

**ATTACHMENT F**

**FIRST NOTICE OF PUBLIC AVAILABILITY OF 15-DAY AMENDMENT TEXT**

**Proposed Amendments to the California Cap on Greenhouse Gas Emissions and  
Market-Based Compliance Mechanisms Regulation**

**Analysis of the Energy Imbalance Market and Mandatory Greenhouse Gas  
Reporting and Cap-and-Trade Regulations**

**State of California**

**AIR RESOURCES BOARD**

**Release Date: December 21, 2016**

## California Air Resources Board

### Analysis of the Energy Imbalance Market and Mandatory Greenhouse Gas Reporting and Cap-and-Trade Regulations

This document further describes the issues the California Air Resources Board (ARB) seeks to address regarding greenhouse gas (GHG) accounting in the Energy Imbalance Market (EIM). ARB held a June 24, 2016 Cap-and-Trade Program public workshop on this topic,<sup>1</sup> and also described these issues in the public notices for these rulemaking packages, and held an October 21, 2016 workshop on potential EIM modifications.<sup>2</sup> At the workshop ARB staff committed to releasing information to describe the impact on greenhouse gas (GHG) emissions reporting from the current California Independent System Operator's (CAISO) Energy Imbalance Market (EIM).

Staff developed an analysis to compare EIM imported electricity emissions resulting from serving California load as reported to ARB through the Mandatory Reporting Regulation (MRR) over a 12-month period to the emissions to the atmosphere that may occur in connection with EIM imported electricity but for which ARB's program does not fully account. This raises emissions undercounting concerns. Staff is concerned with potential emissions leakage if the EIM footprint expanded to include additional EIM market participants and estimated the magnitude of potential leakage.<sup>3</sup> These analyses, and ARB's obligation to minimize emissions leakage, inform the proposed solutions described in regulatory amendments staff has proposed.

Based on staff's analysis, the emissions associated with EIM imported electricity specified resource attribution is underreported to ARB by 43.8 percent over a 12-month period relative to unspecified source electricity. This ratio is based on verified data reported to ARB.<sup>4</sup> As EIM expands to include each additional balancing authority, the quantity of electricity being deemed delivered to serve load in California and the percentage of deemed delivered electricity being attributed to zero-emitting resources are increasing. The proposed amendments released in 2016 as part of the Cap-and-Trade<sup>5</sup> and MRR<sup>6</sup> rulemakings are intended to address this issue.

#### 1) Accounting for California's Electricity Emissions under AB 32

Under Assembly Bill (AB 32), ARB must account for statewide GHG emissions, including all emissions resulting from the generation of electricity delivered to and

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<sup>1</sup> [http://www.arb.ca.gov/cc/capandtrade/meetings/062416/arb\\_and\\_caiso\\_staff\\_presentations\\_updated.pdf](http://www.arb.ca.gov/cc/capandtrade/meetings/062416/arb_and_caiso_staff_presentations_updated.pdf)

<sup>2</sup> <https://www.arb.ca.gov/cc/capandtrade/meetings/20161021/oct-21-workshop-slides.pdf>

<sup>3</sup> Emissions leakage here is used to mean a reduction in emissions of GHGs within the State that is offset by an increase in emissions of GHGs outside the State due to California regulation.

<sup>4</sup> ARB has opened the provisions associated with EIM in the MRR and Cap-and-Trade Regulations for potential changes as part of the 2016 amendment process.

<sup>5</sup> <https://www.arb.ca.gov/regact/2016/capandtrade16/capandtrade16.htm>

<sup>6</sup> <https://www.arb.ca.gov/regact/2016/ghg2016/ghg2016.htm>

consumed in California, accounting for transmission and distribution lines losses, whether that electricity is generated in-state or imported to California to serve California load.

To account for GHG emissions in the electricity sector California power plants must report their emissions under MRR based on fuel type or using continuous emissions monitoring systems. Under the Cap-and-Trade Program each of these generators has a compliance obligation for the emissions that result from their electricity generation. Electricity importers must report physical delivery of electricity by generation source, allowing ARB to account for the emissions profile of imported electricity by fuel type of the generation source. Under the Cap-and-Trade Regulation the importer has a compliance obligation associated with the emissions from imported electricity that serves California load.

Electricity reported under MRR is either reported as specified electricity or unspecified electricity. Specified electricity is delivered via an importer from either a specific generating source or asset controlling supplier approved by ARB.<sup>7</sup> This specified source accounting framework allows ARB to accurately account for the emissions profile and megawatt hours (MWhs) of electricity imported to serve California load. For specified electricity the importer must own, operate, or contract for the electricity and the electricity must be directly delivered to California from the source or system. The electricity must be specified when the parties agree to the deal; electricity from an unknown source at the time it is transacted cannot be resold as specified electricity. In addition, electricity importers are only allowed to report the lesser of power generated or scheduled (with certain exceptions) as specified electricity. Any electricity imported to California that does not meet the requirements of specified electricity must be reported as unspecified.

