

November 19, 2014

The Honorable Kimberly D. Bose
Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, D.C. 20426

**Re: California Independent System Operator Corporation
Compliance Filing
Docket No. ER14-1386-_____**

Dear Secretary Bose:

The California Independent System Operator Corporation (“CAISO”)¹ submits this filing in compliance with the Commission’s “Order on Rehearing, Clarification, and Compliance,” issued in the above-identified proceeding on October 20, 2014.

I. Background

On February 28, 2014, the CAISO filed an amendment to its tariff to provide other balancing authority areas the opportunity to participate in the real-time market for imbalance energy that the CAISO currently operates in its own balancing authority area. The amendment set forth the rules and procedures governing this expansion of the real-time market. Under the amendment, this set of rules and procedures is known as the Energy Imbalance Market or “EIM.” The CAISO requested a July 1, 2014, effective date for various proposed *pro forma* service agreements to be executed by EIM Market Participants, and requested a September 23, 2014, effective date for the balance of the proposed tariff revisions.

On June 19, 2014, the Commission accepted the February 28 Tariff Filing, effective as of the July 1 and September 23, 2014 dates requested by the CAISO, subject to a compliance filing.² The CAISO made its compliance filing on July 21, 2014. In the October 20 Order, the Commission accepted the

¹ Capitalized terms not otherwise defined herein have the meanings set forth in appendix A to the CAISO tariff. References to numbered sections are references to sections of the CAISO tariff unless otherwise indicated.

² *Cal. Indep. Sys. Operator Corp.*, 147 FERC ¶ 61,231 (2014).

compliance filing subject to a further compliance filing regarding two matters. The instant filing addresses those two matters as discussed below.

II. Compliance with the October 20 Order

A. Greenhouse Gas Bid Adder

In the October 20 Order, the Commission responded to a requested by Powerex that it direct the CAISO to provide additional detail in the tariff on the greenhouse gas bid adder. In an April 15, 2014, Answer to Protests, the CAISO has expressed a willingness to provide additional detail. The Commission found that section 29 generally provides an adequate description of the bid adder and its purpose, consistent with the June 19 Order. However, the Commission recognized Powerex's concerns as to the level of detail addressing how the greenhouse gas bid adder will be used, even though the Commission had not previously expressly directed CAISO to include that detail. The Commission therefore directed the CAISO to include additional detail about the greenhouse gas bid adder in its tariff, at a level of detail similar to what is in Appendix C of CAISO's tariff regarding the marginal energy cost component of the locational marginal price, the marginal congestion component, and the marginal losses component.³

The CAISO is therefore submitting in this filing revisions to section 29 and Appendix C of the CAISO Tariff to provide the detail requested by the Commission regarding the use of the greenhouse gas bid adder in the determination of the locational marginal price and the payments to sellers. The use of the greenhouse gas bid adder in dispatching units is already detailed in section 29.32. In addition, to assist the Commission and interested parties understanding of the operation of these provisions, the CAISO is attaching to this filing an excerpt from the business practice manual for the Energy Imbalance Market that provides examples of the interplay of the greenhouse gas adder with dispatch and the locational marginal price.

B. Metering and Settlement Data

In the June 19 Order, the Commission agreed with Powerex that the requirement in proposed section 29.10(e) of CAISO's tariff that an EIM Entity Scheduling Coordinator with an EIM external intertie bid provide hourly transmission profiles and 15-minute energy profiles from respective e-Tags at least 20 minutes before the start of the operating hour was inconsistent with the timeline of the 15-minute market. The Commission directed CAISO to either: (1) explain and provide support for its proposal; or (2) revise section 29.10(e) to

³ October 20 Order at P 59.

reflect that energy profile information must be submitted at least 20 minutes before any 15-minute interval in the 15-minute market.

In the July 21 compliance filing, the CAISO provided the requested explanation, noting that under section 30.6.2, which is applicable to EIM market participants under section 29.30 of its tariff, if a scheduling coordinator receives an intra-hour schedule change, then the scheduling coordinator must, by 20 minutes before the start of the 15-minute market interval to which the schedule change applies, ensure that an updated energy profile reflects the change. The CAISO offered in revise section 29.10(e) to include a reference to section 30.6.2. The Commission directed the CAISO's proposal to include a reference to section 30.6.2 in a compliance filing. This filing includes that revision to section 29.10(e).

III. Materials Provided in this Compliance Filing

In addition to this transmittal letter, this compliance filing includes Attachments A, B, and C. Attachment A contains clean CAISO tariff sheets reflecting the tariff revisions described above. Attachment B shows these revisions in black-line format. Attachment C is the excerpt discussed above from the business practice manual for the Energy Imbalance Market.

IV. Conclusion

The CAISO respectfully requests that the Commission accept these tariff revisions as compliance with the October 20 Order.

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Respectfully submitted,

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John C. Anders

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Counsel for the California Independent System Operator Corporation

CERTIFICATE OF SERVICE

I hereby certify that I have served the foregoing document upon all of the parties listed on the official service list for the captioned proceeding, in accordance with the requirements of Rule 2010 of the Commission's Rules of Practice and Procedure (18 C.F.R. § 385.2010).

Dated at Folsom, CA this 19th day of November, 2014.

/s/ Sarah Garcia
Sarah Garcia

Attachment A – Clean Tariff Records
Compliance Filing – Energy Imbalance Market
California Independent System Operator Corporation

29.10. Metering and Settlement Data.

- (a) **Telemetry Requirements.** The EIM Entity shall ensure that each EIM Resource and non-participating resource in an EIM Entity Balancing Authority Area that is not a Generating Unit or is a Generating Unit with a rated capacity of 10 MW or greater (including each aggregated resource with a total rated capacity of 10 MW or greater) and each EIM Intertie has telemetry meeting the requirements of the Business Practice Manual for the Energy Imbalance Market.
- (b) **Metering for Settlement Purposes.** The EIM Entity shall ensure that each EIM Participating Resource and non-participating resource in an EIM Entity Balancing Authority Area becomes either a CAISO Metered Entity or a Scheduling Coordinator Metered Entity and complies with the requirements of Section 10 except as provided in Section 29.10(c).
- (c) **Exception to Requirements of Section 10.3.9.** In the absence of metering standards set by a Local Regulatory Authority, EIM Participating Resources and non-participating resources in an EIM Entity Balancing Authority Area may qualify as Scheduling Coordinator Metered Entities without the need for third party certification if the CAISO determines that the applicable metering standards meet or exceed the standards for CAISO Metered Entities.
- (d) **Interchange Meter Data.** Metering for Settlement purposes is required for all EIM Interties.
- (e) **EIM Energy Imbalance with an External Balancing Authority Area.** For each EIM External Intertie Bid that clears the FMM resulting in a 15-minute EIM External Intertie schedule—
 - (1) the EIM Entity Scheduling Coordinator must submit to the CAISO the corresponding hourly transmission profile and 15-minute Energy profiles from the respective E-Tags, which must reflect the Point of Receipt and Point of Delivery that was declared in the FMM Bid submittal, at least 20 minutes before the start of the Operating Hour; and

- (2) the EIM Entity Scheduling Coordinator must provide an updated Energy profile to the extent required by Section 30.6.2.

* * *

29.32 Greenhouse Gas Regulation and EIM Bid Adders.

(a) EIM Bid Adders.

- (1) **In General.** EIM Participating Resources will have an opportunity to recover costs of compliance with California Air Resources Board greenhouse gas regulations, which may include the cost of allowances, uncertainty on the final resource specific emission factor, and other costs of greenhouse gas regulation compliance.
- (2) **Bid Submission.** EIM Participating Resource Scheduling Coordinators may submit an EIM Bid Adder as a separate Bid component to recover costs of compliance with California Air Resources Board greenhouse gas regulations.
- (3) **Cap on Bid Adder.** The sum of the EIM Bid Adder and the Energy cost portion of the Bid cannot exceed \$1000/MWh.
- (4) **Minimum Bid Adder.** The EIM Bid Adder shall not be less than \$0/MWh.
- (5) **Limit on Use of Bid Adders.** An EIM Participating Resource Scheduling Coordinator may submit no more than one Bid Adder per day for an EIM Resource.

