Business Requirements Specification

Energy Imbalance Market Resource Sufficiency Enhancements

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Revision History

Date	Version	Description
11/27/2018	1.0	Initial document release.
1/25/2019	1.1	Update now addresses 15-minute Capacity Test failure by automatically failure the same 15-minute interval's Flexible Ramping Sufficiency Test in the associated direction (not the entire trade hour): • Section 4.1, bullet 3: revised description • Section 5.1: updated EIM, Market Operations, and Market Instruments BPM impact descriptions • BRQs 005, 007 • Appendices D, E OASIS will report EIM Transfer Limits with "Import" and "Export" Limit Types (instead of "High" and "Low"), requiring the following document changes: • BRQs 155, 160 • Appendix F
2/22/2019	1.2	Updates to the following BRQs and Appendix's • BRQs-155, 160 (update so market may populate "Net EIM Transfer Limit" values under additional LMPME condition, EIM operator locked transfer) • BRQ-165 (OASIS report shall change name from "EIM Transfer Limit" to "Net EIM Transfer Limit") • Appendix F (new conditions for report, report name change from "EIM Transfer Limit" to "Net EIM Transfer Limit" to reflect netted BAA-to-BAA transfer limit) • Align verbiage with BPM language in Appendix C, CSTE-BRQ-150 • CSTE-BRQ-155: Clarified LMPME condition will be out-of-scope for this project, and tracked/tested in LMPME instead

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1 Introduction

1.1 Purpose

Earlier in 2018, as part of its stakeholder engagement, the ISO conducted stakeholder workshops entitled “EIM Offer Rules” which discussed improvements for the EIM resource sufficiency evaluation. A subsequent policy whitepaper capturing these discussions was later published which proposed transitioning EIM Capacity and Sufficiency Tests from an hourly assessment to independently evaluating each 15-minute interval. This project implements those proposed changes.

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 determining the scope of projects and to all Business Process Modeling and System Requirements Specifications efforts.

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2.1 Checklist

CAISO retains intellectual property ownership of the following:

- Design of EIM; includes mathematical formulation of design principles
- Related Business Practice Manuals
- Software codes to implement the EIM design
- All rights reserved for works included within this BRS document

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3 Acronym Definitions

Acronym	Definition
API	Application Programmable Interface
BAA	Balancing Authority Area
BAAOP	Balancing Authority Area Operations Portal
BPM	Business Process Manual
BRS	Business Requirements Specification
BSAP	Base Schedule Aggregation Portal
CAISO	California Independent System Operator
CISO	California Independent System Operator
CMRI	CAISO Market Results Interface
DA	Day-Ahead
DAM	Day-Ahead Market
DAME	Day-Ahead Market Enhancements
EIM	Energy Imbalance Market
FMM	Fifteen Minute Market
FRD	Flexible Ramping Downward
FRST	Flexible Ramping Sufficiency Test
FRU	Flexible Ramping Upward
HASP	Hour-Ahead Scheduling Process
IFM	Integrated Forward Market
ISO	Independent System Operator

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Acronym	Definition
MF	MasterFile
MOO	Must-Offer Obligation
MQS	Market Quality System
OASIS	Open Access Same Time Information System
RST	Resource Sufficiency Test *[comprehensively includes Balancing, Capacity, Flexible Ramping sufficiency (FRST), and feasibility tests]*
RTBS	Real-Time Base Schedule
RTD	Real-Time Dispatch
RTM	Real-Time Market
RTPD	Real-Time Pre-Dispatch
RUC	Residual Unit Commitment
SC	Scheduling Coordinator
SIBR	Scheduling Infrastructure and Business Rules
STUC	Short-Term Unit Commitment
UI	User Interface

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4 Details of Business Need/Problem

4.1 Description

From stakeholder feedback during the “Energy imbalance market offer rules” workshops earlier in 2018, improvements for business needs related to EIM resource sufficiency evaluation were identified:

1. Allowing a tolerance threshold of 1% for the flexible ramping sufficiency test would prevent a substantial impact on transfers from sufficiency test failure due to missing the uncertainty requirement by an inconsequential amount
2. Independently evaluating each 15-minute interval for its Flexible Ramping Sufficiency Test (FRST), would allow imposed transfer limits for RST failure to apply specifically to the failed 15-minute interval and not the entire trade hour
3. Capacity Test evaluation at a 15-minute interval basis will ensure bid range capacity is evaluated against both the minimum and maximum load forecasts of the trade hour (instead of just the average of the intervals), and will associate any interval’s failed capacity test with automatic FRST failure for the same 15-minute interval
4. Currently, balancing and bid range capacity tests that pass do not report the margin of balancing or bid capacity sufficiency. For instances when the margin is very slight, knowing the amount would benefit the EIM participant by providing attention to possibly entering into a fail status in a subsequent test run (e.g. failing T-40 when T-75 and T-55 passed by a narrow margin).

