The California ISO Business Practice Manual for the Energy Imbalance Market, Version 14, dated February 29, 2019 is available in its entirety at: https://bpmcm.caiso.com/Pages/BPMDetails.aspx?BPM=Energy Imbalance Market.

Business Practice Manual

For The

Energy Imbalance Market

Version 14

Revision Date February 28, 2019

Approval History

Approval Date: October 2, 2014

Effective Date: October 2, 2014

BPM Owners: Mike Turner and Jamal Batakji

BPM Owners' Titles: Manager, Market Settlement Validation and Resolution and Lead Day-Ahead Market Operator

Revision History

Version	PRR	Date	Description
14	1117	02/28/2019	PRR1117 Added a note in section 11.3.11 to refer to Market Operations Appendices BPM for load conformance.
13	1090	11/29/2018	PRR1090: This change is to provide clarity for EIM entities scheduling practices related to dynamic pseudo-tie wheeling schedules.
12	1072, 1082, 1085,1093	10/25/2018	PRR1072: This is due to EIM Enhancement 2018 project requirements where the market will not procure flexible ramping up and flexible ramping down capacity when any EIM balancing authority is undergoing a contingency. Expected effective date is Fall 2018. PRR1082: This is to extend the Persistence Forecast modeling to EIM entities. PRR1085: This is due to the EIM Greenhouse Gas Enhancements policy to limit EIM participating resources' greenhouse gas bid quantity to the MW value between the EIM participating resource's base schedule and the resource's upper economic level. PRR1093: This is for an enhancement to modify the calculation logic for the Fifteen-Minute Schedules from hourly resources. The change is explained in a new section 11.3.13. Additionally, we added a clarification in section 16.2.1.1.4 in regards to Energy Transfer System Resource (ETSR) treatment of tagged quantities where EIM BAAs paring includes the ISO BAA.

Version	PRR	Date	Description
11	1068	09/04/2018	Added new paragraphs to define the behavior of the energy imbalance market total and incremental flow constraint. Additionally, a clarification was added to paragraph 11.1.6 entitlement constraint for rate of changes. Effective date is August 2018.
10	1033, 1051	4/02/2018	(1033) This revision is due to the EIM Enhancement 2017 initiative which includes the following functionalities; • Automated matching of import/export schedule changes. • Automated mirror system resources at CAISO intertie scheduling points. • Base EIM transfer resource imbalance settlement. • New non-generator resource (NGR) modeling functionality. • Allow submission of base generation distribution factors (GDFs) for aggregated EIM non-participating resources.. In addition, this revision includes some clarification of the provisions associated with the submission and processing of variable energy resource forecasts; • Allow an EIM Entity VER forecast to be considered independent if it is used for balancing their system • Allow for freezing VER forecast between T-55 and T-40. (1051) clarifying the flexible ramping requirements for the new EIM entities joining the EIM
9	1032	1/2/2018	This BPM change is to enhance the current methodology used to calculate histogram percentile that is utilized in the bid range capacity test requirements. Effective 1/4/2018. Section 11.3.2.2 is updated accordingly. PRR 1032.
8	984	5/31/2017	This is due to a recent discovery regarding netting, versus not netting, imports and exports for every hour, for the purpose of calculating histograms percentage differences. Effective 4/1/17.
7	964	4/10/2017	Added new Tariff language to “Metering” Section 8 to include SQMD Plan & requirements for SCME’s; Removed section 12 (PRD/RDRR) from being unavailable to EIM market participants; Added 15-min option to “Participating” Generators granularity level.
6	939	8-31-16	This revision includes congestion cost content due to EIM Y1 P2 enhancement project

Version	PRR	Date	Description
5	891	03-31-2016	This revision introduces incremental language pertaining to Available Balancing Capacity (ABC), additionally it improves the language throughout the document.
4	866	12/02/2015	Updates for EIM Year 1 policy enhancements. Addition of Readiness Criteria
3	846	07/06/2015	for clarification on the transmission relaxation, changes to section 10.1.6 and adding new section 10.1.7
2	788	10/30/2014	Clarification to section 10.3.2.1
1	748	10/2/2014	First version released.
0.3		9/18/2014	Updated draft section 10.3.3.
0.2		9/3/2014	Draft updated to reflect answers to the Market Participants' questions and comments.
0.1		7/1/2014	Created BPM draft.