An electricity import is classified as coming from an unspecified source when the electricity does not meet specified source requirements, including imported electricity that is not specified at the time the importer contracts for the electricity, or the source of electricity generation is unknown. Emissions from unspecified electricity are reported using the unspecified emission factor. This factor, known as the default emission factor under MRR, is set at the emissions rate of the “marginal” source of electricity in western power markets. If imported electricity meets the requirements of specified source electricity it must be reported as such, and the importer cannot opt to report the electricity as unspecified.

Exported electricity from California and wheeled electricity through California is also reported to ARB. Exported electricity is electricity that is sourced in California and sinks

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<sup>7</sup> Asset Controlling Supplier (ACS). Accessed 12/5/2016: <http://www.arb.ca.gov/cc/reporting/ghg-rep/ghg-rep-power/acs-power.htm>

to serve load outside of California. Wheeled electricity is electricity that is sourced outside of California and passes through California before it ultimately sinks to serve load outside of California. Both exported and wheeled electricity are defined in section 95102 of MRR and do not have a compliance obligation under the Cap-and-Trade Program (the compliance obligation for exported electricity is accounted for at the smokestack of the in-state generator). Electricity importers must separately report imported and exported electricity pursuant to section 95111(a)(2) of MRR. Under the accounting framework in MRR, exported electricity is not subtracted or credited against imported electricity into California, except in rare situations where a reporting entity has a qualified export in the same hour under section 95852(b)(5) of the Cap-and-Trade Regulation. The qualified exports are very small: many entities are not importing and exporting electricity in the same hour for simultaneous exchanges.

Beginning in 2014, some imports also resulted from non-California plants serving short-term electricity imbalances in California, where these imports are coordinated through the EIM. The EIM market was implemented after the start of the Cap-and-Trade Program. The EIM works through a computer optimization based on the base schedule for power plants, and attempts to update these base schedule instructions for participating power plants to satisfy updated estimates of total demand while reducing costs as much as possible for each market interval (e.g., by increasing output from a lower cost plant and decreasing output from a higher cost plant). Out-of-state power plant participation in the EIM market is voluntary, and is only possible once the power plant's balancing authority (e.g., utility whose service territory the power plant is located in) joins the EIM.

In many market intervals, California load is partially served by out-of-state EIM resources, which happens when the updated instructions delivered by the EIM optimization result in an increased flow of electricity, or EIM transfer, into California from other regions. This EIM transfer that serves California load represents a quantity of imported electricity that must be reported to ARB by entities participating in EIM, hereafter called EIM entities, and the emissions associated with the generated electricity have a compliance obligation in the Cap-and-Trade Program, as with any other source of imported electricity. Under MRR, electricity imported through EIM is reported as specified source electricity<sup>8</sup> because at the time of the rulemaking that incorporated EIM it was thought by staff to be attributable to specific generating resources that increase generation to meet California's load.

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<sup>8</sup> MRR Section 95102(a)(246), the Imported Electricity definition reads, in part: "Imported electricity shall include Energy Imbalance Market dispatches designated by the CAISO's optimization model and reported by the CAISO to EIM Participating Resource Scheduling Coordinators as electricity imported to serve retail customers load that are located within the State of California."

## 2) Staff Analysis of GHG Emissions from EIM Imports

Although electricity imported through EIM is currently reported as specified source electricity under MRR based on ARB's original understanding of the EIM market, an evaluation of market operations warrants a review of the current approach for specifying electricity in the EIM model going forward. Market operations suggest that the full carbon content of EIM electricity may be better represented, consistent with AB 32's accounting mandates, as marginal power from the western power system, using an unspecified electricity framework with an emissions rate of default emissions factor for unspecified electricity.

