California ISO

Business Requirements Specification

Energy Storage Enhancements Track 1

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Date	Version	Description
03/29/2023	1.4	**Posted to CAISO** **Note:** This is the first EXT BRS version posted for ESE Track 1 as version 1.4 reflects internal BRS numbering.
10/26/2023	1.5	**Updated BRQs:** BRQ039, BRQ041 **Added BRQs:** BRQ400, BRQ401 **Note: All updates to V1.5 are reflected in red.**

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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 (SRS) 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).

Project Background

Storage developers are rapidly deploying new utility-scale resources onto the California grid to provide replacement capacity for retiring resources and to meet procurement mandates authorized by the California Public Utilities Commission. This initiative evolves processes and systems to help storage resource scheduling coordinators better manage resource state of charge and continue to ensure efficient market outcomes.

The purpose of this initiative is to enhance reliability tools with regards to storage resources. The enhancements includes updates to bidding rules, exceptional dispatch of storage resources, and storage resource opportunity costs. The scope of this document covers the enhancements slated for Track 1, i.e. pre-summer 2023. The remaining scope in the Energy Storage Enhancements Policy will be covered in a separate BRS document for Track 2.

Reliability Enhancements

- Include expected impacts from regulation in State of Charge (SOC)
- Require storage to bid energy in the opposite direction of Ancillary Service (AS) awards
    - A resource providing reserves, regulation up, or regulation down must have energy bids to charge/discharge (respectively)
    - Energy bids must be 50% of AS awards

Reference Level Enhancements

- Update DA storage resource default energy bid (DEB) to include storage specific opportunity cost

2 Details of Business Need/Problem

2.1 Description

Business Opportunity/Problem Statement:	
What:	This initiative includes enhancements to reliability processes and tools to better manage energy storage resource state of charge. The initiative also includes day-ahead storage resource DEB updates to better capture storage resource opportunity costs.
Why do we have this opportunity/problem:	The number of storage resources interconnecting to the ISO grid is rapidly growing. Storage resources can charge and discharge; therefore they function inherently differently from one-way generation and load. Current operator tools, bidding rules, market optimization, and settlement rules require enhancements to accommodate the influx of storage resources to the grid.

3 Project Impact Assessment (IA)

3.1 Business Practice Manuals (BPM)

BPM	Description of Impact(s)
Market Instruments	-Updates to reflect bidding rule requirements -Update storage resource Default Energy Bid (DEB) formula
Market Operations	-Update SOC formula to include regulation awards and multipliers -Reflect updates to configurable parameters -Reflect updates to SOC constraints, SOC time index, attenuation constraints, ramp capability constrains

3.2 Other

Impact	Description (optional)
Market Simulation	Yes
Market Participant Impact	ISO BA, WEIM BA
External Bid Publication	No
Customer Readiness Impact	
• **External Communication Needed**	Yes
• **External Onboarding and Maintenance**	No
• **External Training**	Yes
• **External Computer Based Training**	Potential Impacts (Storage CBT, Bidding CBT)
Policy Initiative	Yes

4 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.

4.1 Business Process: Manage SIBR

4.1.1 Business Requirements

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
ESE-BRQ023	The system shall require all storage resources registered as LESR to bid energy in the in the RTM in the opposite direction of their DA AS awards and/or RT bid or self-provision --Energy bids must be greater than or equal to 50% of the AS service awards and/or self-provision --This requirement shall apply to all AS awards (spin/non-spin, regulation up, and regulation down) -- Regulation Up, Spin, and Non spin awards require a charging bid. Regulation down awards require a discharging bid. --Parameter shall default to 50%, and will be configurable	Core	SIBR
ESE-BRQ024	If no energy bid has been submitted for a storage resource registered as LESR with a DA AS awards and/or RT self-provision, the system shall insert a RT energy bid using the DEB price. The inserted bid must be 50% of and in the opposite direction of the DA AS award and/or RT self-provision --Parameter shall default to 50%, and will be configurable	Core	SIBR
ESE-BRQ025	The system shall extend a RT energy bid for a storage resource registered as LESR if an energy bid has been submitted but the bid is less than 50% of the resource's DA AS award and/or RT self-provision --Parameter shall default to 50%, and will be configurable	Core	SIBR

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
ESE-BRQ026	The system shall prohibit storage resources registered as LESR from submitting RT self-schedules that would violate the RT energy bid/AS award and/or RT self-provision requirement	Core	SIBR