TABLE OF CONTENTS

1. INTRODUCTION 8
1.1 Purpose of CAISO Business Practice Manuals 8
1.2 Purpose of This Business Practice Manual 8
1.3 References 9
2. BACKGROUND 9
2.1 Energy Imbalance Market Overview 10
3. ROLES AND RESPONSIBILITIES 11
3.1 Implementing and Terminating the EIM Entity Participation 13
4. SCHEDULING COORDINATOR CERTIFICATION 13
4.1 Determination of SC Certification Requirements 14
5. AGREEMENTS 15
5.1 EIM Entity Agreement 16
5.2 EIM Entity Scheduling Coordinator (Entity SC) 16
The submittals listed below should be sent to: SCRequests@caiso.com 16
5.3 EIM Participating Resource Scheduling Coordinator (EIM PR SC) 17
5.4 EIM Participating Resource (PR) 19
6. CREDIT MANAGEMENT 19
7. FULL NETWORK MODEL 20
8. METERING 22
9. TELEMETRY 24
10. OUTAGE MANAGEMENT 25
10.1 Objectives, Roles, Scope, and Participants 25
10.1.1 Outage Management Objective 26
10.1.2 CAISO Role 26
10.1.3 Facility Owner Role 26
10.1.4 Application to Parties 26
10.1.5 CAISO Outage Coordination Office 27
10.2 Requesting Maintenance Outages 28
10.2.1 EIM Entity and EIM Entity Scheduling Coordinator Outage Request Process 28
10.2.2 Generation Resource Start-Up Time 29
10.2.3 Confirmation and Acknowledgement of Receipt of Outage Request . 29
10.2.4 Withdrawal or Modification of Request 29
10.2.5 Changes to Planned Maintenance Outages 29
10.3 Management of Forced Outages 30
10.3.1 Forced Outages 30
10.3.2 Extended Scheduled Outage 30
10.4 Communication of Maintenance Outage Information 31
10.4.1 Single Point of Contact 31
10.5 Records and Reports 33
10.5.1 Records of Approved Maintenance Outages 33
11. MARKET OPERATIONS 33
11.1 About the Market 33
11.1.1 Ancillary Services 34

11.1.2 Interties Between BAAs 34
11.1.3 EIM Transmission Services Information 35
11.1.4 Maximum EIM Transfer Limits 35
11.1.5 Energy Transfer Scheduling in Energy Imbalance Market 36
11.1.6 Entitlement Constraints for Rate of Changes 39
11.1.7 Constraint Relaxation 40
11.1.8 Transition Period Pricing 40
11.1.9 Coordination with Reliability Coordinator and WECC Unscheduled Flow Mitigation 41
11.1.10 Entitlement Constraints for EIM Incremental Flow 42
11.1.11 Entitlement Constraints for EIM Area Total Flow 42
11.2 Day-Ahead Operations 43
11.3 Real-Time Operations 44
11.3.1 Establishment of Hourly Base Schedules and Hourly Resource Plan 47
11.3.2 Resource Sufficiency Evaluation 48
11.3.3 Locational Marginal Prices 60
11.3.4 Using EIM Available Balancing Capacity to Resolve Infeasible Power Balance Conditions in EIM BAAs 83
11.3.5 EIM Market Power Mitigation 89
11.3.6 Default Energy Bids 91
11.3.7 Compensating Injections in the RTM 92
11.3.8 Auto-Match of Import/Export Schedule Changes 92
11.3.9 Auto Mirror of CAISO Import/Export Schedule Changes 92
11.3.10 Manual Dispatch 93
11.3.11 Load Forecast Operator Adjustments 94
11.3.12 Contingency Dispatch 94
11.3.13 FMM Interchange Schedules based on RTSI 96
11.4 Contingencies and Corrective Actions 97
11.4.1 Recovery Approach 97
11.5 Separation of the EIM Entity 99
11.5.1 EIM Entity Separation from Market 99
11.6 Advanced Load Forecasting System (ALFS) 100
11.6.1 Requirements for Load Forecasting 100
11.7 Variable Energy Resource (VERs) 100
11.7.1 Forecast Fee 100
11.7.2 EIM Variable Energy Resource Forecasting 101
12. SETTLEMENTS AND BILLING 102
12.1 Charge Codes 102
12.2 Disagreements 103
12.3 Suspension 103
13. READINESS 103
13.1 Readiness Criteria Categories 104
13.2 Readiness Metrics, Criteria, and Thresholds 105
13.3 Readiness Reporting, Determination & Certification 113
14. RULES OF CONDUCT 114