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5 Business Impacts

5.1 Business Practice Manual (BPM)

BPM	Description of Impact(s)
Energy Imbalance Market (EIM)	- Bid Range Capacity Test independently evaluates each 15-min intervals of trade hour (instead of hourly basis) - Flexible Ramping Sufficiency Tests independently evaluates 15-min intervals of trade hour, constraining transfer limits for each 15-min interval that failed (instead of entire trade hour); - New rule that automatically fails the Flexible Ramping Sufficiency Test status if the same 15-minute interval's Capacity Test fails - BAAOP (User Guide) display will allow EIM Operator access to: o Bid Range Capacity Test Results at a 15-min interval granularity (detailed report) o Flexible Ramping Sufficiency Test Results at a 15-min granularity o EIM Transfer Limits (for each BAA in EIM Area)

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BPM	Description of Impact(s)
Market Instruments	Although there will be no changes to API technical specifications, unstructured testing shall be facilitated for external participants wishing to assess data impacts from existing OASIS and CMRI APIs, as well as review BAAOP changes. Impacted applications will include: 1) CMRI a. Existing EIM Balance Test results publish regardless of whether test passes or fails b. Existing EIM Bid Range Capacity Test Results report display and API will present: i. results in both over and under conditions (currently only provides one or the other), at a 15min granularity ii. sufficiency amounts provided c. Existing EIM Flexible Ramping Sufficiency Test Results report display and API will present: i. results in both upward and downward ramping directions (currently only provides one or the other), at a 15min granularity ii. sufficiency amounts provided 2) OASIS EIM Transfer Limit report display and API (deprecated in 2015): a. shall be re-purposed and report Net EIM Transfer Limit results for both FMM (15min) and RTD (5min); b. no changes to reporting/API data structure (historical data will remain) 3) Minor changes to the BAAOP RST test status and capacity results displays (providing 15-minute granularity) Unstructured test period will not provide structured tests or require settlement statements (e.g. no settlement impacts). -

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BPM	Description of Impact(s)
Market Operations	- RTPD and RTD enforces new logic that constrains transfer limits for BAAs with failed flexible ramping sufficiency tests at the 15-min interval granularity (instead of entire trade hour) o Constrained transfer limits for 15-min interval sets to the least restrictive of the current interval's base transfer or o the previous 15-min interval's scheduled EIM transfer from the prior FMM
BPM Change Management	Non-Applicable
Candidate CRR Holder	Non-Applicable
Compliance Monitoring	Non-Applicable
Congestion Revenue Rights	Non-Applicable
Credit Management	Non-Applicable
Definitions & Acronyms	Non-Applicable
Direct Telemetry	Non-Applicable
Distributed Generation for Deliverability	Non-Applicable
Generator Interconnection and Deliverability Allocation Procedures	Non-Applicable
Generator Interconnection Procedure (GIP)	Non-Applicable
Generator Management	Non-Applicable
Managing Full Network Model	Non-Applicable
Metering	Non-Applicable
Outage Management	Non-Applicable
Reliability Requirement	Non-Applicable
Rules of Conduct Administration	Non-Applicable
Scheduling Coordinator Certification & Termination	Non-Applicable
Settlements & Billing	Non-Applicable
Transmission Planning Process	Non-Applicable

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5.2 Other

Impact:	Description: (optional)
Market Simulation	Although there will be no changes to API technical specifications, unstructured testing shall be facilitated for external participants wishing to assess data impacts from existing OASIS and CMRI APIs, as well as review BAAOP changes. Impacted applications will include: 1) CMRI Bid Range Capacity Test Results report display and API will present: a. results in both over and under conditions (currently only provides one or the other), at a 15min granularity 2) OASIS EIM Transfer Limit report display and API (deprecated in 2015): a. shall be re-purposed and report Net EIM Transfer Limit results for both FMM (15min) and RTD (5min); b. no changes to reporting/API data structure (historical data will remain) 3) Minor changes to the BAAOP RST test status and capacity results displays Unstructured test period will not provide structured tests or require settlement statements (e.g. no settlement impacts).
Market Participant Impact	Yes (EIM Participants)
External Training	Yes
Policy Initiative	Yes

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6 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.