- (b) **Consideration of EIM Bid Adders in Market Clearing.** The CAISO shall modify its Security Constrained Economic Dispatch in the Real-Time Unit Commitment and Real-Time Dispatch to take into account EIM Bid Adders in selecting Energy produced by EIM Resources outside the CAISO Balancing Authority Area for import into the CAISO Balancing Authority Area or other EIM Entity Balancing Authority Areas in California, but not when selecting EIM Resources to serve Load outside of the CAISO Balancing Authority Area or other

EIM Entity Balancing Authority Areas in California.

- (c) **Effect on Locational Marginal Price.** Using the methodology described in Appendix C, the CAISO will include the marginal EIM Bid Adder as a negative component in the Locational Marginal Prices for EIM Entity Balancing Authority Areas in addition to those specified in Appendix C and Section 27.
- (d) **Notice to EIM Participating Resource.** The CAISO will notify the EIM Participating Resource Scheduling Coordinator through the Dispatch Instruction of the megawatt quantity of any Energy of an EIM Resource that is deemed to have been imported into the CAISO Balancing Authority Area or other EIM Entity Balancing Authority Areas in California as a result of the Market Clearing of the Real-Time Market.
- (e) **Compensation.** The CAISO will allocate the Net Imbalance Energy Export optimally to EIM Participating Resource Scheduling Coordinators and will distribute revenues from the EIM Bid Adder to EIM Participating Resources pursuant to that allocation.
- (f) **Reporting Requirements.** The CAISO will report to each EIM Participating Resource Scheduling Coordinator the portion of the FMM Energy Schedule and the portion of RTD Energy Dispatch that is associated with Energy deemed to have been imported to the CAISO Balancing Authority Area or other EIM Entity Balancing Authority Areas in California from all EIM Resources as part of the Real-Time Market results publication from each of its EIM Resources.

* * *

Appendix A

Master Definition Supplement

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- Net Imbalance Energy Export

The Net Imbalance Energy Export is the net Imbalance Energy imported into the CAISO Balancing Authority Area from EIM Entity Balancing Authority Areas.

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Appendix C

Locational Marginal Price

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A. LMP Composition

In each hour of the Day-Ahead Market for Energy, the CAISO calculates the LMP for each PNode, which is equal to the marginal cost of Energy available at the PNode in the hour, based on the Bids of sellers and buyers selected in the Day-Ahead Market for Energy as specified in the Day-Ahead Schedule. The CAISO designates a Reference Bus, r , for calculation of the System Marginal Energy Cost (SMECr). The CAISO uses a distributed Reference Bus to define an aggregate value of Energy for the CAISO Balancing Authority Area. The Locational Marginal Prices are not determined by resources that are not eligible to set the Locational Marginal Price, which includes resources that have constraints that prevent them from being marginal. For each bus other than the Reference Bus, the Transmission Provider determines separate components of the LMP for the marginal cost of Energy, Marginal Cost of Congestion, and Marginal Cost of Losses relative to the Reference Bus, consistent with the following equation:

$$LMP_i = SMEC_r + MCC_i + MCL_i$$

$$LMP_r = SMEC_r$$

where:

- $SMEC_r$ is the LMP component representing the marginal cost of Energy (also referred to as λ) at the Reference Bus, r (System Marginal Energy Cost).
- MCC_i is the LMP component representing the Marginal Cost of Congestion (also referred to as ρ) at bus i relative to the Reference Bus.
- MCL_i is the LMP component representing the Marginal Cost of Losses (also referred to as γ) at bus i relative to the Reference Bus.

For each PNode within an EIM Entity Balancing Authority Area, the LMP shall include a fourth component, the EIM Bid Adder component.

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E. EIM Bid Adder Component Calculation

For EIM Participating Resources within an EIM Entity Balancing Authority Area and Energy imported to or exported from an EIM Entity Balancing Authority Area, the CAISO will include the marginal cost of the EIM Bid Adder in dispatching Energy from the relevant EIM Participating Resources to serve load in the CAISO Balancing Authority Area. The CAISO will allocate the Net Imbalance Energy Export optimally to EIM Participating Resources. This allocation does not depend on the location of the EIM Entity Participating Resource; i.e. the CAISO does not use a shift factor in the allocation. If the Net Imbalance Energy Export from all EIM Entity Balancing Authority Areas as a group is negative or zero, there is no associated Net Imbalance Energy Export allocation or EIM Bid Adder cost. Otherwise the net imbalance energy export allocation constraint is binding and it may have a nonzero EIM Bid Adder price. The CAISO will include the marginal EIM Bid Adder in the LMP charged to the Net Imbalance Energy Export for each PNode within the EIM Entity Balancing Authority Areas.

F. Trading Hub Price Calculation

The CAISO calculates Existing Zone Generation Trading Hub prices, as provided in Section 27.3, based on the LMP calculations described in this Attachment and in Section 27.2.

G. Load Zone Price Calculation

The CAISO calculates LAP prices as described in Sections 27.2.2.

H. Intertie Scheduling Point Price Calculation

The CAISO calculates LMPs for Scheduling Points, which are represented in the FNM as PNodes or aggregations of PNodes, external to the CAISO Balancing Authority Area, through the same process that is used to calculate LMPs within the CAISO Balancing Authority Area. In some cases, facilities that are part of the CAISO Controlled Grid but are external to the CAISO Balancing Authority Area connect some Intertie Scheduling Points to the CAISO Balancing Authority Area, and in these cases the Scheduling Points are within external Balancing Authority Areas. In both of these cases, the Scheduling Points are represented in the FNM. The CAISO places injections and withdrawals at the Scheduling Point PNodes to represent Bids and

Schedules whose supporting physical injection and withdrawal locations may be unknown, and the LMPs for Settlement of accepted Bids are established at the Scheduling Point PNodes.

H.1 Intertie Scheduling Point Price Calculation for IBAA

H.1.1 Scheduling Point Prices

As described in Section 27.5.3, the CAISO's FNM includes a full model of the network topology of each IBAA. The CAISO will specify Resource IDs that associate Intertie Scheduling Point Bids and Schedules with supporting injection and withdrawal locations on the FNM. These Resource IDs may be specified by the CAISO based on the information available to it, or developed pursuant to a Market Efficiency Enhancement Agreement. Once these Resource IDs are established, the CAISO will determine Intertie Scheduling Point LMPs based on the injection and withdrawal locations associated with each Intertie Scheduling Point Bid and Schedule by the appropriate Resource ID. In calculating these LMPs the CAISO follows the provisions specified in Section 27.5.3 regarding the treatment of Transmission Constraints and losses on the IBAA network facilities. Unless otherwise required pursuant to an effective MEEA, the default pricing for all imports from the IBAA(s) to the CAISO Balancing Authority Area will be based on the SMUD/TID IBAA Import LMP and all exports to the IBAA(s) from the CAISO Balancing Authority Area will be based on the SMUD/TID IBAA Export LMP. The SMUD/TID IBAA Import LMP will be calculated based on modeling of supply resources that assumes all supply is from the Captain Jack substation as defined by WECC. The SMUD/TID IBAA Export LMP will be calculated based on the Sacramento Municipal Utility District hub that reflects Intertie distribution factors developed from a seasonal power flow base case study of the WECC region using an equivalencing technique that requires the Sacramento Municipal Utility District hub to be equivalenced to only the buses that comprise the aggregated set of load resources in the IBAA, with all generation also being retained at its buses within the IBAA. The resulting load distribution within each aggregated set of load resources within the IBAA defines the Intertie distribution factors for exports from the CAISO Balancing Authority Area.

H.1.2 Applicable Marginal Losses Adjustment

For import Schedules to the CAISO Balancing Authority Area at the southern terminus of the California-Oregon Transmission Project at the Tracy substation or at the applicable Scheduling Point that connects the CAISO Balancing Authority and the Western Area Power Administration system, the CAISO will replace the Marginal Cost of Losses at the otherwise applicable source for such Schedules with the Marginal Cost of Losses at the Tracy substation or at the applicable Scheduling point that connects the CAISO Balancing Authority Area and the Western Area Power Administration system, provided that the Scheduling Coordinators certify as discussed further below that the Schedules originate from transactions that use: (a) the California-Oregon Transmission Project; or (b) transmission facilities owned by the Western Area Power Administration within the SMUD/TID IBAA. In addition, as described further below, the Scheduling Coordinator must certify that the Schedules are subject to: (a) charges for losses by the Western Area Power Administration for the use of transmission facilities owned by the Western Area Power Administration within the SMUD/TID IBAA; or (b) charges for losses by the Transmission Agency of Northern California for the use of the California-Oregon Transmission Project. The CAISO will establish Resource IDs that are to be used only to submit Bids, including Self-Schedules, for the purpose of establishing Schedules that are eligible for this loss adjustment.