15. CHANGE MANAGEMENT 114
16. DEFINITIONS AND ACRONYMS 115
16.1 Acronyms 115
16.2 Definitions 116
Appendix A: Mathematical Formulation for EIM Transfer 120
Appendix B: Mathematical Formulation for using Available Capacity resolving infeasible power balance conditions in EIM BAAs 138
Introduction 138
Technical Description 138
Mathematical Formulation 138

Since the non-EIM Entities net schedule interchange (NSI) values are not submitted to CAISO but are required for the calculation of loop flow impact of external schedules on the CAISO and the EIM entities network, CAISO will receive/download automatically all raw tag data from Western Interchange Tool (WIT) for all external BAAs at a pre-defined frequency and time of day.

The data file will contain schedule and path information for every transaction schedule in WIT within the specified time period. Each transaction schedule will present the North American Energy Standards Board (NAESB) defined tag transaction type and composite state. The data will include the source and sink BAA information.

For e-tagging timelines and rules, please refer to the **BPM for Market Operations** Section 7.2.2.1.

EIM Transmission Services Information

The EIM Entity shall send to CAISO its EMS network model information including any flowgates, intertie definitions and physical limits on its transmission equipment and the available capacity limits for the EIM Entity internally enforced flowgates. The submission of the EIM Entity network model shall use the Common Information Model (CIM) industry standard protocol for exchanging network model data. The EIM Entity shall also send to CAISO SCADA and measurements mapped to the EIM Entity EMS network model. The process of submission of the EIM network model shall be consistent and in accordance to the already established CAISO FNM update process and its publically published deadlines for collecting network updates. Please refer to the **BPM for Managing Full Network Model** for a description of this process.

The EIM Entity shall send, via a direct interface to CAISO, the transmission limit updates due to planned or forced outages or derates for its internal major paths or flowgates that are usually posted on its OASIS system.

Maximum EIM Transfer Limits

EIM Entity Scheduling Coordinators shall send to the CAISO market system the EIM intertie Available Transfer Capacity (ATC) and any updates due to planned or forced outages or derates based on physical limits, schedule limits, and/or contract limits or rights owned by the EIM Entity on the EIM interties with neighboring BAAs. The CAISO shall enforce the limits in

corresponding market optimization per applicable Operating Procedures. The EIM Entity shall communicate these limits via direct interface to CAISO.

The EIM Entity shall communicate to the CAISO market system any real-time Dynamic Transfer Capability (DTC) limits enforced by any third party transmission provider that the EIM Entity utilizes its transmission or has transmission rights. The EIM Entity shall reflect the DTC limit in the transmission profile of the corresponding EIM transfer dynamic e-tag.

Each EIM Entity Scheduling Coordinator shall determine and send to the CAISO market system the EIM intertie transmission right limits, static limits, dynamic incremental limits and any updates through the EIMDynamicLimitData file submitted to CAISO as changes to these limits are required by the EIM Entity Scheduling Coordinators (*i.e.*, the EIM Transfer limit). This should be finished prior to the start of the next Dispatch Interval by the EIM Entity Scheduling Coordinator. The CAISO will use this information to calculate the Energy Transfer schedule limit according to Appendix A: Energy Transfer Schedule Limits. The CAISO will provide the EIM Entity Scheduling Coordinator with the Energy Transfer schedule information according to Appendix A: Energy Transfer Schedule Tags.

