



California Independent System Operator Corporation

California ISO

**Assessment of Potential Market Power in
Energy Imbalance Market**

June 9, 2014

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Executive Summary

The ISOs' Energy Imbalance Market (EIM) Design was approved by the Board of Governors in November 2013. Under this design, the ISO's current local market power tests and provisions will be applied to congested constraints within each individual Balancing Authorities Area (BAA) participating in the EIM. At that time, it was determined that further information was required to determine whether these market power mitigation provisions should also be applied to scheduling constraints limiting transfers of energy into EIM BAAs from the ISO and other EIM BAAs. Applying market power mitigation tests and procedures when these scheduling limits became binding would mitigate potential market power that may exist on a broader level due to a high concentration of ownership of supply resources throughout an EIM BAA.

Under the ISO's March 2014 EIM tariff filing; the ISO Board will have the authority to determine, based upon a study and recommendation from Management, whether market power mitigation tests would be applied to scheduling constraints between different BAAs in the EIM. Management intends to submit a recommendation on this issue to the Board at the July 2014 meeting.

DMM has continued to collect additional information and assess the potential need to include the scheduling constraints between BAAs in the EIM market power mitigation procedures. As summarized in this report, DMM continues to believe that based on currently available information it cannot conclude that the two PacifiCorp BAAs will be structurally competitive and therefore recommends that market power mitigation procedures be applied when scheduling constraints into either of these BAAs becomes binding.

As the EIM is implemented, DMM will continue to assess the structural competitiveness of the EIM BAAs and seek to develop other options that might be employed to refine the ISO's current market power mitigation provisions to the EIM. As actual EIM data become available, DMM will be able to employ the pivotal supplier and residual demand index tests outlined in this report using actual data to assess the structural competitiveness of the PacifiCorp BAAs. DMM is also working with the ISO to seek to develop a more automated dynamic approach for assessing the structural competitiveness of EIM BAAs based on actual market conditions each hour, such as the actual amount of scheduling capacity from the ISO into EIM BAAs each hour.

1 Background

The ISO's Department of Market Monitoring (DMM) worked closely with the ISO and other parties in developing the Energy Imbalance Market (EIM) proposal approved by the ISO Board of Governors on November 7, 2013. Under the ISO's initial proposal, the ISO's current Local Market Power (LMPM) provisions would be applied when congestion occurred on constraints within each of the two PacifiCorp Balancing Authority Areas (BAAs) scheduled to participate in the initial EIM in October 2014. However, when scheduling constraints into these BAAs from the ISO become binding, no market power mitigation provisions would be applied. This approach reflected an assumption that the two PacifiCorp BAAs --- like the ISO --- be workably competitive on a BAA-wide level.

As the ISO's proposal was developed, DMM gained additional understanding of the potential market structure within the two PacifiCorp BAAs and the amount of scheduling capacity that could make competitive supply from the ISO available for transfer into these BAAs. However, given the uncertainty about these factors, DMM indicated it could not conclude that the PacifiCorp EIM BAAs would be structurally competitive on a BAA-wide level. Specifically, the potential for market power stemmed from the high portion of resources within the PacifiCorp BAA owned or controlled by PacifiCorp's merchant affiliate (PacifiCorp Energy).

Consequently, DMM recommended that further analysis and consideration be given to applying market power mitigation provisions on a wider level than was provided for in the ISO's initial EIM market design. Specifically, DMM indicated it may be necessary to also apply the ISO's market power mitigation procedures when scheduling constraints into EIM BAAs become binding in order to mitigate potential market power that may exist in these BAAs.

Some stakeholders and the ISO's Market Surveillance Committee (MSC) voiced similar concerns about the need for expanded market power mitigation. Other stakeholders believed expanded market power mitigation was unnecessary or inappropriate. Some of these concerns were based on it would be difficult to develop Default Energy Bids for use in market power mitigation that reflect the true opportunity cost of complex hydro resources in parts of the West.

The ISOs' EIM design was approved by the Board of Governors in November 2013. With respect to the subject of market power mitigation, there was an understanding that further information was required to determine whether market power mitigation should be applied to transfers between balancing authorities participating in the EIM. Therefore, the ISO and DMM committed to further assess the structural competitiveness of the EIM based on additional information that may become available and return with a recommendation in summer 2014.