This dynamic occurs because of the "deeming" system used by the EIM dispatch to identify electricity imports. It is important to emphasize that this system is based on a cost-based market optimization, rather than upon an emissions tracking system, and so does not necessarily identify resources whose generation changes as a result of serving California load. Although the optimization can be redesigned to more accurately identify these resources – and CAISO has indicated that it is exploring ways to do so – the current design appears to fail to account for some emissions that occur as a result of serving California load.<sup>9</sup>

Specifically, to lower the total cost of meeting electricity demand and to determine deemed delivered generation to serve California load, the EIM algorithm updates the base schedules of non-California power plant output in-part based on three bids submitted for each plant.<sup>10</sup> The first bid is a non-Californian plant's energy bid (i.e., how much it will cost the plant to deliver electricity without a California GHG compliance costs). The second bid is a greenhouse gas cost bid adder (hereafter GHG cost bid) that equals the compensation the external power plant would require to cover the cost of complying with the Cap-and-Trade Program for the imported power. The third bid is a greenhouse gas quantity bid (hereafter, GHG MW bid) that designates the MW quantity of electricity the plant operator is willing to deliver to California at the resource's GHG cost bid. GHG bid compensation must be given to enough generators to match compensated electricity (i.e., total GHG MW bids) with the volume of EIM transfers to California. These compensated generators are determined by the EIM algorithm to have deemed delivered electricity to serve California load and the quantity of unit-specific deemed delivered electricity is reported to ARB under MRR by EIM entities. Based on this reported data, ARB assigns this electricity a compliance obligation in the

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<sup>9</sup> CAISO held a December 1, 2016 workshop to explore potential modifications to the EIM market and GHG attribution in the potential regional expansion. Workshop slides are available at: [http://www.caiso.com/Documents/Agenda-Presentation-RegionalIntegration-EIMGreenhouseGasCompliance-Dec1\\_2016.pdf](http://www.caiso.com/Documents/Agenda-Presentation-RegionalIntegration-EIMGreenhouseGasCompliance-Dec1_2016.pdf)

<sup>10</sup> The bids are delivered to CAISO by an entity coordinating bids across multiple plants at once called a Participating Resource Scheduling Coordinator.

Cap-and-Trade Program. But these cost-based assignments, as detailed further in this paper, do not account for the full behavior of the power plants serving California load.

An accounting metric that accounts for the carbon content of EIM electricity as unspecified via an annual compliance obligation on the difference between the specified imports identified by the CAISO market results and the unspecified rate, more accurately reflects emissions experienced by the atmosphere as a result of electricity imported to serve California load.<sup>11,12</sup> Thus, staff has identified a gap in emissions reported to ARB through EIM related reporting as compared with emissions that are actually experienced by the atmosphere due to California electricity consumption served through EIM imports: Imported power from entities identified by the CAISO model reflects only a portion of emissions associated with serving California load. Staff will continue to review available verifiable information on the full atmospheric effect of the emissions associated with EIM transfers prior to future potential changes in the EIM algorithm.

The default emissions factor is an appropriate way of calculating these outstanding emissions. The ARB default emissions factor captures the emissions rate of power plants operating at 60 percent or less of capacity. Plants that operate at 60 percent or less of capacity are marginal plants, and are generally capable of modifying output to support changes in load.<sup>13</sup> To support EIM transfers to serve California load, the EIM increments up plants capable of increasing output (or maintain output of plants that otherwise would decrement down). The plants economically capable of modifying output in the EIM are the marginal plants the Western Climate Initiative identified in calculating the default emission factor. Until future modifications allow direct identification of the complete emissions supporting EIM transfers, the default emissions factor is the best identification of the emissions rate of these marginal plants, and should supplement the emissions reported directly through the current deeming algorithm.

### **Specified Source Requirements Versus Deemed Delivered Electricity**

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<sup>11</sup> Staff is not suggesting that entities now reporting under the regulation consistent with the current EIM import methodology are out of conformance; rather, staff is considering what regulatory changes may be necessary or appropriate to improve accuracy going forward.

<sup>12</sup> The calculations used in developing the default emission factor are available here as the average of the emissions factors in the 2006, 2007, and 2008 calculators:  
<http://www.westernclimateinitiative.org/component/repository/Electricity-Team-Documents/Default-Emission-Factor-Calculators/>.

<sup>13</sup> Cap-and-Trade 2010 Final Statement of Reasons:  
<https://www.arb.ca.gov/regact/2010/capandtrade10/fsor.pdf>

The deemed delivery mechanism in the current EIM algorithm creates a scenario in which specific resources are deemed to serve California load without accurately capturing emissions resulting from the imported electricity.

When EIM determines which out-of-state resources are deemed delivered to California in a particular interval, the EIM model will always minimize costs by attributing delivery to the cleanest participating resources that elected to be deemed delivered to serve California load. The cleanest resources are deemed delivered, in CAISO's technical term, regardless of whether the emissions associated with those specific resources are the only emissions used to satisfy the EIM energy transfer to California. For instance, in some intervals GHG awards are being awarded to units within one balancing authority area, but EIM transfers of electricity to California are coming from another balancing authority area's generating resources.

