover the range that that supports sum of PT-exports associate with the supporting resource	Core	SIBR
DAME-BRQ-04080	**Accept and validate IRU/IRD bid** • Market participants will submit separate IR bids for IRU, IRD • IRU/IRD bids shall be a single segment ($/MWh) of capacity products. IRU/IRD bids can have different hourly bids. • IRU/IRD bids shall have energy bids cover the IRU/IRD range • The IRU, IRD bids will subject to corresponding IRU, IRD bid price configurable Caps $55 as default , floor $0 as default • The capacity bid MW quantity must be greater than zero and will be capped by the minimum of associated registered quantities from MF and Pmax, forecast • Modify the Raw Bids and Clean Bids include market product type IRU and IRD	Core	SIBR
DAME-BRQ-04090	**Accept and validate RCU/RCD capacity bids** • Market participants will submit separate bids for RCU, RCD • A single segment ($/MWh) for capacity products RCU, RCD. RCU/RCD bids can have different hourly bids. • Energy bids shall be required to cover for RCU/RCD bids range (except for VER, since they don't have to bid En for RCU). • RCU/RCD will subject bid cap $55, floor $0	Core	SIBR

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	• The capacity bid MW quantity must be greater than zero and will be capped by the minimum of associated certification quantities and Pmax • Modify the Raw Bids and Clean Bids replace market product RUC with RCU and RCD Note: In SIBR, no forecast is consumed in current design, so the VER forecast limit will be enforced in IFM and RUC.		
DAME-BRQ-04130	**Set configurable parameters for Imbalance Reserve Penalty Prices in DAM** • For IRU, define single penalty cost for that higher than the LPT self-schedule export in schedule run and price run separately Note: use penalty cost in EDAM DA RSE for IRU/IRD resource sufficiency evaluation of the BAA.	Core	[IFM pre-DAM]
DAME-BRQ-04131	**IRU/IRD requirements subjects to demand price curve** • Apply the demand price curve to the relax variable for the IRU/IRD requirement above the protected amount Note: no calculation change for demand price curve for ISO and other EDAM BAAs	Core	DAM
DAME-BRQ-04132	**Consume IRU/IRD demand price curve** At 10 am, the system shall consume the IRU and IRD demand price curves $\{Q_k, P_k, k = 1,2,...,n\}$ for each hour interval of the DAM market horizon for each BAA in the EDAM Area. Note: Same as FRU, the IRU demand price curve has increasing positive quantities (an ascending ordering shall be performed on the quantities to ensure the MW quantities monotonically increasing) and decreasing positive prices:	Core	DAM (from Internal ISO System)

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	  Same as FRD, the IRD demand price curve has decreasing negative quantities (a <u>descending</u> ordering shall be performed on the quantities to ensure the MW quantities monotonically decreasing) and decreasing positive prices 		
DAME-BRQ-04134	**Apply IRU/ IRD demand price curve on IRU/IRD surplus variables in optimization to procure IRU/IRD** • Cover the IRUR/IRDR range: system shall extend or prune the end of the IRU/IRD demand price curve for each BAA in the EDAM Area to match the corresponding IRU/IRD requirement distributed to that BAA: $$Q_n = IRUR \text{ for IRU}$$ $$Q_n = -IRDR \text{ for IRD}$$ • Transform **demand price curve** to monotonic increase price curve for surplus variables for IRU/IDR for each hour each BAA	Core	DAM

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ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	o Flip the monotonically decreasing IRU demand price curve form the monotonically increasing price curve for the IRU surplus that varies from zero to *IRUR*. All $_{Qi}$ capped by $_{Qn}$. o Offset the IRD demand price curve by +*IRDR* to form the monotonically increasing price curve for the IRD surplus that varies from zero to *IRDR*. All Q_i shall be capped by Q_n • Limit from above all segments of the IRU/IRD price curve by the IRU/IRD configurable cap price $55		

DAME-BRQ-04140	**Consume Histogram and the second-order polynomial coefficients for DAM hourly (60min) IRU and IRD**
	
	for each Trading Hour of the next Trading Day, for each BAA and DAM Area:
	
	• the High/low Percentile hourly forecast uncertainty histogram for:
	
	• net demand: $(ND_{60}^{H97.5})/(ND_{60}^{H2.5})$
	
	• demand: $(D_{60}^{H97.5})/(D_{60}^{H2.5})$
	
	• adjusted solar: $(S_{60}^{H97.5})/(S_{60}^{H2.5})$
	
	• adjusted wind: $(W_{60}^{H97.5})/(W_{60}^{H2.5})$
	
	• the second-order polynomial coefficients of the High/low Percentile quadratic quantile regression of hourly forecast uncertainty
	
	   o demand: $(A_{60}^{D97.5}, B_{60}^{D97.5}, C_{60}^{D97.5}) /(A_{60}^{D2.5}, B_{60}^{D2.5}, C_{60}^{D2.5})$
	
	   o Solar: $(A_{60}^{S97.5}, B_{60}^{S97.5}, C_{60}^{S97.5}) /(A_{60}^{S2.5}, B_{60}^{S2.5}, C_{60}^{S2.5})$
	
	   o Wind: $(A_{60}^{W97.5}, B_{60}^{W97.5}, C_{60}^{W97.5}) /(A_{60}^{W2.5}, B_{60}^{W2.5}, C_{60}^{W2.5})$
	
	   o Mosaic (net load) $(A_{60}^{M97.5}, B_{60}^{M97.5}, C_{60}^{M97.5}) /(A_{60}^{M2.5}, B_{60}^{M2.5}, C_{60}^{M2.5})$
	
	• the hourly High/low Percentile Threshold forecast uncertainty histogram
	
	   o net demand $(ND_{60}^{H99})/ (ND_{60}^{H1})$
		Core	DAM
			
			[pre-DAM close]
			
			(from Internal ISO System)

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ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	• Threshold value of IRU and IRD requirements $(IRUR_{60}^{max})/(IRUR_{60}^{min})$; $(IRDR_{60}^{max})/(IRDR_{60}^{min})$ Note**:** **General rule:** For IRU, using P97.5 for load, P2.5 for solar and wind, for IRD, using P2.5 for load P97.5 for solar and wind		
DAME-BRQ-04150	**Calculate the hourly IRU/IRD requirements (IRUR/IRDR) every time [IFM pre-DAM] runs** for each Trading Hour of the next Trading Day of the day type, for each BAA and DAM Area use the corresponding parameters to Calculate • Imbalance reserve upper requirement (IRUR): $$IRUR_{60} = A_{60}^{M97.5} (M_{60}^{P97.5})^2 + B_{60}^{M97.5} M_{60}^{P97.5} + C_{60}^{M97.5}$$ Where: $M_{60}^{P97.5}(nd,d,s,w) \equiv ND_{60}^{H97.5} - (D_{60}^{H97.5} - S_{60}^{H2.5} - W_{60}^{H2.5}) + (D_{60}^{P97.5}(d) - S_{60}^{P2.5}(s) - W_{60}^{P2.5}(w))$ $$D_{60}^{P97.5}(d) \equiv A_{60}^{D97.5} d^2 + B_{60}^{D97.5} d + C_{60}^{D97.5}$$ $$S_{60}^{P2.5}(s) \equiv A_{60}^{S2.5} s^2 + B_{60}^{S2.5} s + C_{60}^{S2.5}$$ $$W_{60}^{P2.5}(w) \equiv A_{60}^{W2.5} w^2 + B_{60}^{W2.5} w + C_{60}^{W2.5}$$ • Imbalance reserve down requirement (IRDR): $$IRDR_{60} = A_{60}^{M2.5} (M_{60}^{P2.5})^2 + B_{60}^{M2.5} M_{60}^{P2.5} + C_{60}^{M2.5}$$ Where: $M_{60}^{P2.5}(nd,d,s,w) \equiv ND_{60}^{H2.5} - (D_{60}^{H2.5} - S_{60}^{H97.5} - W_{60}^{H97.5}) + (D_{60}^{P2.5}(d) - S_{60}^{P97.5}(s) - W_{60}^{P97.5}(w))$ $$D_{60}^{P2.5}(d) \equiv A_{60}^{D2.5} d^2 + B_{60}^{D2.5} d + C_{60}^{D2.5}$$ $$S_{60}^{P97.5}(s) \equiv A_{60}^{S97.5} s^2 + B_{60}^{S97.5} s + C_{60}^{S97.5}$$	Core	IFM [pre-DAM close]

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	$$W_{60}^{P97.5}(w) \equiv A_{60}^{W97.5}\, w^2 + B_{60}^{W97.5}\, w + C_{60}^{W97.5}$$ Note • d − latest demand forecast for each BAA and DAM Area • w − latest wind forecast for each BAA and DAM Area • s − latest solar forecast for each BAA and DAM Area • There shall be no dependency between DAME and EDAM; the IRU/IRD requirements shall be calculated even if EDAM RSE is not yet available.		
DAME-BRQ-04160	**The system shall bound the hourly IRU/IRD requirements** for each Trading Hour of the next Trading Day, for each BAA and DAM Area $$IRUR_{60} = max\begin{pmatrix} IRUR_{60}^{min}, ND_{60}^{H1}, \\ min\big((ND_{60}^{H99}, IRUR_{60}, IRUR_{60}^{max})\big) \end{pmatrix}$$ $$IRDR_{60} = min\begin{pmatrix} -1 * IRDR_{60}^{min}, ND_{60}^{H99}, \\ max\big((ND_{60}^{H1}, IRDR_{60}, -1 * IRDR_{60}^{max})\big) \end{pmatrix}$$	Core	DAM [pre-DAM close]
DAME-BRQ-04180	**The system shall calculate the IRU requirement allocation factors to demand, solar, and wind for each hour of the trading day for ISO BAA:** • $IRUDF_{60}(d,s,w) \equiv \dfrac{|D_{60}^{P97.5}(d)|}{|D_{60}^{P97.5}(d)|+|S_{60}^{P2.5}(s)|+|W_{60}^{P2.5}(w)|}$ • $IRUSF_{60}(d,s,w) \equiv \dfrac{|S_{60}^{P2.5}(s)|}{|D_{60}^{P97.5}(d)|+|S_{60}^{P2.5}(s)|+|W_{60}^{P2.5}(w)|}$ • $IRUWF_{60}(d,s,w) \equiv \dfrac{|W_{60}^{P2.5}(w)|}{|D_{60}^{P97.5}(d)|+|S_{60}^{P2.5}(s)|+|W_{60}^{P2.5}(w)|}$	Core	DAM
DAME-BRQ-04190	**The system shall calculate the IRD requirement allocation factors to demand, solar, and wind for each hour of the trading day for ISO BAA,** • $IRDDF_{60}(d,s,w) \equiv \dfrac{|D_{60}^{P2.5}(d)|}{|D_{60}^{P2.5}(d)|+|S_{60}^{P97.5}(s)|+|W_{60}^{P97.5}(w)|}$	Core	DAM

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	• $IRDSF_{60}(d,s,w) \equiv \frac{|S_{60}^{P97.5}(s)|}{|D_{60}^{P2.5}(d)|+|S_{60}^{P97.5}(s)|+|W_{60}^{P97.5}(w)|}$ • $IRDWF_{60}(d,s,w) \equiv \frac{|W_{60}^{P97.5}(w)|}{|D_{60}^{P2.5}(d)|+|S_{60}^{P97.5}(s)|+|W_{60}^{P97.5}(w)|}$		
DAME-BRQ-04200	**The system shall distribute the IRU/IRD requirement allocated to demand nodes, superimposed on the load schedule** For each hour of the trading day in the IR deployment scenario, with the same distribution factors (LDF) used for distributing the demand forecast in RUC • Allocate IRU as positive load to the load nodes: $\Delta L_{i,t}^{(u)} = (LDF_{i,t} * IRUR_{60} * IRUDF_{60}(d,s,w))$ • Allocate IRD as negative load to the load nodes: $\Delta L_{i,t}^{(d)} = (-LDF_{i,t} * IRDR_{60} * IRDDF_{60}(d,s,w))$	Core	DAM
DAME-BRQ-04210	**Calculate solar and wind distribution** **Factors of each VER nodes proportion to the forecasts:** Solar Resource distribution factor: $$SDF_{i,t} = \frac{FS_{i,t}}{\sum_i FS_{i,t}}$$ Wind Resource distribution factor: $$WDF_{i,t} = \frac{FW_{i,t}}{\sum_i FW_{i,t}}$$	Core	DAM
DAME-BRQ-04220	**Distribute the IRU/IRD requirement to VER nodes, superimposed on the VER schedule** • Distribute IRU as positive load to the Solar and wind VER nodes: $\Delta L_{i,t}^{(u)} = (SDF_{i,t} * IRUR_{60} * IRUSF_{60}(d,s,w))$ $\Delta L_{i,t}^{(u)} = (WDF_{i,t} * IRUR_{60} * IRUWF_{60}(d,s,w))$ • Distribute IRD as negative load to the solar and wind VER nodes: $\Delta L_{i,t}^{(d)} = (-SDF_{i,t} * IRDR_{60} * IRDSF_{60}(d,s,w))$ $\Delta L_{i,t}^{(d)} = (-WDF_{i,t} * IRDR_{60} * IRDWF_{60}(d,s,w))$	Core	DAM

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
DAME-BRQ-04230	**IRU/IRD additional deployment scenarios use same topology as base case and base with contingencies in NA, apply DIRU/DIRD on the specified set of transmission constraints** • No additional AC power flow runs for IRU/IRD deployment scenarios, instead use same base cases and contingencies cases shift factors set to calculate the transmission constraints for IRU, and for IRD deployment scenarios for each intervals (DAME-BRQ-04310) • Apply the DIRU/DIRD contribution of IRU/IRD deployment scenarios (parameter defined in DAME-BRQ-04005) in the transmission constraints • Only enforce the set transmission constraints (specified in DAME-BRQ-04004) in IRU/IRD deployment scenarios	Core	DAM
DAME-BRQ-04232	**Identify the critical constraints for IRU/IRD, deployment scenarios** Determine the critical set in the deployment scenarios superimposing the linear IR flows from UC **Note** • Refer to DAME-BRQ-06070 for RTM.	Core	DAM
DAME-BRQ-04235	**Calculate Shift Factors for base case and base case with contingencies** Calculate Shift factor based on AC power flow runs: • Shift Factor $SF_{i,m,t}$ for the node i on transmission m and hour t of base case • Shift Factor $SF_{i,m,t}^{(k)}$ for N-1 preventive transmission contingencies • Shift Factor $SF_{i,m,t}^{(g)}$ for GCARM generation/transmission contingencies • Adjusted Shift Factor $SF'^{(g)}_{i,m,t}$ for GCARM generation/transmission contingencies with post-contingency correction • Store the calculated the shift factors. Note: The same Shift factors will apply to the base scenario, IRU/IRD deployment scenarios in IFM, and RUC RCU/RCD procurement	Core	DAM

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted

DAME-BRQ-04240	**Apply LMPM for energy bid by Including IRU and IRD deployment scenario in DCPA counter flow calculation and Energy LMP calculation**
	
	• For IRU deployment scenario:
	
	To calculate counter flow for the binding transmission constraint from the resource shall be the product of negative shift factor and energy schedule plus IRU award
	
	• For IRD deployment scenario:
	
	To calculate counter flow for the binding transmission constraint from the resource shall be the product of negative shift factor and energy schedule minus IRD award; no mitigation for IRD bid, but still should be considered for En bid mitigation
	
	• To calculate the Energy competitive LMP for each node,
	    ○ Calculate LMP's congest cost MCC that include energy, IRU deployment scenario and IRD deployment scenario
	    ○ Break the LMP congestion cost MCC into two components: non-competitive component (based on DCPA uncompetitive paths that include IRU/IRD deployment scenarios in the counter-flow) and a competitive component.
	    ○ Calculate the nodal competitive LMP that exclude the non-competitive MCC.
	• Apply the LMPM for the applicable resource's energy bid mitigate it to the higher of the default energy bid (DEB) and its competitive LMP
		Core	MPM

DAME-BRQ-04250	**Apply LMPM for IRU bid by Including IRU deployment scenario in DCPA counter flow calculation and IRU nodal price calculation** • Build Activation switch for turn on/off of IR LMPM function • In DCPA process, the counter flow calculation, to determine the uncompetitive paths: • For IRU deployment scenario: same uncompetitive paths as in DCPA with IRU deployment for energy LMPM	Core	MPM

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted

	• To calculate the IRU competitive nodal price for each node,
	    o Calculate IRU nodal price congest cost MCC that include energy, IRU deployment scenario
	    o Break the IRU nodal price congestion cost MCC into two components: non-competitive component (based on DCPA uncompetitive paths that include IRU deployment scenarios in the counter-flow) and a competitive component.
	    o Calculate the nodal competitive IRU price that exclude the non-competitive MCC.
	 • Apply the existing LMPM for the applicable resource's IRU bid mitigate it to greater of (its nodal competitive IRU price and IRU DAB) if it below submitted bid.
	 Note:
	 LMPM applies to IRU only, not for IRD.		