4.2 Business Process: Manage IFM and RTM

4.2.1 Business Requirements

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
ESE-BRQ033	Opposite dispatchable energy bid requirement: System shall limit the DA AS awards to reserve a portion for charging and discharging storage resource energy in RT as represented below: IFM/RUC: $\begin{Bmatrix} CF\left(RU_{i,t}+SR_{i,t}+NR_{i,t}\right) \le -LCL_{i,t}-RD_{i,t} \\ CF\ RD_{i,t} \le UCL_{i,t}-RU_{i,t}-SR_{i,t}-NR_{i,t} \end{Bmatrix}$ RTM: $\left.\begin{Bmatrix} CF\left(RU_{i,t}+SR_{i,t}+NR_{i,t}\right) \le -LCL_{i,t}-RD_{i,t} \\ CF\left(RU_{i,t}+SR_{i,t}+NR_{i,t}\right) \le \max(0,-LEL_{i,t}) \\ CF\ RD_{i,t} \le UCL_{i,t}-RU_{i,t}-SR_{i,t}-NR_{i,t} \\ CF\ RD_{i,t} \le \max(0,UEL_{i,t}) \end{Bmatrix}\right\}, \forall i \in S_{LESR} \wedge t = 1,2,\dots,T$ -CF: Coverage Factor: configurable, default=0.5 -LCL: Lower capacity limit $LCL_{i,t} = \max\left(LOL_{i,t}, LRL_{i,t}\right)$ -UCL: Upper capacity Limit $UCL_{i,t} = \min\left(UOL_{i,t}, URL_{i,t}, CL_{i,t}\right)$	Core	IFM
ESE-BRQ036	SOC Constraints: The system shall update the time index for SOC from SOC(t) to SOC(t-1):	Core	IFM/RTM

	IFM/RUC: $\begin{Bmatrix} SOC_{i,t-1} - RU_{i,t} - SR_{i,t} - NR_{i,t} \geq \underline{SOC}_{i,t} \\ SOC_{i,t-1} + \eta_i \left(RD_{i,t}\right) \leq \overline{SOC}_{i,t} \end{Bmatrix}$ FMM: $\begin{Bmatrix} SOC_{i,t-1} - \left(RU_{i,t} + SR_{i,t} + NR_{i,t}\right) \frac{T_{30}}{T_{60}} - FRU_{i,t} \frac{T_{15}}{T_{60}} \geq \underline{SOC}_{i,t} \\ SOC_{i,t-1} + \eta_i \left(RD_{i,t} \frac{T_{30}}{T_{60}} + FRD_{i,t} \frac{T_{15}}{T_{60}}\right) \leq \overline{SOC}_{i,t} \end{Bmatrix}$ RTD: $\begin{Bmatrix} SOC_{i,t-1} - \left(RU_{i,t} + SR_{i,t} + NR_{i,t}\right) \frac{T_{30}}{T_{60}} - FRU_{i,t} \frac{T_{5}}{T_{60}} \geq \underline{SOC}_{i,t} \\ SOC_{i,t-1} + \eta_i \left(RD_{i,t} \frac{T_{30}}{T_{60}} + FRD_{i,t} \frac{T_{5}}{T_{60}}\right) \leq \overline{SOC}_{i,t} \end{Bmatrix}, \forall i \in S_{LESR} \wedge t = 1,2,\dots,T$ FRU/FRD awards shall align with the FRP functionality: --FRU and FRD awards from previous RTD run and multiplied by a configurable reserve factor shall be protected by the EIM FRU/FRD buffer interval violation penalty price for the binding RTD interval --FRU and FRD awards from previous RTPD run and multiplied by a configurable reserve factor shall be protected by the EIM FRU/FRD buffer interval violation penalty price for the buffer and binding RTPD intervals		
ESE-BRQ037	General Ramp Capability Constraints: FRU/FRD awards shall align with the FRP functionality: --FRU and FRD awards from previous RTD run and multiplied by a configurable reserve factor shall be protected by the EIM FRU/FRD buffer interval violation penalty price for the binding RTD interval --FRU and FRD awards from previous RTPD run and multiplied by a configurable reserve factor shall be protected by the EIM FRU/FRD buffer interval violation penalty price for the buffer and binding RTPD intervals $\begin{Bmatrix} RU_{i,t} + SR_{i,t} + NR_{i,t} \leq RRU_i\left(EN_{i,t}, T_{10}\right) \\ RD_{i,t} \leq RRD_i\left(EN_{i,t}, T_{10}\right) \end{Bmatrix}, \forall i \wedge t = 1,2,\dots,T$	Existing	IFM/RTM