At the time that CAISO filed the tariff with the Federal Energy Regulatory Commission ARB staff understood the model to result in dispatches designated by the EIM model in which both the GHG and MWhs of electricity serving an EIM transfer would be procured from the same out-of-state resource(s). However, the current design of the EIM model allows for the GHG attribution to be attached to a different specific resource than the resource in an EIM balancing authority for which actual electricity was dispatched and physically transferred to California (EIM transfer). Further, the deemed delivered electricity is predominantly of lower carbon content than the impact on the atmosphere as a result of an EIM transfer, which is further discussed in section 3 of this document.

This market behavior suggests that MRR should be revised to account for any additional emissions associated with the marginal behavior of the power market, as well as resources currently deemed delivered to California, in order to fully capture the atmospheric greenhouse gas impacts of changes in California loads. The unspecified electricity rate used for transactions in the larger western power market provides a way to quantify the scope of the issue.<sup>14</sup> Staff has proposed regulatory amendments that use this rate as a way of determining outstanding emissions from EIM imports.

To illustrate the current emissions gap between deemed delivered imports and EIM transfer imports, staff therefore has quantified the shortfall based on verified data reported to ARB under MRR and the reported emissions that would have been assigned a compliance obligation by ARB at the unspecified rate. During a 12-month period of historic EIM data, reported total EIM emissions attributable to imports were 243,474 MTCO<sub>2</sub>e. This emissions number is based on reporting of emissions associated with specific resources deemed delivered by CAISO's EIM algorithm, and therefore subject

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<sup>14</sup> Cap-and-Trade 2010 Final Statement of Reasons:  
<https://www.arb.ca.gov/regact/2010/capandtrade10/fsor.pdf>

to a compliance obligation. Because these emissions are attributed to specific resources, but additional marginal resources were likely operating as well to serve EIM (and California) load, staff has applied the unspecified emissions factor to determine the amount of emissions that would have been reported at the unspecified rate. Using the default unspecified emissions rate, total emissions subject to a compliance obligation would be 433,548 MTCO<sub>2</sub>e. The gap in reported EIM imported emissions versus EIM imported emissions using the default emissions rate is 190,075 MTCO<sub>2</sub>e.

Thus, ARB is potentially not accounting for 43.8 percent of the emissions associated with EIM imports in this 12-month period. This is illustrated in Table 1 below. It should be noted that a majority of the timeframe for which this analysis was conducted included only one EIM entity participating in EIM. As additional EIM entities join EIM, staff expects the gap between reported and actual emissions experienced by the atmosphere to become larger, as discussed in the next section of this document.

