Comments of Pacific Gas & Electric Company

Second Revised Final Draft Proposal EIM Greenhouse Gas Enhancements

Submitted by	Company	Date Submitted
Paul Gribik (415-973-6274)	Pacific Gas & Electric Company	March 1, 2018

Pacific Gas and Electric Company (PG&E) appreciates the ISO's efforts to develop a method to account for GHG emissions from secondary dispatch in the Energy Imbalance Market (EIM). After further investigation of the properties of the two-stage approaches that the ISO had previously proposed in the Final Draft Proposal and in the Revised Final Draft Proposal, the ISO rightly concluded that those approaches have pricing and incentive-compatibility problems. Treating GHG emissions from secondary dispatch in EIM in a way that achieves the goals desired by the California Air Resources Board (ARB) while maintaining proper incentives in the Energy Imbalance Market is a very difficult problem. PG&E thanks the ISO for its continuing efforts in this area.

PG&E reiterates its previous comments that the EIM must balance three objectives:

1. Produce an efficient market dispatch across the EIM Area consisting of the ISO and the EIM Entities.
2. Produce proper price signals that reflect the locational marginal cost of service at nodes across the EIM Area and that do not give participants incentives to "game" the market to increase their profits.
3. Account for GHG emissions resulting from secondary dispatch in EIM Entities caused by imports into California.

Each of the three objectives enables EIM to continue to improve real-time dispatch efficiency, provide a broader market for California renewables, and serve as a valuable tool for reducing

emissions. In its efforts to achieve a design that balances these goals, the ISO developed the Second Revised Final Draft Proposal.

In general, PG&E supports the ISO's decision to develop a single-stage EIM dispatch and to calculate a floor on the GHG bid costs to capture the effects of emissions from secondary dispatch. PG&E provides more detail on our reasons for supporting these aspects of the latest proposal in sections below.

However, PG&E has some questions regarding the approach that the ISO proposes to use to calculate the floor and proposed adjustment to the caps on the deemed imports ascribed to resources in the EIM Entity. Our questions and requests for clarification which are described in more detail in later sections include:

- Is it appropriate to use base schedules in calculating average historic emissions rates for secondary dispatch given that the base schedules may not be optimized to serve load in EIM Entities or trades between EIM Entities? In prior proposals, the ISO proposed using a counterfactual dispatch instead of the base schedules to address this issue.
- The formulae used to calculate the historic emission rate due to secondary dispatch could produce a positive rate even if the EIM dispatch reduces the emissions in the EIM Entities below the emissions from the base schedules. In such a situation there would appear to be no emissions caused by secondary dispatch, so should not the formulae calculate a zero rate for emissions due to secondary dispatch in this case?
- The ISO proposes using data from an historical period (e.g. quarter) to estimate the emission rate for secondary dispatch. Going forward, the EIM Entities participating in EIM may change or the transmission and generation facilities in EIM Entities may undergo significant changes. How would the ISO take such changes into account when using historical data to estimate the emission rate for secondary dispatch going forward?
- Why is it necessary to limit deemed import from a resource to the maximum economic limit for the resource less the base schedule for the resource given that the ISO

proposes to estimate the emissions from secondary dispatch which would be applied even if energy from a base schedule is deemed to be imported?

PG&E also believes that further discussions with stakeholders are required to develop methods to:

- Incorporate GHG emissions from secondary dispatch that may occur in a Day-Ahead Market which is expanded to enable EIM Entities to participate,
- Incorporating multiple GHG regimes in different states since no details on the possible requirements in such regimes are available.

Finally, factors beyond pricing may cause a clean resource to block EIM from importing its energy into the ISO. For example, the clean resource may want to avoid the cost of setting up a shop to purchase GHG allowances for secondary emissions ascribed to its deemed imports. Should the ISO consider ways that other parties could take on the reporting and GHG allowance requirements for a clean resource that arise from secondary emissions to remove this possible incentive for a clean resource to block imports?