DAME-BRQ-04260	**System shall procure IRU/IRD through co-optimization with energy and AS** **Objective function:** • Include IRU/IRD bid costs in Objective function. • IRU can be provided by offline 15min-start units • IRD can only be provided by online resources • MSG configuration in transition cannot provide IRU/IRD	Core	IFM, MPM
DAME-BRQ-04280	**Procurement constraints for IRU/IRD in co-optimization energy, AS and IR** • Keep power balance constraint unchanged, include losses • Keep ancillary services procurement constraints unchanged • Add IRU/IRD procurement constraints to meet IRU/IRD requirements for each hour for each BAA and for EDAM area in DAM.	Core	IFM, MPM
DAME-BRQ-04290	**Capacity constraints for IRU/IRD in co-optimization energy, AS and IR** • Include IRU/IRD upper/lower bound constraints for each resource by certified quantities. • Include IRU/IRD with energy and AS in resource upper/lower bound capacity constraint	Core	IFM, MPM

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	• Include IRU/IRD with AS capacity awards in resource upper/lower bound adjusted economic limit constraint For VER: • VER for IRU/IRD, UOL/UEL limited by VER forecast		

DAME-BRQ-04300	**Ramp capability constraints for IRU/IRD in co-optimization energy, AS and IR**
	
	• Include IRU/IRD with energy and AS in resource ramp capability constraint
	
	• The ramp capability constraint for offline start up at beginning of the hour to support IRU and upward AS
	• The ramp capability constraint for the resource shut down at the end of hour to support IRD and downward AS
	• Use dynamic ramp capability on IRU/IRD awards.
	   o For resource remain on-line, AS and IRU/IRD Capacity awards and day ahead energy schedule changes across hours share the resource dynamic ramp capability, use granularity adjustment factor 2 converts 30min IRU/IRD awards to the hourly.
	   o For resource start up use configurable granularity adjustment factor (defaulted to 2) for IRU
	   o For resource shut down use configurable granularity adjustment factor (defaulted to 2) for IRD. (same factor as the one used for IRU)
	
	Note:
	
	With the adjustment factor, there is no need to develop 15min dynamic ramp for IRU/IRD
		Core	IFM, MPM

DAME-BRQ-04310	**Transmission constraints in co-optimization energy, AS and IRU/IRD** From base case • Enforce transmission constraints for energy and virtual energy base case, the incremental energy injections are multiplied by the corresponding shift factors $SF_{i,m,t}$ for the relevant network constraint to account for changes in the active power flow from the AC power flow solution From base case with contingencies	Core	IFM, MPM

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	• Enforce transmission constraints for energy and virtual energy base case with N-1 transmission contingencies using shift factor $SF_{i,m,t}^{(k)}$ • Enforce transmission constraints for energy and virtual energy base case with GCARM generation/transmission contingencies using adjusted shift factor $SF'^{(g)}_{i,m,t}$ From IRU/IRD deployment scenarios • Enforce additional transmission constraints that add IRU deployment scenario in upper active power limits • Enforce additional transmission constraints that add IRD deployment scenario in lower active power limits • The shift factors in the IRU/IRD deployment scenarios are the same as the ones in the base scenario $SF_{i,m,t}$ adjusted for a change in reference to the distributed IRU/IRD requirement From IRU/IRD deployment scenarios with contingencies • Enforce transmission constraints in IRU/IRD deployment scenarios with contingencies: • The shift factors in the IRU/IRD deployment scenarios with N-1 transmission contingencies using shift factor $SF_{i,m,t}^{(k)}$ • The shift factors in the IRU/IRD deployment scenarios with GCARM generation/transmission contingencies using adjusted shift factor $SF'^{(g)}_{i,m,t}$ Note: • Critical transmission constraints will be different in general for Base scenario, with/without contingencies and IRU/IRD deployment scenarios, with/without contingencies. • ACPF will determine CCS in IRU/IRD deployment scenarios by evaluating power flow with deployment of IRU/IRD awards with relevant deployment factor		
DAME-BRQ-04320	**Scheduling Limit constraints in co-optimization energy, AS and IR** • Include IRU in ITC/ISL upper limit (import) constraints for energy plus upward AS (EA type) • Include IRU in ITC/ISL upper limit constraints for upward AS without energy (AS type)	Core	IFM, MPM

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	• Include IRD in ITC/ISL lower limit (export) constraints for energy plus downward AS (EA type) • Include IRD in ITC/ISL lower limit constraints for downward AS without energy (AS type) **Notes** • Import and export Netting is allow for the energy, not allowed between energy and capacity (AS,IR). • AS Type: AS Only • EA Type: Energy + AS		
DAME-BRQ-04330	**Energy limit, Gas-burn, pump and other constraints in co-optimization energy, AS and IR** • Gas-Burn Nomogram: Add IRU, in addition to Energy, in the Gas-Burn nomograms • Daily Energy limit: Add IRU, in addition to Energy, in the Daily Energy limit constraint • Pump-storage Hydro (PSH): Add IRU, in addition to Energy, in the PSH positive limit (generating mode) constraint; minus IRD, in addition to Energy, in the PSH negative limit (pumping mode) constraint.	Core	IFM, MPM
DAME-BRQ-04331	**Include IRU/IRD in storage resource ASSOC constraint** Include IRU in the ASSOC constraint that SOC be able to discharge to support minimum SOC plus upward AS and IRU; Include IRD, in the ASSOC constraint that SOC be able to charge to support downward AS and IRD with charge efficiency that not exceed the maximum SOC. **Notes** • $SOC_{i,t-1} - RU_{i,t} - SR_{i,t} - NR_{i,t} - IRU_{i,t} \geq \underline{SOC_{i,t}}$ $SOC_{i,t-1} + \eta_i \left(RD_{i,t} + IRD_{i,t} \right) \leq \overline{SOC_{i,t}}$ • ASSOC constraints of LESR shall be consistent with Energy Storage Enhancements initiative, model attenuation and coverage factor to have SOC to support AS, and IRU/IRD provided by storage resource.	Core	IFM, MPM

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
DAME-BRQ-04331A	**Include IRU/IRD and RCU/RCD in storage resource ASSOC constraint** Include IRU and RCU in the ASSOC constraint that SOC be able to discharge to support minimum SOC plus upward AS and IRU/RCU; Include IRD and RCD in the ASSOC constraint that SOC be able to charge to support downward AS and IRD/RCD with charge efficiency that not exceed the maximum SOC. **Notes** - $SOC_{i,t-1} - RU_{i,t} - SR_{i,t} - NR_{i,t} - IRU_{i,t} - \text{RCU}_{i,t} \geq \underline{SOC}_{i,t}$ $SOC_{i,t-1} + \eta_i \left(RD_{i,t} + IRD_{i,t} + RCD_{i,t} \right) \leq \overline{SOC}_{i,t}$ - ASSOC constraints of LESR shall be consistent with Energy Storage Enhancements initiative, model attenuation and coverage factor to have SOC to support AS, IRU/IRD, and RCU/RCD provided by storage resource.	Core	RUC

DAME-BRQ-04332	**Include attenuation from capacity IR/RC awards in SOC envelop constraint in MPM, IFM, RUC**
	
	- Set hourly configurable parameters by BAA for attenuation factors for IR and RC capacity awards to storage resource in DAM
	  - System shall allow user to setup configurable parameters for attenuation factors for DAM and RTM, apply to all the storage resource SOC **envelop** constraints
	  - Attenuation factor shall be defined for Imbalance reserve and Reliability Reserve:
	    - IRU
	    - IRD
	    - RCU
	    - RCD
	  - Each Attenuation factor must be between 0 to 1,
	- The day-ahead market will generate an upper and lower bound, or envelope, for state of charge
	  - The envelope could constrain operation for storage resources
		Core	DAM

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	o The initial upper and lower bounds will be set to the initial day-ahead state of charge o The initial multiplier attached to the imbalance reserves in the envelope equation will be 0.85 IFM: $\begin{cases} SOC_{i,t}^{(l)} = SOC_{i,t-1}^{(l)} - EN_{i,t}^{(+)} - \eta_i\,EN_{i,t}^{(-)} - AIRU_t IRU_{i,t} \geq \underline{SOC}_{i,t} \\ SOC_{i,t}^{(u)} = SOC_{i,t-1}^{(u)} - EN_{i,t}^{(+)} - \eta_i\,EN_{i,t}^{(-)} + \eta_i\left(AIRD_t IRD_{i,t}\right) \leq \overline{SOC}_{i,t} \end{cases}$ RUC: $\begin{cases} SOC_{i,t}^{(l)} = SOC_{i,t-1}^{(l)} - EN_{i,t}^{(+)} - \eta_i\,EN_{i,t}^{(-)} - AIRU_t IRU_{i,t} - ARCU_t RCU_{i,t} \geq \underline{SOC}_{i,t} \\ SOC_{i,t}^{(u)} = SOC_{i,t-1}^{(u)} - EN_{i,t}^{(+)} - \eta_i\,EN_{i,t}^{(-)} + \eta_i\left(AIRD_t IRD_{i,t} + ARCD_t RCD_{i,t}\right) \leq \overline{SOC}_{i,t} \end{cases}$		
DAME-BRQ-04334	**Add configurable parameters coverage factor for AS and IR capacity awards to storage resource opposite dispatch energy bids in IFM** • Set the Coverage Factor (CF) for each AS and IRU/IRD • The CF value 0 to 1, default for RegU and RegD 0.5 **Note** • Refer to DAME-BRQ-06075 for RTM. • This BRQ shall be consistent with Energy Storage Enhancements initiative.	Core	IFM
DAME-BRQ-04337	**Add configurable parameters coverage factor for AS and IR and RC capacity awards to storage resource opposite dispatch energy bids in RUC** • Set the Coverage Factor (CF) for each AS, IRU/IRD, and RCU/RCD • The CF value 0 to 1, default for RegU and RegD 0.5 **Note** • This BRQ shall be consistent with Energy Storage Enhancements initiative.	Core	RUC

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
DAME-BRQ-04350	**Calculate hourly locational marginal price (LMP) for energy in DAM include IRU/IRD deployment scenarios on congestion, for nodal and resource** Energy locational marginal price LMP for each hour in IFM: • Shadow price of PBC/ Loss Penalty Factor (LPF) of res/node (existing) • (minus) Marginal Congestion cost components (MCC) of base case using shift factor $SF_{i,m,t}$ • (minus) MCC components of **base case** with N-1 preventive transmission contingency using shift factor $SF_{i,m,t}^{(k)}$ • (minus) MCC components of **base case** with GCARM generation/ transmission contingency using adjusted shift factor $SF'^{(g)}_{i,m,t}$ • (minus) MCC components of deployment case of **IRU**, using DIRU* shift factor $SF_{i,m,t}^{(u)}$ • (minus) MCC components of **IRU** deployment case with N-1 preventive transmission contingency using DIRU* shift factor $SF_{i,m,t}^{(k,u)}$ • (minus) MCC components of **IRU** deployment case with GCARM generation/ transmission contingency using DIRD*adjusted shift factor $SF'^{(g,d)}_{i,m,t}$ • (minus) MCC components of deployment case of **IRD**, using DIRD* shift factor $SF_{i,m,t}^{(d)}$ • (minus) MCC components of **IRD** deployment case with N-1 preventive transmission contingency using DIRD*shift factor $SF_{i,m,t}^{(k,d)}$ • (minus) MCC components of **IRD** deployment case with GCARM generation/ transmission contingency using DIRD*adjusted shift factor $SF'^{(g,d)}_{i,m,t}$ • The intertie congestion components shall be included in LMP for energy • Gas nomogram shadow prices shall be reflected in resource prices only, not the Pnode/APnode IRUMP. Note: MCC is the sum of all congestion costs, each calculated as product of shift factor and shadow price of the binding network constraint	Core	IFM, MPM

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
DAME-BRQ-04360	**Calculate hourly SP-Tie LMP for energy in DAM include IRU/IRD deployment scenarios on congestion as normal nodal LMP plus shadow price of ITC/ISL, for nodal and resource** • The SP nodal price of energy minus the shadow prices of all binding Intertie Scheduling Limits (ISLs) and Inter-Tie Constraints (ITCs) associated with that SP-Tie Location	Core	IFM, MPM
DAME-BRQ-04370	**Calculate hourly nodal IRU marginal price (IRUMP) in DAM for nodal and resource** • Shadow price of IRU procurement constraint (no loss component) • (minus) MCC components of deployment case of **IRU**, using shift factor $SF_{i,m,t}$ • (minus) MCC components of **IRU** deployment case with N-1 preventive transmission contingency using shift factor $SF_{i,m,t}^{(k)}$ • (minus) MCC components of **IRU** deployment case with GCARM generation/ transmission contingency using adjusted shift factor $SF'^{(g)}_{i,m,t}$ • Gas nomogram shadow prices shall be reflected in resource prices only, not the Pnode/APnode IRUMP.	Core	IFM, MPM
DAME-BRQ-04380	**Calculate hourly nodal IRD marginal price (IRDMP) in DAM for node and resource** • Shadow price of IRD procurement constraint (no loss component) • (plus) MCC components of deployment case of **IRD**, using shift factor $SF_{i,m,t}$ • (plus) MCC components of **IRD** deployment case with N-1 preventive transmission contingency using shift factor $SF_{i,m,t}^{(k)}$ • (plus) MCC components of **IRD** deployment case with GCARM generation/ transmission contingency using adjusted shift factor $SF'^{(g)}_{i,m,t}$ • The intertie congestion components shall be included in IRDMP	Core	IFM, MPM
DAME-BRQ-04390	**Calculate hourly SP-tie IRU marginal price (IRUMP) in DAM for nodal and resource** • SP nodal price of IRU	Core	IFM, MPM