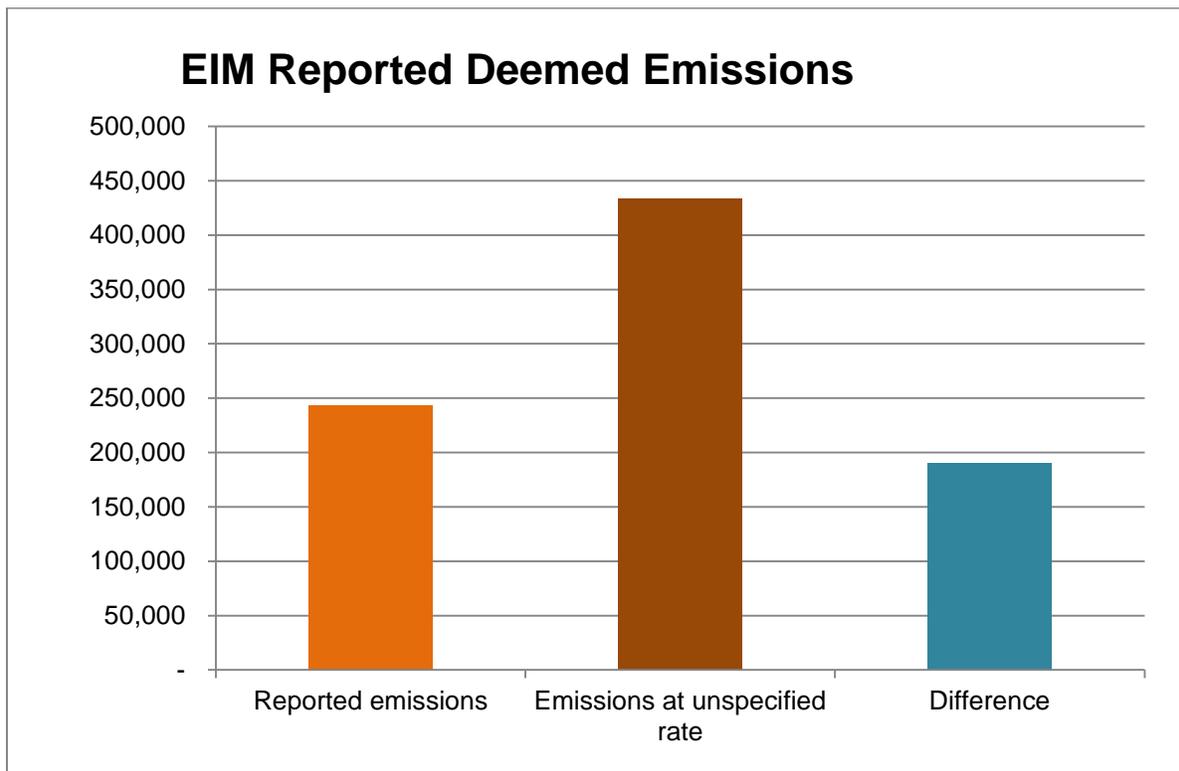


Figure 1: Difference in EIM Imported Electricity Emissions Reported to ARB Compared to Emissions at the Unspecified Rate Over a 12-month Period

The crediting of exported electricity emissions against imported electricity emissions is not allowed under MRR or the Cap-and-Trade Program. This ensures that California is fully accounting for emissions from electricity whether generated in-state or imported to serve California load. ARB's regulations also do not allow the crediting of exports against electricity imported under EIM. CAISO posted a preliminary analysis in August

2016 to show the existing GHG compliance obligation shortfall for 2016 using a counterfactual methodology.<sup>15</sup> In CAISO's analysis, this shortfall was offset (via CAISO's methodology) by a quantification of the GHG benefits of avoided non-California GHG-emitting generation by EIM renewable exports. ARB's regulations do not support this type of accounting as it would not account for emissions from electricity generated in-state which is required by AB 32.

### **3) Potential Impact of Expanding EIM Market on GHG Accounting**

In November 2014, the EIM market began with only one EIM entity, PacifiCorp, participating. Beginning in December 2015, EIM was expanded to add a second EIM entity, NV Energy. Staff has conducted an analysis of the potential magnitude for emissions leakage as new EIM entities join the EIM using publicly available EIM transfer data posted by CAISO for the time period of January 2015 through June 2016.<sup>16</sup> Specifically, staff looked at historical imports assigned to be deemed delivered for import to California through the EIM, and the mixture of technologies being deemed delivered to California, before and after a second EIM entity joined the EIM.

First, staff looked at data related to the quantity of electricity that is being deemed delivered to California through the EIM algorithm as the EIM footprint has expanded. Staff finds that the quantity of electricity deemed delivered in EIM as imported to California increased with the addition of a second balancing authority area. When a second EIM entity joined the EIM in December 2015, additional transmission was available for out-of-state generators to serve California load imbalances. When PacifiCorp was the only EIM entity, the monthly-average MWhs deemed delivered through the EIM was 76,441 MWhs. The public data for the period in which there was only one EIM entity started in January 2015 and ended in November 2015. Once NV Energy joined in December 2015, the average monthly MWhs increased to 128,605 MWhs, as shown in Figure 2. The data for the period of PacifiCorp and NV Energy EIM participation is from December 2015 to June 2016. This is an increase of 68.2 percent in per-month EIM imports.

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<sup>15</sup> [http://www.caiso.com/Documents/EIMGreenhouseGasCounter-FactualComparison-PreliminaryResults\\_Jan-Jun\\_2016\\_.pdf](http://www.caiso.com/Documents/EIMGreenhouseGasCounter-FactualComparison-PreliminaryResults_Jan-Jun_2016_.pdf)

<sup>16</sup> Available at [http://www.caiso.com/Documents/MonthlyEIM\\_Transfer\\_ISO\\_Imbalances\\_MWh.xlsx](http://www.caiso.com/Documents/MonthlyEIM_Transfer_ISO_Imbalances_MWh.xlsx)