Problems Identified with Approaches in the Final Draft Proposal and Revised Final Draft Proposal

In the ISO's February 22 stakeholder call on the Second Revised Final Draft Proposal, the ISO outlined the problems that were discovered with the two-stage processes previously proposed for treating GHG emissions from secondary dispatch:

- The two-stage process proposed in the Final Draft Proposal could result in the ISO being unable to set prices that were consistent with the dispatch and deemed imports into California.
- The two-stage process proposed in the Revised Final Draft Proposal could give a participant in an EIM Entity an incentive to adjust its Energy Bid Cost to increase its profits by avoiding dispatch in the first stage so that it is eligible to be dispatched and

deemed imported into California in the second stage. This could also unjustifiably increase market prices in EIM Entities.

Either design could distort the EIM dispatch and pricing, reduce market efficiency, and damage the ability of EIM to attract and retain participants.

Using a Single-Stage EIM Dispatch

In the Second Revised Final Draft Proposal, the ISO outlined a single-stage EIM design that addresses the above problems. It is possible to show that a single-stage EIM dispatch approach can maintain the following desired goals for dispatch and pricing in an energy market:

- The LMP at a node in the ISO is the marginal cost of serving load at the node. This is inclusive of the effect of GHG allowances for energy generated in the ISO and GHG allowances for imports into the ISO.

- The LMP at a node in an EIM Entity is the marginal cost of serving load at the node. The LMP does not include the effects of any GHG costs for emissions in the EIM Entities since GHG costs are not incurred when generation in an EIM Entity is used to serve load in the EIM Entities.

- For nodes in the ISO, the LMP at a node is consistent with the dispatch of incremental energy for a committed resource.

- For nodes in EIM Entities, the LMP at a node and the negative of the GHG Shadow Price used to compensate any deemed imports into the ISO are consistent with the dispatch of incremental energy for a committed resource and any deemed import from the resource.

PG&E agrees that the use of a single-stage EIM dispatch as proposed by the ISO would address the issues identified with the two-stage approaches described in the prior proposals.

In addition to moving to a single-stage EIM dispatch, the approach addresses:

- Setting requirements on GHG Bid Costs for resources in EIM Entities to capture an estimate of the effects of secondary dispatch;
- Adjusting limits on energy imports into the ISO from specific resources in EIM Entities.

We comment on these aspects of the Second Revised Final Draft Proposal next.

Use of a GHG Bid Floor to Capture the Effects of Secondary Dispatch

Before discussing the way the GHG Bid Cost floor will be calculated, we comment on the appropriateness of placing a floor on GHG Bid Costs to capture the effect of secondary emissions in a single-stage EIM dispatch model. In general, PG&E supports using a floor on GHG Bid Costs to incorporate the emissions effects of secondary dispatch in the EIM solution.

Secondary dispatch occurs when EIM deems that energy is imported from a relatively cleaner resource while EIM dispatches a relatively dirtier resource to "backfill" the energy required to serve load in the EIM Entity that could have been served by the cleaner resource. Consider a simple example.

Assume that EIM imports energy into the ISO and that EIM changes the dispatch of only one resource in an EIM entity and it is an emitting resource. Further, assume that a non-emitting resource has a base schedule and headroom between its base schedule and max import quantity. If EIM imports energy into the ISO, absent considering emissions from secondary dispatch, it would deem the import of energy was sourced from the non-emitting resource while using the energy from the emitting resource to backfill and serve EIM Entity load. In this case, there would be secondary emissions that should be ascribed to the deemed import from the clean resources. The GHG allowance costs to cover the secondary emissions resulting from importing energy from the cleaner resources could be captured by increasing the GHG-costs for the imports from the non-emitting resources.

Now assume that the non-emitting resources had no headroom but that the emitting resource did have headroom. EIM could not deem that the import was from the clean resources. It

would deem the import was from the emitting resource. In this case, there would be no secondary dispatch. EIM would calculate the emissions effect of the import using the actual GHG cost of the emitting resource to which the deemed import was ascribed.

Using a floor to include an estimate of the effect of secondary emissions on total cost is consistent with the above simple example. GHG costs for clean resources whose actual GHG related costs are below the floor would be raised to capture expected secondary dispatch effects. GHG costs for emitting resources whose actual GHG related costs are above the floor would be unchanged since secondary dispatch effects are not expected to occur.