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	• (minus) the shadow prices of all binding Intertie Scheduling Limits (ISLs) and Inter-Tie Constraints (ITCs) associated with that SP-Tie Location of IRU		
DAME-BRQ-04400	**Calculate hourly SP-tie IRD marginal price (IRDMP) in DAM for nodal and resource** • SP nodal price IRD • (plus) the shadow prices of all binding Intertie Scheduling Limits (ISLs) and Inter-Tie Constraints (ITCs) associated with that SP-Tie Location of IRD	Core	IFM, MPM
DAME-BRQ-04451	**Calculate weight of distribution of IRUR/IRDR in the BAA** **For each load/Solar/Wind (d/s/w) distribution** **Weight factors for IRU/IRD,** using (D/S/W) Distribution factor*(D/S/W) Allocation Factor $$w_{i,t}^u(d) = (LDF_{i,t} * IRUDF_{60}(d,s,w)$$ $$w_{i,t}^u(s) = (SDF_{i,t} * IRUSF_{60}(d,s,w)$$ $$w_{i,t}^u(w) = (WDF_{i,t} * IRUWF_{60}(d,s,w)$$ $$w_{i,t}^d(d) = (LDF_{i,t} * IRDDF_{60}(d,s,w)$$ $$w_{i,t}^d(s) = (SDF_{i,t} * IRDSF_{60}(d,s,w)$$ $$w_{i,t}^d(w) = (WDF_{i,t} * IRDWF_{60}(d,s,w)$$	Core	IFM, MPM, RUC
DAME-BRQ-04452	**Calculate BAA Imbalance Upward deployment Shift Factors on market footprint distributed Imbalance demand reference point** Calculate BAA market footprint aggregated Imbalance demand Shift Factor $SF_{IRUR,m,t}$ (that reference point of market footprint distributed load) as sum of product of nodal weight and nodal shift factor for base case and contingency case	Core	IFM, MPM, RUC

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	Linear Transform every $SF_{i,m,t}$ Imbalance reserve Upward deployment scenario Shift Factor $SF_{i,m,t}^{(u)}$ to the reference point of market footprint distributed Imbalance reserve $$SF_{i,m,t}^{(u)} = SF_{i,m,t} - SF_{IRUR,m,t}$$ Base case and contingency cases		
DAME-BRQ-04452A	**Calculate BAA Imbalance Downward deployment Shift Factors on market footprint distributed Imbalance demand reference point** Calculate BAA market footprint aggregated Imbalance demand Shift Factor $SF_{IRDR,m,t}$ (that reference point of market footprint distributed load) as sum of product of nodal weight and nodal shift factor for base case and contingency case Linear Transform every $SF_{i,m,t}$ Imbalance reserve Downward deployment scenario Shift Factor $SF_{i,m,t}^{(d)}$ to the reference point of market footprint distributed Imbalance reserve $$SF_{i,m,t}^{(d)} = SF_{i,m,t} - SF_{IRDR,m,t}$$ Base case and contingency cases	Core	IFM, MPM, RUC
DAME-BRQ-04453	**Include IRU/IRD awards and demand contribution in transmission constraint using transformed shift factor** Include IRUR/IRDR and IRUS/IRDS (equal total IRU/IRD awards) contribution using transformed $SF_{i,m,t}^{(u)}$ / $SF_{i,m,t}^{(d)}$ on transmission constraint $F_{i,m,t}^{(u)} = \tilde{F}_{m,t} + \sum_i (\Delta EN_{i,t} + \Delta VS_{i,t} - \Delta VD_{i,t} - \Delta L_{i,t}) SF_{i,m,t} + DIRU * \sum_i IRU_{i,t} SF_{i,m,t}^{(u)}$ $F_{i,m,t}^{(d)} = \tilde{F}_{m,t} + \sum_i (\Delta EN_{i,t} + \Delta VS_{i,t} - \Delta VD_{i,t} - \Delta L_{i,t}) SF_{i,m,t} - DIRD * \sum_i IRD_{i,t} SF_{i,m,t}^{(d)}$ Apply to base case and contingency cases Note: the transformed SF that reference on distributed imbalance reserve demand and Deployment factor shall be used in Transmission constraint and MCC formation for the IRU/IRD deployment scenarios	Core	IFM, MPM, RUC

5.5 Business Process: Manage DAM – RUC

- MOO for RA in RUC, VER to the forecast

- Define notion REN=EN+RCU-RCD

- Build RUC-MPM, apply LMPM for RCU

- Apply mitigated RUC bids for 24 hours, un-mitigated bids for 48 hour RUC or 72 hour RUC

- Procure RCU/RCD through optimization

- Fixed EN, AS and IRU/IRD IFM awards

- Model MSG transition in RUC

- RUC-NA use REN as injection, no IRU/IRD deployment scenarios

- Calculate LMP for RCU/RCD

5.5.1 Business Requirements

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
DAME-BRQ-05000	**Consume RCU/RCD resource bids and MOO in RUC, insert DAB bids for RA capacity not bid in, insert DAB bid for VER that does not bid in** - Consume MF defined physical market resource eligibility for Reliability Capacity (RC): Separate flag for upper (RCU), down (RCD) - Consume MF defined Certified quantity (MW) for RCU and RCD - Consume MF defined BAA-Specific EDAM Participation Flag. - Fix the resource day-ahead market IFM awards/self-schedules for energy (EN), Ancillary Services (AS), Imbalance Reserves (IRU, IRD) in RUC - Accept resource RCU/RCD bids through SIBR. SIBR will insertion DAB bids up to UEL for RCU in RUC if RA resource not bid in for any RC product	Core	RUC (from MF) (from SIBR)

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
DAME-BRQ-05002	**Create Proxy RCU Bid for Exports with IFM LPT and/or Economic Energy Schedules with Not Enough RCU Clean Bid with No RCU Clean Bid or Not Enough RCU Clean Bid** • If exports cleared IFM with LPT and/or economic energy schedules and do not have RCU clean bids, in the RUC schedule run, System shall create proxy RCU bids for them that covers their cleared IFM energy schedules with a bid price higher than the RCU penalty prices while maintain the merit order of their highest energy bid price in the IFM (between DAB bid price and RUC PBC penalty in the scheduling run and at DAB bid price in the pricing run). The proxy RCU award due to proxy penalty bids will be fixed in pricing run. • If exports cleared IFM with LPT and/or economic energy schedules and have RCU clean bids that does not cover all energy bid range, (not *enough* RCU clean bids), in the RUC schedule run, System shall create proxy RCU bids for them (extending their RCU clean bids) to cover their cleared IFM energy schedules with a bid price higher than the RCU penalty prices while maintain the merit order of their highest energy bid price in the IFM (between DAB bid price and RUC PBC penalty in the scheduling run and at DAB bid price in the pricing run). The proxy RCU award due to proxy penalty bids will be fixed in pricing run. • System shall create a resource-specific hourly flag to indicate the creation of such proxy bids and their proxy RCU awards if market awarded them. • The proxy RUC bids shall not apply to PT export, and wheeling export. **Notes** • The Proxy Awards can co-exist for same resource and hour with RCU Awards. • This bid insertion is a mechanism to indicate the cleared IFM LPT and/or economic schedules for these exports are subject to Curtailment in RTM, if they are awarded RCU awards in RUC. • Since these exports have their created RCU bids at the penalty prices, they will only be awarded RCU awards if there is no available physical supply capacity in the RUC above energy schedules to meet both the demand forecast and the economic and LPT exports that cleared the IFM. • The SCs for these exports will be obligated to submit energy bids for the RCU capacity, similar to the MOO for RCU awards. • These created proxy RCU bids and proxy RCU awards will not be paid at the relevant marginal RCUMP in Settlements, while the clean	Core	RUC

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	RCU bids and RCU awards will be paid the relevant marginal RCUMP in Settlements. • Proxy RCU bids shall be excluded from final bid set		
DAME-BRQ-05005	**Ensure VER bid RUC capacity up to forecast , insert DAB bid for the capacity not bid in** • Extend VERs RCU bid RCU quantity up to their forecast • Insert DAB RCU bid for VER up to the forecast if eligible VER not bid in RCU • Adjust the clean RCU/RCD VER bid down as necessary if the forecast is less than the max MW value of the bid.	Core	RUC
DAME-BRQ-05010	**Define the notion of Reliability Energy REN** In the RUC, • Set the notion of REN as resource reliability energy schedules that RCU/RCD awards are related to the day-ahead energy schedules fixed EN $$REN_{i,t} \equiv EN_{i,t} + RCU_{i,t} - RCD_{i,t}$$	Information-Only	RUC
DAME-BRQ-05020	**Build RUC-MPM pass, perform market power mitigation for RCU** • Build Activation switch for turn on/off of RUC-MPM • If RUC-MPM is off, skip RUC-MPM pass **Note:** **With RUC-MPM is on:** • Add market power mitigation pass in RUC (DAME-BRQ-05021, DAME-BRQ-05025) • Run RUC optimization with SIBR submitted bids in RUC-MPM path.	Core	RUC -MPM

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
DAME-BRQ-05021	**Build RUC- DCPA,** • use same process as IFM MPM for energy, except use REN in place of energy EN, in the counter-flow calculation to identify the non-competitive binding constraints use $$REN_{i,t} \equiv EN_{i,t} + RCU_{i,t} - RCD_{i,t}$$	Core	RUC -MPM
DAME-BRQ-05025	**Build RUC- LMPM**: • The shadow price of REN PBC of each BAA is used in price formation/decomposition in LMP for RCU. • Calculate competitive LMP for RCU that excludes non-competitive path congestion prices, in the same manner as IFM-MPM for energy (no change to reference point for calculate LMP) • Mitigation: If the non-competitive constraint congestion component of a RCU supply bid is greater than Mitigation Threshold Price (default value 0.02), the resource RCU bid will be mitigated to greater of (RCU competitive LMP and RCU DAB) if it is lower than the unmitigated bid.	Core	RUC
DAME-BRQ-05030	**Apply mitigated RCU bids for trading day hours only** • Use mitigated bids for RCU in RUC optimization for Trading day hours (24 hours) • Use un-mitigated bids for other hours in RUC (RUC 48 hours run or RUC 72 hours run).	Core	RUC
DAME-BRQ-05050	**Procure RCU/RCD through optimization in RUC** **Objective function:** • Include resource RCU and RCD bid cost in OBJ function of RUC, and corresponding start-up cost and minimum load cost. • No de-commitment: Resources that are committed in IFM are modeled as must run in RUC, kept online, no de-commitment. The resource dispatch level in RUC is determined by REN optimization. • RCU and RCD are zero when the resource is offline, except for RCU that can be provided by offline resources that can start within 60min (SUT ≤ 60min), which the optimization will	Core	RUC

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	determine the resource commitment based on the min load cost, start-up cost and energy bid. • For the MSG committed in IFM, model MSG transition cost • System Resources (SRs) and Non-Generator Resources (NGRs) have no discontinuities or inter-temporal constraints and are always modeled as online. Note: Fixed IFM schedules for EN, AS, IRU/IRD are not be optimized in RUC.		
DAME-BRQ-05060	**Allow MSG transition in RUC** • Keep online for the MSG is committed in IFM • Allow all feasible transitions modeled. The resource dispatch level and stage are determined by REN, can be at different stage, different MW from IFM **Note:** MSG may be transitioned to a lower configuration but not shut down in RUC. Lower configuration MLC shall be set to 0 for both CISO and EDAM BAAs in the objective function. The compromise with Ops was that RUC will not shut down any resource, including MSG, if scheduled by IFM. Regular resources can be assigned RCD down to Pmin, and MSGs down to the Pmin of lowest configuration. The rationale is that the operator may still ED a resource up if it is online, but not if it is shut down. In any case, the IFM schedule is the DA schedule (and that is why RUC does not shut down); The difference between the RUC schedule and the IFM schedule is RCU or RCD.	Core	RUC
DAME-BRQ-05070	**Procurement REN balance constraints in RUC** ○ Reliability energy (REN) Power Balance Constraint (PBC) is **for t**he REN to balance the demand forecast (D) include losses. $$\sum_i REN_{i,t} = D_t,$$ $t = 1,2,\dots,T.$ ○ Ancillary Service awards are fixed in RUC at IFM solution • IRU/IRD awards are fixed in RUC at IFM solution	Core	RUC
DAME-BRQ-05080	**RCU/RCD Capacity upper/lower bound constraints in RUC** • The RCU/RCD upper/lower bound constraints by certified the RCU/RCD capacities	Core	RUC

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	• an energy bid is required for reliability energy schedules and RCU/RCD awards		
DAME-BRQ-05090	**Resource Capacity constraint for RCU/RCD in RUC** • For online physical resource, the REN is limited by capacity between the physical resource UCL minus upward AS and IRU awards, and LCL plus the downward AS and IRD • The REN is limited by economic limit between the adjusted LEL + IRD and adjusted UEL-IRU • For offline physical resource the upward capacity awards NR + IRU +RCU is limited by capacity UCL, RCU+IRU is limited by economic limit adjusted UEL For VER, • the capacity and economic limit are limited by the VER forecast Note: Adjusted LEL = max(LCL, LEL) ensure the resource must bid IFM Adjusted UEL=min(UCL,UEL)	Core	RUC
DAME-BRQ-05100	**Ramp capability constraints for REN in RUC** • Include REN, AS and IRU/IRD in resource ramp capability constraint • The ramp capability constraint for offline start up at beginning of the hour to support REN and upward AS, IRU • The ramp capability constraint for the resource shut down at the end of hour to support REN, IRD and downward AS • Use same granularity adjustment factors as in IFM	Core	RUC
DAME-BRQ-05110	**RUC-NA use REN as injection, no IRU/IRD deployment scenarios:** • Use REN as nodal injection in RUC-NA. • Not include IRU/IRD deployment scenarios in RUC-NA power flow. • The demand forecast is distributed to the load nodes using LDF Note: Treat IRU/IRD the similar manner as AS. Not include in power flow and transmission constraints, but include in the resource capacity constraint.	Core	RUC

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted

DAME-BRQ-05120	**Network constraints in RUC using same network topology and transmission limits as IFM**
	
	• Enforce critical transmission constraints from NA power flow by REN injection for
	  ○ base case, using same topology in IFM base case (shift factor set $SF_{i,m,t}$)
	  ○ base case with contingencies of N-1 transmission using same topology in IFM base case with contingencies (shift factor set $SF_{i,m,t}^{(k)}$)
	  ○ base case with contingencies of GCARM generation/transmission using same topology in IFM base case with contingencies of GCARM (shift factor set $SF_{i,m,t}^{(g)}$)
	• Use the same transmission limits as used in IFM
	
	Note:
	
	Not include critical constraints that generated by IRU/IRD deployment scenarios
		Core	RUC

DAME-BRQ-05130	**Scheduling Limit constraints in RUC** • Include RCU in ITC/ISL upper limit (import) constraints for energy plus upward AS plus IRU • Include RCU in ITC/ISL upper limit constraints for upward AS and IRU without energy • Include RCD in ITC/ISL lower limit (export) constraints for energy plus downward AS plus IRD • Include RCD in ITC/ISL lower limit constraints for downward AS and IRD without energy **Note:** The ITC/ISL constraints allow netting of import and export energy schedules, but they prevent netting among energy schedules and ancillary services or RCU/RCD/IRU/IRD awards.	Core	RUC
DAME-BRQ-05140	**Energy limit, Gas-burn, pump and other constraints in RUC** • *Gas-Burn Nomogram*: Add RCU/RCD, in addition to En+IRU, in the Gas-Burn nomograms • *Daily Energy limit:* include En, RCU and IRU in the Daily Energy limit constraint	Core	RUC