Under the ISO's March 2014 EIM tariff filing; the ISO Board will have the authority to determine, based upon a study and recommendation from Management, whether market power mitigation tests would be applied to scheduling constraints between different BAAs in the EIM. Management intends to submit a recommendation on this issue to the Board at the July 2014 meeting.

DMM has continued to collect additional information and assess the potential need to include the scheduling constraints between BAAs in the EIM in market power mitigation procedures. This report presents results of this analysis and its resulting recommendations.

2 PacifiCorp EIM Market Power Mitigation

The ISO's proposed EIM design includes provisions to mitigate market power in the real-time market within each BA participating in the EIM. This process mirrors market power mitigation (LMPM) currently applied in the ISO's real-time market. This section describes the ISO's current market power mitigation procedures and how these will be applied under the ISO's proposed EIM design.

As in the ISO real-time market, EIM market power mitigation procedures will be performed on a 15-minute basis based on projected system and market conditions 37 minutes in advance of each 15-minute interval. This process utilizes results of the ISO's 15-minute dispatch runs to identify future 15-minute intervals when congestion is projected to occur on specific individual constraints. For each constraint that is projected to be binding, a 3-pivotal supplier test is performed to determine if the supply available to relieve the binding constraint is structurally competitive or non-competitive.

If this test determines that the constraint is structurally non-competitive, bids of resources that are effective at relieving congestion on the constraint are subject to potential bid mitigation. Under the EIM design, only resources within the BAA in which this constraint is located will be subject to this bid mitigation.

Resources subject to bid mitigation may have their market bids lowered if these bids exceed the higher of the maximum of (1) a competitive market price calculated based on system energy prices plus any congestion on competitive constraints, or (2) Default Energy Bids that reflect the marginal cost or opportunity costs of the resource.

Bids mitigated in the 15-minute process will remain mitigated in the 5-minute process. No additional bid mitigation is performed if congestion occurs on a constraint in the 5-minute market that was not projected to occur in the 15-minute process.

Based on input from DMM, the ISO's EIM proposal includes three modifications in how these market power mitigation procedures will be applied in EIM compared to the ISO's current market power mitigation procedures.

First, real-time LMPM procedures will be applied separately within the ISO and each EIM BAA by performing tests for constraint competitiveness and bid mitigation only on resources within the same BAA in which a constraint is located. This ensures that resources can only be subject to bid mitigation for market power within the same BAA in which they are located. This component of the EIM design was chosen to prevent potentially low scheduling limits between EIM BAAs in a given interval from undermining the results of local market power mitigation on constraints within a BAA.

Second, all suppliers participating in the EIM will be considered potentially pivotal suppliers in the three pivotal supplier test used to determine the competitiveness of constraints. In the ISO, suppliers classified as net buyers are not considered potentially pivotal suppliers. Therefore, supply controlled by participants classified as net buyers is not excluded under the 3 pivotal supplier test since participants that are consistently net buyers in the ISO market do not have an incentive to raise prices. However, DMM believes it is not possible to reliably determine which entities are net sellers or net buyers of imbalance energy or the net impact that congestion has on an entity's overall settlement each time interval in the EIM.

Finally, a different reference bus for determining shift factors used in the LMP decomposition step of the LMPM procedures may be utilized based on the topology and control of resources within each EIM BAA.

The goal is to select a reference bus at which the congestion component of LMPs are least influenced by market power. After further review of this issue, however, DMM has recommended that the ISO initially use the same reference buses used in the CAISO's own LMPM procedures. This recommendation is based on DMM's assessment that the congestion component of LMPs at these buses will not be significantly influenced by market power within BAAs that will join the EIM. However, as the ISO gains more experience with BAAs in the EIM, it may be possible to identify a different reference bus in each EIM BAA that would be more appropriate for use in the LMP decomposition.

As noted above, one remaining issue in the ISO's EIM market power mitigation design is whether the scheduling constraints between EIM BAAs and the ISO should be subjected to these market power mitigation procedures when these constraints become binding into an EIM BAA, or combination of EIM BAAs.