	IFM: $\begin{Bmatrix} EN_{i,t} - EN_{i,t-1} \le RRU_i\left(EN_{i,t-1}, \Delta T\right) - \left(\alpha\ RU_{i,t} + \beta\ SR_{i,t} + \gamma\ NR_{i,t}\right) \\ EN_{i,t} - EN_{i,t-1} \ge -RRD_i\left(EN_{i,t-1}, \Delta T\right) + \alpha\ RD_{i,t} \end{Bmatrix}$ RUC: $\begin{Bmatrix} EN_{i,t} - EN_{i,t-1} \le RRU_i\left(EN_{i,t-1}, \Delta T\right) - \left(\alpha\ RU_{i,t} + \beta\ SR_{i,t} + \gamma\ NR_{i,t}\right) \\ EN_{i,t} - EN_{i,t-1} \ge -RRD_i\left(EN_{i,t-1}, \Delta T\right) + \alpha\ RD_{i,t} \end{Bmatrix}$ FMM: $\begin{Bmatrix} EN_{i,t} - EN_{i,t-1} \le RRU_i\left(EN_{i,t-1}, \Delta T\right) - \left(\alpha\ RU_{i,t} + \beta\ SR_{i,t} + \gamma\ NR_{i,t}\right) - 3\ \delta\ FRU_{i,t} \\ EN_{i,t} - EN_{i,t-1} \ge -RRD_i\left(EN_{i,t-1}, \Delta T\right) + \alpha\ RD_{i,t} + 3\ \delta\ FRD_{i,t} \end{Bmatrix}$ RTD: $\begin{Bmatrix} EN_{i,t} - EN_{i,t-1} \le RRU_i\left(EN_{i,t-1}, \Delta T\right) - \frac{1}{2}\left(\alpha\ RU_{i,t} + \beta\ SR_{i,t} + \gamma\ NR_{i,t}\right) - \delta\ FRU_{i,t} \\ EN_{i,t} - EN_{i,t-1} \ge -RRD_i\left(EN_{i,t-1}, \Delta T\right) + \frac{1}{2}\ \alpha\ RD_{i,t} + \delta\ FRD_{i,t} \end{Bmatrix}$ $, \forall i \in S_{LESR} \wedge t = 1,2, \dots, T$		
ESE-BRQ038	General Capacity Constraints: FRU/FRD awards shall align with the FRP functionality: --FRU and FRD awards from previous RTD run and multiplied by a configurable reserve factor shall be protected by the EIM FRU/FRD buffer interval violation penalty price for the binding RTD interval --FRU and FRD awards from previous RTPD run and multiplied by a configurable reserve factor shall be protected by the EIM FRU/FRD buffer interval violation penalty price for the buffer and binding RTPD intervals IFM/RUC: $\begin{Bmatrix} EN_{i,t} \le UCL_{i,t} - RU_{i,t} - SR_{i,t} - NR_{i,t} \\ LCL_{i,t} + RD_{i,t} \le EN_{i,t} \\ LEL_{i,t}^{'} \le EN_{i,t} \le UEL_{i,t}^{'} \end{Bmatrix}$ RTM: $\begin{Bmatrix} EN_{i,t} \le UCL_{i,t} - RU_{i,t} - SR_{i,t} - NR_{i,t} - FRU_{i,t} \\ LCL_{i,t} + RD_{i,t} + FRD_{i,t} \le EN_{i,t} \\ LEL_{i,t}^{'} + FRD_{i,t} \le EN_{i,t} \le UEL_{i,t}^{'} - SR_{i,t} - NR_{i,t} - FRU_{i,t} \end{Bmatrix}$ $, \forall i \wedge t = 1,2, \dots, T$ Where: $RU_{i,t} + RD_{i,t} > 0 \Longrightarrow \begin{Bmatrix} UCL_{i,t} = \min\left(UOL_{i,t}, URL_{i,t}, CL_{i,t}\right) \\ LCL_{i,t} = \max\left(LOL_{i,t}, LRL_{i,t}\right) \end{Bmatrix}$ $RU_{i,t} + RD_{i,t} = 0 \Longrightarrow \begin{Bmatrix} UCL_{i,t} = UOL_{i,t} \\ LCL_{i,t} = LOL_{i,t} \end{Bmatrix}$ $, \forall i \wedge t = 1,2, \dots, T$	Existing	IFM/RTM