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	• Pump-storage Hydro (PSH): En+ IRU+RCU, in the PSH upper limit constraint; En-IRD-RCD, in the PSH lower limit constraint;		
DAME-BRQ-05144	**Model State of Charge (SOC) constraints envelop and limits of LESR:** Use RCU/RCD for energy charge/discharge SOC balance constraint, SOC limit constraint, attenuation factors and coverage factor apply to the AS and IR capacity awards (same as DAME-BRQ-04331, DAME-BRQ-04332, DAME-BRQ-04334) Envelop constraint include RCU/RCD • $SOC_{i,t}^{(u)} = SOC_{i,t-1}^{(u)} - EN_{i,t}^{(+)} - \eta_i\, EN_{i,t}^{(-)} + \eta_i\, AIRD_t\, IRD_{i,t} + \eta_i\, ARCD_t\, RCD_{i,t} \leq \overline{SOC}_{i,t}$ $SOC_{i,t}^{(l)} = SOC_{i,t-1}^{(l)} - EN_{i,t}^{(+)} - \eta_i\, EN_{i,t}^{(-)} - AIRU_t\, IRU_{i,t} - ARCU_t\, RCU_{i,t} \geq \underline{SOC}_{i,t}$ SOC limit include RCU/RCD: $$SOC_{i,t} - RU_{i,t} - SR_{i,t} - NR_{i,t} - IRU_{i,t} - RCU_{i,t} \geq \underline{SOC}_{i,t}$$ $$SOC_{i,t} + \eta_i\left(RD_{i,t} + IRD_{i,t} + RCD_{i,t}\right) \leq \overline{SOC}_{i,t}$$		
DAME-BRQ-05160	**Calculate hourly nodal RCU marginal price (RCUMP) and price breakdowns and sub-components of marginal congestion prices in RUC for nodal and resource** • Shadow price of REN balance constraint / Loss Penalty Factor (LPF) of res/node • (minus) MCC components of **REN**, using shift factor $SF_{i,m,t}$ • (minus) MCC components of **REN** with N-1 preventive transmission contingency using shift factor $SF_{i,m,t}^{(k)}$ • (minus) MCC components of **REN** with GCARM generation/ transmission contingency using adjusted shift factor $SF'^{(g)}_{i,m,t}$ • The intertie congestion components shall be included in RCUMP **Note:** For RCUMP and RCDMP, the sign is opposite for each component of price formation, represent the RCU RCD opposite direction impact on price. Loss factor in area control feature need apply	Core	RUC

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ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
DAME-BRQ-05170	**Calculate hourly nodal RCD marginal price (RCDMP) and breakdowns and sub- components of marginal congestion prices in RUC for node and resource for nodal and resource** • (minus)Shadow price of REN balance constraint / Loss Penalty Factor (LPF) of res/node • (plus) MCC components of **REN**, using shift factor $SF_{i,m,t}$ • (plus) MCC components of **REN** with N-1 preventive transmission contingency using shift factor $SF_{i,m,t}^{(k)}$ • (plus) MCC components of **REN** with GCARM generation/ transmission contingency using adjusted shift factor $SF'^{(g)}_{i,m,t}$ • The intertie congestion components shall be included in RCDMP	Core	RUC
DAME-BRQ-05180	**Calculate hourly SP-tie RCU marginal price (RCUMP) in DAM for nodal and resource** • SP nodal price of RCU • (minus) the shadow prices of all binding Intertie Scheduling Limits (ISLs) and Inter-Tie Constraints (ITCs) associated with that SP-Tie Location of RCU	Core	RUC
DAME-BRQ-05182	**Calculate hourly SP-tie RCD marginal price (RCDMP) in DAM for nodal and resource** • SP nodal price RCD • (plus) the shadow prices of all binding Intertie Scheduling Limits (ISLs) and Inter-Tie Constraints (ITCs) associated with that SP-Tie Location of RCD	Core	RUC

5.6 Business Process: Manage RTM

- MOO for Resource have DAM IRU/IRD, RCU/RCD awards
- MOO for RA resource that no DAM EN/AS/IR/RC awards
- Use IFM schedule for MSG reference stage to calculate min load
- Identify the critical constraints for FRU/FRD deployment scenarios
- Add configurable parameters coverage factor for AS and FRP capacity awards to storage resource opposite dispatch energy bids in RTM

5.6.1 Business Requirements

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
DAME-BRQ-06010	**Enforce must offer obligation in RTM for the resources with IRU/IRD, RCU/RCD DAM awards:** • Resources that are awarded reliability capacity (RCU/RCD), or imbalance reserve awards (IRU/IRD) in the day-ahead market will have real-time market bidding obligations. • Resources must bid economically energy bid the full range of their reliability capacity and imbalance reserve awards in the real-time market. • Real-time must offer obligations apply in the hours that a resource has a reliability capacity or imbalance reserve award. • The resources that do not submit the bids will have economic energy bids inserted for them at their Default Energy Bid (DEB) for the full range of RC and IR awards.	Core	SIBR *For RTM*
DAME-BRQ-06020	**Maintain the CAISO BAA resource adequacy real-time must-offer obligation** System shall maintain the CAISO BAA RA RT MOO.	Core	SIBR *For RTM*
DAME-BRQ-06060	**Use IFM schedule for MSG reference stage to calculate MLC** In RTM, use IFM schedule as MSG reference stage to calculate MLC.	Core	RTM

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	Note: The difference between the RUC schedule and the IFM schedule is RCU or RCD, RUC stage will not be used as reference stage for MSG.		
DAME-BRQ-06070	**Identify the critical constraints for FRU/FRD deployment scenarios** Determine the critical set in the deployment scenarios superimposing the linear FR flows from UC **Note** • Refer to DAME-BRQ-04232 for DAM.	Core	RTM
DAME-BRQ-06075	**Add configurable parameters coverage factor for AS and FRP capacity awards to storage resource opposite dispatch energy bids in RTM** • Set the Coverage Factor (CF) for each AS and FRU/FRD • The CF value 0 to 1, default for RegU and RegD 0.5 **Note** • Refer to DAME-BRQ-04334 for IFM. • This BRQ shall be consistent with Energy Storage Enhancements initiative.	Core	RTM

5.7 Business Process: Manage Market Quality System

- Calculate 15-min IRU/IRD and RCU/RCD Overlapping RA Capacity

- Calculate 15-min IRU/IRD LOC for Overlapping RA Capacity

- Calculate DA/Base Schedule Forecasted Movement Data

- Resource IRU/IRD Award 5-min Ramp Capable Portion Calculation

- FMM Ex-Post Capacity Calculation

- FMM Ex-Post IR/RC Capacity Allocations

- Update Commitment Cost Determination Logic to Account for RC

- Use IFM MSG Configuration as Reference for RT MLC Calculations

- Account for IRU/IRD in CRR1B Logic

5.7.1 Business Requirements

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted

DAME-BRQ-07265	**Calculate 15-min IRU/IRD and RCU/RCD Overlapping RA Capacity**
	On daily basis, and after all RTM markets run for a trade day, and after everytime corrections occurred on any of the data used in the calculations, System shall have the capability to calculate 15-min resource-specific IRU/IRD and RCU/RCD Overlapping RA Capacity, as sliced by final DA energy bid segments and as total, using latest available data for RA-resources only:
	
	• 15-min IRU/IRD and RCU/RCD Overlapping RA Capacity are calculated as the overlapped capacity between RA Capacity and corresponding IRU/IRD and RCU/RCD awards, as sliced by final DA energy bid segments and as a total, accounting for any Pmax derates and/or Pmin re-rates that occur in FMM, where
	
	    o RA Capacity is the most restrictive between monthly RA showing and Daily RA Capacity.
	
	    o Monthly RA showing is fetched from the monthly showing plan and does not account for the RA substitution.
	
	    o Daily RA capacity accounts for RA resources substitution and accounts for both Generic RA capacity and Flex RA Capacity.
		Core	• Internal ISO System

	Notes • No substitutions will be accounted for in the monthly RA showing and mapping data. • Substitution will be included in the daily RA capacity and identification data.		

DAME-BRQ-07270	**Calculate 15-min IRU/IRD LOC for Overlapping RA Capacity**
	On daily basis, and after all RTM markets run for a trade day, and after everytime corrections occurred on any of the data used in LOC calculations, System shall have the capability to calculate 15-min resource-specific IRU/IRD Lost Opportunity Cost (LOC) for each IRU/IRD Overlapping RA Capacity, sliced by final DA energy bid segments, using latest available data for RA-resources only, include internal RA resources and intertie RA resources:
	
	• 15-min IRU/IRD LOC is calculated as difference between DA Energy LMP and final DA energy bid for the amount of 15-min resource IRU/IRD Overlapping RA capacity, and converted into 15-min granularity, where:
	
	• Mathematically:
	
	    ○ 15-min IRx LOC = (¼) * Sum over all corresponding DA energy bid segment i of (15-min resource IRx Overlapping RA Capacity, sliced by final DA energy bid segment i) * (hourly DA Energy LMP – hourly DA Final Energy Bid Price for bid segment i)
	
	    ○ Where, x is { U , D}
	
	Notes
	• No substitutions will be accounted for in the monthly RA showing and mapping data.
	• Substitution will be included in the daily RA capacity and identification data.
		Core	• Internal ISO System

DAME-BRQ-07320	**Calculate DA/Base Schedule Forecasted Movement Data**
	Using similar calculation calendar as FMM and RTD Forecasted Movement, and for every trade hour (h) of each trade day, System shall calculate resource-specific hourly DA/Base Schedule Forecasted Movement as:
	
	• For CAISO and EDAM BAA resources:
	
	    ○ DA Schedule Forecasted Movement (h) = $DAES_{DAM,h} - DAES_{DAM,h-1}$
	
	• For WEIM BAA-only (non-EDAM) resources:
	
	    ○ Base Schedule Forecasted Movement (h) = $BS_h - BS_{h-1}$
		Core	• Internal ISO System

	Notes		
	• For the calculation of the DA/Base Schedule Forecasted Movement for first hour of the day, results from the previous day last hour will be used. • Movement shall be calculated for all hours when there is a non-zero DAES/Base Schedule for at least one hour in the day, or there is a non-zero DAES/Base Schedule in the last hour of the previous day. • This FM calculation shall run in the same run as existing FMM/RTD Forecasted Movement calculation run.		
DAME-BRQ-07580	**FMM Ex-Post Capacity Calculation** System shall automatically calculate FMM Ex-Post Capacities ($MinExCap_{FMM}$, $MaxExCap_{FMM}$) on resource-specific 15-minute basis by utilizing FMM bid data and data that are available in FMM run, and using similar formulation as the ones used for the calculation of RTD Ex-Post Capacities ($MinExCap$, $MaxExCap$).	Core	• Internal ISO System
DAME-BRQ-07600	**Resource IRU/IRD Award 5-min Ramp Capable Portion Calculation** System shall automatically calculate IRU/IRD award 5-min ramp capable portion ($IRU5_{DAM}$, $IRD5_{DAM}$) on resource-specific hourly basis as follows: • Determine DAM upward ramp rate segment (RRU_{DAM} in MW/min) that corresponds to $DAES_{DAM} + IRU_{DAM}$. • Determine DAM downward ramp rate segment (RRD_{DAM} in MW/min) that corresponds to $DAES_{DAM} - IRD_{DAM}$. • $IRU5_{DAM} = min(IRU_{DAM}, [RRU_{DAM} * 5'])$ • $IRD5_{DAM} = min(IRD_{DAM}, [RRD_{DAM} * 5'])$	Core	• Internal ISO System
DAME-BRQ-07610	**FMM Ex-Post Capacity Calculation** System shall automatically calculate FMM Ex-Post Capacities ($MinExCap_{FMM}$, $MaxExCap_{FMM}$) on resource-specific 15-minute basis by utilizing FMM bid data and data that are available in FMM run, and using similar formulation as the ones used for the calculation of RTD Ex-Post Capacities ($MinExCap$, $MaxExCap$).	Core	• Internal ISO System
DAME-BRQ-07615	**FMM Ex-Post IR/RC Capacity Allocations** System shall automatically calculate FMM Ex-Post IRU/IRD and RCU/RCD capacity allocations on resource-specific 15-minute basis: 	$IRUC_{FMM}$	Imbalance Reserve Up allocated capacity range (FMM).		Core	• Internal ISO System

	$IRDC_{FMM}$	Imbalance Reserve Down allocated capacity range (FMM).		
	$IRUC5_{FMM}$	Imbalance Reserve Up allocated capacity range (FMM), for the IRU 5-minute Ramp-Capable Portion.		
	$IRDC5_{FMM}$	Imbalance Reserve Down allocated capacity range (FMM), for the IRD 5-minute Ramp-Capable Portion.		
	$IRUC5+_{FMM}$	Imbalance Reserve Up allocated capacity range (FMM), excluding IRU 5-minute Ramp-Capable Portion.		
	$IRDC5+_{FMM}$	Imbalance Reserve Down allocated capacity range (FMM), excluding IRD 5-minute Ramp-Capable Portion.		
	$RCUC_{FMM}$	Reliability Capacity Up allocated capacity range (FMM).		
	$RCDC_{FMM}$	Reliability Capacity Down allocated capacity range (FMM).		
DAME-BRQ-07620	**Update Commitment Cost Determination Logic to Account for RC** • System shall be updated to use RCU Awards instead of RUC Awards in commitment cost determination logic, starting from Go-Live date going forward. • System shall account for RCD Awards in commitment cost determination logic, as applicable to commitment to downward MSG commitments in RUC due to RCD Awards.	Core	• Internal ISO System	
DAME-BRQ-07630	**Use IFM MSG Configuration as Reference for RT MLC Calculations** System shall use IFM MSG configuration as reference for RT MLC calculations.	Core	• Internal ISO System	
DAME-BRQ-07860	**Account for IRU/IRD in CRR1B Logic** System shall update CRR1B logic to account for IRU/IRD, by utilizing Transformed Shift Factors for IRU/IRD, IRU/IRD Deployment Factor (DIRU/DIRD), and IRU/IRD Resource Awards, for all upward/downward deployment scenarios, as follows: • Calculate Hourly IRU/IRD flow by constraint and constraint case, considering IRU/IRD deployment factors. • Update calculations of hourly Constraint Flow Difference (Market flow vs CRR flow) to account for IRU/IRD. • Update calculations of hourly portion of CRR-settled flow by constraint and constraint case.	Core	• Internal ISO System	