6.1 Business Process: EIM Resource Sufficiency Evaluation Enhancements

6.1.1 Business Requirements: Balancing Test Enhancements

ID#	Business Feature	Req Type	Potential Application(s) Impacted
CSTE-BRQ-001	At T-75, T-55, and T-40 (minutes prior to the start of the next trade hour T), the systems shall display and broadcast, if applicable, BAA balancing test results to downstream systems, whether balancing test results fail or pass. The hourly imbalance amount and percentage values shall be presented as an absolute value. See Appendix C for EIM Balancing Test Result examples.	Core	- CMRI - BAAOP
CSTE-BRQ-002	Systems shall receive, store, and display Balancing Test results for T-75, T-55, and T-40 (minutes prior to the start of the next trade hour T), regardless of whether the test was passed or failed. The hourly imbalance amount and percentage values shall be presented as an absolute value. See Appendix C for EIM Balancing Test Result examples.	Existing Function	- BAAOP - CMRI

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6.1.2 Business Requirements: Capacity Test Enhancements

ID#	Business Feature	Req Type	Potential Application(s) Impacted
CSTE-BRQ-005	At T-75, T-55, and T-40 (minutes prior to the start of the next trade hour T), the system shall independently evaluate all 15-minute intervals within the trade hour for sufficient bid range capacity in both over and under capacity requirements. The following rules shall apply to the 15-min interval EIM Capacity Test evaluation: • Demand Forecast will be 15-min interval • ISO BAA Schedules will be hourly (T-75 will use RUC schedule, T-55/T-40 will use HASP schedule) • Base schedule logic regarding cross-hour ramping should remain as exists today • Bid capacity shall always be assessed in both directions (over and under) regardless how the BAA is assessed during the balancing test and irrespective of auto-matching functionality • Capacity Test results shall display for operator at a 15-minute interval granularity •	Core	- EIM
CSTE-BRQ-007	At T-75, T-55, and T-40, system shall automatically fail the Flexible Ramping Sufficiency Test for the same 15-minute interval as a failed Bid Range Capacity Test in the same direction, such that: • Failed “over” Capacity Tests will auto-fail upward FRST • Failed “under” Capacity Tests will auto-fail downward FRST	Core	- EIM
CSTE-BRQ-010	For T-75, T-55, and T-40, system shall display in its detailed report all Capacity Test results in both directions at the 15-minute interval for each BAA to the associated BAA’s EIM entity operator and ISO operator. See Appendix D for EIM Capacity Test Result examples.	Core	- BAAOP

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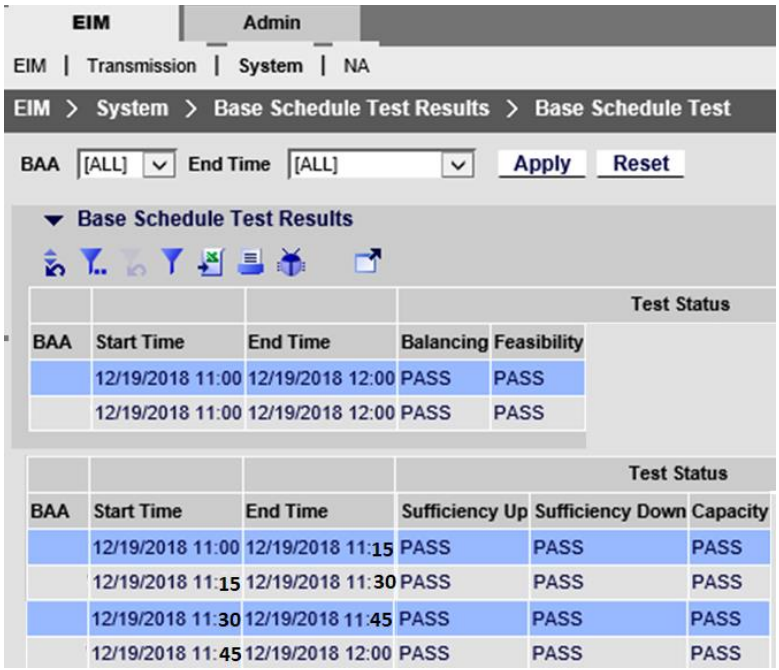
ID#	Business Feature	Req Type	Potential Application(s) Impacted
CSTE-BRQ-011	Operator Display shall maintain the hourly operator basis for the Feasibility and Balancing Tests, moving the Bid Range Capacity, Flexible Ramping Sufficiency Up, and Flexible Ramping Sufficiency Down tests to a second table with 15-minute results (see screenshot below). 	Core	- BAAOP
CSTE-BRQ-015	For T-75, T-55, and T-40, system shall display the highest-insufficiency Capacity Test 15-minute interval result in both over and under direction to downstream systems, regardless of whether test status is fail or pass. The bid capacity insufficiency amount and percentage values will follow the following sign convention: • Negative values represent sufficiency • Positive values represent insufficiency See Appendix D for EIM Capacity Test Result examples.	Core	- BAAOP

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ID#	Business Feature	Req Type	Potential Application(s) Impacted
CSTE-BRQ-025	System shall receive, publish to display, and broadcast externally the worst 15-minute interval Capacity Test result (i.e. interval with highest bid insufficiency amount) for each insufficiency direction, regardless of whether test status is fail or pass. The bid capacity insufficiency amount and percentage values will follow the following sign convention: • Negative values represent sufficiency • Positive values represent insufficiency *No modifications shall be made to the EIM Bid Range Capacity Test Results report or payload structure.* See Appendix D for EIM Capacity Test Result examples.	Core	- CMRI Note: No XSD, WSDL changes for API

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6.1.3 Business Requirements: Flexible Ramping Up/Down Sufficiency Test Enhancements

<table>
<tr><th>ID#</th><th>Business Feature</th><th>Req Type</th><th>Potential Application(s) Impacted</th></tr>
<tr><td>CSTE-BRQ-100</td><td>For T-75, T-55, and T-40, system shall apply a tolerance band threshold to Flexible Ramping Sufficiency Tests for each BAA's resulting insufficiency amount (both upward and downward), such that the test passes if the insufficiency amount is equal to or less than the greater of the configurable absolute MW or the product of a configurable percentage * uncertainty requirement.