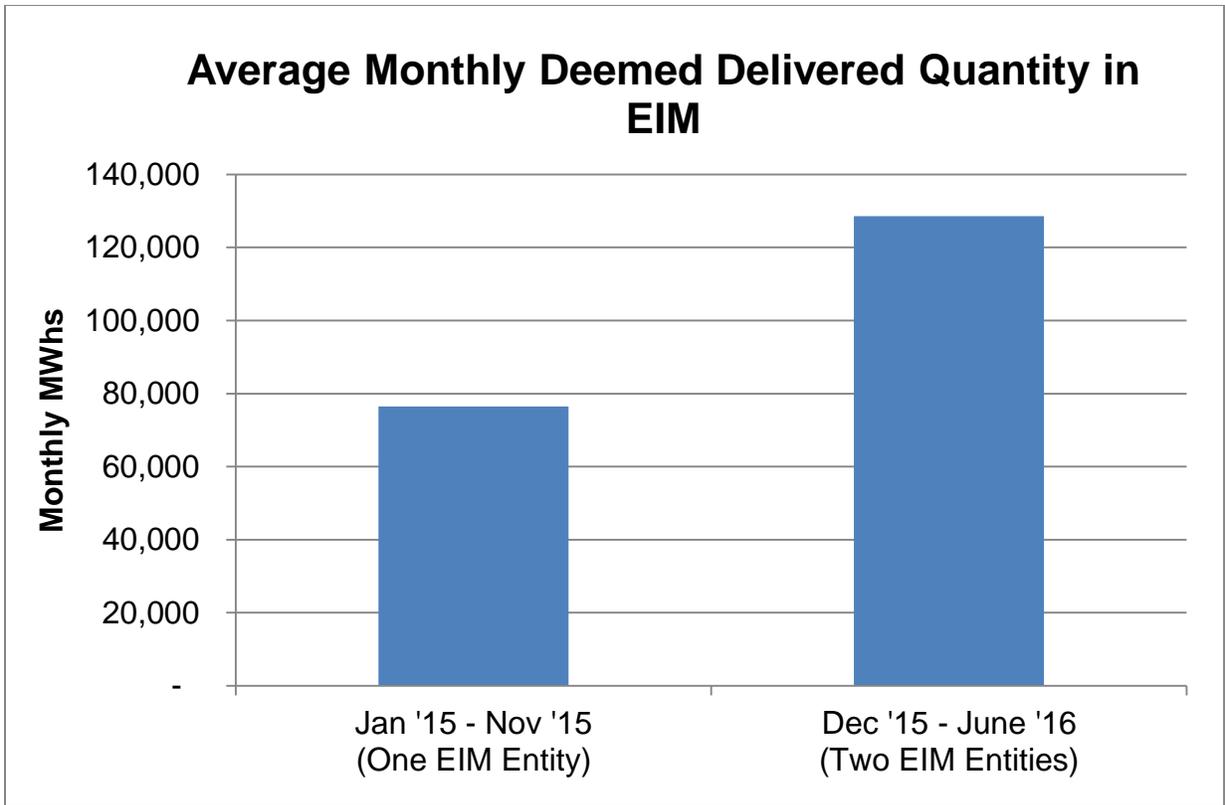


Figure 2: Comparison of Average Monthly Deemed Delivered Quantities in MWhs with Original and Expanded EIM Footprint (using available public data)

Another way to compare the amount of deemed delivered electricity for the current expanded EIM consisting of two EIM entities, is to compare data of like-months in the year (e.g., February 2015 to February 2016, rather than August 2015 to February 2016). When comparing like-months only, the increase in deemed delivered was 69 percent in per-month load imbalance, as shown in Figure 3. This compares January 2015 to June 2015 and January 2016 to June 2016,