PG&E supports using a floor on GHG Bid Costs to capture the effects of secondary dispatch. However, we believe that the approach used to calculate the GHG Bid Floor as well as some other issues should be discussed more thoroughly in the stakeholder process before seeking Board approval.

Questions Regarding the Proposed Approach for Adjusting the GHG Bid Cost

According to the Second Revised Final Draft Proposal, ARB and the ISO would estimate the rate of GHG emissions from resources in EIM Entities per MWh of EIM dispatch above the dispatch in the base schedules for peak and off-peak periods. These values would be used in setting the GHG Bid Floor. As PG&E understands the proposal, the ISO would calculate the following values for dispatch intervals in the previous quarter:

- $Emissions_t^{EIM,}$ = The total GHG Emissions in period t from resources in the EIM Entities at the EIM solution for all periods in the previous quarter,
- $Dispatch_t^{EIM}$ = The total energy dispatch in period t from resources in the EIM Entities at the EIM solution for all periods in the previous quarter,
- $Emissions_t^{base}$ = The total GHG Emissions in period t from resources in the EIM Entities at the EIM Base Schedules submitted by the EIM Entities for all periods in the previous quarter,

- $Dispatch_t^{base}$ = The total energy dispatch in period t from resources in the EIM Entities at the EIM Base Schedules submitted by the EIM Entities for all periods in the previous quarter.

The ISO would then calculate:

- $AverageRate_{peak} = \dfrac{abs\left(\sum_{t \in peak}\left(Emissions_t^{EIM} - Emissions_t^{base}\right)\right)}{\left(\sum_{t \in peak}\left(Dispatch_t^{EIM} - Dispatch_t^{base}\right)\right)}$

- $AverageRate_{off-peak} = \dfrac{abs\left(\sum_{t \in off-peak}\left(Emissions_t^{EIM} - Emissions_t^{base}\right)\right)}{\left(\sum_{t \in off-peak}\left(Dispatch_t^{EIM} - Dispatch_t^{base}\right)\right)}$

These averages would be used to calculate a floor on GHC Bid Costs for peak and off-peak periods:

- $GHG\_Bid\_Cost\_Floor_{peak} = AllowanceCost \cdot AverageRate_{peak}$
- $GHG\_Bid\_Cost\_Floor_{off-peak} = AllowanceCost \cdot AverageRate_{off-peak}$

For a dispatch interval t that is a peak time, the GHG Bid Cost for a resource, i, that will be used in the EIM single-stage dispatch would be:

$GHG\_Bid\_Cost\_in\_EIM_{i,t} = max\{GHG\_Bid\_Cost\_Floor_{peak}, Actual\_GHG\_Bid\_Cost_{i,t}\}$
where $Actual\_GHG\_Bid\_Cost_{i,t}$ is based on resource i's actual emission rate.

For a dispatch interval t that is an off-peak time, the GHG Bid Cost for a resource, i, that will be used in the EIM single-stage dispatch would be:

$GHG\_Bid\_Cost\_in\_EIM_{i,t} = max\{GHG\_Bid\_Cost\_Floor_{0ff-peak}, Actual\_GHG\_Bid\_Cost_{i,t}\}$
where $Actual\_GHG\_Bid\_Cost_{i,t}$ is based on resource i's actual emission rate.

As mentioned above, PG&E has some concerns about the proposed method for calculating the floor.