Prior to obtaining such Resource IDs, the relevant Scheduling Coordinator shall certify that it will only use this established Resource ID for Bids, including Self-Schedules, that originate from transactions that use: (a) the California-Oregon Transmission Project; or (b) transmission facilities owned by the Western Area Power Administration within the SMUD/TID IBAA. In addition, the Scheduling Coordinator must certify that the Schedules are subject to: (a) charges for losses by the Western Area Power Administration for the use of transmission facilities owned by the Western Area Power Administration within the SMUD/TID IBAA; or (b) Transmission Agency of Northern California for the use of the California-Oregon Transmission Project. Further, by actually using such Resource ID, the Scheduling Coordinator represents that such Bids, including Self-Schedules, that originate from transactions that use: (a) the California-Oregon Transmission

Project; or (b) transmission facilities owned by the Western Area Power Administration within the SMUD/TID IBAA. In addition, the Scheduling Coordinator must certify that the Schedules are subject to: (a) charges for losses by the Western Area Power Administration for the use of transmission facilities owned by the Western Area Power Administration within the SMUD/TID IBAA; or (b) Transmission Agency of Northern California for the use of the California-Oregon Transmission Project. Schedules and Dispatches settled under such Resource IDs shall be subject to an LMP which has accounted for the Marginal Cost of Losses as if there were an actual physical generation facility at the Tracy Scheduling Point or at the applicable Scheduling Point that connects the CAISO Balancing Authority Area and the Western Area Power Administration system as opposed to the Marginal Cost of Losses under the IBAA LMPs specified in Section G.1.1 of this Appendix. The CAISO may request information on a monthly basis from such Scheduling Coordinators to verify these certifications. Any such request shall be limited to transactions that use the designated Resource IDs during the six month prior period to the date of the request. The CAISO will calculate a re-adjustment of the Marginal Cost of Losses at the Tracy substation or at the applicable Scheduling Point that connects the CAISO Balancing Authority Area and the Western Area Power Administration system to reflect the otherwise applicable source for such Schedules for any Settlement Interval in which the CAISO has determined that the Scheduling Coordinator's payments did not reflect transactions that meet the above specified certification requirements. Any amounts owed to the CAISO for such Marginal Cost of Losses re-adjustments will be recovered by the CAISO from the affected Scheduling Coordinator by netting the amounts owed from payments due in subsequent Settlements Statements until the outstanding amounts are fully recovered.

For export Schedules from the CAISO Balancing Authority Area at the southern terminus of the California-Oregon Transmission Project at the Tracy substation or at the applicable Scheduling Point that connects the CAISO Balancing Authority Area and the Western Area Power Administration system, the CAISO will replace the Marginal Cost of Losses at the otherwise applicable sink for such Schedules with the Marginal Cost of Losses at the Tracy substation or at the applicable Scheduling Point that connects the CAISO Balancing Authority Area and the

Western Area Power Administration system, provided that the Scheduling Coordinator certifies, as discussed below, where the export Schedules use: (a) the California-Oregon Transmission Project; or (b) any transmission facilities owned by the Western Area Power Administration within the SMUD/TID IBAA. In addition, the Scheduling Coordinator must certify that the affected Schedules are charged losses by: (a) the Western Area Power Administration for the use of transmission facilities owned by the Western Area Power Administration within the SMUD/TID IBAA; or (b) Transmission Agency of Northern California for the use of the California-Oregon Transmission Project. The CAISO will establish Resource IDs that are to be used only to submit Bids, including Self-Schedules, for the purpose of establishing Schedules that are eligible for this loss adjustment. Prior to obtaining such Resource IDs, the relevant Scheduling Coordinator shall certify that it will only use this established Resource ID for Bids, including Self-Schedules, where the export Schedules use: (a) the California-Oregon Transmission Project; or (b) any transmission facilities owned by the Western Area Power Administration within the SMUD/TID IBAA. In addition the Scheduling Coordinator must certify that the affected Schedules are charged losses by: (a) the Western Area Power Administration for the use of transmission facilities owned by the Western Area Power Administration within the SMUD/TID IBAA; or (b) Transmission Agency of Northern California for the use of the California-Oregon Transmission Project. Further, by actually using such Resource ID, the Scheduling Coordinator represents that such Bids, including Self-Schedules, are used for the above specified conditions.

Schedules and Dispatches settled under such Resource IDs shall be subject to an LMP which has accounted for the Marginal Cost of Losses as if there were an actual physical generation facility at the Tracy Scheduling Point or at the applicable Scheduling Point that connects the CAISO Balancing Authority Area and the Western Area Power Administration system as opposed to the Marginal Cost of Losses under the IBAA LMPs specified in Section G.1.1 of this Appendix. The CAISO may request information on a monthly basis from such Scheduling Coordinators to verify that schedules for such Resource IDs meet the above specified conditions. Any such request shall be limited to transactions that use the designated Resource IDs during the six month prior period to the date of the request.

The CAISO will calculate a re-adjustment of the Marginal Cost of Losses at the Tracy substation or at the applicable Scheduling Point that connects the CAISO Balancing Authority Area and the Western Area Power Administration system to reflect the otherwise applicable sink for such Schedules for any Settlement Interval in which the CAISO has determined that the Scheduling Coordinator's payments did not reflect transactions that met the above specified conditions. Any amounts owed to the CAISO for such Marginal Cost of Losses re-adjustments will be recovered by the CAISO from the affected Scheduling Coordinator by netting the amounts owed from payments due in subsequent Settlements Statements until the outstanding amounts are fully recovered.

Attachment B – Marked Tariff Records
Compliance Filing – Energy Imbalance Market
California Independent System Operator Corporation

29.10. Metering and Settlement Data.

- (a) **Telemetry Requirements.** The EIM Entity shall ensure that each EIM Resource and non-participating resource in an EIM Entity Balancing Authority Area that is not a Generating Unit or is a Generating Unit with a rated capacity of 10 MW or greater (including each aggregated resource with a total rated capacity of 10 MW or greater) and each EIM Intertie has telemetry meeting the requirements of the Business Practice Manual for the Energy Imbalance Market.
- (b) **Metering for Settlement Purposes.** The EIM Entity shall ensure that each EIM Participating Resource and non-participating resource in an EIM Entity Balancing Authority Area becomes either a CAISO Metered Entity or a Scheduling Coordinator Metered Entity and complies with the requirements of Section 10 except as provided in Section 29.10(c).
- (c) **Exception to Requirements of Section 10.3.9.** In the absence of metering standards set by a Local Regulatory Authority, EIM Participating Resources and non-participating resources in an EIM Entity Balancing Authority Area may qualify as Scheduling Coordinator Metered Entities without the need for third party certification if the CAISO determines that the applicable metering standards meet or exceed the standards for CAISO Metered Entities.
- (d) **Interchange Meter Data.** Metering for Settlement purposes is required for all EIM Interties.
- (e) **EIM Energy Imbalance with an External Balancing Authority Area.** For each EIM External Intertie Bid that clears the FMM resulting in a 15-minute EIM External Intertie schedule
(1) _____, the EIM Entity Scheduling Coordinator must submit to the CAISO the corresponding hourly transmission profile and 15-minute Energy profiles from the respective E-Tags, which must reflect the Point of Receipt and Point of Delivery that was declared in the FMM Bid submittal, at least 20 minutes before the start of the Operating Hour; and

(2) the EIM Entity Scheduling Coordinator must provide an updated Energy profile to the extent required by Section 30.6.2.

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29.32 Greenhouse Gas Regulation and EIM Bid Adders.

(a) **EIM Bid Adders.**

- (1) **In General.** EIM Participating Resources will have an opportunity to recover costs of compliance with California Air Resources Board greenhouse gas regulations, which may include the cost of allowances, uncertainty on the final resource specific emission factor, and other costs of greenhouse gas regulation compliance.
- (2) **Bid Submission.** EIM Participating Resource Scheduling Coordinators may submit an EIM Bid Adder as a separate Bid component to recover costs of compliance with California Air Resources Board greenhouse gas regulations.
- (3) **Cap on Bid Adder.** The sum of the EIM Bid Adder and the Energy cost portion of the Bid cannot exceed \$1000/MWh.
- (4) **Minimum Bid Adder.** The EIM Bid Adder shall not be less than \$0/MWh.
- (5) **Limit on Use of Bid Adders.** An EIM Participating Resource Scheduling Coordinator may submit no more than one Bid Adder per day for an EIM Resource.