5.8 Business Process: Manage Market Billing and Settlements

- IFM IR & RUC RC Payments

- IFM IR & RUC Cost Allocation

- IR DA & RC RT BCR Settlements

- Inclusion of IR & RC in GMC Settlements

- IRU/IRD & RCU/RCD Unavailability No-Pay Charges

- IR and RC Unavailability No-Pay Charges Priority

- IR – FRP RTM Ramp Deviation Settlements

- FMM Forecasted Movement Deviation Settlements

- Settlements of Overlapping RA Capacity for True-Up Settlements Mechanism

- Apply CRR 1B Methodology for CAISO BAA

- Calculate BAA IRU/IRD and Energy Congestion Revenues

- Distribute BAA IRU/IRD Congestion Revenues for CAISO and EDAM BAAs

5.8.1 Business Requirements

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
DAME -BRQ- 09140	**IFM IR & RUC RC Payments** System shall be updated for the following: - All eligible resources (including MSS resources) that have been awarded hourly IFM IRU/IRD shall be paid hourly IFM IRUMP/IRDMP prices, respectively. - All eligible resources (including CAISO RA resources and MSS resources) that have been awarded hourly RUC RCU (but excluding resources with proxy RCU awards) shall be paid hourly RUC RCUMP prices, respectively. - All eligible resources (including CAISO RA resources and MSS resources) that have been awarded hourly RUC RCD shall be paid hourly RUC RCDMP prices, respectively **Notes** - This shall apply to MSS resources that have been awarded IR, regardless of the MSS operator's selection of Net or Gross settlement.	Core	• Settlements

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
DAME-BRQ-09160	**IFM IR Cost Allocation** • System shall be updated to allocate IFM IRx costs in two Tiers, where x = U, D. • **Tier-1** IRx Cost Allocation, for each individual component, and on hourly basis: ○ Tier-1 IFM IRx Allocation Cost = Tier-1 IRx Allocation Quantity * Tier-1 IRx BAA Allocation Price. ○ Tier-1 IRx Allocation Quantity shall be calculated as follows:	Core	• Settlements

Component Type	Tier-1 IRU Allocation Quantity	Tier-1 IRD Allocation Quantity
Generation (including ESR)	$\max(0, [DAES_{DAM} - MaxExCap_{FMM}])$ as affected by de-rates and reduction in VER forecast between DAM and RTM (if applicable))	$\max(0, [MaxExCap_{FMM} - DAES_{DAM}])$ as affected by rerates or self-schedules (if applicable))
Import	$\max(0, [DAES_{DAM} - MaxExCap_{FMM}])$ as affected by e-Tag transmission profile)	$\max(0, [SS_{FMM} - DAES_{DAM}])$
Load	ABS (Negative UIE)	Positive UIE
Export	$\max(0, [SS_{FMM} - DAES_{DAM}])$	$\max(0, [DAES_{DAM} - eTag$ transmission profile])
MSS (on Load Following)	MSS operator's net portfolio uninstructed deviations.	MSS operator's net portfolio uninstructed deviations.
MSS	Same as non-MSS resources	Same as non-MSS resources

ID#	Business Feature			Requirement Type	Potential Application(s) Impacted
	(NOT on Load Following, regardless of their Net versus Gross selection)				

- For each BAA, and on hourly basis, Tier-1 IRx BAA Allocation Price shall be calculated as follows:

  - Min (IRx BAA Average Price , IRx BAA Derived Price)

  - where

    - IRx BAA Average Price = Sum of IRx Payments across BAA / Sum of IRx Award across BAA.

    - IRx BAA Derived Price = Sum of IRx Payments across BAA / Sum of Tier-1 IRx Allocation Quantity across BAA.

- **Tier-2** IRx Cost Allocation, for each BAA, and on hourly basis:

  - System shall calculate Tier-2 IRx BAA Allocation Cost as the remainder (left over) of unallocated IRx costs from Tier-1, as follows:

    - Tier-2 IRx BAA Allocation Cost = max (0 , [Sum of IRx Payments across BAA – Sum of Tier-1 IRx Cost Allocation across BAA])

  - System shall allocate Tier-2 IRx BAA Allocation Cost proportional to Metered Demand within each BAA, except for:

  - If a BAA is Gen-only (does not have metered demand), Tier-2 IRx BAA Allocation Cost shall be directly allocated to the Entity of the BAA.

- **Treatment of MSS**

  - If MSS operator has elected to load follow to manage its own load variability, it shall get IRx Tier-1 and IRx Tier-2

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted

	cost allocations based on the MSS operator's net portfolio uninstructed deviations.
	
	     ▪ **Note:** Load Following is an MSS Annual Election. For the MSS that has elected to Load Follow, the generation and load resource shall be excluded from the Generation Bucket and Load Bucket, and instead be calculated as a separate bill determinant at the MSS portfolio level based upon Net Deviation of the portfolio (Net of Generation UIE and Load UIE). The Net UIE shall determine if that MSS Bubble receives an IRU or IRD allocation for any given interval.
	
	    o Otherwise, for both IRx Tier-1 and IRx Tier 2 cost allocations, MSS resources shall be settled in a similar manner as non-MSS resources, regardless of their Net versus Gross selection.
	
	• **Treatment of ETC, and TOR**
	
	    o System shall exclude the ETC and TOR self-schedules from IR Tier-1 and IR Tier-2 allocations up to the valid and balanced portion of ETC and TOR self-schedules.
	
	    o In contrast, System shall consider quantities above the valid and balanced portion of the ETC or TOR self-schedules in IRx Tier-1 and IRx Tier-2 cost allocations.
	
	Notes
	
	• This cost allocation does not apply to EIM BAAs.
	
	• Tier-1 IRx Cost Allocation to Generation and Import/Export component types applies to all generation resources, regardless whether they are awarded IRx or not.
	
	• ESRs (using either the NGR model or the proposed ESR mode) will be considered under the "Generation" component type of the Tier-1 IRx cost allocations.
	
	• For each BAA, if the IRx obligation is higher than the IRx awards, all of the IRx cost will be allocated to IRx Tier-1, otherwise, IRx cost will be split between Tier-1 and Tier-2.		

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted

DAME -BRQ- 09180	**RUC RC Cost Allocation**
	
	• System shall be updated to allocate RUC RCx costs in two Tiers, where x = U, D.
	
	• **Tier-1** RCx Cost Allocation, for each individual component, and on hourly basis:
	
	    o Tier-1 RUC RCx Allocation Cost = Tier-1 RCx Allocation Quantity * Tier-1 RCx BAA Allocation Price.
	
	    o Tier-1 RCx Allocation Quantity shall be calculated as follows:
		Core	• Settlements

Component Type	Tier-1 RCU Allocation Quantity	Tier-1 RCD Allocation Quantity
Virtual Bids	max (0 , SC Net Virtual Supply Awards). Applies only if the BAA has total net virtual supply.	max (0 , SC Net Virtual Demand Awards). Applies only if the BAA has total net virtual demand.
Load	ABS (Net Negative Metered Demand) i.e. Under-Scheduled Load See note below about Net Negative Metered Demand exclusions.	Net Positive Metered Demand i.e. Over-Scheduled Load See note below about Net Positive Metered Demand exclusions.

    o For each BAA, Tier-1 RCx BAA Allocation Price shall be calculated as follows:

        ▪ Min (RCx BAA Average Price , RCx BAA Derived Price)

        ▪ where

            • RCx BAA Average Price = Sum of RCx Payments across BAA / Sum of RCx Awards across BAA.

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted

	• RCx BAA Derived Price = Sum of RCx Payments across BAA / Sum of Tier-1 RCx Allocation Quantity across BAA.
	
	• **Tier-2** RCx Cost Allocation, for each BAA, and on hourly basis:
	
	    ○ System shall calculate Tier-2 RCx BAA Allocation Cost as the remainder (left over) of unallocated RCx costs from Tier-1, as follows:
	
	        ▪ Tier-2 RCx BAA Allocation Cost = max (0 , [Sum of RCx Payments across BAA – Sum of Tier-1 RCx Cost Allocation across BAA])
	
	    ○ System shall allocate Tier-2 RCx BAA Allocation Cost proportional to Metered Demand within each BAA.
	
	    ○ If a BAA is Gen-only (does not have metered demand), Tier-2 RCx BAA Allocation Cost shall be directly allocated to the Entity of the BAA.
	
	• **Treatment of MSS**
	
	    ○ If MSS operator has elected to load follow to manage its own load variability, it shall NOT get RCx Tier-1 nor RCx Tier-2 cost allocations.
	
	        ▪ **Note:** Because an MSS Operator that has elected to Load Follow is required to provide sufficient resources in DAM to follow its Load within the MSS Deviation Band, the MSS Bubble which has elected to Load Follow shall not receive a RCU/RCD allocation.
	
	    ○ Otherwise, for both RCx Tier-1 and RCx Tier 2 cost allocations, MSS resources shall be settled in a similar manner as non-MSS resources, regardless of their Net versus Gross selection.
	
	• **Treatment of ETC, and TOR**
	
	    ○ System shall exclude the ETC and TOR self-schedules from RC Tier-1 and IR Tier-2 allocations up to the valid and balanced portion of ETC and TOR self-schedules.
	
	    ○ In contrast, System shall consider quantities above the valid and balanced portion of the ETC or TOR self-schedules in RCx Tier-1 and IR Tier-2 cost allocations.		

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	Notes • This cost allocation does not apply to EIM BAAs. • For Tier-1 RCU (RCD, respectively) cost allocations to Load component type, the net negative (positive) metered demand will exclude net negative (positive) demand associated with balanced ETC/TOR rights, negative (positive) deviation for Participating Load (PL) resulting from a market dispatch, and MSS that have elected not to participate in RC. • For each BAA, If the RCx obligation is higher than the RCx awards, all of the RCx cost will be allocated to RCx Tier-1, otherwise, RCx cost will be split between Tier-1 and Tier-2, where x = U, D.		

DAME-BRQ-09200	**IR DA BCR Settlements**
	
	System shall be updated for the following:
	• Revenue and bid costs for IRU/IRD awards (after netting No-Pay) shall be included in the calculation of DA BCR.
	• Mathematically, for each resource, for each hour:
	    ○ IR Revenues = ([IFM IRU Awards – IRU No-Pay Quantity] * IFM IRUMP) + ([IFM IRD Awards – IRD No-Pay Quantity] * IFM IRDMP)
	    ○ IR Bid Costs = ([IFM IRU Awards – IRU No-Pay Quantity] * IFM IRU Bid Price) + ([IFM IRD Awards – IRD No-Pay Quantity] * IFM IRD Bid Price)
	
	Notes
	• Resources committed in IFM, including resources that are scheduled for IRU/IRD, shall be eligible to get DA BCR.
	• Accounting Commitment Costs in DA BCR will remain intact as existing.
		Core	• Settlements

DAME-BRQ-09220	**RC RT BCR Settlements** System shall be updated for the following: • Revenue and bid costs for RCU awards (but excluding resources with proxy RCU awards) (after netting No-Pay) shall be included in the calculation of RT BCR. • Revenue and bid costs for RCD awards (after netting No-Pay) shall be included in the calculation of RT BCR. • Mathematically, for each resource, for each hour: ○ RC Revenues = ([RUC RCU Awards – RCU No-Pay Quantity] * RUC RCUMP) +	Core	• Settlements

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	([RUC RCD Awards – RCD No-Pay Quantity] * RUC RCDMP) o RC Bid Costs = ([RUC RCU Awards – RCU No-Pay Quantity] * RUC RCU Bid Price) + ([RUC RCD Awards – RCD No-Pay Quantity] * RUC RCD Bid Price) • RUC BCR costs shall be allocated, in alignment with RCU cost allocation, to net virtual supply and under scheduled load. **Notes** • Resources committed in RUC, including resources that are scheduled for RCU/RCD, shall be eligible to get RT BCR. • A resource can be awarded either RCU or RCD awards, but not both, for the same hour. • Accounting Commitment Costs in RT BCR will remain intact as existing.		
DAME-BRQ-09240	**Inclusion of IR & RC in GMC Settlements** System shall be updated for the following: • GMC Bid Transaction Fee shall be applied for IRU/IRD and RCU/RCD bid segments. • GMC Market Services Charge shall be applied for IRU/IRD and RCU/RCD awards (but excluding proxy RCU awards). **Notes** • Eligible resources will include these GMC costs in their IR and RC bids. • Final RCU bids will not contain any proxy RCU bids.	Core	• Settlements
DAME-BRQ-09260	**IRU/IRD Unavailability No-Pay Charges** System shall be updated for the following: • Resources with an FMM Ex-post capacity range that does not support $(DAES_{DAM} + [IRU_{DAM} - IRU5_{DAM}])$ will be charged the resource-specific IRU No-Pay Penalty Price of Max (FMM FRUMP, IRUMP) for the undelivered MW quantity after accounting for DA Spinning Reserve award (SR_{DAM}) and DA Non-Spinning Reserve award (NS_{DAM}), in that respective order. • Resources with an FMM Ex-post capacity range that does not support $(DAES_{DAM} - [IRD_{DAM} - IRD5_{DAM}])$ will be charged the resource-specific IRD No-Pay Penalty Price of Max (FMM FRDMP, IRDMP) for the undelivered MW quantity.	Core	• Settlements

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
DAME -BRQ- 09280	**RCU/RCD Unavailability No-Pay Charges** System shall be updated for the following: • Resources with an FMM Ex-post capacity range that does not support ($DAES_{DAM} + RCU_{DAM}$) (but excluding proxy RCU awards) will be charged the 5-minute resource-specific RCU No-Pay Penalty Price of Max (FMM FRUMP, RCUMP) for the undelivered MW quantity after accounting for DA Spinning Reserve award (SR_{DAM}), DA Non-Spinning Reserve award (NS_{DAM}), in that respective order. Exception is for VERs, where RCU No-Pay Penalty Price shall be the RCUMP. • Resources with an FMM Ex-post capacity range that does not support ($DAES_{DAM} - RCD_{DAM}$) will be charged the 5-minute resource-specific RCD No-Pay Penalty Price of Max (FMM FRDMP, RCDMP) for the undelivered MW quantity	Core	• Settlements
DAME -BRQ- 09300	**IR and RC Unavailability No-Pay Charges Priority** System shall be updated for the following: • Resources that have been awarded both a RC and IR and are not available, or only bid a portion of their combined award, shall have the unavailability charge applied first to RC and then to IR.	Core	• Settlements
DAME -BRQ- 09320	**IR – FRP RTM Ramp Deviation Settlements** System shall be updated for the following: • Resources that have been awarded both IRU (IRD) in IFM and FRU (FRD) in FMM shall be charged (paid) for the deviation between the FMM FRU (FRD) award and the 5-min ramp capable portion of the IRU (IRD) award [$IRU5_{DAM}$ ($IRD5_{DAM}$) from MQS] at the FMM FRUMP (FRDMP), respectively. **Notes** • Deviation settlements between FMM FRU (FRD) and RTD FRU (FRD), respectively, is existing functionality.	Core	• Settlements
DAME -BRQ- 09340	**FMM Forecasted Movement Deviation Settlements** System shall be updated for the following: • For CAISO and EDAM BAAs, resources that have upward (downward) deviation in Forecasted Movement in FMM relative to DAM is paid (charged) net difference between FMM FRUMP and FMM FRDMP, respectively.	Core	• Settlements

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	• For EIM BAAs, resources that have upward (downward) deviation in Forecasted Movement in FMM relative to Base Schedule Forecasted Movement is paid (charged) net difference between FMM FRUMP and FMM FRDMP, respectively. **Notes** • DA/Base Schedule Forecasted Movement is not settled. It is used to determine the deviation settlement of FMM Forecasted Movement Deviation only. DA/Base Schedule Forecasted Movement settlement is embedded in Day Ahead Energy settlement already or in the bi-lateral market settlement. • Forecasted Movement Deviation settlements between FMM and RTD is existing functionality. • If the 5-minute ramp capability that is awarded in IFM (as either energy movement or an IR award) is available and awarded in FMM (as either forecasted movement or a FRP award), there should be No net deviation settlement in FMM. • If the 5-minute ramp capability that is awarded in FMM is available and awarded in RTD (as either forecasted movement or a FRP award), there should be No net deviation settlement in RTD. • If the 5-minute ramp capability of a resource is awarded between forecasted movement and uncertainty awards the same across markets, from IFM to FMM to RTD, there are no net payments or charges due to deviations in RTM. • The only exceptions are when a resource reaches their Pmin or Pmax at a different time than in the preceding market, there is a ramp rate de-rate, or the resource's ramp capability is not fully used.		