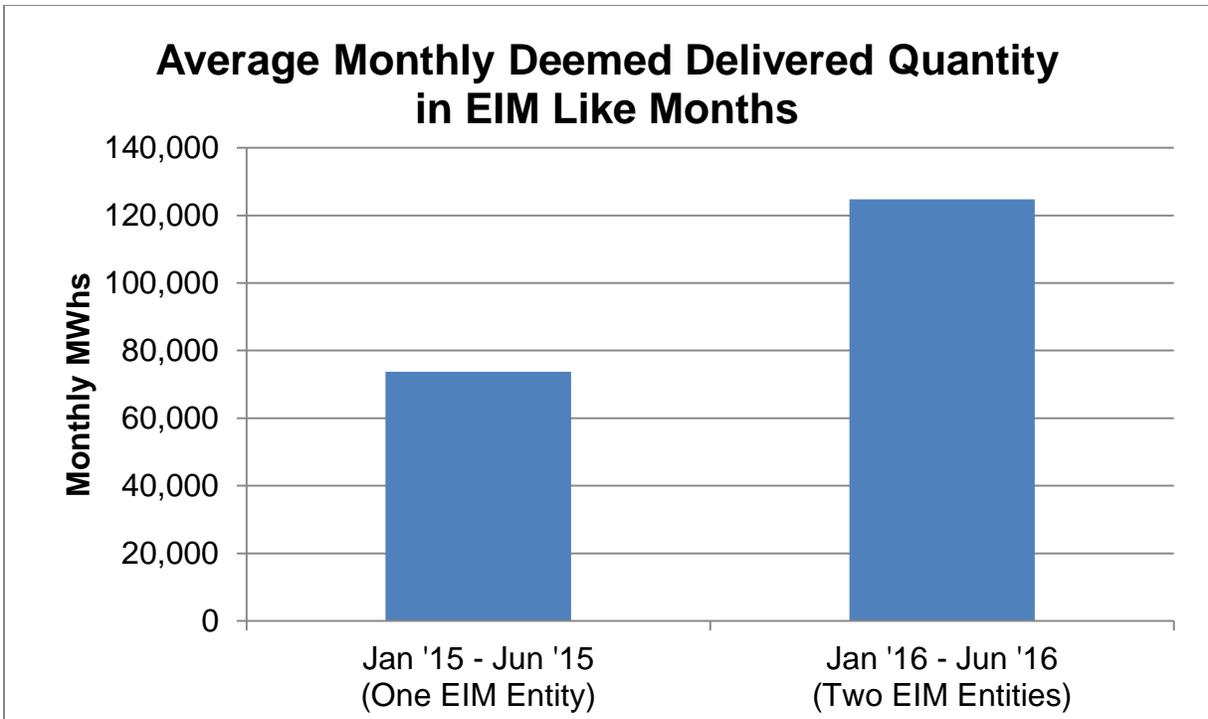


Figure 3: Comparison of Average Monthly Deemed Delivered Quantities in MWhs in Like-Months with Original and Expanded EIM Footprint

Staff anticipates the volume of electricity deemed delivered through the EIM will increase further as additional EIM entities join the EIM resulting in additional transmission available for out-of-state generators to serve California load imbalances. Arizona Public Service and Puget Sound Energy joined in October of 2016.<sup>17</sup> The addition of Arizona Public Service and Puget Sound Energy provides the EIM market with additional transmission and 9,500 additional megawatts of generating capacity. Further, Portland General Electric and Idaho Power plan to join the EIM in 2017 and 2018, respectively.

In addition to looking at changes in the quantity of deemed delivered electricity in the current EIM once expanded to two EIM entities, staff also looked at the trends in the type of deemed delivered technologies. When the EIM was limited to one EIM entity (PacifiCorp) there were fewer opportunities for the EIM algorithm to attribute GHGs to one resource, while delivering energy from another resource, which results in emissions undercounting. During this time period, a moderate amount of zero-emitting, and a large amount of gas generation were deemed delivered to California in EIM, as shown in the left column of Figure 4.

<sup>17</sup> <http://www.caiso.com/informed/pages/eimoverview/default.aspx>

When the EIM footprint expanded to include NV Energy in December 2015, there was a slight decrease in the amount of natural gas, and an expansion of zero-emitting generation deemed delivered to California, as shown in the right-hand column of Figure 4.<sup>18</sup>