For this implementation, the absolute MW shall be set to 1.0 MW, and the percentage value shall be set to 1.0 %.

The table below provides examples of Sufficiency Test pass/fail outcomes using the tolerance threshold logic.

<table>
<tr><th>Uncertainty Requirement</th><th>Insufficient Amount</th><th>Insufficient %</th><th>Tolerance Parameter: Absolute MW</th><th>Tolerance Parameter: Percentage</th><th>Sufficiency Test Result</th></tr>
<tr><td>100 MW</td><td>1.2 MW</td><td>1.2%</td><td>1.0 MW</td><td>1.0 %</td><td>Fail</td></tr>
<tr><td>50 MW</td><td>0.7 MW</td><td>1.4%</td><td>1.0 MW</td><td>1.0 %</td><td>Pass</td></tr>
<tr><td>150 MW</td><td>1.5 MW</td><td>1.0%</td><td>1.0 MW</td><td>1.0 %</td><td>Pass</td></tr>
</table>
</td><td>Core</td><td>- EIM</td></tr>
<tr><td>CSTE-BRQ-105</td><td>For T-75, T-55, and T-40, system shall independently evaluate Flexible Ramping Sufficiency Tests for each BAA within the EIM Area on a 15-minute interval basis for the entire trade hour.

The following rules shall apply to the 15-min interval EIM Flexible Ramping Sufficiency Test evaluation:

• Demand and VER Forecasts will be 15-min interval
• ISO Schedules will be hourly (T-75 will use RUC schedule, T-55/T-40 will use HASP schedule)
• Base schedule logic regarding cross-hour ramping should remain as exists today
• Flexible Ramping sufficiency shall always be assessed in both directions (upward and downward) regardless how the BAA is assessed during the balancing test and irrespective of auto-matching functionality
• Flexible Ramping Sufficiency Test results may vary for each 15-minute interval</td><td>Core</td><td>- EIM</td></tr>
</table>

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ID#	Business Feature	Req Type	Potential Application(s) Impacted
CSTE-BRQ-110	For T-75, T-55, and T-40, system shall transfer each 15-minute interval of Flexible Ramping Sufficiency Test result (up and down) to the RPTD and RTD real-time markets for each BAA within the EIM Area. Each result for the 15-minute RTPD interval shall apply to the three underlying 5-minute RTD intervals.	Core	Source: EIM Target: RTPD, RTD

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6.1.4 Business Requirements: Manage Real-Time Market

ID#	Business Feature	Req Type	Potential Application(s) Impacted
CSTE-BRQ-150	For each BAA in the EIM Area that fails ~~either~~ its Flexible Ramping Up or Flexible Ramping Down Sufficiency Test for a 15-minute interval in the next trade hour, the market shall limit the net EIM transfer from below (import) for upward (export) failure and from above for downward failure, to the less-restrictive of the following values: • *Base Transfer Schedule* for the failed 15-minute interval: or • *Net EIM transfer schedule* for the interval prior to the failed 15-minute interval as provided by the last successful FMM market run (i.e. the "last previous" 15-minute interval) The following rules shall apply to the 15-minute interval EIM Sufficiency Test evaluation: • The same EIM transfer limit applied to the failed 15-minute interval shall also apply to its three corresponding 5-minute market intervals • The last previous 15-minute interval shall be last 15-minute interval of the current hour if the 15-minute interval that fails the FRU/FRD test is the first 15-minute interval of the next hour • Likewise, the same is true if the 15-min interval that fails the FRU/FRD test is the second, third, or fourth 15-minute interval in the second hour of the HASP time horizon for which there is no previous solution for the immediately prior 15-minute interval • If a FMM run, other than HASP, fails, the EIM Transfer schedules from the last FMM run that has succeeded shall be used to derive the EIM Transfer limits for the 15-minute intervals that fail the FRU/FRD test • If HASP or all prior FMM runs fail, the base EIM Transfer shall be used Appendix B provides examples of logic applied for limiting EIM transfer for intervals with failed flexible ramping sufficiency test results.	Core	- RTPD - RTD