Use of Base Schedules in Calculating Secondary Emission Rates

PG&E has concerns about using base schedules submitted by the EIM Entities as described above. As discussed in the stakeholder process in 2016 and 2017, the base schedules may not be optimized within an EIM Entity or across EIM Entities. EIM will optimize schedules to serve load in an EIM Entity and trades between EIM Entities as well as imports into the ISO. As a result, the historic average increase in emissions rates between the EIM dispatch and the base schedules may include emissions that result from optimizing schedules within the EIM Entities that were not optimal in the EIM Entities. This could inappropriately increase the emissions ascribed to secondary dispatch resulting from importing energy into California by ascribing emissions that result from optimizing schedules within EIM Entities and trades between EIM Entities to imports into the ISO. Any increase in emissions resulting from optimizing schedules within and between EIM Entities to serve load in EIM Entities should not be subject to ARB GHG requirements since they occur outside California to serve load that is outside California. To address this possibility in earlier proposals, the ISO discussed using a counterfactual as the base against which the secondary emissions would be calculated. Previously, the ISO had proposed that it calculate the counterfactual dispatch by optimizing the schedules in the EIM Entities as well as trades between EIM Entities while capping imports into the ISO by zero.

We would request that the ISO use the previously proposed counterfactual as opposed to the base schedules when calculating the GHG Bid Floor. If the ISO still proposes to use the base schedules to calculate the floor, PG&E would request that the ISO provide data comparing the emissions ascribed to secondary dispatch when using the base schedules in the above calculation with the estimated emissions ascribed to secondary dispatch when the previously proposed counterfactual is used in the calculation.

Use of Absolute Values in Calculating Secondary Emission Rates

PG&E has concerns about the use of absolute values in calculating the average rates in the above formulae.

- $AverageRate_{peak} = \dfrac{abs\left(\sum_{t \in peak}\left(Emissions_t^{EIM} - Emissions_t^{base}\right)\right)}{\left(\sum_{t \in peak}\left(Dispatch_t^{EIM} - Dispatch_t^{base}\right)\right)}$

$$\bullet \quad AverageRate_{off-peak} = \frac{abs\left(\sum_{t \in off-peak}\left(Emissions_t^{EIM} - Emissions_t^{base}\right)\right)}{\left(\sum_{t \in off-peak}\left(Dispatch_t^{EIM} - Dispatch_t^{base}\right)\right)}$$

Suppose that the emissions decrease when moving to the EIM dispatch from the Base Schedule while the energy dispatched increases when moving to the EIM dispatch from the Base Schedule. It would be inappropriate to say that EIM causes emissions from secondary dispatch since EIM actually results in decreased emissions in the EIM areas. Rather than an absolute value, the formulae should use the maximum of the change in emissions and zero. Other changes may be required as well.

The Historic Period used to calculate the GHG Emission Floor and Frequency of Calculation

The ISO proposes to perform the analysis outlined above on a periodic basis to calculate the average emission rate that results from the EIM dispatch. It suggests that it could calculate this for peak and off-peak periods on a quarterly basis. The ISO asked for stakeholder feedback on the frequency that it should perform such calculations.

PG&E believes that stakeholders do not have the data to answer this question. For example, they do not have the data to evaluate how the average emission rates would change between periods and over time. This would require access to historic base schedules for EIM Entities and detailed historic market results for EIM Entities. As such PG&E cannot express an opinion. It would instead request that the ISO perform such studies and provide the results to stakeholders for discussion.

Other factors could affect the calculations and affect their accuracy going forward. For example, it is unclear how changes over time in the EIM Entities that participate in EIM or changes over time in their systems would affect the calculation of the GHG Bid Cost floor.

- As new EIM Entities join, the ISO would not have the information for the new members (base schedule data, EIM dispatch data, and emissions data) that it would require to calculate an historic average GHG emission rate for the new EIM footprint over a

9

previous period since the new members did not participate in EIM in the historic quarter used in the calculation.

- Changes in transmission and generation facilities could cause large changes in the EIM dispatch going forward when compared to the past. This may cause the historic average emission rate to be a bad estimate of average emissions going forward.

PG&E requests that the ISO discuss how it plans to address such issues and seek stakeholder input.

Capping the GHG Bid Quantity

The ISO proposes to cap the GHG Bid Quantity for a resource by

Upper Economic Limit for the Resource less the Base Schedule for the Resource.

If the GHG Bid Floor accurately captures the cost of emissions from secondary dispatch, the above limitation on GHG Bid Quantity would not be necessary. If EIM imports energy covered by the Base Schedule into the ISO, EIM would ascribe the emissions from secondary dispatch needed to back fill to this deemed import. As such, it will capture the costs of the secondary emissions. The need for this cap on deemed imports should be further addressed.