- (b) **Consideration of EIM Bid Adders in Market Clearing.** The CAISO shall modify its Security Constrained Economic Dispatch in the Real-Time Unit Commitment and Real-Time Dispatch to take into account EIM Bid Adders in selecting Energy produced by EIM Resources outside the CAISO Balancing Authority Area for import into the CAISO Balancing Authority Area or other EIM Entity Balancing Authority Areas in California, but not when selecting EIM Resources to serve Load outside of the CAISO Balancing Authority Area or other

EIM Entity Balancing Authority Areas in California.

- (c) **Effect on Locational Marginal Price.** Using the methodology described in Appendix C, the CAISO will include ~~the marginal EIM Bid Adder shall be included~~ as a negative component in the Locational Marginal Prices for EIM Entity Balancing Authority Areas in addition to those specified in Appendix C and Section 27.
- (d) **Notice to EIM Participating Resource.** The CAISO will notify the EIM Participating Resource Scheduling Coordinator through the Dispatch Instruction of the megawatt quantity of any Energy of an EIM Resource that is deemed to have been imported into the CAISO Balancing Authority Area or other EIM Entity Balancing Authority Areas in California as a result of the Market Clearing of the Real-Time Market.
- (e) **Compensation.** The CAISO will allocate the Net Imbalance Energy Export optimally to compensate the ~~EIM Participating Resource Scheduling Coordinators and will distribute revenues from the EIM Bid Adder to EIM Participating Resources pursuant to that allocation. for any Energy that is deemed to have been imported into the CAISO Balancing Authority Area or other EIM Entity Balancing Authority Areas in California at the marginal EIM Bid Adder price.~~
- (f) **Reporting Requirements.** The CAISO will report to each EIM Participating Resource Scheduling Coordinator the portion of the FMM Energy Schedule and the portion of RTD Energy Dispatch that is associated with Energy deemed to have been imported to the CAISO Balancing Authority Area or other EIM Entity Balancing Authority Areas in California from all EIM Resources as part of the Real-Time Market results publication from each of its EIM Resources.

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Appendix A

Master Definition Supplement

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- Net Imbalance Energy Export

The Net Imbalance Energy Export is the net Imbalance Energy imported into the CAISO Balancing Authority Area from EIM Entity Balancing Authority Areas.

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Appendix C

Locational Marginal Price

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A. LMP Composition

In each hour of the Day-Ahead Market for Energy, the CAISO calculates the LMP for each PNode, which is equal to the marginal cost of Energy available at the PNode in the hour, based on the Bids of sellers and buyers selected in the Day-Ahead Market for Energy as specified in the Day-Ahead Schedule. The CAISO designates a Reference Bus, r , for calculation of the System Marginal Energy Cost (SMECr). The CAISO uses a distributed Reference Bus to define an aggregate value of Energy for the CAISO Balancing Authority Area. The Locational Marginal Prices are not determined by resources that are not eligible to set the Locational Marginal Price, which includes resources that have constraints that prevent them from being marginal. For each bus other than the Reference Bus, the Transmission Provider determines separate components of the LMP for the marginal cost of Energy, Marginal Cost of Congestion, and Marginal Cost of Losses relative to the Reference Bus, consistent with the following equation:

$$LMP_i = SMEC_r + MCC_i + MCL_i$$

$$LMP_r = SMEC_r$$

where:

- $SMEC_r$ is the LMP component representing the marginal cost of Energy (also referred to as λ) at the Reference Bus, r (System Marginal Energy Cost).
- MCC_i is the LMP component representing the Marginal Cost of Congestion (also referred to as ρ) at bus i relative to the Reference Bus.

- MCL_i is the LMP component representing the Marginal Cost of Losses (also referred to as γ) at bus i relative to the Reference Bus.

For each PNode within an EIM Entity Balancing Authority Area, the LMP shall include a fourth component, the EIM Bid Adder component.

* * *

E. EIM Bid Adder Component Calculation

For EIM Participating Resources within an EIM Entity Balancing Authority Area and Energy imported to or exported from an EIM Entity Balancing Authority Area, the CAISO will include the marginal cost of the EIM Bid Adder in dispatching Energy from the relevant EIM Participating Resources to serve load in the CAISO Balancing Authority Area. The CAISO will allocate the Net Imbalance Energy Export optimally to EIM Participating Resources. This allocation does not depend on the location of the EIM Entity Participating Resource; i.e. the CAISO does not use a shift factor in the allocation. If the Net Imbalance Energy Export from all EIM Entity Balancing Authority Areas as a group is negative or zero, there is no associated Net Imbalance Energy Export allocation or EIM Bid Adder cost. Otherwise the net imbalance energy export allocation constraint is binding and it may have a nonzero EIM Bid Adder price. The CAISO will include the marginal EIM Bid Adder in the LMP charged to the Net Imbalance Energy Export for each PNode within the EIM Entity Balancing Authority Areas.

EF. Trading Hub Price Calculation

The CAISO calculates Existing Zone Generation Trading Hub prices, as provided in Section 27.3, based on the LMP calculations described in this Attachment and in Section 27.2.

FG. Load Zone Price Calculation

The CAISO calculates LAP prices as described in Sections 27.2.2.

GH. Intertie Scheduling Point Price Calculation

The CAISO calculates LMPs for Scheduling Points, which are represented in the FNM as PNodes or aggregations of PNodes, external to the CAISO Balancing Authority Area, through the same process that is used to calculate LMPs within the CAISO Balancing Authority Area. In some cases, facilities that are part of the CAISO Controlled Grid but are external to the CAISO

Balancing Authority Area connect some Intertie Scheduling Points to the CAISO Balancing Authority Area, and in these cases the Scheduling Points are within external Balancing Authority Areas. In both of these cases, the Scheduling Points are represented in the FNM. The CAISO places injections and withdrawals at the Scheduling Point PNodes to represent Bids and Schedules whose supporting physical injection and withdrawal locations may be unknown, and the LMPs for Settlement of accepted Bids are established at the Scheduling Point PNodes.

GH.1 Intertie Scheduling Point Price Calculation for IBAA

GH.1.1 Scheduling Point Prices

As described in Section 27.5.3, the CAISO's FNM includes a full model of the network topology of each IBAA. The CAISO will specify Resource IDs that associate Intertie Scheduling Point Bids and Schedules with supporting injection and withdrawal locations on the FNM. These Resource IDs may be specified by the CAISO based on the information available to it, or developed pursuant to a Market Efficiency Enhancement Agreement. Once these Resource IDs are established, the CAISO will determine Intertie Scheduling Point LMPs based on the injection and withdrawal locations associated with each Intertie Scheduling Point Bid and Schedule by the appropriate Resource ID. In calculating these LMPs the CAISO follows the provisions specified in Section 27.5.3 regarding the treatment of Transmission Constraints and losses on the IBAA network facilities. Unless otherwise required pursuant to an effective MEEA, the default pricing for all imports from the IBAA(s) to the CAISO Balancing Authority Area will be based on the SMUD/TID IBAA Import LMP and all exports to the IBAA(s) from the CAISO Balancing Authority Area will be based on the SMUD/TID IBAA Export LMP. The SMUD/TID IBAA Import LMP will be calculated based on modeling of supply resources that assumes all supply is from the Captain Jack substation as defined by WECC. The SMUD/TID IBAA Export LMP will be calculated based on the Sacramento Municipal Utility District hub that reflects Intertie distribution factors developed from a seasonal power flow base case study of the WECC region using an equivalencing technique that requires the Sacramento Municipal Utility District hub to be equivalenced to only the buses that comprise the aggregated set of load resources in the IBAA, with all generation also being retained at its buses within the IBAA. The resulting load distribution within each

aggregated set of load resources within the IBAA defines the Intertie distribution factors for exports from the CAISO Balancing Authority Area.