	$RU_{i,t} + RD_{i,t} > 0 \Longrightarrow \begin{cases} UCL_{i,t} = \min\left(UOL_{i,t}, URL_{i,t}, CL_{i,t}\right) \\ LCL_{i,t} = \max\left(LOL_{i,t}, LRL_{i,t}\right) \end{cases}$ $RU_{i,t} + RD_{i,t} = 0 \Longrightarrow \begin{cases} UCL_{i,t} = UOL_{i,t} \\ LCL_{i,t} = LOL_{i,t} \end{cases}$ $\left.\begin{matrix} UEL'_{i,t} = \min\left(UCL_{i,t}, UEL_{i,t}\right) \\ LEL'_{i,t} = \max\left(LCL_{i,t}, LEL_{i,t}\right) \end{matrix}\right\}, \forall i \wedge t = 1,2,\dots,T$		
ESE-BRQ039	SOC calculation:	Core	IFM/RTM

$$\left.\begin{matrix} SOC_{i,t} = SOC_{i,t-1} - \left(EN_{i,t}^{(+)} + \eta_i\, EN_{i,t}^{(-)}\right)\frac{\Delta T}{T_{60}} \\ \underline{SOC_{i,t}} \le SOC_{i,t} \le \overline{SOC_{i,t}} \\ SOC_{i,t}^{AT} = SOC_{i,t-1}^{AT} - \left(EN_{i,t}^{(+)} + \eta_i\, EN_{i,t}^{(-)} + ATRU_t\, RU_{i,t} - ATRD_t \eta_i RD_{i,t}\right)\frac{\Delta T}{T_{60}} \\ \underline{SOC_{i,t}^{AT}} \le SOC_{i,t}^{AT} \le \overline{SOC_{i,t}^{AT}} \\ 0 \le EN_{i,t}^{(+)} \le u_{i,t}\, UEL'_{i,t} \\ \left(1 - u_{i,t}\right) LEL'_{i,t} \le EN_{i,t}^{(-)} \le 0 \\ EN_{i,t} = EN_{i,t}^{(+)} + EN_{i,t}^{(-)} \\ u_{i,t} = \{0,1\} \\ = 1,2,\dots,T \end{matrix}\right\}, \forall i \in S_{LESR} \wedge t$$

~~$$\left.\begin{matrix} SOC_{i,t} = SOC_{i,t-1} - \left(EN_{i,t}^{(+)} + \eta_i\, EN_{i,t}^{(-)} + ATRU_t\, RU_{i,t} - ATRD_t \eta_i RD_{i,t}\right)\frac{\Delta T}{T_{60}} \\ 0 \le EN_{i,t}^{(+)} \le u_{i,t}\, UEL'_{i,t} \\ \left(1 - u_{i,t}\right) LEL'_{i,t} \le EN_{i,t}^{(-)} \le 0 \\ EN_{i,t} = EN_{i,t}^{(+)} + EN_{i,t}^{(-)} \\ u_{i,t} = \{0,1\} \\ = 1,2,\dots,T \end{matrix}\right\}, \forall i \in S_{LESR} \wedge t$$~~

ESE-BRQ040	The system shall update storage resource DA DEB equation to include Opportunity Cost: DA storage DEB $= \max\left[\left(\max\left(\mathrm{En}_{\frac{\delta}{\eta}}, 0\right) + \rho\right), \mathrm{OC}_{\delta}\right] * 1.1$ where: $\mathrm{En}_{\frac{\delta}{\eta}}$ Estimated cost for resource to buy energy δ Energy charging duration = (Registered Max Energy Storage Limit – Registered Min Energy Storage Limit) / ABS(Pmin) η Round trip efficiency ρ Variable cost OC_{δ} Opportunity cost --Opportunity cost will use the same source of LMPs as the energy charging cost (i.e. using the MPM run results). --Opportunity cost is the rth highest hourly MPM LMP price of the same trade day of MPM. $\mathrm{r} = \min\left\{24, \max[1, \mathrm{RoundDown}(\gamma)]\right\}$ where: γ is the energy discharging duration = (Registered Max Energy Storage Limit – Registered Min Energy Storage Limit) / Pmax "r" is the energy discharging Duration, rounded to the nearest lower integer and bounded by values of 1 and 24.	Core	IFM
ESE-BRQ041	Initial SOC: ~~Init_SOC: Simplified way when attenuation is in the same SOC constraint.~~ $SOC_{i,0}^{AT} = SOC_{i,0} = SOC_{i,tel} - \frac{1}{2} * \left[EN_{i,tel}^{+} - EN_{i,tel}^{-}\eta\right] * \frac{DT}{T} - \left[EN_{i,0}^{+} - EN_{i,0}^{-}\eta\right] * \frac{DT}{T}$	Core	RTD