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ID#	Business Feature	Req Type	Potential Application(s) Impacted
CSTE-BRQ-155	Market systems shall calculate and broadcast the ~~Total~~ Net EIM Transfer Limits for both the import and export directions, as applicable, with each binding 15-minute and 5-minute market interval. "As applicable" will apply to the following conditions (and impacted markets): - Flexible Ramping Sufficiency Test failure for interval (RTPD and RTD), only reports the direction of FRST failure. - EIM BAA contingency event occurs (RTD only), occurs for both import and export direction~~(RTD only)~~ - EIM Operator manually locks EIM transfer level via BAAOP (RTPD, RTD), occurs for both import and export directions - (LMPME future scenario) EIM BAA export transfers are limited for mitigated intervals (RTPD and RTD), occurs only for export direction - Note: LMPME condition will be tracked and tested in the LMPME project scope.	Core	- RTPD - RTD
CSTE-BRQ-160	Systems shall receive and publish binding 15-minute and 5-minute interval Total EIM Transfer Limits for each BAA within the EIM Area, only ~~when applicable (e.g. when enforced), such that:~~ for the following conditions: ~~Only displays records for intervals where BAAs have freezes on their Transfer Limit (which occurs during a failed FRST or EIM BAA contingency event)~~ ~~EIM limits will be reported for both import and export directions~~ Flexible Ramping Sufficiency Test failure for interval (RTPD and RTD), only reports the direction of FRST failure EIM BAA contingency event occurs (RTD only), occurs for both import and export direction EIM Operator manually locks EIM transfer level via BAAOP (RTPD, RTD), occurs for both import and export directions (LMPME future scenario) EIM BAA export transfers are limited for mitigated intervals (RTPD and RTD), occurs only for export direction Note: LMPME condition will be tracked and tested in the LMPME project scope.	Core	- OASIS Note: No XSD, WSDL changes for API

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ID#	Business Feature	Req Type	Potential Application(s) Impacted
CSTE-BRQ-165	System shall update identified report name from “EIM Transfer Limits” to “Net EIM Transfer Limits” Note: • OASIS menu label will also be updated • OASIS API name shall *not* be updated • Atlas Reference documentation will be updated • Market Instruments BPM will be updated	Core	- OASIS OASIS API

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Appendix A: [Intentionally Blank]

Appendix B: Example of 15-Minute EIM Transfer Limit Logic for BAA with Failed Flexible Ramping Sufficiency Test

As an example of how the EIM transfer limit logic will curtail limits for 15-minute intervals (and associated 5-minute intervals) with failed FRU/FRD sufficiency.

The following table shows the net EIM Transfer limit from below when failing the *FRU sufficiency test.*

Market Run			15-min Interval				
Market	**Run Time**	**Result**	**0 (*T*–7.5')**	**1 (*T*+7.5')**	**2 (*T*+22.5')**	**3 (*T*+37.5')**	**4 (*T*+52.5')**
FMM	*T*–82.5'	EIM Transfer (MW)	–200				
RTBS	***T*–75'**	Base Transfer (MW)		–300	–300	–300	–300
		FRU Test		**Pass**	**Pass**	**Fail**	**Fail**
FMM	*T*–67.5'	Transfer Limit (MW)				**–300**	**–300**
		EIM Transfer (MW)		–400	–320	–210	–300
RTBS	***T*–55'**	Base Transfer (MW)		–100	–100	–100	–100
		FRU Test		**Fail**	**Pass**	**Fail**	**Fail**
FMM	*T*–52.5'	Transfer Limit (MW)		**–200**		**–320**	**–210**
		EIM Transfer (MW)		–200	–270	–180	–210
RTBS	***T*–40'**	Base Transfer (MW)		–250	–250	–250	
		FRU Test		**Fail**	**Pass**	**Fail**	**Fail**
FMM	*T*–37.5'	Transfer Limit (MW)		**–250**		**–270**	**–250**
		EIM Transfer (MW)		–230	–350	–270	–250
FMM	*T*–22.5'	Transfer Limit (MW)		**–250**		**–350**	**–270**
		EIM Transfer (MW)		–240	–330	–300	–270
FMM	*T*–7.5'	Transfer Limit (MW)				**–330**	**–300**
		EIM Transfer (MW)			–280	–330	–300
FMM	*T*+7.5'	Transfer Limit (MW)				**–280**	**–330**
		EIM Transfer (MW)				–260	–330
FMM	*T*+22.5'	Transfer Limit (MW)					**–260**
		EIM Transfer (MW)					–260