GH.1.2 Applicable Marginal Losses Adjustment

For import Schedules to the CAISO Balancing Authority Area at the southern terminus of the California-Oregon Transmission Project at the Tracy substation or at the applicable Scheduling Point that connects the CAISO Balancing Authority and the Western Area Power Administration system, the CAISO will replace the Marginal Cost of Losses at the otherwise applicable source for such Schedules with the Marginal Cost of Losses at the Tracy substation or at the applicable Scheduling point that connects the CAISO Balancing Authority Area and the Western Area Power Administration system, provided that the Scheduling Coordinators certify as discussed further below that the Schedules originate from transactions that use: (a) the California-Oregon Transmission Project; or (b) transmission facilities owned by the Western Area Power Administration within the SMUD/TID IBAA. In addition, as described further below, the Scheduling Coordinator must certify that the Schedules are subject to: (a) charges for losses by the Western Area Power Administration for the use of transmission facilities owned by the Western Area Power Administration within the SMUD/TID IBAA; or (b) charges for losses by the Transmission Agency of Northern California for the use of the California-Oregon Transmission Project. The CAISO will establish Resource IDs that are to be used only to submit Bids, including Self-Schedules, for the purpose of establishing Schedules that are eligible for this loss adjustment.

Prior to obtaining such Resource IDs, the relevant Scheduling Coordinator shall certify that it will only use this established Resource ID for Bids, including Self-Schedules, that originate from transactions that use: (a) the California-Oregon Transmission Project; or (b) transmission facilities owned by the Western Area Power Administration within the SMUD/TID IBAA. In addition, the Scheduling Coordinator must certify that the Schedules are subject to: (a) charges for losses by the Western Area Power Administration for the use of transmission facilities owned by the Western Area Power Administration within the SMUD/TID IBAA; or (b) Transmission Agency of Northern California for the use of the California-Oregon Transmission Project. Further, by

actually using such Resource ID, the Scheduling Coordinator represents that such Bids, including Self-Schedules, that originate from transactions that use: (a) the California-Oregon Transmission Project; or (b) transmission facilities owned by the Western Area Power Administration within the SMUD/TID IBAA. In addition, the Scheduling Coordinator must certify that the Schedules are subject to: (a) charges for losses by the Western Area Power Administration for the use of transmission facilities owned by the Western Area Power Administration within the SMUD/TID IBAA; or (b) Transmission Agency of Northern California for the use of the California-Oregon Transmission Project. Schedules and Dispatches settled under such Resource IDs shall be subject to an LMP which has accounted for the Marginal Cost of Losses as if there were an actual physical generation facility at the Tracy Scheduling Point or at the applicable Scheduling Point that connects the CAISO Balancing Authority Area and the Western Area Power Administration system as opposed to the Marginal Cost of Losses under the IBAA LMPs specified in Section G.1.1 of this Appendix. The CAISO may request information on a monthly basis from such Scheduling Coordinators to verify these certifications. Any such request shall be limited to transactions that use the designated Resource IDs during the six month prior period to the date of the request. The CAISO will calculate a re-adjustment of the Marginal Cost of Losses at the Tracy substation or at the applicable Scheduling Point that connects the CAISO Balancing Authority Area and the Western Area Power Administration system to reflect the otherwise applicable source for such Schedules for any Settlement Interval in which the CAISO has determined that the Scheduling Coordinator's payments did not reflect transactions that meet the above specified certification requirements. Any amounts owed to the CAISO for such Marginal Cost of Losses re-adjustments will be recovered by the CAISO from the affected Scheduling Coordinator by netting the amounts owed from payments due in subsequent Settlements Statements until the outstanding amounts are fully recovered.

For export Schedules from the CAISO Balancing Authority Area at the southern terminus of the California-Oregon Transmission Project at the Tracy substation or at the applicable Scheduling Point that connects the CAISO Balancing Authority Area and the Western Area Power Administration system, the CAISO will replace the Marginal Cost of Losses at the otherwise

applicable sink for such Schedules with the Marginal Cost of Losses at the Tracy substation or at the applicable Scheduling Point that connects the CAISO Balancing Authority Area and the Western Area Power Administration system, provided that the Scheduling Coordinator certifies, as discussed below, where the export Schedules use: (a) the California-Oregon Transmission Project; or (b) any transmission facilities owned by the Western Area Power Administration within the SMUD/TID IBAA. In addition, the Scheduling Coordinator must certify that the affected Schedules are charged losses by: (a) the Western Area Power Administration for the use of transmission facilities owned by the Western Area Power Administration within the SMUD/TID IBAA; or (b) Transmission Agency of Northern California for the use of the California-Oregon Transmission Project. The CAISO will establish Resource IDs that are to be used only to submit Bids, including Self-Schedules, for the purpose of establishing Schedules that are eligible for this loss adjustment. Prior to obtaining such Resource IDs, the relevant Scheduling Coordinator shall certify that it will only use this established Resource ID for Bids, including Self-Schedules, where the export Schedules use: (a) the California-Oregon Transmission Project; or (b) any transmission facilities owned by the Western Area Power Administration within the SMUD/TID IBAA. In addition the Scheduling Coordinator must certify that the affected Schedules are charged losses by: (a) the Western Area Power Administration for the use of transmission facilities owned by the Western Area Power Administration within the SMUD/TID IBAA; or (b) Transmission Agency of Northern California for the use of the California-Oregon Transmission Project. Further, by actually using such Resource ID, the Scheduling Coordinator represents that such Bids, including Self-Schedules, are used for the above specified conditions.

Schedules and Dispatches settled under such Resource IDs shall be subject to an LMP which has accounted for the Marginal Cost of Losses as if there were an actual physical generation facility at the Tracy Scheduling Point or at the applicable Scheduling Point that connects the CAISO Balancing Authority Area and the Western Area Power Administration system as opposed to the Marginal Cost of Losses under the IBAA LMPs specified in Section G.1.1 of this Appendix. The CAISO may request information on a monthly basis from such Scheduling Coordinators to verify that schedules for such Resource IDs meet the above specified conditions. Any such

request shall be limited to transactions that use the designated Resource IDs during the six month prior period to the date of the request.

The CAISO will calculate a re-adjustment of the Marginal Cost of Losses at the Tracy substation or at the applicable Scheduling Point that connects the CAISO Balancing Authority Area and the Western Area Power Administration system to reflect the otherwise applicable sink for such Schedules for any Settlement Interval in which the CAISO has determined that the Scheduling Coordinator's payments did not reflect transactions that met the above specified conditions. Any amounts owed to the CAISO for such Marginal Cost of Losses re-adjustments will be recovered by the CAISO from the affected Scheduling Coordinator by netting the amounts owed from payments due in subsequent Settlements Statements until the outstanding amounts are fully recovered.

Attachment C – Business Practice Manual Excerpt

Compliance Filing – Energy Imbalance Market

California Independent System Operator Corporation

Business Practice Manual For The Energy Imbalance Market

Version 2

Revision Date: October 30, 2014

Case 2: Flexible Ramp Sufficiency Test Fail

BAA		T-7.5'	T+7.5'	T+22.5'	T+37.5'	T+52.5'
CAISO	Total CAISO load	200	220	210	200	190
	Cumulative flexible ramp requirement		20	10	0	0
BAA ₁	L ₁ + L ₂	100	120	140	160	180
	EIM diversity benefit		0	0	0	-5
	Flexible ramp requirement credit		-10	-10	-10	-10
	Cumulative flexible ramp requirement		10	30	50	65
	Cumulative flexible ramp capacity		30	60	85	90
	Flexible ramp sufficiency test outcome		✓	✓	✓	✓
BAA ₂	L ₃ + L ₄	100	120	150	170	180
	EIM diversity benefit		0	0	0	-5
	Cumulative flexible ramp requirement		20	50	70	75
	Cumulative flexible ramp capacity		30	50	65	80
	Flexible ramp sufficiency test outcome		✓	✓	✗	✓
EIM	Total EIM load	400	460	500	530	550
	Cumulative flexible ramp requirement		60	100	130	150
	Sum of BAA flexible ramp requirement		60	100	130	160

Case 2: Flexible Ramp Capacity Constraints

For T+7.5'

- $FRC_0 \geq \max(0, FRR_0 - 20) = 0$
- $FRC_1 \geq \max(0, FRR_1 - 30) = 0$
- $FRC_2 \geq FRR_2 = 20$
- $FRC_0 + FRC_1 \geq FRR_{0,1} = 40$
- $NSI_2 \geq -10$

10.3.3 Locational Marginal Prices

The CAISO Markets, including the EIM, are based on using a Full Network Model coupled with locational marginal pricing. This coupling is meant to ensure that the Locational Marginal Prices (LMPs) reflect both the physical system as well as the schedules produced by the market

applications. A detailed explanation for how the LMPs are derived is contained in Section 3.2 of the [BPM for Market Operations](#).