DAME-BRQ-09380	**Settlements of Overlapping RA Capacity for True-Up Settlements Mechanism**
	If an RA resource is mapped to one or more LSEs that have their LSE RA True-Up Flag set to Opt-In for a trading day,
	• System shall calculate the Settlements Amount for that RA Resource and each hour as:
	  ○ IRx Overlapping RA Capacity Amount
	    ▪ Sum over all 15-min within the hour { (15-min IRx Overlapping RA Capacity * [Hourly IRxMP / 4]) – 15-min IRx LOC for Overlapping RA Capacity }
	  ○ RCx Overlapping RA Capacity Amount
		Core	• Settlements

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	▪ Sum over all 15-min within the hour { (15-min RCx Overlapping RA Capacity * [Hourly RCxMP / 4]) } ○ Where x = {U, D} • System shall allocate the hourly IRx and RCx Overlapping RA Capacity Amount for that RA resource to the LSEs associated with it pro-rata to their monthly RA showing for LSEs that have Opted-In LSE RA True-Up Flag, resulting in: ○ Hourly IRx Overlapping RA Capacity LSE Amount ○ Hourly RCx Overlapping RA Capacity LSE Amount • SCs of LSEs that have their LSE RA True-Up Flag opted-in shall be paid Hourly IRx Overlapping RA Capacity LSE Amount and RCx Overlapping RA Capacity LSE Amount for all RA resources that are associated with them. • SCs of resources shall be charged the Hourly IRx Overlapping RA Capacity LSE Amount and RCx Overlapping RA Capacity LSE Amount for all LSEs that are associated with it.		
DAME-BRQ-09520	**Apply CRR 1B Methodology for CAISO BAA** For CAISO BAA: System shall apply CRR 1B methodology per existing Tariff	**Existing System Functionality**	• Settlements
DAME-BRQ-09540	**Calculate BAA IRU/IRD Congestion Revenues** For CAISO and EDAM BAAs: • System shall calculate BAA IRU/IRD congestion revenues as the product of IRU/IRD Awards and the sub-components of marginal congestion prices of IRUMP/IRDMP (for corresponding BAA), respectively.	Core	• Settlements
DAME-BRQ-09560	**Calculate BAA Energy Congestion Revenues** For CAISO and EDAM BAAs: • System shall calculate BAA Energy congestion revenues as product of DA Energy Awards and congestion sub-components MCC of Energy LMP (for corresponding BAA).	**Existing System Functionality**	• Settlements
DAME-BRQ-09580	**Distribute BAA IRU/IRD Congestion Revenues for CAISO BAA** For CAISO BAA: • System shall distribute the BAA IRU/IRD congestion revenues net of BAA Energy congestion revenues through the existing CRR Balancing Account.	Core	• Settlements
DAME-BRQ-09600	**Distribute BAA IRU/IRD Congestion Revenues for EDAM BAAs** For EDAM BAA: • System shall return the BAA IRU/IRD congestion revenues, along with BAA Energy congestion revenues, to EDAM BAAs through BAA Congestion Offset Account, for distribution to its participants according to their OATT processes.	Core	• Settlements

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	Notes • Congestion contributions to transmission constraints in an EDAM BAA from resources in other EDAM BAAs contribute to the congestion offset of the EDAM BAA where the congestion occurs.		

5.9 Business Process: Manage Market Reporting

OASIS

- Publish IR/RC Bid-Related Data

- Publish IFM IR and RUC RC Nodal Prices

- Publish IFM IR and RUC Binding Constraints Shadow Prices

- Publish IFM IR and RUC RC Nomogram/Branch and Interties Shadow Prices

- Publish IFM IR and RUC RC MPM Intertie Constraint Competitive Path

- Publish IFM IR and RUC RC Aggregate Awards

- Publish IRU/IRD Requirements

- Publish IRU/IRD Requirement Thresholds

- Publish IRU/IRD Requirements Input Polynomials

- Publish IRU/IRD Requirements Uncertainty Histograms

- Publish IRU/IRD Forecasts

- Publish IRU/IRD Demand Curves

- Publish IFM Forecast Movement

- Publish Payment and No-Payments of IR/RC-Charge Code Settlements Amounts Data

CMRI

- Publish IR and RC DAB Curves

- Publish IFM IRU and RUC RCU Mitigated Bids

- Publish IFM IR and RUC RC Resource Awards

- Publish IFM IR and RUC RC Resource Prices

- Publish IFM IR and RUC RC LSE Resource Awards

- Publish 15-min IRU/IRD LOC for Overlapping RA Capacity

- Publish DA/Base Schedule Forecasted Movement Data

5.9.1 Business Requirements

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted

DAME-BRQ-10140	**Publish IR/RC Bid-Related Data**
	Upon data receipt, System shall report the following IR/RC bid-related data (original and corrected):
	• Resource-Specific Hourly Data
	    o IRU/IRD Clean Bids
	    o RCU/RCD Clean Bids
		Core	• OASIS

DAME-BRQ-10160	**Publish IFM IR and RUC RC Nodal Prices**
	Upon data receipt, System shall report the following IFM IR and RUC RC market results data (original and corrected):
	• Nodal Hourly Data
	    o IFM & IFM-MPM IRUMP/IRDMP Nodal Prices and their price breakdown, but shall not include the sub-components of their marginal congestion prices
	    o RUC & RUC-MPM RCUMP/RCDMP Nodal Prices (single total prices [no price breakdown])
		Core	• OASIS

DAME-BRQ-10180	**Publish IFM IR and RUC RC Binding Constraints Shadow Prices**
	Upon data receipt, System shall report the following IFM IR and RUC RC market results data (original and corrected):
	• Network Constraints Hourly Data
	    o Binding Constraint due to IFM IRU/IRD.
	    o Binding Constraint due to RUC.
	    o IFM IRU/IRD Constraint Shadow Prices
	    o RUC Constraint Shadow Prices
		Core	• OASIS

DAME-BRQ-10200	**Publish IFM IR and RUC RC Nomogram/Branch and Interties Shadow Prices**
	Upon data receipt, System shall report the following IFM IR and RUC RC market results data (original and corrected):
	• Network Constraints Hourly Data
	    o IFM & IFM-MPM IRU/IRD Nomogram/Branch Shadow Prices
	    o RUC & RUC-MPM RCU/RCD Nomogram/Branch Shadow Prices
	    o IFM & IFM-MPM IRU/IRD Intertie Shadow Prices
		Core	• OASIS

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	o RUC & RUC-MPM RCU/RCD Intertie Shadow Prices		
DAME-BRQ-10220	**Publish IFM IR and RUC RC MPM Intertie Constraint Competitive Path** Upon data receipt, System shall report the following IFM IR and RUC RC market results data (original and corrected): • Intertie Constraint Competitive Path Hourly Data o MPM Intertie Constraint Competitive Path	Core	• OASIS

DAME-BRQ-10240	**Publish IFM IR and RUC RC Aggregate Awards**
	Upon data receipt, System shall report the following IFM IR and RUC RC market results data (original and corrected):
	• BAA Hourly Data
	
	    o IFM IRU/IRD Awards
	
	    o RUC RCU/RCD Awards (including proxy RCU awards)
		Core	• OASIS

DAME-BRQ-10260	**Publish IRU/IRD Requirements** Upon data receipt, System shall report the following data (original data only, no data corrections): • BAA Hourly Data o IRU/IRD Requirements	Core	• OASIS
DAME-BRQ-10280	**Publish IRU/IRD Requirement Thresholds** Upon data receipt, System shall report the following data (original data only, no data corrections): • BAA Hourly Data o IRU/IRD Requirement Thresholds	Core	• OASIS
DAME-BRQ-10300	**Publish IRU/IRD Requirements Input Polynomials** Upon data receipt, System shall report the following data (original data only, no data corrections): • BAA Hourly Data o IRU/IRD Requirements Input Polynomials	Core	• OASIS
DAME-BRQ-10320	**Publish IRU/IRD Requirements Uncertainty Histograms** Upon data receipt, System shall report the following data (original data only, no data corrections): • BAA Hourly Data o IRU/IRD Requirements Uncertainty Histograms	Core	• OASIS

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
DAME-BRQ-10340	**Publish IRU/IRD Forecasts** Upon data receipt, System shall report the following data (original data only, no data corrections): • BAA Hourly Data o IRU/IRD Forecasts	Core	• OASIS
DAME-BRQ-10360	**Publish IRU/IRD Demand Curves** Upon data receipt, System shall report the following data (original data only, no data corrections): • BAA Hourly Data o IRU/IRD Demand Curves	Core	• OASIS
DAME-BRQ-10380	**Publish IFM Forecast Movement** Upon data receipt, System shall report the following data (original and corrected data): • BAA Hourly Data, split by (Registered Generator, Load, and Intertie) o IFM Forecast Movement	Core	• OASIS

DAME-BRQ-10400	**Publish Payment and No-Payments of IR/RC-Charge Code Settlements Amounts Data**
	Upon data receipt, System shall report the following payment and no-payments of IR/RC charge code Settlements amounts (original and corrected):
	• Resource-Specific Monthly Data and Zonal-Specific Daily Data
	   o CC-6800 – DA RUC Availability Settlement
	      ▪ (or tentative replacement: CC-6xxxx – DA RUC Reliability Capacity Up Settlement)
	   o CC-06824 – No Pay Residual Unit Commitment (RUC) Settlement
	      ▪ (or tentative replacement: CC-6xxxx – No Pay Residual Unit Commitment (RUC) Reliability Capacity Up Settlement)
	   o CC-6xxx (tentative) – No Pay Residual Unit Commitment (RUC) Reliability Capacity Down Settlement
	   o CC-6xxx (tentative) – DA Imbalance Reserve Up Settlement)
	   o CC-6xxx (tentative) – No Pay DA Imbalance Reserve Up Settlement
	   o CC-6xxx (tentative) – DA Imbalance Reserve Down Settlement)
	   o CC-6xxx (tentative) – No Pay DA Imbalance Reserve Down Settlement
		Core	• OASIS

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted

DAME-BRQ-10680	**Publish IR and RC DAB Curves**
	Upon data receipt, System shall report the following data:
	• Resource-specific Daily
	  o DAB Curves (MW , Bid Price)
	  o Market Product Type:
	    ▪ IRU
	    ▪ IRD
	    ▪ RCU
	    ▪ RCD
		Core	• CMRI

DAME-BRQ-10700	**Publish IFM IRU and RUC RCU Mitigated Bids**
	Upon data receipt, System shall report the following **I**FM IR and RUC RC market results data (original and corrected):
	• Resource-Specific Hourly Data
	  o IRU Mitigated Bids
	  o RCU Mitigated Bids
		Core	• CMRI

DAME-BRQ-10720	**Publish IFM IR and RUC RC Resource Awards**
	Upon data receipt, System shall report the following **I**FM IR and RUC RC market results data (original and corrected):
	• Resource-Specific Hourly Data
	  o IFM IRU/IRD Resource Awards
	  o RUC RCU/RCD Resource Awards
	  o Retire RUC Awards as it is replaced with RCU Awards.
	  o Proxy RCU Flag
	
	Notes
	• The Proxy Awards can co-exist for same resource and hour with RCU Awards.
		Core	• CMRI

DAME-BRQ-10740	**Publish IFM IR and RUC RC Resource Prices** Upon data receipt, System shall report the following **I**FM IR and RUC RC market results data (original and corrected): • Resource-Specific Hourly Data o IFM IRUMP/IRDMP Resource Prices and their price breakdown, but shall not include the sub-components of their marginal congestion prices (by BAA).	Core	• CMRI

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	○ RUC RCUMP/RCDMP Resource Prices (single total prices [no price breakdown])		
DAME-BRQ-10780	**Publish 15-min IRU/IRD LOC for Overlapping RA Capacity** Upon data receipt, System shall report the following data (original and corrected) and shall be accessed by each resource's SC and by each resource's associated LSE: • RA-Resource-Specific 15-min ○ IRU/IRD LOC for Overlapping RA Capacity	Core	• CMRI
DAME-BRQ-10800	**Publish DA/Base Schedule Forecasted Movement Data** Upon data receipt, System shall report the following data (original and corrected) and shall be accessed by each resource's SC: • Resource-Specific Hourly ○ DA Schedule Forecasted Movement (for CAISO and EDAM BAAs) ○ Base Schedule Forecasted Movement (for WEIM BAAs)	Core	• CMRI

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5.10 Business Process: Manage FERC Reporting

- Publish Market Data FERC
- Publish Settlements Data FERC

5.10.1 Business Requirements

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted

DAME-BRQ-11420	**Publish Market Data to FERC**
	System shall have the capability to automatically publish the following data to FERC:
	• System Parameters Daily Data
	  o IRU/IRD Deployment Factor (DIRU/DIRD)
	• Resource-Specific Data
	
	  o IR Eligibility Flag
	
	  o RC Eligibility Flag
	
	• RA-Resource-Specific Monthly Data
	
	  o Mapping between RA Resources and LSEs
	  o RA Resources RA Shown Capacity for each mapped LSE
	
	• RA-Resource-Specific Daily Data
	
	  o RA Resources Identification
	  o RA Resources Generic RA Capacity
	  o RA Resources Flex RA Capacity
	
	• Resource-Specific Daily Data
	
	  o DAB Curves (Capacity MW , Bid Price) for:
	    ▪ IRU
	    ▪ IRD
	    ▪ RCU
	    ▪ RCD
	• Resource-Specific Hourly Data
	
	  o IRU/IRD and RCU/RCD Clean Bids
	
	  o IRU/IRD and RCU/RCD Final Bids (including mitigation flags)
	
	  o IRU/IRD and RCU/RCD Resource Awards
		Core	• Internal ISO System

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
	- Retire RUC Awards (from go-live) as it is replaced with RCU Awards. - Proxy RCU Flag - IRUMP/IRDMP Resource Prices and their price breakdown, but excluding sub-components of marginal congestion prices (by BAA). - RCUMP/RCDMP Resource Prices and their price breakdown, but excluding sub-components of marginal congestion prices (by BAA). - DA Schedule Forecasted Movement (for CAISO and EDAM BAAs) - Base Schedule Forecasted Movement (for EIM BAAs) **RA-Resource-Specific 15-min** - IRU/IRD LOC for Overlapping RA Capacity - IRU/IRD Overlapping RA Capacity - RCU/RCD Overlapping RA Capacity **Nodal Hourly Data** - IRUMP/IRDMP Nodal Prices and their price breakdown, including sub-components of marginal congestion prices (by BAA). - RCUMP/RCDMP Nodal Prices and their price breakdown, including sub-components of marginal congestion prices (by BAA). **Network Constraints Hourly Data** - Binding Constraint due to IRU/IRD and RUC. - IRU/IRD and RUC Constraint Shadow Prices **Network Constraints Daily Data** - Deployment Scenario Deliverability Constraints Activation Flag for IRU/IRD Awards (separate activation flags for IRU and IRD) - Deployment Scenario Deliverability Inclusion Constraints Flag due RCU/RCD Awards (separate activation flags for RCU and RCD)		

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted

	• BAA Hourly Data
	
	    o IRU/IRD Requirements
	
	    o IRU/IRD Requirement Thresholds
	
	    o IRU/IRD Requirements Input Polynomials
	
	    o IRU/IRD Requirements Uncertainty Histograms
	
	    o IRU/IRD Forecasts
	
	    o IRU/IRD Demand Curves
	
	• BAA Hourly Data, by Resource Category
	
	    o DA Schedule Forecasted Movement (for CAISO and EDAM BAAs)
	
	    o Base Schedule Forecasted Movement (for WEIM BAAs)
	
	Notes
	
	• The Proxy Awards can co-exist for same resource and hour with RCU Awards.		