Including these EIM scheduling constraints in market power procedures is akin to treating them like any other constraint within the combined ISO and EIM footprint. For example, if congestion occurs into the Pacific Gas & Electric (PG&E) service territory on the major transmission line connecting PG&E service territory with southern California (Path 15), the competitiveness of this constraint is assessed based on the supply of resources effective in relieving this congestion in the PG&E area north of Path 15. These resources are subject to bid mitigation if Path 15 is deemed structurally non-competitive in the south-to-north direction.

Excluding these EIM scheduling constraints from market power mitigation procedures is akin to treating them like an inter-tie constraint from another BAA into the ISO. When interties into the ISO become congested in the import direction, the competitiveness of these interties is not assessed based on the available supply within the ISO to relieve this import congestion. This reflects the assumption incorporated in the ISO market design that the supply within the total ISO system, that is effective in relieving import congestion, is sufficiently competitive and is unnecessary to mitigate bids of all resources within the ISO to relieve import congestion on these interties. In the case of the ISO, years of experience have confirmed that the total supply within the ISO system available when import congestion does occur on interties is generally highly competitive.

3 Structural Competiveness of EIM BAAs

3.1 Methodological Framework

As indicated in DMM’s memo to the Board on the EIM design, prior to the establishment of any new market, the potential competitiveness of this market can only be assessed based on structural criteria, rather than market conduct or performance.¹ The degree of structural market power in the two PacifiCorp EIM balancing authority areas will depend on a number of factors. Three main factors include the following:

- Net demand for imbalance energy from other load serving entities and intermittent resources.** Most of the imbalance energy met in the EIM may be associated with PacifiCorp’s own load and generation deviations. Structurally, the incentive for the exercise of market power in the EIM will also depend largely on the amount of net imbalance energy demand associated with load and generation deviations by entities other than PacifiCorp, such as other load serving entities and intermittent resources. As described in Section 3.2, DMM has obtained information on the demand for imbalance energy associated with these entities for use in this analysis.
- Scheduling constraints between EIM balancing authority areas and the ISO.** The ability for any entity to exercise market power within the two PacifiCorp BAAs can be limited by competition from energy scheduled into these BAAs from the ISO in the EIM dispatch process. As described in Section 3.3, although DMM has obtained additional information and clarification about the amount of EIM scheduling capacity between the ISO and the two PacifiCorp BAAs, the actual amount of this EIM scheduling capacity under actual market and system conditions remains uncertain at this time.
- The amount and ownership of generation participating in EIM.** Although there may be a substantial amount of generation within the PacifiCorp BAAs owned by entities other than PacifiCorp, it is also uncertain how much, if any, of this generation will participate in the EIM, particularly in the initial phases. As described in Section 3.4, the amount and competitiveness of any non-PacifiCorp supply within the PacifiCorp BAAs that will be offered in the EIM remains uncertain at this time.

Based on these supply and demand conditions, the structural competitiveness of an individual EIM BAA and the combination of the two PacifiCorp BAAs can be assessed using a single pivotal supplier test. This test essentially examines whether there is sufficient supply from non-PacifiCorp resources to meet the net demand for imbalance energy by non-PacifiCorp loads and resource deviations within each EIM BAA.

A simplified mathematical formulation of this single pivotal supplier test can be expressed as the *residual supply index* for any dispatch period as follows:

$$\frac{\text{Scheduling Limit}_{\text{ISO} \rightarrow \text{BAA}} + \text{Non-PacifiCorp Supply}_{\text{BAA}}}{\text{Non-PacifiCorp Demand}_{\text{BAA}}}$$

¹ Insert footnote and hyperlink.

Where:

Scheduling Limit $_{ISO \rightarrow BAA}$ = the scheduling limit for additional EIM energy transfers from the ISO to the BAA in the dispatch period.

Non-PacifiCorp Supply $_{BAA}$ = the amount of energy bids available for dispatch in the EIM from other suppliers within the BAA in the dispatch period.

Non-PacifiCorp Demand $_{BAA}$ = the net demand for imbalance energy from non-PacifiCorp loads and generation deviations in the BAA in the dispatch period.