10.3.3.1 Accounting for Greenhouse Gas Regulation

Imports of energy into CAISO and generation of energy within CAISO from greenhouse gas emitting resources are subject to the California Cap on Greenhouse Gas Emissions regulated by the California Air Resources Board (CARB). According to CARB rules, energy generated outside of California that is not imported into California is not subject to this regulation.

The EIM design accounts for this regulation through the following:

- For generation within an EIM balancing authority, the cost of the greenhouse gas compliance obligation will be included in dispatching energy from resources located outside of the CAISO BAA that serve CAISO load as determined by the EIM market optimization, but will otherwise be excluded. Thus, for resources located outside CAISO that do not serve CAISO load under the EIM market optimization, the cost of the greenhouse gas compliance obligation will be excluded from dispatching energy from these resources.
- The energy produced by each generator within an EIM balancing authority that serves CAISO load will be calculated by CAISO. Through a market results interface, CAISO will provide EIM Participating Resource Scheduling Coordinators with summary reports listing the amounts of energy exported to CA as determined by the EIM market optimization, which will be the basis of their greenhouse gas regulation compliance obligation with the California Air Resources Board (CARB).
- EIM Participating Resource Scheduling Coordinators can include the costs of their greenhouse gas regulation compliance obligation as an adder to their energy bids.

The EIM has been designed so that the greenhouse gas compliance costs will not affect the locational marginal price in an EIM balancing authority area. Rather, the market optimization will calculate the marginal cost difference between EIM generation serving load in CAISO and serving load outside of CAISO. This difference will be the marginal greenhouse gas regulation compliance cost and will be the rate CAISO will use to calculate a payment to each generator in an EIM balancing authority for its output that served CAISO imbalances. This payment will be funded through the price paid within CAISO for imbalance energy. CAISO will publish the marginal GHG compliance price.

10.3.3.2 Greenhouse Gas Methodology

The following methodology describes the real time optimal dispatch that accounts for the greenhouse gas allowance costs of resources in EIM Entity BAAs:

- The net imbalance energy export from all EIM Entity BAAs, exclusive of import/export imbalance energy schedules to non-EIM BAAs, is imbalance energy imported into the CAISO BAA. This energy would be allocated optimally to supply resources in the EIM Entity BAAs.
- The net imbalance energy export allocation to supply resources in EIM Entity BAAs does not depend on the location of these resources; no shift factors are used in this allocation. The rationale is that this allocation is an accounting problem, which is irrelevant to the actual flow of energy on the network; in other words, supply resources in EIM Entity BAAs are only differentiated in terms of their respective energy and emission costs, as reflected by a greenhouse gas (GHG) bid adder, and not in terms of their physical location.
- Each EIM Participating Resource in an EIM Entity BAA may submit a greenhouse gas bid adder that reflects the cost of procuring GHG allowances required by CARB for energy imports to California. This cost is added to the objective function for an efficient cost-effective imbalance energy dispatch.
- If the net imbalance energy export from all EIM Entity BAAs as a group is negative or zero, there is no associated net imbalance energy export allocation or greenhouse gas allowance cost. Otherwise the net imbalance energy export allocation constraint is binding and it may have a nonzero shadow price.
- Greenhouse gas allowance costs are reflected through the net imbalance energy export allocation shadow prices in the Locational Marginal Prices (LMPs) in the EIM Entity BAAs through a fourth component that is the same for all locations in the EIM Entity BAAs. This LMP component can be seen as an adder to the marginal energy component that reflects the marginal cost of greenhouse gas allowance credits in EIM Entity BAAs. This LMP component is absent for locations in CAISO, or other BAAs that do not participate in EIM, because in these cases the cost of greenhouse gas allowance credits is included in the energy bids; hence it is already reflected in the marginal energy component.
- The absence of the fourth LMP component for locations in CAISO results in no impact on existing Market Participants that would not have to modify their systems.

- As a result of the imbalance energy settlement, the CAISO will collect greenhouse gas allowance revenue for the net imbalance energy export from the EIM Entity BAAs at the respective net imbalance energy export allocation constraint shadow price, similarly to the congestion revenue. Distributing this revenue back to the optimal net imbalance energy export allocations in addition to the imbalance energy settlement at the LMP would adequately compensate supply resources in EIM Entity BAAs for their energy and greenhouse gas allowance costs without a need for any side payments and uplift.
- This methodology is very general and robust and it does not depend on the particular network configuration or how the various BAAs are interconnected. Therefore, it is readily expandable to any number of BAAs in the Full Network Model (FNM) with any number of EIM Entity BAAs and any BAA interconnection pattern.

10.3.3.2.1 Mathematical Formulation

To illustrate the method, consider a simple network configuration that consists only of the CAISO and a single EIM Entity BAA. Furthermore, day-ahead and base schedules are ignored for simplicity, as well as ancillary services, transmission losses, and inter-temporal constraints, focusing on a single time period.

Notation

The following notation is used to formulate the problem:

i	Node index in CAISO.
j	Node index in EIM Entity BAA.
k	Oriented transmission line index.
\forall	For all...
G_i	Imbalance energy dispatch for generator at node i .
G_{MINi}	Minimum capacity for generator at node i .
G_{MAXi}	Maximum capacity for generator at node i .
L_i	Distributed load forecast at node i .
C_i	Incremental energy bid for generator at node i .
C_{Gj}	GHG bid adder for generator at node j .
$S_{i,k}$	Shift Factor of power injection at node i on transmission line k .
F_k	Active power flow on transmission line k .
F_{MAXk}	Active power flow limit on transmission line k .
E	Net imbalance energy export from EIM Entity BAA.

E_S	Net imbalance energy export surplus (cannot be allocated).
E_j	Net imbalance energy export from EIM Entity BAA allocated to generator j .
LMP_i	Locational Marginal Price at node i .
λ	Shadow price of power balance constraint.
μ_k	Shadow price of active power flow limit constraint on transmission line k .
η	Shadow price of net imbalance energy export allocation constraint.
R_G	Greenhouse gas allowance revenue.
R_{Gj}	Greenhouse gas allowance revenue distribution to generator at node j .
M	Penalty cost for net imbalance energy export surplus (E_S).
ε	A small tolerance.

Optimization Problem

The mathematical formulation is as follows:

$$\min \left(\sum_i C_i G_i + \sum_j (C_j G_j + C_{Gj} E_j) \right)$$

subject to:

$$\text{power balance: } \sum_i (G_i - L_i) + \sum_j (G_j - L_j) = 0$$

$$\begin{aligned} \text{transmission line flow: } F_k &\equiv \sum_i S_{i,k} (G_i - L_i) + \sum_j S_{j,k} (G_j - L_j) \\ &\leq F_{\text{MAX}k}, \forall k \end{aligned}$$

$$\text{net export allocation: } E \equiv \sum_j (G_j - L_j) \leq \sum_j E_j$$

$$\begin{aligned} \text{generator limits: } G_{\text{MIN}i} &\leq G_i \leq G_{\text{MAX}i}, \forall i \\ G_{\text{MIN}j} &\leq G_j \leq G_{\text{MAX}j}, \forall j \end{aligned}$$

$$\text{allocation limits: } 0 \leq E_j \leq G_j, \forall j$$

When the net export E is zero or negative (import), the net export allocation constraint is not binding and all allocations E_j are zero.

The LMPs are determined as follows:

$$LMP_i = \lambda + \sum_i S_{i,k} \mu_k, \forall i$$

$$LMP_j = \lambda + \sum_j S_{j,k} \mu_k + \eta, \forall j$$

Where the marginal loss component is missing because transmission losses are ignored.

The greenhouse gas allowance revenue is calculated as follows:

$$R_G = -\eta E$$

This revenue is then distributed to the optimal net imbalance energy export allocations as follows:

$$R_{Gj} = -\eta E_j$$

10.3.3.2.2 Implementation Details

With non-EIM BAAs in the FNM, the net export allocation E in the formulation of §0 is the net EIM Transfer from all EIM BAAs, i.e., the opposite of the EIM Transfer for the CAISO BAA. When it is negative, i.e., an import to the EIM BAAs from the CAISO BAA, the net export allocation constraint is irrelevant (not binding) and its shadow price is zero. When it is positive, i.e., an export from the EIM BAAs to the CAISO BAA, the net export allocation constraint is binding and its shadow price may be nonzero. In the latter case, the positive EIM Transfer from all EIM BAAs must be allocated to EIM Participating Resources. There should be no allocation to EIM Non-Participating Resources because these resources do not bid in the EIM, thus they do not submit a GHG compliance bid.