Specific procedures may be developed to document specific conditions, communication of EIM Entity, External BAA, or third party transmission provider as designed by EIM Entity.

If there are two or more EIM Entity Balancing Authority Areas that share the same EIM Internal Intertie, the CAISO's Security Constrained Economic Dispatch in the Real-Time Unit Commitment and Real-Time Dispatch will enforce the individual EIM Transfer limit for each EIM Entity Balancing Authority Area while allowing Energy to wheel through the EIM Entity Balancing Authority Areas based on the transmission made available for use in the Real-Time Market.

Energy Transfer Scheduling in Energy Imbalance Market

Energy Transfer Scheduling aims to determine the Energy Transfer schedules among the EIM BAAs and the CAISO from the optimal EIM Transfers of the BAAs in the EIM Area using the transmission rights available to the EIM without violating them. This is a part of the market optimization problem in Fifteen Minute Market and RTD of EIM.

The Appendix A Mathematical Formulation for EIM Transfers outlines how the CAISO enforces scheduling constraints in the market optimization to ensure the energy from base schedules and EIM Transfers in the FMM and RTD are consistent with intertie scheduling limits.

In calculating real-time neutrality by BAA, the System Marginal Energy Cost (SMEC) is used for the Energy Transfer (see Appendix A for an example).

Energy Transfer System Resources

For the convenience of modeling of the Energy Transfer Scheduling problem, Energy Transfer System Resources (ETSRs) are defined as aggregate resources at the EIM BAA Default Generation Aggregation Point (DGAP), which is an aggregation of all supply resources in the BAA. They are dedicated System Resources in each EIM BAA to anchor the Energy Transfer schedules from that BAA to other BAAs in the EIM Area for tracking, tagging, and settlement. Each ETSR is defined as either an import or an export resource, and it is associated with an EIM intertie with another EIM BAA, or a CAISO intertie with the CAISO. The associated intertie is one where the EIM Entity for the relevant EIM BAA has made transmission rights available for scheduling Energy Transfers from/to the other EIM BAA or the CAISO.

Base Schedules

Before EIM market optimization, base Energy Transfer schedules between EIM BAAs are submitted along with the generation and intertie base schedules. The base Energy Transfer schedules are assumed to be feasible. For each EIM BAA and CAISO, the base EIM Transfer, the base NSI, the base demand, the base generation and the base load are obtained from the base Energy Transfer schedules and RUC schedules. The base load for EIM BAA is adjusted in the ACPF to absorb the loss error. The base load for EIM BAAs is significant because it is used as a reference for imbalance energy settlement. Base schedules are also calculated for non-EIM BAAs to model unscheduled loop flow through the EIM area.

Energy Transfer Schedule Calculation

Additional variables and constraints are added to the market optimization problem for the Energy Transfer Scheduling problem. In the market optimization problem, the NSI variables for each BAA are used to derive the EIM Transfer for each EIM BAA and for the CAISO. The EIM Transfer Schedules represented by the ETSR variables are constrained by applicable EIM Transfer limits.