DAME-BRQ-11440	**Publish Settlements Data to FERC**
	System shall have the capability to automatically publish the following data to FERC:
	
	• IRU/IRD and RCU/RCD Settlements Charge Codes
	
	    o Payments
	
	    o No-Pay Charges
	
	    o Cost Allocations
	
	    o BCR
	
	    o GMC
	
	    o IR – FRP Ramp Deviation
		Core	• Internal ISO System

5.11 Business Process: <Market/Business Simulation>

This section shall provide a basis for the development of the Market/Business Simulation Scenarios. These requirements will provide guidance on the market participant impacts, inputs into the Scenarios, endpoints to the Scenarios and reasons for potential Scenarios. The guidance on market participant impacts shall be gathered from the requirements that impact rules, interfaces, applications/reports, new system processes, new/modified data models, and new user roles. The source and sink systems shall be determined through the development of the system context diagram and the web service requirements. The *Reason for the Potential Scenario* column will be to offer guidance regarding what potential scenarios, and their context, may be needed for this project. This section applies to all policy development projects, market enhancements, technology enhancements, operation enhancements, Western Energy Imbalance Market (WEIM) implementations, and Reliability Coordination (RC) service implementations.

In the Reason for Potential Scenario column, select one or more of the following reasons:

1. **Rule Impacts**: Generalized changes in market rules, bidding rules, settlements rules, market design changes, or other business rules.

2. **Interface changes**: Changes that impact templates (e.g., the Resource Adequacy (RA) supply plan), user interface (UI), and application programming interface (API) (e.g., retrievals of new shadow settlement data).

3. **New application/report**: Changes that cause addition/modification of market software or reports, especially when market data input is required by the market participant.

4. **New system process**: Modification of data flow in systems, especially if the new process requires the market participant to demonstrate proficiency prior to production.

5. **New/Modified model data**: Addition or substantial modification of model data as a market solution or export provided by the ISO.

6. **New user role**: The addition or modification of access permissions for a user role applied to specific business units within a WEIM entity or market participant organization (e.g., Load Serving Entity (LSE) as a Local Regulatory Authority (LRA) role). Scenarios are beneficial for market participants taking on a new function or process within their organization.

5.11.1 Business Requirements

ID#	Guidance on Market Participant Impacts	Source System	Sink System	Reason for Potential Scenario
DAME-MSIM-15020	**ISO SCs Submit IRU/IRD & RCU/RCD Bids**	• SIBR	• CMRI • OASIS • MRI-S	1. Rule Impacts 2. Interface changes

ID#	Guidance on Market Participant Impacts	Source System	Sink System	Reason for Potential Scenario

	• Set up a scenario where SCs for resources within CAISO BAA submit bid combinations, including IRU/IRD and RCU/RCD bids.
	
	• Run DAM (IFM and RUC).
	
	• Run Settlements
	
	• Follow the results in sink systems to verify market results:
	
	    ○ OASIS
	
	        ▪ IR/RC Bid-Related Data
	
	        ▪ IFM IR and RUC RC Nodal Prices
	
	        ▪ IFM IR and RUC Binding Constraints Shadow Prices
	
	        ▪ IFM IR and RUC RC Nomogram/Branch and Interties Shadow Prices
	
	        ▪ IFM IR and RUC RC MPM Intertie Constraint Competitive Path
	
	        ▪ IFM IR and RUC RC Aggregate Awards
	
	        ▪ IRU/IRD Requirements
	
	        ▪ IRU/IRD Requirement Thresholds
	
	        ▪ IRU/IRD Requirements Input Polynomials
	
	        ▪ IRU/IRD Requirements Uncertainty Histograms
	
	        ▪ IRU/IRD Forecasts
	
	        ▪ IRU/IRD Demand Curves
	
	        ▪ IFM Forecast Movement
	
	        ▪ Payment and No-Payments of IR/RC-Charge Code Settlements Amounts Data
	
	    ○ CMRI
	
	        ▪ IR and RC DAB Curves
				3. new application /report
				
				4. New system process

ID#	Guidance on Market Participant Impacts	Source System	Sink System	Reason for Potential Scenario

	▪ IFM IRU and RUC RCU Mitigated Bids
	
	      ▪ IFM IR and RUC RC Resource Awards
	
	      ▪ IFM IR and RUC RC Resource Prices
	
	      ▪ IFM IR and RUC RC LSE Resource Awards
	
	      ▪ IRU/IRD LOC for Overlapping RA Capacity
	
	      ▪ DA/Base Schedule Forecasted Movement Data
	
	   o Settlements
	
	      ▪ IFM IR & RUC RC Payments
	
	      ▪ IFM IR & RUC RC Cost Allocation
	
	      ▪ IR DA and RC RT BCR Settlements
	
	      ▪ Inclusion of IR & RC in GMC Settlements
	
	      ▪ IRU/IRD & RCU/RCD Unavailability No-Pay Charges
	
	      ▪ IR and RC Unavailability No-Pay Charges Priority
	
	      ▪ IR – FRP RTM Ramp Deviation Settlements
	
	      ▪ FMM Forecasted Movement Deviation Settlements
	
	      ▪ Settlements of Overlapping RA Capacity for True-Up Settlements Mechanism
	
	      ▪ Accounting IRU/IRD in CRR Settlements for CAISO and EDAM BAAs			

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ID#	Guidance on Market Participant Impacts	Source System	Sink System	Reason for Potential Scenario
DAME-MSIM-15040	**Change Setting of IRU/IRD Deployment Factors** • Set up a scenario where CAISO set the IRU/IRD Deployment Factors to 50%. • Follow same scenario setup as the one described in DAME-MSIM-15020.	• DAM • SIBR	• CMRI • OASIS • MRI-S	1. Rule Impacts 2. Interface changes 3. new application /report 4. New system process
DAME-MSIM-15060	**Change Set of Activated Transmission Constraints in the IRU/IRD Deployment Scenarios** • Set up a scenario where CAISO BAA Operator changes set of activated transmission constraints that are monitored in the IRU/IRD deployment scenarios. • Follow same scenario setup as the one described in DAME-MSIM-15020.	• DAM • SIBR	• CMRI • OASIS • MRI-S	1. Rule Impacts 2. Interface changes 3. new application /report 4. New system process

6 Appendices

6.1 Appendix-A – Acronym Definition

Acronym	Definition
A2A	Application-to-Application
ABC	Available Balancing Capacity
ABS	Absolute value
AC	Alternating Current
ACL	Access Control List
ACPF	Alternating Current Power Flow
ADS	Automatic Dispatch System
AGC	Automatic Generation Control
AIM	Access and Identity Management
ALFS	Automated Load Forecast System
Anode	Aggregate Node
API	Application Program Interface
Apnode	Aggregate Pricing Node
AS	Ancillary Services
ASSOC	Ancillary Services State Of Charge
AUX	Auxiliary
B2B	Business-to-Business
BA	Business Analyst
BAA	Balancing Authority Area

Acronym	Definition
BAAOP	Balancing Authority Area Operations Portal
BARC	Balancing Area Requirement Calculator
BCR	Bid Cost Recovery
BPM	Business Process Manual
BRS	Business Requirement Specifications
BS	Base Schedule
BSAP	Base Schedule Aggregation Portal
BSC	Base Schedule Coordinator
BSSD	(WEIM) Base Schedule Submission Deadline
CAISO	California Independent System Operator
CB	Convergence Bidding
CC	Commitment Cost
CC	Charge Code
CCDEBE	Commitment Costs and Default Energy Bid Enhancements
CDN	Conformed Dispatch Notice
CF	Capacity Factor
CIDI	Customer Inquiry, Dispute and Information system
CIM	Common Information Model
CIP	Critical Infrastructure Protection
CIRA	Customer Interface for Resource Adequacy
CISO	California Independent System Operator
CLAP	Custom Load Aggregation Point

Acronym	Definition
CMRI	Customer Market Results Interface
CMT	Commitment
Cnode	Connectivity Node
COG	Constrained-Output Generator
CPM	Capacity Procurement Mechanism
CRN	Contract Reference Number
CRR	Congestion Revenue Rights
CRR1B	Congestion Revenue Rights Auction Efficiency 1B Project
CRRS	Congestion Revenue Rights Settlements (aka CRR Clawback system)
CSS	Critical Systems Support
CSV	Comma Separated Value
D	Day
D+1	Trading Day plus 1 day
D+2	Trading Day plus 2 days
DA	Day-Ahead
DAB	Default Availability Bid
DACA	Day-Ahead Contingency Analysis
DAES	Day-Ahead Energy Schedule
DAM	Day-Ahead Market
DAME	Day-Ahead Market Enhancements
DART	Day-Ahead Reliability Tool
DCC	Default Commitment Cost

Acronym	Definition
DCPA	Dynamic Competitive Path Assessment
DCPF	Direct Current Power Flow
DEB	Default Energy Bid
Dec	Decremental
DER	Distributed Energy Resource
DF	Demand Forecast
DGAP	Default Generation Aggregation Point
DIRD	Imbalance Reserve Down Deployment Factor (used in IRU Deployment Scenarios)
DIRU	Imbalance Reserve Up Deployment Factor (used in IRD Deployment Scenarios)
DMLC	Default Minimum Load Cost
DMM	Department of Market Monitoring
DOP	Dispatch Operating Point
DOT	Dispatch Operating Target
DR	Demand Response
DRP	Demand Response Program
DSA	Dynamic Stability Analysis
DSTC	Default State Transition Cost
DSUC	Default Start Up Cost
DUIT	Detailed Unit Information Tool
EA	Energy + Ancillary Services
ECIC	Energy Costs and Index Calculator
ED	Exceptional Dispatch

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Acronym	Definition
EDAM	Extended Day-Ahead Market
EDR	Enterprise Data Repository
EE	Expected Energy
EEA	Expected Energy Allocation
EEA	Energy Emergency Alert
EEA2	Energy Emergency Alert Stage-2
EESC	Energy Imbalance Market Entity Scheduling Coordinator
EFC	Effective Flexible Capacity
EMM	Enterprise Model Management
EMMS	Enterprise Model Management System
EMNA	Energy Management Network Application
EMS	Energy Management System
En	Energy
EN	Energy
EPI	Electricity Price Index
ESP	Electronic Security Perimeter
ESR	Energy Storage Resource
ETC	Existing Transmission Contract
ETSR	Energy Transfer System Resources
FERC	Federal Energy Regulatory Commission
FIT	Fully Integrated Tracking (ISO reporting tool that provides system operators various reports for RT operations, such as Capacity Forecast, Day Ahead Reports, Load Shedding, Peak Day, Market Impacts Checker, etc.)

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Acronym	Definition
FM	Forecasted Movement
FMCA	Fifteen-Minute Contingency Analysis
FMM	Fifteen-Minute Market
FMU	Frequently Mitigated Unit
FNM	Full Network Model
FODD	FERC Outgoing Data Depository
FRCT	Forbidden Region Crossing Time
FRD	Flexible Ramp Down
FRDMP	Flexible Ramp Down Marginal Price
FRP	Flexible Ramp Product
FRU	Flexible Ramp Up
FRUMP	Flexible Ramp Up Marginal Price
GCARM	Generator Contingency and RAS Modeling
GDF	Generation Distribution Factor
GHG	Green House Gas
GIP	Generator Interconnection Procedure
GMC	Grid Management Charge
GPI	Gas Price Index
GRDT	Generator Resource Data Template
GUI	Graphical User Interface
h	Trading Hour
HASP	Hour-Ahead Scheduling Process

Acronym	Definition
HAVGC	Heat Average Cost (for non-gas resources)
HR	Heat Rate
ICE	InterContinental Exchange
ICM	Infrastructure Contracts and Management
ID	Identifier
IFM	Integrated Forward Market
Inc	Incremental
ISL	Intertie Scheduling Limit
ISO	California Independent System Operator
Isomon	ISO Monitoring application
IOOC	Integrated Optimal Outage Coordination
IR	Imbalance Reserve
IRD	Imbalance Reserve Down (award)
IRD5	IRD Award 5-minute Ramp-Capable Portion
IRD5+	IRD Award excluding 5-minute Ramp-Capable Portion
IRDC	Imbalance Reserve Down allocated Capacity range
IRDC5	Imbalance Reserve Down allocated Capacity range, for the IRD 5-minute Ramp-Capable Portion.
IRDC5+	Imbalance Reserve Down allocated Capacity range, excluding IRU 5-minute Ramp-Capable Portion.
IRDMP	Imbalance Reserve Down Marginal Price
IRDR	Imbalance Reserve Down Requirement
IRDS	Imbalance Reserve Down Surplus
IRU	Imbalance Reserve Up (award)

Acronym	Definition
IRU5	IRU Award 5-minute Ramp-Capable Portion
IRU5+	IRU Award excluding 5-minute Ramp-Capable Portion
IRUC	Imbalance Reserve Up allocated Capacity range
IRUC5	Imbalance Reserve Up allocated Capacity range, for the IRU 5-minute Ramp-Capable Portion.
IRUC5+	Imbalance Reserve Up allocated Capacity range, excluding IRU 5-minute Ramp-Capable Portion.
IRUMP	Imbalance Reserve Up Marginal Price
IRUR	Imbalance Reserve Up Requirement
IRUS	Imbalance Reserve Up Surplus
ISL	Interchange Scheduling Limit
IT	Information Technology
ITC	Inter-Tie Constraint
ITPD	Information Technology Product Development
ITS	Interchange Transaction Scheduler
ITSM	Information Technology Service Management
JOU	Joint Owned Unit
LACA	Look-Ahead Contingency Analysis
LAP	Load Aggregation Point
LCL	Lower Capacity Limit
LDF	Load Distribution Factor
LEL	Lower Economic Limit
LEL$_{FMM}$	Lower Economic Limit (FMM)
LF	Load Forecast

Acronym	Definition
LFD	Load Following Down qualified self-provision capacity
LFD	Load Following Down qualified self-provision capacity
LFDC	Load Following Down allocated Capacity.
LFR	Lower Forbidden Region
LFU	Load Following Up qualified self-provision capacity
LFU	Load Following Up qualified self-provision capacity
LFUC	Load Following Up allocated Capacity.
LMP	Locational Marginal Price
LMPM	Locational Market Power Mitigation
LOC	Lost Opportunity Cost
LOL	Lower Operating Limit
LPF	Loss Penalty Factor
LPT	Low Priority Price Taker
LRA	Local Regulatory Authority
LRL	Lower Regulation Limit
LSE	Load Serving Entity
LTCA	Long-Term Contingency Analysis
Max	Maximum
MaxExCap	Maximum Ex-post Capacity
MaxExCap$_{FMM}$	Maximum Ex-post Capacity (FMM)
MCC	Marginal Congestion Cost
MCI	Model and Contract Implementation