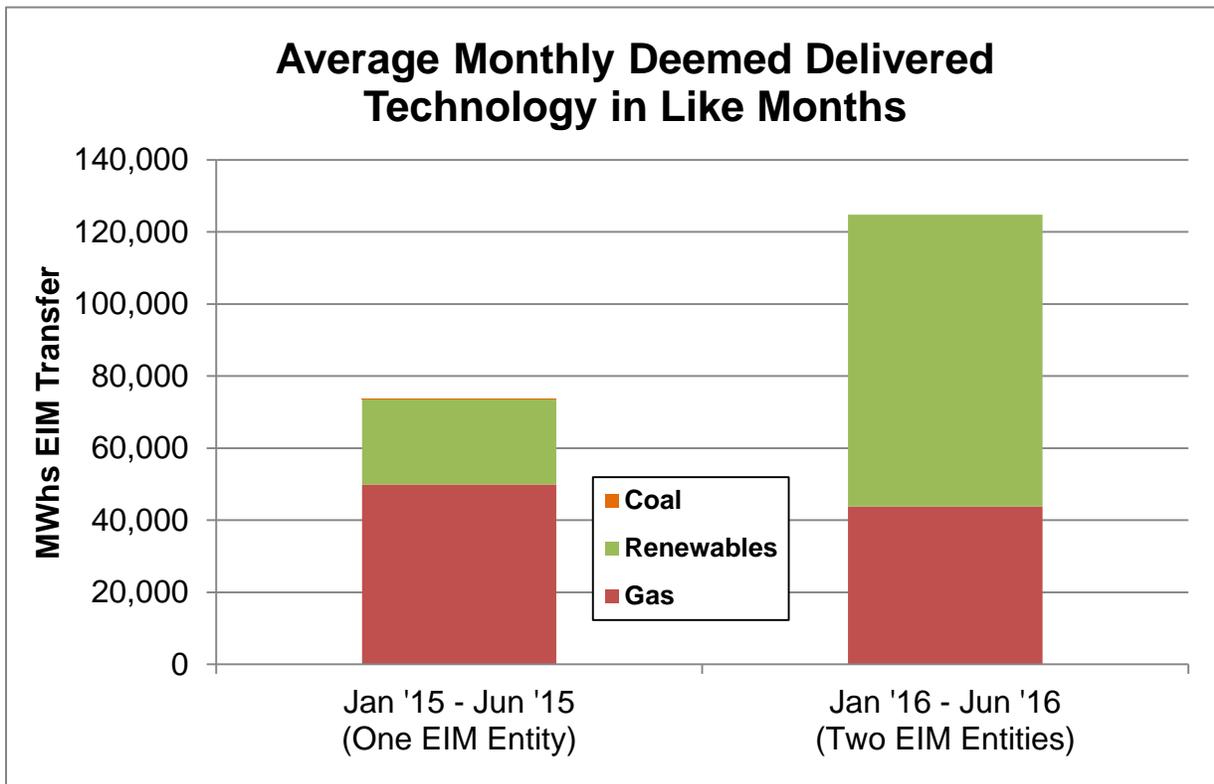


Figure 4: Deemed Delivered by Technology Type with One EIM Entity Participating in EIM (January 2015 to June 2015), versus Two EIM Entities (January 2016 to June 2016)

Only a very small fraction of NV Energy’s assets are zero-emitting (less than one percent),<sup>19</sup> indicating that expanded EIM energy transfers were delivered from NV Energy (as the transfer capability between the PacifiCorp and California did not increase upon NV Energy’s entry), but the increased zero-emitting energy were deemed from zero-emitting resources in PacifiCorp.<sup>20</sup>

<sup>18</sup> Also in December of 2016, the EIM tariff was revised to enable GHG MW bids for a resource, allowing coal resources to opt out of receiving a Cap-and-Trade GHG compliance obligation. Even for high-emitting resources, however, a sufficiently-high GHG adder covers expected compliance costs and may allow for additional revenue if the market-clearing GHG adder is above the resource-submitted adder.

<sup>19</sup> Summer capacity: <https://www.nvenergy.com/company/energytopics/where.cfm>

<sup>20</sup> The particular increase in the quantity of deemed zero-emitting resources appears either a function of increased intermittent generation, or the availability of water resources (i.e., a year with greater winter rain) within PacifiCorp territory. July through December of 2015 saw an increased quantity of deemed natural gas (indicating hydropower may be a source of deemed electricity), but aggregate EIM transfer data in MWs is not available for the second half of 2016 for comparison. Analogous to 2015, it is likely

Based on staff's analysis there is a trend towards a growing quantity of electricity being deemed delivered to serve load in California through the EIM as more transmission is available to satisfy California load imbalances with out-of-state generation. There is also a trend towards an increased percentage of deemed delivered electricity being attributed to zero-emitting resources as a greater quantity of zero-emitting generation is available to be deemed within each market interval. Both of these trends indicate a growing potential for emissions leakage as the EIM market continues to expand and include additional EIM entities such as Arizona Public Service and Puget Sound Energy.

### **Next Steps**

ARB currently has two regulations that are open for potential amendments and public comment: the Regulation for the Mandatory Reporting of Greenhouse Gas Emissions and the Cap-and-Trade Regulation. During the 15-day comment period, ARB is seeking comments from stakeholders to inform amendments for ensuring accurate accounting of GHGs associated with the Energy Imbalance Market. All comments received during the 15-day comment period become part of the public record. CAISO has also begun the process of proposing and developing amendments to the EIM tariff that it anticipates will ultimately resolve issues with its deeming algorithm. ARB will also coordinate with CAISO processes going forward, to the extent possible. Until these tariff amendments can be approved; however, an interim solution is needed to ensure accurate greenhouse gas accounting. ARB has recently proposed amendments proposing an interim solution. The information related to the current rulemaking documents can be found at the following links:

- Mandatory Reporting  
Regulation: <https://www.arb.ca.gov/regact/2016/ghg2016/ghg2016.htm>
- Cap-and-Trade  
Regulation: <https://www.arb.ca.gov/regact/2016/capandtrade16/capandtrade16.htm>

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that an analysis of EIM deemed delivered resources from July to September of 2016 would show a greater volume of natural gas (based on available deemed fractional totals (p43: <http://www.caiso.com/Documents/MarketPerformanceReportforSep2016.pdf>). However, it is likely that an analysis of EIM deemed delivered resources from October through December of 2016 would again show higher levels of deemed electricity from zero-emitting resources with the inclusion of additional renewables in the Pacific Northwest and increased winter rainfall.