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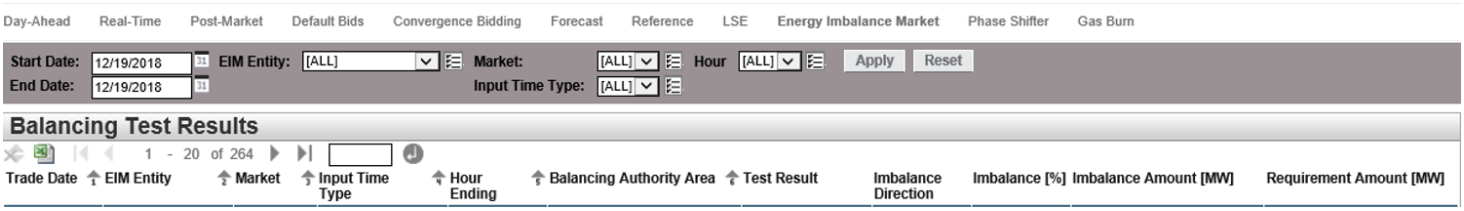
Appendix C: Example of EIM Balancing Test Results

For each trade hour, the EIM Balancing Test determines whether the BAA's base transfer schedule is within a 1% margin (over or under) of the hourly demand forecast. Imbalance results, the absolute difference between the BAA's base transfer schedule and the hourly demand forecast (either in the over or under direction), will now also report when within the 1% margin.



No.	Scenario Description	Expected Results
1	EIM Balancing Test result fails (over): - BAA ~~Base Schedule Transfer~~ sum of base schedules = 3500 MW - BAA Hourly Demand Forecast = 3580 MW	Since absolute (3500 MW – 3580 MW) > 0.01 * 3580 MW, CMRI results shall provide records as follows: • Test Result: Fail • Imbalance Direction: UNDER • Imbalance Amount (MW): 80.0 • Imbalance Percentage (%): 2.23 • Requirement Amount (MW): 3,580.0
2	EIM Balancing Test result fails (over): - BAA ~~Base Schedule Transfer~~ sum of base schedules = 3500 MW - BAA Hourly Demand Forecast = 3400 MW	Since absolute (3500 MW – 3400 MW) > 0.01 * 3400 MW, CMRI results shall provide records as follows: • Test Result: Fail • Imbalance Direction: OVER • Imbalance Amount (MW): 100.0 • Imbalance Percentage (%): 2.94 • Requirement Amount (MW): 3,400.0
3	EIM Balancing Test result passes (over or under): - BAA ~~Base Schedule Transfer~~ sum of base schedules = 3500 MW - BAA Hourly Demand Forecast = 3480 MW	Since absolute (3500 MW – 3480 MW) < 0.01 * 3480 MW, CMRI results shall provide records as follows: • Test Result: Pass • Imbalance Direction: OVER • Imbalance Amount (MW): 20.0 • Imbalance Percentage (%): 0.57 • Requirement Amount (MW): 3,480.0

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Appendix D: Example of EIM Capacity Test Results

No.	Scenario Description	Expected Results
1	BAA's EIM Capacity Test result fails for a single 15-min interval, where the following conditions occur for trade hour:	CMRI reports will now provide Bid Range Capacity test results for both over and under directions each trade hour. In each direction, the most-insufficient 15-minute interval result (presented in blue text) will displayed and broadcasted (e.g. :15 for the over direction, :45 for the under direction). Only the intervals' trade hour will be identified in the report.

Value	:15	:30	:45	:60
Base Transfer Schedule	1100	1100	1100	1100
15-minute Load Forecast	975	1050	1125	1025
Imbalance Direction	Over	Over	Under	Over
Imbalance Amount	125	50	25	75
Bid Range Capacity (Up)	100	100	100	100
Bid Range Capacity (Down)	100	100	100	100

Value Description	:15	:30	:45	:60
Test Status (Over)	Fail	Pass	Pass	Pass
Insufficiency Direction (Over)	Over	Over	Over	Over
Insufficiency Percentage (%)	25.0	-50.0	-125.0	-25.0
Insufficiency Amount (MW)	25	-50	-125	-25
Test Status (Under)	Pass	Pass	Pass	Pass
Insufficiency Direction (Under)	Under	Under	Under	Under
Insufficiency Percentage (%)	-225.0	-150.0	-75.0	-175.0
Insufficiency Amount (MW)	-225	-150	-75	-175

Since one of the 15-minute intervals failed the "over" capacity test, the BAA's Flexible Ramping Sufficiency Test fails for the same 15-minute interval in the upward direction, reducing the BAA's import EIM transfer limits (see BRQ-0150).