	$SOC_{i,0} = SOC_{i,tst} - \frac{1}{2} * \left[EN^{+}_{i,tst} - EN^{-}_{i,tst}\eta\right] * \frac{DT}{T} - \left[EN^{+}_{i,0} - EN^{-}_{i,0}\eta\right] * \frac{DT}{T} + \left[ATRD_{0}\eta_{t}RD_{i,0} - ATRU_{0}RU_{i,0}\right] * \frac{DT}{T}$		
ESE-BRQ043	$EN^{+}_{i,0}$ and $EN^{-}_{i,0}$ shall come from the latest RTD run for time interval 10 min before the RTPD/STUC interval start. $SOC_{i,0}$ comes from the latest RTD run for time interval 5 min before the RTPD/STUC interval start. Example, for RTPD/STUC interval start XX:15, $EN^{+}_{i,0}$ and $EN^{-}_{i,0}$ come from latest RTD interval XX:05 and $SOC_{i,0}$ comes from latest RTD interval XX:10.	Existing	RTPD STUC

4.3 Business Process: Manage RTM ED Instructions

4.3.1 Business Requirements

ID#	Business Feature	Requirement Type	Potential Application(s) Impacted
ESE-BRQ400	System shall update the definition of EDs to allow the operator to enter EDs for storage resources identified with two new Reason Codes: "SOC Hold" and "SOC Charge". Both Reason Codes shall be added under Instruction Type: System Emergency ("SYSEMR") Note: "SOC Hold"=0 MW and fixed ED and will trigger new settlement process described in MQS Section 5.8 -"SOC Charge"=negative fixed MW ED, and will trigger existing ED settlement process Notes: -Only applicable to storage resources -Applies to CISO BAA only	Business Process *Compliance: N/A* *BPM: Market Instruments*	RTM (ED Instructions)
ESE-BRQ401	System shall broadcast the information provided in BRQ0400 to downstream systems	Core *Compliance: N/A* *BPM: N/A*	RTM (ED Instructions)

4.4 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, Energy Imbalance Market (EIM) implementations, and Reliability Coordination (RC) service implementations. If the project team has deemed that no structured testing is needed, an end-to-end test case must be specified.

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 an EIM 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.

4.4.1 Business Requirements

Market Sim scenarios have been deferred to Track 2 BRS.

5 Acronyms and Definitions

Acronym	Definition
A2A	Application-to-Application
ABC	Available Balancing Capacity
ACL	Access Control List
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
AUX	Auxiliary
B2B	Business-to-Business
BA	Business Analyst
BAA	Balancing Authority Area
BAAOP	Balancing Authority Area Operations Portal
BCR	Bid Cost Recovery
BPM	Business Process Manual
BRS	Business Requirement Specifications
BSAP	Base Schedule Aggregation Portal

Acronym	Definition
BSC	Base Schedule Coordinator
BSSD	(WEIM) Base Schedule Submission Deadline
CAISO	California Independent System Operator
CB	Convergence Bidding
CC	Commitment Cost
CCDEBE	Commitment Costs and Default Energy Bid Enhancements
CDN	Conformed Dispatch Notice
CIM	Common Information Model
CIP	Critical Infrastructure Protection
CIRA	Customer Interface for Resource Adequacy
CISO	California Independent System Operator
CLAP	Custom Load Aggregation Point
CMRI	Customer Market Results Interface
Cnode	Connectivity Node
COG	Constrained-Output Generator
CPM	Capacity Procurement Mechanism
CRN	Contract Reference Number
CRR	Congestion Revenue Rights
CRRS	Congestion Revenue Rights Settlements (aka CRR Clawback system)
CSS	Critical Systems Support
DA	Day-Ahead