Implementing EIM in Day-Ahead

The Second Revised Final Draft Proposal anticipates that the enhancements could be applied in a Day-Ahead market if EIM Entities elect to participate in a Day-Ahead market. How the method proposed in the Second Revised Final Draft Proposal for calculating an historic average emission rate to use as a floor on emissions rate for deemed imports could be used in the Day-Ahead Market is unclear since EIM Entities would not submit base schedules in a Day-Ahead Market. In the stakeholder meeting, the ISO suggested that self-schedules submitted by participants in EIM Entities could be used instead of base schedules. PG&E would expect the self-schedules in the EIM Entities would serve less than the total load in the EIM Entities that would be cleared in an expanded Day-Ahead Market. That is, the Day-Ahead Market could schedule an increase in

generation in the EIM Entities compared to the self-schedules to serve load outside California. However, the emissions resulting from the Day-Ahead schedule changes compared to the self-schedules would be incorporated in the average emission rate used to set the GHG Bid Cost floor. This could over-estimate the emissions ascribed to secondary dispatch caused by imports into the ISO by including emissions for generation used to serve load in EIM Entities in the calculation of the average. This could increase costs to California loads unjustly.

The ISO should consider other approaches to calculate a GHG Bid floor to capture secondary emission effects.

In addition, it would be best to use a common approach to account for GHG emissions from secondary dispatch in a Day-Ahead market and in the Real-Time EIM to avoid creating arbitrage opportunities that do not result from changing market conditions between the Day-Ahead Market and the Real-Time Market but rather from changing market rules between the Day-Ahead Market and the Real-Time Market.

Multiple GHG Programs in the West

It is premature to discuss incorporating other GHG regimes in the EIM since the details on other GHG regimes are unknown. Incorporating multiple GHG regimes in EIM may necessitate coordination between state agencies across multiple states. How such requirements could be modeled in EIM cannot be known without more detail regarding potential requirements.

Subsidiary Incentive Effects

PG&E believes that implementing a properly designed GHG Bid Cost Floor can incorporate an appropriate estimate of the GHG cost of emissions from secondary dispatch in the EIM. As mentioned in our comments supporting the use of a single-stage EIM, this should result in high-level incentive compatibility between EIM dispatch, deemed imports, and prices.

A resource in an EIM Entity that is assigned a deemed import will:

- Be required to purchase GHG allowances to cover the implied emission rate for its GHG bid cost as adjusted by the bid floor (i.e. its actual emissions and any assigned secondary dispatch emissions) for its deemed import,
- Be paid the negative of the GHG shadow price for its deemed import.

The negative of the GHG shadow price will meet or exceed the GHG Bid Cost as adjusted by the bid floor for resources assigned a deemed import. As a result the resource will be paid at least enough to buy its assigned GHG allowance requirements at the forecast GHG allowance price used in EIM. Financially it will be at least kept whole for GHG related costs and may earn a GHG related profit by allowing its energy to be imported.

A clean resource in an EIM Entity may not find the possible profit sufficient to set up a shop to satisfy ARB reporting requirements and to purchase GHG allowances. Rather than deal with these requirements, it may opt out of allowing its energy to be deemed imported into the ISO. This could adversely affect the EIM.

The ISO could consider allowing a clean resource to opt out of the need to report its emissions (that are zero) to ARB and to purchase the allowances to cover its ascribed secondary emissions. This could be achieved by allowing another party to take on the requirement to surrender allowances for the ascribed secondary emissions. That party would in turn be paid the negative of the GHG shadow price for the import deemed to be sourced at the clean resource. It would earn the GHG related profits for the deemed import that would have gone to the clean resource while the clean resource would retain the profits for its energy sale in EIM. This may be attractive to a party that already reports GHG emissions to ARB and participates in GHG allowance markets. The clean resource would avoid the cost of setting up a shop to satisfy ARB reporting requirements and purchasing GHG allowances. It would remove potential disincentives for a clean resource to allow deemed imports into the ISO.