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No.	Scenario Description	Expected Results
2	BAA's EIM Capacity Test result fails for at least one 15-minute interval for each direction in same trade hour, where the following conditions occur: Value / :15 / :30 / :45 / :60 Base Transfer Schedule: 1100 / 1100 / 1100 / 1100 15-minute Load Forecast: 975 / 950 / 1110 / 1225 Imbalance Direction: Over / Over / Under / Under Imbalance Amount: 125 / 150 / 10 / 125 Bid Range Capacity (Up): 100 / 100 / 100 / 100 Bid Range Capacity (Down): 100 / 100 / 100 / 100	For this scenario, CMRI shall report the most-insufficient 15-minute interval results (in blue text) for interval :30 results for the "over" direction, and interval :60 results for the "under" direction. Only the intervals' trade hour will be identified in the report. Description / :15 / :30 / :45 / :60 Test Status (Over): Fail / Fail / Pass / Pass Insufficiency Direction (Over): Over / Over / Over / Over Insufficiency Percentage (%): 25.0 / 50.0 / -110.0 / -225.0 Insufficiency Amount (MW): 25 / 50 / -110 / -225 Test Status (Under): Pass / Pass / Pass / Fail Insufficiency Direction (Under): Under / Under / Under / Under Insufficiency Percentage (%): -225.0 / -250.0 / -90.0 / 25.0 Insufficiency Amount (MW): -225 / -250 / -90 / 25 Since the 15-minutes intervals failed the BAA's capacity test (intervals :15 and :30 in over direction, interval :60 in under direction), the BAA's Flexible Ramping Sufficiency Test (FRST) fails for the same 15-minute intervals in the associated direction. Intervals :15 and :30 will fail in the upward direction (reducing the import EIM Transfer Limit), and Interval :60 in the downward direction (reducing the export EIM Transfer Limit). See BRQ-0150.
3	BAA's EIM Capacity Test result passes for all 15-minute interval for each direction in same trade hour, where the following conditions occur: Value / :15 / :30 / :45 / :60 Base Transfer Schedule: 1100 / 1100 / 1100 / 1100 15-minute Load Forecast: 1050 / 1075 / 1125 / 1150 Imbalance Direction: Over / Over / Under / Under Imbalance Amount: 50 / 25 / 25 / 50 Bid Range Capacity (Up): 100 / 100 / 100 / 100 Bid Range Capacity (Down): 100 / 100 / 100 / 100	For this scenario, CMRI shall report the most-insufficient 15-minute interval results (in blue text, using interval :30 results for the "over" direction, interval :60 results for the "under" direction). Only the intervals' trade hour will be identified in the report. Description / :15 / :30 / :45 / :60 Test Status (Over): Pass / Pass / Pass / Pass Insufficiency Direction (Over): Over / Over / Over / Over Insufficiency Percentage (%): -50.0 / -25.0 / -125.0 / -150.0 Insufficiency Amount (MW): -50 / -25 / -125 / -150 Test Status (Under): Pass / Pass / Pass / Pass Insufficiency Direction (Under): Under / Under / Under / Under Insufficiency Percentage (%): -150.0 / -125.0 / -75.0 / -50 Insufficiency Amount (MW): -150 / -125 / -75 / -50 Since none of the 15-minute intervals failed the BAA's capacity test, no EIM transfer limits will be reduced for any of the intervals within the trade hour in either the import or export direction (see BRQ-0150).

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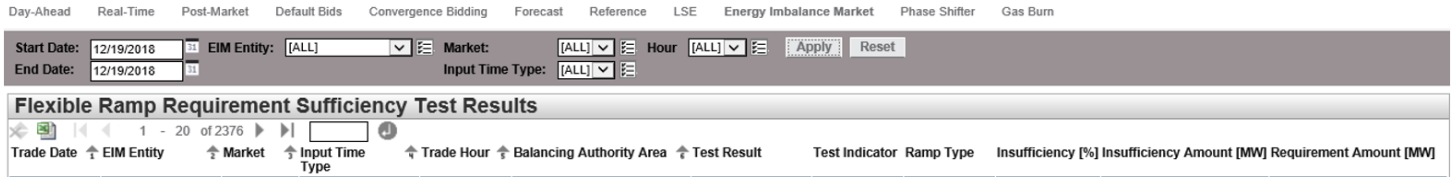
Appendix E: Example of EIM Flexible Ramping Sufficiency Test Results



No.	Scenario Description	Expected Results
1	BAA's EIM Flexible Ramping Sufficiency Test result fails for at least one 15-minute interval for a given direction in same trade hour, where the following conditions occur:	Results will be presented in both directions (up, down) for the trade hour, regardless of whether the test passed or failed. Values are algebraically presented (with negative values as sufficient results).

Value	:15	:30	:45	:60
Flexible Ramping Up Uncertainty Req	100	100	100	100
Flexible Ramping Upward Capacity	99.5	110	130	90
Flexible Ramping Dn Uncertainty Req	200	200	200	200
Flexible Ramping Downward Capacity	150	175	220	250

Description	:15	:30	:45	:60
Test Status (Upward)	Pass	Pass	Pass	Fail
Test Indicator	1	2	3	4
Ramp Type	Up	Up	Up	Up
Insufficiency Percentage (%)	0.5	-10.0	-30.0	10.0
Insufficiency Amount (MW)	0.5	-10	-30	10.0
Requirement Amount (MW)	100	100	100	100
Test Status (Downward)	Fail	Fail	Pass	Pass
Test Indicator	1	2	3	4
Ramp Type	Down	Down	Down	Down
Insufficiency Percentage (%)	25.0	12.5	-10.0	-25.0
Insufficiency Amount (MW)	50	25	-20	-50
Requirement Amount (MW)	200	200	200	200

In the upward ramping direction, the first interval (:15) has insufficiency within the 1%/1 MW tolerance bandwidth and therefore passes the FRST. In interval :60, the upward insufficiency exceeds the tolerance threshold and FRST fails.