When this ratio, or residual supply index, is less than 1, PacifiCorp is individually pivotal, so that some of its supply would be needed to meet the demand for imbalance energy from non-PacifiCorp loads and generation deviations.

When the residual supply index is equal to or greater than 1, PacifiCorp would not be individually pivotal, since the demand for imbalance energy from non-PacifiCorp loads and generation deviations could be net by transfers from the ISO and/or other suppliers within the BAA.

A more detailed description of this approach is provided in Appendix A. In practice, DMM notes that it may be appropriate to utilize a more stringent test – such as the three pivotal supplier test used on the ISO’s market power mitigation test – in the event that only a limited number of suppliers account for large portions of the residual supply from suppliers other than PacifiCorp within the EIM BAAs. However, for the sake of this initial analysis, we have illustrated this approach using a simple single pivotal supplier test. DMM also notes that this approach may be employed to assess the structural competitiveness of EIM BAAs after implementation of the EIM as actual market data become available. This is discussed in the final section of this report.

The following sections summarize additional information that DMM has been able to obtain on each of three factors affecting the structural competitiveness of the PacifiCorp EIM BAAs.

3.2 Demand for Imbalance Energy

One key factor affecting the potential for market power in the Energy Imbalance Market is the demand for Imbalance Energy. For this analysis, DMM requested and obtained data on the demand for imbalance energy in the two PacifiCorp Balancing Areas. The data only include imbalance energy demand for entities excluding PacifiCorp. The data include load deviations from non-PacifiCorp load serving entities, as well as generation deviations from non-PacifiCorp generation. The deviations are differences between base schedules and metered quantities. PacifiCorp has indicated that the data also exclude some demand that is not subject to standard imbalance energy charges. Only data for 2012 are available at this time. Figure 1 and Figure 2 show hourly 2012 imbalance energy data for the PacifiCorp East and PacifiCorp West BAAs, respectively, as an hourly duration curve (i.e. sorted in descending order of the amount of hourly non-PacifiCorp demand for imbalance energy). As shown in Figure 2:

- In the PacifiCorp East BAA, the non-PacifiCorp demand for imbalance energy exceeded 150 MW only about 8 hours and was over about 90 MW during only 100 hours in 2012.
- In the PacifiCorp West BAA, the non-PacifiCorp demand for imbalance energy never 100 MW and over about 60 MW during only 100 hours in 2012.

Figure 1. Annual duration curve of non-PacifiCorp imbalance energy demand (2012)