Specifically, in RTUC, since the net base EIM Transfer from all EIM BAAs is zero, the positive 15-minute net EIM Transfer must be allocated to the 15-minute schedule of EIM Participating Resources. This allocation considers the entire 15-minute schedule and not only the incremental portion above the base schedule. This is because the energy from these resources is used for meeting imbalance energy requirements in the EIM BAAs as well as supplying energy exports to the CAISO BAA. Therefore, it can be argued that these resources could potentially be decremented below their base schedule absorbing negative imbalance energy to meet imbalance energy requirements in the EIM BAAs, while producing positive imbalance energy to supply exports to the CAISO BAAs. Hence, it is conceivable that the imbalance energy export allocation quantity that receives GHG compliance revenue at the 15-minute marginal GHG compliance price could exceed the 15-minute incremental imbalance energy that receives a 15-minute imbalance energy settlement, both on an EIM Participating Resource level, and overall.

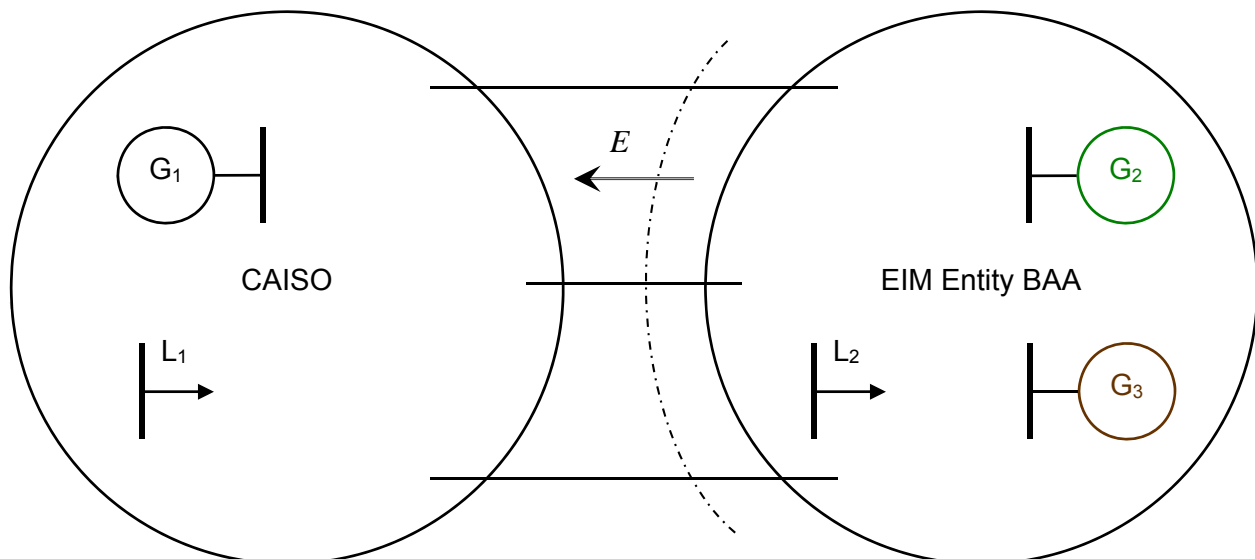
In RTD, the mathematical formulation is no different than in RTUC: the positive 5-minute net EIM Transfer must be allocated to the 5-minute dispatch of EIM Participating Resources. Similarly, to the RTUC allocation, the 5-minute allocation considers the entire 5-minute dispatch and not only the incremental portion above the 15-minute schedule or the base schedule. However, the settlement for the 5-minute GHG compliance revenue at the 5-minute marginal GHG compliance price is for the algebraic deviation of the imbalance energy export allocation between the 5-minute and the 15-minute quantities. If the 5-minute allocation is lower than the 15-minute allocation, the participant will buy back the difference at the 5-minute marginal GHG compliance price. Nevertheless, since the imbalance energy export allocation is optimally determined in both RTUC and RTD based on the GHG compliance bids, the net settlement will not result in a financial loss. The participant will be required to report to CARB only the 5-minute imbalance energy export allocations from RTD, for which they may need to acquire emission credits.

10.3.3.2.3 Examples

The following examples show the application of this method:

- **Example 1**

One generator and a load are in the CAISO, and two generators and a load are in the EIM Entity BAA, as shown in the figure below.



The power transfer (E) between the BAAs is limited to 100MW. The resource data is as follows:

Load	Forecast (MW)
L ₁	200
L ₂	50

Generator	Minimum (MW)	Maximum (MW)	Energy Bid (\$/MWh)	GHG Compliance Bid Adder (\$/MWh)
G ₁	0	300	50	-
G ₂	0	200	35	0
G ₃	0	200	30	6

Generator G₂ is a non-emitting resource with a GHG compliance bid adder of zero, whereas G₃ is an emitting resource with a GHG compliance bid adder of \$6.00. They are both less expensive than G₁. Therefore, the power export from the EIM Entity BAA to the ISO is binding at the optimal solution at 100MW. The optimal dispatch and export allocation are as follows:

Resource	Dispatch (MW)	Export Allocation (MW)	LMP (\$/MWh)
G1	100	-	50
G2	100	100	30
G3	50	0	30
L1	200	-	50
L2	50	-	30

Example 1: $\mu = -\$15/\text{MWh}$; $\eta = -\$5/\text{MWh}$

Generator G₃ is the least expensive resource for serving Load L₂, and as such it sets the LMP in the EIM Entity Area to \$30/MWh. However, for serving Load L₁, a \$6/MWh additional GHG compliance cost would be incurred to G₃, making G₂ more effective for that purpose. Consequently, G₂ is dispatched with its energy all exported to the ISO at the limit of the power

transfer capability. The balance of 100MW of L_1 can only be served by G_1 , which sets the LMP in the ISO to \$50/MWh.

The LMP difference of \$20/MWh is made up by the marginal congestion cost of \$15/MWh and the marginal GHG compliance cost of \$5/MWh. The marginal congestion cost can be easily verified if the power transfer limit is relaxed by 1MW to 101MW, in which case one additional MWh from G_2 will displace 1MWh from G_1 for a net benefit of \$15. The marginal GHG compliance cost can be easily verified if the export allocation (which carries the GHG compliance cost) is relaxed by 1 MW to 99MW, in which case one additional MWh from G_3 will displace 1MWh from G_2 for a net benefit of \$5. It is interesting to note that there is a non-zero marginal GHG compliance cost in the optimal solution even when all the exported energy is allocated to the non-emitting resource G_2 who bid zero. This is because the cost of that export to California is \$5/MWh higher than otherwise available energy from G_3 .

The marginal congestion cost of \$15/MWh and the marginal GHG compliance cost of \$5/MWh on a 100MWh energy export result in a congestion revenue of \$1,500 and a GHG compliance revenue of \$500, respectively. Assuming that the GHG compliance revenue is distributed to the optimal export allocations, the settlement is as follows:

Resource	Energy Cost	GHG Compliance Cost	Total Cost	Energy Payment	GHG Compliance Payment	Total Payment
G_1	\$5,000	-	\$5,000	\$5,000	-	\$5,000
G_2	\$3,500	\$0	\$3,500	\$3,000	\$500	\$3,500
G_3	\$1,500	\$0	\$1,500	\$1,500	\$0	\$1,500
L_1				-\$10,000		
L_2				-\$1,500		
Congestion Revenue				\$1,500		
GHG Compliance Revenue				\$500		

Where it is assumed that GHG compliance costs for G_1 are included in the energy bid (cost) and recovered through the energy payment, and as such they are not shown explicitly. It can be seen in the settlement results above that the total payment to each generator is sufficient to cover the respective energy and GHG compliance costs.