Acronym	Definition
DACA	Day-Ahead Contingency Analysis
DAM	Day-Ahead Market
DART	Day-Ahead Reliability Tool
DCPA	Dynamic Competitive Path Assessment
DEB	Default Energy Bid
DER	Distributed Energy Resource
DCC	Default Commitment Cost
DGAP	Default Generation Aggregation Point
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
ECIC	Energy Costs and Index Calculator
ED	Exceptional Dispatch
EDAM	Extended Day-Ahead Market
EDR	Enterprise Data Repository

Acronym	Definition
EE	Expected Energy
EEA	Expected Energy Allocation
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
EPI	Electricity Price Index
ESP	Electronic Security Perimeter
ETC	Existing Transmission Contract
ETSR	Energy Transfer System Resources
FERC	Federal Energy Regulatory Commission
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
FRU	Flexible Ramp Up

Acronym	Definition
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
HASP	Hour-Ahead Scheduling Process
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
ISL	Intertie Scheduling Limit
ISO	California Independent System Operator
IOOC	Integrated Optimal Outage Coordination
IT	Information Technology
ITC	Inter-Tie Constraint
ITPD	Information Technology Product Development
ITS	Interchange Transaction Scheduler

Acronym	Definition
ITSM	Information Technology Service Management
JOU	Joint Owned Unit
LACA	Look-Ahead Contingency Analysis
LAP	Load Aggregation Point
LDF	Load Distribution Factor
LEL	Lower Economic Limit
LFR	Lower Forbidden Region
LF	Load Forecast
LMP	Locational Marginal Price
LMPM	Locational Market Power Mitigation
LOL	Lower Operating Limit
LRA	*Local Regulatory Authority*
LRL	Lower Regulation Limit
LSE	Load Serving Entity
LTCA	Long-Term Contingency Analysis
MCI	Model and Contract Implementation
MD	Manual Dispatch
MDT	Minimum Down Time
MDS	Maximum Daily Startups
MF	Master File
MIBP	Maximum Import Bid Price

Acronym	Definition
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
MOS	Manage Operations Support & Settlements
MPM	market Power Mitigation
MQS	Market Quality System
MRID	Master Resource IDentifier
MRI-S	Market Results Interface – Settlements
MSSA	Metered Sub System Agreement
MSG	Multi-Stage Generator
MUT	Minimum Up Time
MV&A	Market Validation & Analysis
MVT	Market Validation Tool
N/A	Not Applicable

Acronym	Definition
NA	Network Application
NDEB	Negotiated Default Energy Bid
NGR	Non-Generating Resource
NM	Network Model
NQC	Net Qualifying Capacity
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
PAM	Program and Application Management
PBC	Power Balance Constraint
PC	Pre-Calculation
PCA	Price Correction Admin
PCT	Price Correction Tools
PDR	Proxy Demand Resource
PI	Plant Information

Acronym	Definition
PL	Participating Load
Pmax	Maximum Generation Capacity
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
PTO	Participating Transmission Owner
QRB	Quality Review Board
RA	Resource Adequacy
RC	Reliability Coordinator
RC-BSAP	Reliability Coordinator - Base Schedule Aggregation Portal
RCD	Reliability Capacity Down
RCSA	Reliability Coordinator Service Agreement
RCU	Reliability Capacity Up
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)

Acronym	Definition
RDRR	Reliability Demand Response Resource
RDT	Resource Data Template
RIG	Remote Intelligent Gateway
RIMS	Resource Interconnection Management System
RMR	Reliability Must Run
ROPR	Operating Reserve Ramp Rate
RR	Ramp Rate
RREG	Regulation Ramp Rate
RSE	Resource Sufficiency Evaluation
RSEE	Resource Sufficiency Evaluation Enhancements
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
RTUC	Real-Time Unit Commitment
RUC	Residual Unit Commitment
SADS	System And Design Specifications

Acronym	Definition
SC	Scheduling Coordinator
SCME	Scheduling Coordinator Meter Entity
SE	State Estimator
SIBR	Scheduling Infrastructure and Business Rules
SME	Subject Matter Expert
SOA	Service-Oriented Architecture
SQMD	Settlements Quality Meter Data
SRS	System Requirement Specifications
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 Hour
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
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
WebOMS	Web-based Outage Management System
WEIM	Western Energy Imbalance Market
XML	Extensible Markup Language
XSD	XML Schema Definition