For downward flexible ramping, the first and second intervals (:15 and :30) fail the downward FRST (reducing the BAA's export EIM Transfer Limit per BRQ-150).

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No.	Scenario Description	Expected Results
2	BAA's EIM Capacity Test results failed for the :15 and :30 (under) and :60 (over) 15-minute intervals, resulting in automatic FRST failure for those same 15-minute intervals. Capacity Test failure in the under direction shall apply to the FRST downward test, over direction applies to FRST upward test. Flexible Ramping Sufficiency Tests for the remaining interval/direction pairings pass. :	Results will be presented in both directions (up, down) for the trade hour, regardless of whether the associated 15-minute interval's capacity test has passed or failed. For instances where the 15-minute interval FRST fails due to a failed capacity test for the same interval, the insufficiency percentage and MW amount values will be set to zero values by default.

Value	:15	:30	:45	:60
Flexible Ramping Up Uncertainty Req	100	100	100	100
Flexible Ramping Upward Capacity	150	150	150	150
Flexible Ramping Dn Uncertainty Req	200	200	200	200
Flexible Ramping Downward Capacity	250	250	250	250

Description	:15	:30	:45	:60
Test Status (Upward)	Pass	Pass	Pass	Fail
Test Indicator	1	2	3	4
Ramp Type	Up	Up	Up	Up
Insufficiency Percentage (%)	-50.0	-50.0	-50.0	0.0
Insufficiency Amount (MW)	-50	-50	-50	0
Requirement Amount (MW)	100	100	100	100
Test Status (Downward)	Fail	Fail	Pass	Pass
Test Indicator	1	2	3	4
Ramp Type	Down	Down	Down	Down
Insufficiency Percentage (%)	0.0	0.0	-25.0	-25.0
Insufficiency Amount (MW)	0	0	-50	-50
Requirement Amount (MW)	200	200	200	200

Interval :60 will fail in the upward direction (reducing the import EIM Transfer Limit), and Intervals :15 and :30 in the downward direction (reducing the export EIM Transfer Limit). See BRQ-0150.

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Appendix F: NET EIM Transfer Limits Report (OASIS)

For binding 15-minute or 5-minute market intervals failing their Flexible Ramping Sufficiency Test, or if the EIM or ISO BAA is in Contingency, the Energy > EIM Transfer Limits Report shall be repurposed to display the following BAA Transfer Limit results:

- Only displays records for interval where BAAs have freezes on their EIM Transfer Limit (specifically, when an FRST fails or EIM BAA contingency event occurs)
- EIM limits will be reported for ~~both import and export directions~~ the following market conditions:
    - Flexible Ramping Sufficiency Test failure for interval (RTPD and RTD), only reports the direction of FRST failure
    - EIM BAA contingency event occurs (RTD only), occurs for both import and export direction
    - EIM Operator manually locks EIM transfer level via BAAOP (RTPD, RTD), occurs for both import and export directions
    - (LMPME future scenario) EIM BAA export transfers are limited for mitigated intervals (RTPD and RTD), occurs only for export direction

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Market	Opr Date	Balancing Authority Area Group ID	Limit Type	Opr Interval	HE01	HE02	HE03	HE04	HE05	HE06	HE07	HE08	HE09	HE10	HE11	HE12	HE13	HE14	HE15	HE16	HE17	HE18	HE19	HE20	HE21	HE22	HE23	HE24	HE25
RTD	09/16/2015	PACE	Import	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
RTD	09/16/2015	PACE	Import	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
RTD	09/16/2015	PACE	Import	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
RTD	09/16/2015	PACE	Import	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
RTD	09/16/2015	PACE	Import	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
RTD	09/16/2015	PACE	Import	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
RTD	09/16/2015	PACE	Import	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
RTD	09/16/2015	PACE	Import	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
RTD	09/16/2015	PACE	Import	9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
RTD	09/16/2015	PACE	Import	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
RTD	09/16/2015	PACE	Import	11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
RTD	09/16/2015	PACE	Import	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
RTD	09/16/2015	PACE	Export	1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
RTD	09/16/2015	PACE	Export	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
RTD	09/16/2015	PACE	Export	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
RTD	09/16/2015	PACE	Export	4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
RTD	09/16/2015	PACE	Export	5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
RTD	09/16/2015	PACE	Export	6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
RTD	09/16/2015	PACE	Export	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
RTD	09/16/2015	PACE	Export	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
RTD	09/16/2015	PACE	Export	9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
RTD	09/16/2015	PACE	Export	10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
RTD	09/16/2015	PACE	Export	11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
RTD	09/16/2015	PACE	Export	12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	

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