Acronym	Definition
MD	Manual Dispatch
MDT	Minimum Down Time
MDS	Maximum Daily Startups
MF	Master File
MIBP	Maximum Import Bid Price
Min	Minimum
MinExCap	Minimum Ex-post Capacity
MLAC	Minimum Load Average Cost
MLC	Minimum Load Cost
MLHAVGC	Minimum Load Heat Average Cost (for non-gas resources)
MLHR	Minimum Load Heat Rate
MMA	Major Maintenance Adder
MMAMLC	Major Maintenance Adder for Minimum Load Cost
MMASUC	Major Maintenance Adder for Start Up Cost
MMASTC	Major Maintenance Adder for MSG State Transition Cost
MMG	Manage Markets & Grid
MMR	Manage Market & Reliability
MOO	Must Offer Obligation
MOS	Manage Operations Support & Settlements
MP	Marginal Price
MP	Market Participant
MPM	Market Power Mitigation

Acronym	Definition
MQS	Market Quality System
MRID	Master Resource IDentifier
MRI-S	Market Results Interface – Settlements
MSS	Metered Sub System
MSSA	Metered Sub System Agreement
MSG	Multi-Stage Generator
MUT	Minimum Up Time
MV	Materialized View
MV&A	Market Validation & Analysis
MVT	Market Validation Tool
N/A	Not Applicable
NA	Network Application
ND	Net Demand
NDAB	Negotiated Default Availability Bid
NDEB	Negotiated Default Energy Bid
NGR	Non-Generating Resource
NM	Network Model
NPM	Nodal Price Model
NQC	Net Qualifying Capacity
NR	Non-Spinning Reserve award
NS	Non-Spinning Reserve award; it includes qualified self-provision capacity
NSC	Non-Spinning Reserve allocated Capacity range

Acronym	Definition
OASIS	Open Access Same-time information System
OATI	Open Access Technology International
OC	Opportunity Cost
OCC	Opportunity Cost Calculator
ODCP	On Demand Capacity Procurement
OES	Operations Engineering Services
OMS	Outage Management System
OOM	Out Of Market
OTS	Operations Training Simulator
P97.5	97.5% Percentile
PAC	PacifiCorp
PACE	PacifiCorp East
PACW	PacifiCorp West
PAM	Program and Application Management
PBC	Power Balance Constraint
PC	Pre-Calculation
PCA	Price Correction Admin
PDR	Proxy Demand Resource
PF	Power Flow
PI	Plant Information
PL	Participating Load
Pmax	Maximum Generation Capacity

Acronym	Definition
Pmin	Minimum Generation Capacity
PMO	Program Management Office
PNM	Public New Mexico
Pnode	Pricing Node
POC	Point Of Contact
PRSC	Participating Resource Scheduling Coordinator
PSH	Pump Storage Hydro
PSTD	Power Systems Technology Development
PSTO	Power Systems Technology Operations
PT	Price Taker
PT	High Priority Price Taker
PTO	Participating Transmission Owner
QRB	Quality Review Board
RA	Resource Adequacy
RAS	Remedial Action Schemes
RC	Reliability Coordinator
RC	Reliability Capacity
RC-BSAP	Reliability Coordinator - Base Schedule Aggregation Portal
RCD	Reliability Capacity Down (award)
RCDC	Reliability Capacity Down allocated Capacity range (FMM).
RCDMP	Reliability Capacity Down Marginal Price
RCSA	Reliability Coordinator Service Agreement

Acronym	Definition
RCU	Reliability Capacity Up (award)
RCUMP	Reliability Capacity Up Marginal Price
RCUC	Reliability Capacity Up allocated Capacity range
RD	Regulation Down (award)
RDC	Regulation Down allocated Capacity.
RDOT	Ramping Dispatch Operating Target (a continuous piecewise linear curve connecting consecutive *DOT*s using their mid-interval points, from RTD, RTCD, or RTDD runs, as applicable)
RDRR	Reliability Demand Response Resource
RDT	Resource Data Template
RegD	Regulation Down (award)
RegU	Regulation Up (award)
REN	Reliability Energy
RIG	Remote Intelligent Gateway
RIMS	Resource Interconnection Management System
RMR	Reliability Must Run
ROPR	Operating Reserve Ramp Rate
RR	Ramp Rate
RRD	Ramp Rate that corresponds to $DAES_{DAM} - IRD_{DAM}$
RREG	Regulation Ramp Rate
RRU	Ramp Rate that corresponds to $DAES_{DAM} + IRU_{DAM}$
RSE	Resource Sufficiency Evaluation
RSEE	Resource Sufficiency Evaluation Enhancements

Acronym	Definition
RT	Real-Time
RTBS	Real-Time Base Scheduler
RTCA	Real-Time Contingency Analysis
RTCD	Real-Time Contingency Dispatch
RTD	Real-Time Dispatch
RTDD	Real-Time Disturbance Dispatch
RTPD	Real-Time Pre-Dispatch
RTM	Real-Time Market
RTN	Real-Time Nodal (Market)
RTUC	Real-Time Unit Commitment
RU	Regulation Up (award)
RUC	Residual Unit Commitment
RUC	Regulation Up allocated Capacity.
SADS	System And Design Specifications
SC	Scheduling Coordinator
SCME	Scheduling Coordinator Meter Entity
SDF	Solar Distribution Factor
SE	State Estimator
SF	Shift Factor
SIBR	Scheduling Infrastructure and Business Rules
SME	Subject Matter Expert
SOA	Service-Oriented Architecture

Acronym	Definition
SOC	State Of Charge
SP	Scheduling Point
SPCE	Siemens Price Correction Engine
SQMD	Settlements Quality Meter Data
SR	Spinning Reserve (award)
SRC	Spinning Reserve allocated Capacity range
SRS	System Requirement Specifications
SS	Self-Schedule
SSAE	Statement on Standards for Attestation Engagements
STC	State Transition Cost
STF	Short-Term Forecast
STC	State Transition Cost
STT	State Transition Time
STUC	Short-Term Unit Commitment
SUC	Start Up Cost
SUE	Start Up Energy
SUF	Start Up Fuel
SURT	Start Up Ramp Time
SUT	Start Up Time
T	Trading Day
TBD	To Be Determined
TEP	Tucson Electric Power

Acronym	Definition
TG	Tie Generator
TNA	Transmission Network Application
TOP	Transmission Operator Provider
TOR	Transmission Ownership Contract
TEE	Total Expected Energy
TTEE	Total Target Expected Energy (based on RDOT)
UAT	User Acceptance Testing
UCL	Upper Capacity Limit
UEL	Upper Economic Limit
UFR	Upper Forbidden Region
UI	User Interface
UIE	Uninstructed Energy Imbalance
UL	User Limited
UOL	Upper Operating Limit
URL	Upper Regulation Limit
VER	Variable Energy Resource
VOM	Variable Operations & Maintenance
VOMC	Variable Operations & Maintenance Cost
WDF	Wind Distribution Factor
WebOMS	Web-based Outage Management System
WEIM	Western Energy Imbalance Market
XML	Extensible Markup Language

Acronym	Definition
XSD	XML Schema Definition

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6.2 Appendix-B: Formulas, Calculation Details, and Examples

6.2.1 Eligibility Tables

6.2.1.1 Resource Eligibility Table

Reference BRQs

- DAME-BRQ-01000
- DAME-BRQ-01010
- DAME-BRQ-04008
- DAME-BRQ-04020

	EN	RCU	RCD	EN needed for RCU/D award	IRU	IRD	EN needed for IRU award	EN needed for IRD award
Non-Participating Load	Yes	Not Eligible	Not Eligible	N/A	Not Eligible	Not Eligible	N/A	N/A
Virtual Supply	Yes	Not Eligible	Not Eligible	N/A	Not Eligible	Not Eligible	N/A	N/A
Virtual Demand	Yes	Not Eligible	Not Eligible	N/A	Not Eligible	Not Eligible	N/A	N/A
Hourly Block Import	Yes	Eligible	Eligible	None	Not Eligible	Not Eligible	N/A	N/A
Hourly Block Export	Yes	Eligible	Eligible	None	Not Eligible	Not Eligible	N/A	N/A
15-Min Import	Yes	Eligible	Eligible	None	Eligible	Eligible	None	EN >= IRD
15-Min Export	Yes	Eligible	Eligible	None	Eligible	Eligible	EN >= IRU	None
Dynamic Import	Yes	Eligible	Eligible	None	Eligible	Eligible	EN >= Pmin	EN <= Pmax

	EN	RCU	RCD	EN needed for RCU/D award	IRU	IRD	EN needed for IRU award	EN needed for IRD award
							$EN \leq Pmax - IRU$	$EN \geq Pmin + IRD$
Long-Start Generator	Yes	Eligible	Eligible	$EN \geq Pmin$	Eligible	Eligible	$EN \geq Pmin$ $EN \leq Pmax - IRU$	$EN \leq Pmax$ $EN \geq Pmin + IRD$
Short-Start Generator	Yes	Eligible	Eligible	None	Eligible	Eligible	$EN \geq Pmin$ $EN \leq Pmax - IRU$	$EN \leq Pmax$ $EN \geq Pmin + IRD$
Participating Load w/ 15-Min dispatch capability	Yes	Eligible	Eligible	None	Eligible	Eligible	$EN \geq Pmin$ $EN \leq Pmax - IRU$	$EN \leq Pmax$ $EN \geq Pmin + IRD$
Participating Load w/ Hourly dispatch capability	Yes	Eligible	Eligible	None	Not Eligible	Not Eligible	N/A	N/A
Variable Energy Resources (Wind/Solar)	Yes	Eligible	Eligible	TBD	Eligible	Eligible	TBD	TBD
Non-Generator	Yes	Eligible	Eligible	N/A	Eligible	Eligible	N/A	N/A

	EN	RCU	RCD	EN needed for RCU/D award	IRU	IRD	EN needed for IRU award	EN needed for IRD award
Resources (Storage)		(only for positive range)	(only for negative range)		(only for positive range)	(only for negative range)		
Hybrid Resource	Yes	Eligible	Eligible	N/A	Eligible	Eligible	N/A	N/A
Co-Located Resource	--- Eligibility determined by individual storage and VER components ---							
Energy Storage Resource	Yes	Eligible	Eligible	N/A	Eligible	Eligible	N/A	N/A
60-Minute Proxy Demand Resource	Yes	Eligible	Eligible	None	Not Eligible	Not Eligible	N/A	N/A
15-Minute Proxy Demand Resource	Yes	Eligible	Eligible	None	Eligible	Eligible	EN >= Pmin EN <= Pmax – IRU	EN <= Pmax EN >= Pmin + IRD
5-Minute Proxy Demand Resource	Yes	Eligible	Eligible	None	Eligible	Eligible	EN >= Pmin EN <= Pmax – IRU	EN <= Pmax EN >= Pmin + IRD
Reliability Demand Response Resource	Yes	Not Eligible	Not Eligible	None	Not Eligible	Not Eligible	N/A	N/A

6.2.1.2 Proposed and Existing DAM Products

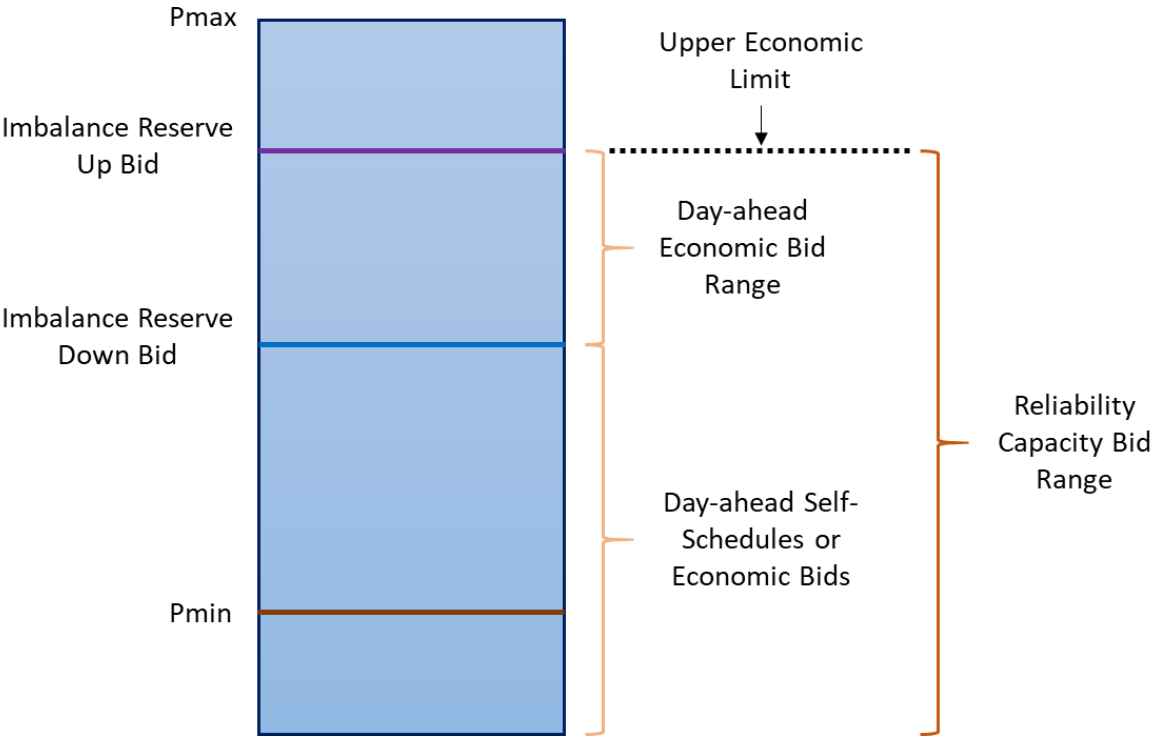| Title	Acronym	Time Granularity	Purpose	Eligibility*	Procured In	Status
Energy	EN	Hourly	Energy schedules cleared to meet bid-in demand	All resources	IFM	Existing
Reliability Capacity, Up	RCU	Hourly	Incremental capacity procured to meet the positive difference between the net load forecast and cleared non-VER physical supply	Physical resources based on 60-minute ramp capability	RUC	Replaces RUC awards
Reliability Capacity, Down	RCD	Hourly	Decremental capacity procured to meet the negative difference between net load forecast and cleared non-VER physical supply	Physical resources based on 60-minute ramp capability	RUC	Proposed
Imbalance Reserves, Up	IRU	15-min	Incremental capacity procured relative to the net load forecast to meet the upward uncertainty requirement	15-minute dispatchable physical resources, award based on 15-minute ramp capability	IFM	Proposed

Title	Acronym	Time Granularity	Purpose	Eligibility*	Procured In	Status
Imbalance Reserves, Down	IRD	15-min	Decremental capacity procured relative to the net load forecast to meet the downward uncertainty requirement	15-minute dispatchable physical resources, award based on 15-minute ramp capability	IFM	Proposed
Ancillary Services	AS	10-min	Incremental capacity procured and reserved to meet real-time regulation and contingency reserve requirements	Resources certified to provide the respective service	IFM	Existing

6.2.2 Bidding Obligation

6.2.2.1 Day-Ahead Bidding Rules for Imbalance Reserves and Reliability Capacity

6.2.2.2 Real-Time Bidding Obligations