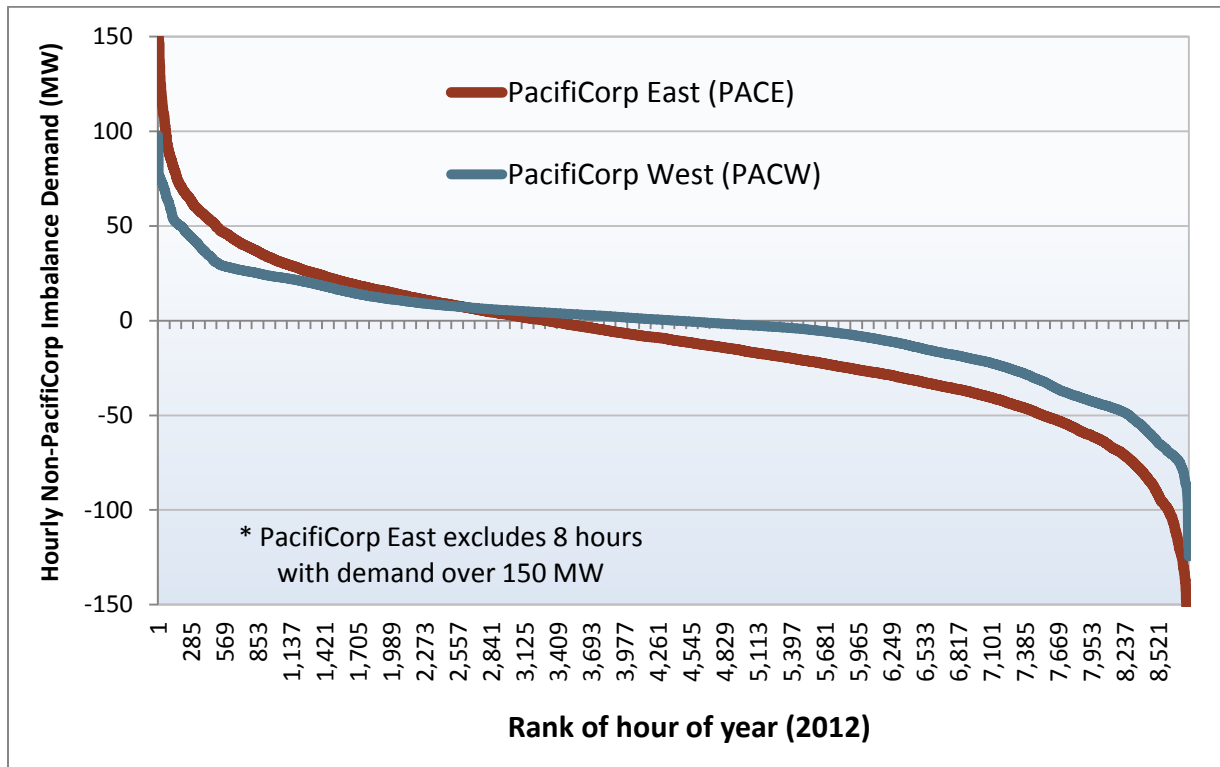
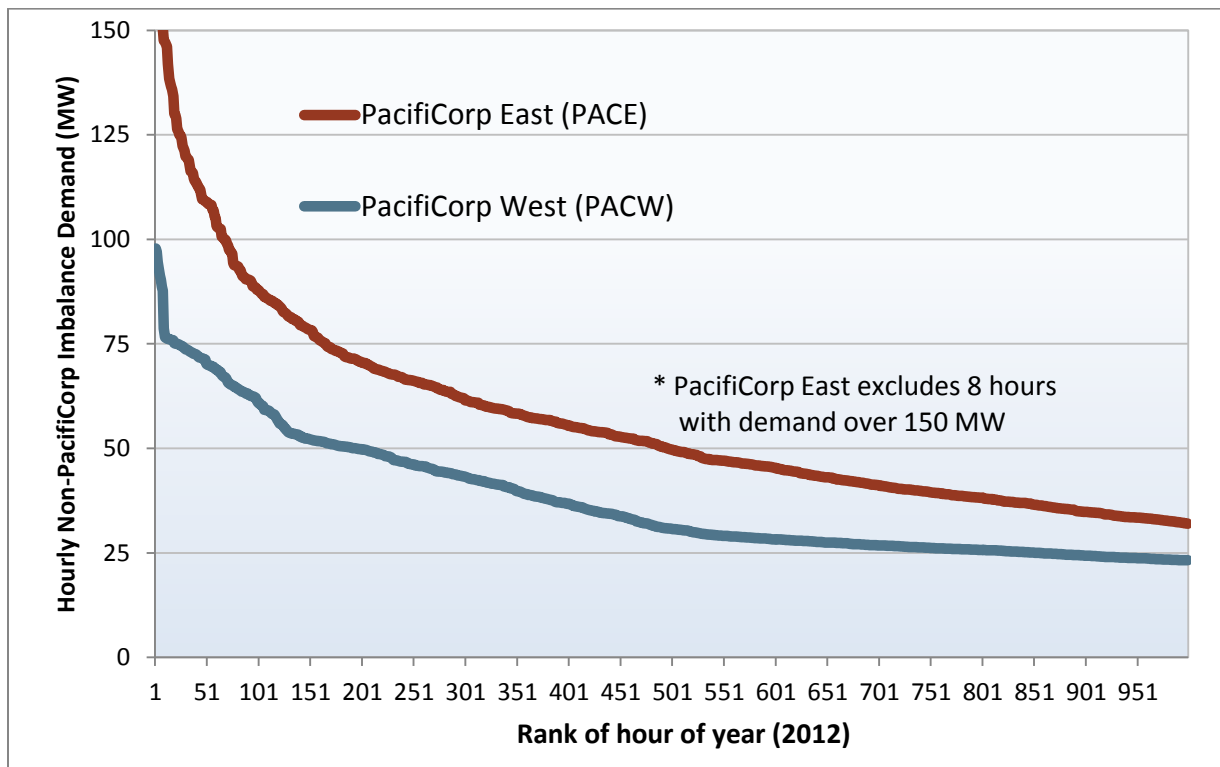