The base Energy Transfer schedules may be included in the optimal Energy Transfer schedules or specified separately. After the market solution is obtained, the base and optimal Energy Transfer schedules assigned to the corresponding ETSRs are tagged to the associated intertie using the corresponding ETSR identification. Including the base Energy Transfer in the optimal Energy Transfer allows the optimal dynamic Energy Transfer to counter flow on the base Energy Transfer maximizing transmission capacity use. If the base Energy Transfer is scheduled separately on dedicated ETSRs, the Base ETSRs, it is not optimized but kept constant in the market, unless modified by the EIM Entity SC after T–40' through the real-time intertie schedule interface. The transmission capacity consumed by the base Energy Transfer scheduled on Base ETSRs cannot be used for counter flow dynamic Energy Transfers. Schedules associated with pseudo tie or dynamic e-Tags for pseudo-tied resources or loads that involve one or multiple EIM Entity BAAs should not be included in base Energy Transfers between EIM BAAs or intertie transactions between EIM and non EIM BAAs because these schedules have no effect on the NSI of the source/sink BAA or the NSI of intermediate BAAs.
In the mathematical formulation, without loss of generality, the base Energy Transfer schedules are included in the optimal Energy Transfer schedules, and the optimal Energy Transfer schedules are constrained by the EIM Transfer limits determined by the transmission limits, static limits and incremental dynamic limit. In other words, the amount of total intertie utilization is modeled to be constrained by the total transmission capacity, rather than the amount of incremental intertie utilization being constrained by the available transmission capacity. There are three different types of ETSRs defined in the Master File: Base ETSR, Static ETSR (15 min), and Dynamic ETSR (5 min). This is to distinguish between the base and dynamic Energy Transfers so that EIM Entity SCs can submit base Energy Transfers that will not be optimized by the market, while submitting ETSR limits that would apply to dynamic Energy Transfers only. The Static ETSRs are used only when dynamic transmission capability constraints apply in the ETSR contract path, necessitating separate limits for Static ETSRs in FMM and Dynamic ETSRs in RTD.

Base ETSRs are not optimized, thus they do not factor in the procurement of the Flexible Ramping Product (FRP), except for their contribution to the base net EIM Transfer. For example, for anon-optimized dynamic ETSR, the difference between its limit and its optimal value contributes to NIC/NEC for calculating FRP requirements; however, for a base ETSR, there is no such contribution because it is fixed.

Non-Generator Resource (NGR) Modeling Functionality

Refer to section 2.1.13 of the Market Operations BPM for details on the NGR modeling.

EIM Transfer Schedule Cost

To maximize the efficiency and robustness of Energy Transfer schedules without circulating Energy Transfer schedules, a small nominal cost, the EIM Transfer schedule cost, is included in the objective function of the market optimization problem for each optimizable (static and dynamic) ETSR. The EIM Transfer schedule cost will ensure the most optimal path or paths for the EIM Transfer are used by placing a higher priority on the most optimal path over less optimal paths. This approach will also minimize the number of e-tags which must be updated and reduces the complexity of settling the financial value of the EIM transfer used for neutrality calculations.

The CAISO determines the appropriate level of the transfer cost balancing the benefits of the transfer costs with the impact to locational marginal costs pursuant to Section 29.17(g)(2). The EIM Transfer Cost shall be less than $0.01. The EIM Transfer Cost can be different for each Intertie. In case absent any priority defined by the entity and approved by the CAISO , the CAISO will set $0.0001 for the EIM Transfer schedule cost associated with each EIM Internal Intertie.

The CAISO may adjust the EIM Transfer schedule costs to maintain the path priorities established by the criteria in Section 29.17(g)(2) when an EIM Entity Balancing Authority Area is added or subtracted from the EIM Area, as seasonal transmission system ratings change or the transmission system topology changes.

Entitlement Constraints for Rate of Changes

The entitlement constraints limit power flow contributions from the dispatch of resources in an EIM Entity Balancing Authority Area (BAA), or the CAISO BAA, on interties or transmission corridors in external BAAs. Power flow contributions from intertie transactions participating in the EIM or DAM can also be constrained by entitlement constraints. The limit in an entitlement constraint represents either contractual rights or scheduling rights that have been agreed upon between BAAs. The difference between entitlement constraints and regular transmission constraints is that the former constraint only a subset of the resources that participate in a market, as opposed to the latter where all such resources are constrained. Furthermore, entitlement constraints in the EIM limit the rate of change only of the relevant power flow contributions across 5-minute dispatch intervals. All resources which are in either start-up, shutdown or transition status are excluded from the rate of change constraints. In addition, resources that are online without bids are excluded from the rate of change constraints.