- **Example 2**

This is a variation on the first example where G3 reduces its bid price to \$28 to become a more competitive exporter to the ISO compared to G2, taking into account the additional GHG compliance bid of \$6/MWh. In this case, the optimal dispatch and export allocation are as follows:

Resource	Dispatch (MW)	Export Allocation (MW)	LMP (\$/MWh)
G ₁	100	-	50
G ₂	0	0	28
G ₃	150	100	28
L1	200	-	50
L2	50	-	28

Example 2: $\mu = -\$16/\text{MWh}$; $\eta = -\$6/\text{MWh}$

G3 is the least expensive resource for serving L2, and as such it sets the LMP in the EIM Entity Area to \$28/MWh. It is also the least expensive resource for serving L1 at \$34/MWh (including the \$6/MWh GHG compliance cost). Consequently, G3 is dispatched at 150MW with 100MW exported to the ISO at the limit of the power transfer capability. The balance of 100MW of L1 can only be served by G1, which sets the LMP in the ISO to \$50/MWh.

The LMP difference of \$22/MWh is made up by the marginal congestion cost of \$16/MWh and the marginal GHG compliance cost of \$6/MWh. The marginal congestion cost can be easily verified if the power transfer limit is relaxed by 1MW to 101MW, in which case one additional MWh from G3 will displace 1MWh from G1 for a net benefit of \$16. The marginal GHG compliance cost can be easily verified if the export allocation (which carries the GHYG allowance cost) is relaxed by 1 MW to 99MW, in which case 1MWh from G3 will not incur GHG allowance costs for a benefit of \$6.

The marginal congestion cost of \$16/MWh and the marginal GHG compliance cost of \$6/MWh on a 100MWh energy export result in a congestion revenue of \$1,600 and a GHG compliance revenue of \$600, respectively. Assuming that the GHG compliance revenue is distributed to the optimal export allocations, the settlement is as follows:

Resource	Energy Cost	GHG Compliance Cost	Total Cost	Energy Payment	GHG Compliance Payment	Total Payment
G ₁	\$5,000	-	\$5,000	\$5,000	-	\$5,000
G ₂	\$0	\$0	\$0	\$0	\$0	\$0
G ₃	\$4,200	\$600	\$4,800	\$4,200	\$600	\$4,800
L ₁				-\$10,000		
L ₂				-\$1,400		
Congestion Revenue				\$1,600		
GHG Compliance Revenue				\$600		

It can be seen in the settlement results above that the total payment to each generator is sufficient to cover the respective energy and GHG allowance costs.

- **Example 3**

This is a variation on the second example where the available maximum capacity of G3 is reduced to 75MW in addition to reduced bid price of \$28/MWh as in Example 2. In this case, G2 is dispatched to make up for the remaining 75MW and the optimal dispatch and export allocation are as follows:

Resource	Dispatch (MW)	Export Allocation (MW)	LMP (\$/MWh)
G ₁	100	-	50
G ₂	75	75	29
G ₃	75	25	29
L1	200	-	50
L2	50	-	29

Example 3: $\mu = -\$15/\text{MWh}$; $\eta = -\$6/\text{MWh}$

G3 is the least expensive resource for serving L2; one additional MW of L2 will divert 1MW of G3 export to L2 saving \$6/MWh on GHG compliance costs and that export will be made up by one additional MW from G2 at a net cost of \$29/MWh, which is the LMP in the EIM Entity BAA. The balance of 100MW of L1 can only be served by G1, which sets the LMP in the ISO to \$50/MWh.

The LMP difference of \$21/MWh is made up by the marginal congestion cost of \$15/MWh and the marginal GHG compliance cost of \$6/MWh. The marginal congestion cost can be easily verified if the power transfer limit is relaxed by 1MW to 101MW, in which case one additional MWh from G2 will displace 1MWh from G1 for a net benefit of \$15. The marginal GHG compliance cost can be easily verified if the export allocation (which carries the GHG compliance cost) is relaxed by 1 MW to 99MW, in which case 1MWh from G3 will not incur GHG compliance costs for a benefit of \$6.

The marginal congestion cost of \$15/MWh and the marginal GHG compliance cost of \$6/MWh on a 100MWh energy export result in a congestion revenue of \$1,500 and GHG compliance revenue of \$600, respectively. Assuming that the GHG compliance revenue is distributed to the optimal export allocations, the settlement is as follows:

Resource	Energy Cost	GHG Compliance Cost	Total Cost	Energy Payment	GHG Compliance Payment	Total Payment
G ₁	\$5,000	-	\$5,000	\$5,000	-	\$5,000
G ₂	\$2,625	\$0	\$2,625	\$2,175	\$450	\$2,625
G ₃	\$2,100	\$150	\$2,250	\$2,175	\$150	\$2,325
L ₁				-\$10,000		
L ₂				-\$1,450		
Congestion Revenue				\$1,500		
GHG Compliance Revenue				\$600		

It can be seen in the settlement results above that the total payment to each generator is sufficient to cover the respective energy and GHG compliance costs.

- **Example 4**

This is a variation on the third example where a new resource G4 is introduced in the EIM Entity BAA with a generating capacity of 100MW, a GHG compliance bid adder of \$3.00/MWh, and an energy bid of \$30/MWh, while the power transfer capability is increased to 300MW. Therefore, the resource data is as follows:

Generator	Minimum (MW)	Maximum (MW)	Energy Bid (\$/MWh)	GHG Compliance Bid Adder (\$/MWh)
G ₁	0	300	50	-
G ₂	0	200	35	0
G ₃	0	75	28	6
G ₄	0	100	30	3

The purpose of this example is to show that the LMP in the ISO would include the GHG compliance costs for imports; this effect was masked in the previous examples because the more expensive resource G1 was setting the LMP in the ISO. In this case, without a binding power transfer limit, G2, G3 and G4 are dispatched to serve both loads L1 and L2. The optimal dispatch and export allocation are as follows:

Generator	Dispatch (MW)	Export Allocation (MW)	LMP (\$/MWh)
G ₁	0	-	35
G ₂	75	75	29
G ₃	75	25	29
G ₄	100	100	29

Example 4: $\mu = \$0/\text{MWh}$; $\eta = -\$6/\text{MWh}$

G3 is the least expensive resource for serving L2 and G4 is the least expensive resource for serving L1; consequently, both resources are dispatched at their maximum capacity. G2 is marginal for serving L1 and sets the LMP in the ISO to \$35/MWh. One additional MW of L2 will divert 1MW of G3 export to L2 saving \$6/MWh on GHG compliance costs and that export will be made up by one additional MW from G2 at a net cost of \$29/MWh, which is the LMP in the EIM Entity BAA.

Since there is no transmission congestion, the LMP difference of \$6/MWh amounts to the marginal GHG compliance cost of \$6/MWh. The marginal GHG compliance cost can be easily verified if the export allocation (which carries the GHG compliance cost) is relaxed by 1 MW to 199MW, in which case 1MWh from G3 will not incur GHG compliance costs for a benefit of \$6.

The marginal GHG compliance cost of \$6/MWh on a 200MWh energy export results in a GHG compliance revenue of \$1,200. Assuming that the GHG compliance revenue is distributed to the optimal export allocations, the settlement is as follows:

Resource	Energy Cost	GHG Compliance Cost	Total Cost	Energy Payment	GHG Compliance Payment	Total Payment
G ₁	\$0		\$0	\$0		\$0
G ₂	\$2,625	\$0	\$2,625	\$2,175	\$450	\$2,625
G ₃	\$2,100	\$150	\$2,250	\$2,175	\$150	\$2,325
G ₄	\$3,000	\$300	\$3,300	\$2,900	\$600	\$3,500
L ₁				-\$7,000		
L ₂				-\$1,450		
Congestion Revenue				\$0		
GHG Compliance Revenue				\$1,200		

It can be seen in the settlement results above that the total payment to each generator is sufficient to cover the respective energy and GHG compliance costs. Furthermore, all export allocations receive the marginal GHG compliance cost irrespective of the resource's GHG compliance bid.

10.3.4 EIM Market Power Mitigation

CAISO is authorized to adjust a resource's submitted energy bid downward to the level of the resource's cost based bid, or Default Energy Bid, when the resource has been determined to wield Local Market Power. The Local Market Power Mitigation procedure is administrated by an automated process integrated into the Day-Ahead and Real-Time Market systems. This section describes the Local Market Power Mitigation procedure as it is applied to the EIM market. Applicable portions of Sections 6 and 7 of the [BPM for Market Operations](#) describe the general operation and timeline of the Local Market Power Mitigation process for the Day-Ahead and Real-Time Markets, respectively.

As mentioned in the previous section, the Default Energy Bid is a resource's cost-based bid that may be used in the event that the CAISO markets determine that the resource wields Local Market Power. See also the [BPM for Market Instruments](#) Appendix Attachment D for additional details.