Figure 2. Duration curve of non-PacifiCorp imbalance energy demand (Highest 1000 hours)



In the EIM, demand for imbalance energy will be settled on both a 15-minute and 5-minute basis. Demand for imbalance energy in the 15-minute market is based on the difference between base load and generation schedules and the 15-minute market load forecasts and generation schedules. Demand for 5-minute imbalance energy will be based on the difference between 15-minute market load forecasts and generation schedules and metered load and generation.

Currently, imbalance energy data is only available on an hourly level, since this is the granularity of current imbalance energy settlements in the PacifiCorp BAAs. Thus, actual demand for imbalance energy during 15-minute intervals within each hour would often be higher. However, the degree of variation within each hour cannot be determined at this time.

The amount of 5-minute demand for imbalance energy may be lower (since this will be measured based on the difference between 15-minute load and generation schedules compared to actual 5-minute loads and generation). However, the amount of non-PacifiCorp supply within the EIM BAA and which can be scheduled into the EIM BAAs will also be more limited on a 5-minute basis.

3.3 EIM Scheduling Constraints

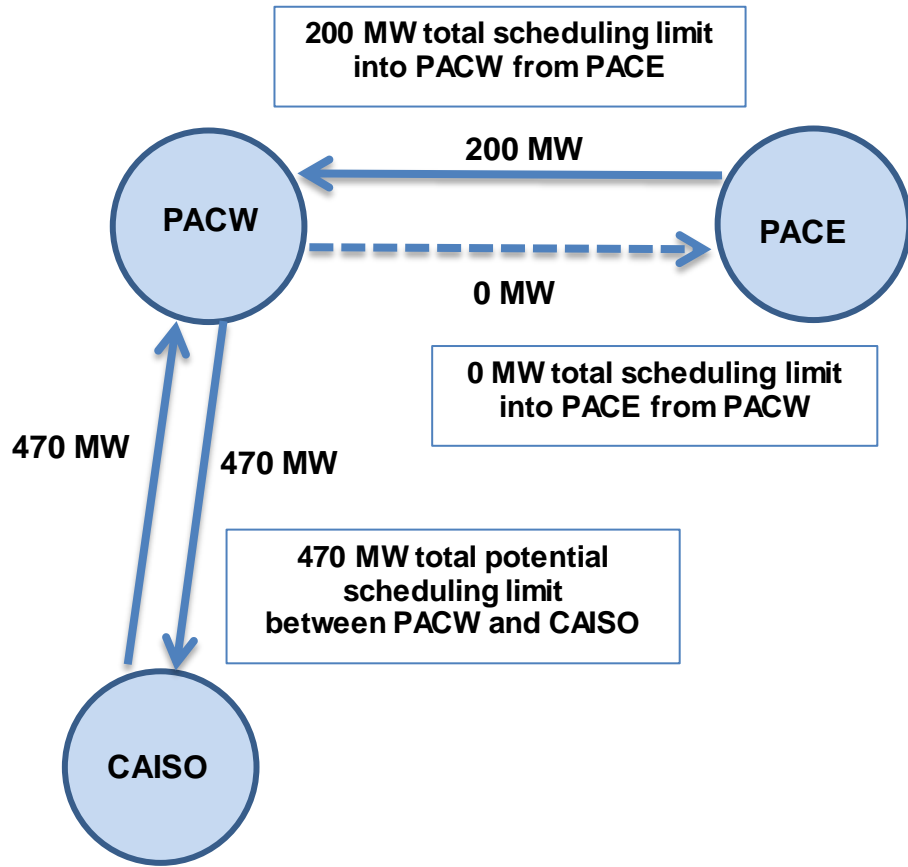
The incentive for any entity to exercise market power within the two PacifiCorp BAAs can be limited by competition from imports from the ISO. Figure 3 illustrates DMM's understanding of the maximum amount of the scheduling limits that may be incorporated in the EIM at the point of implementation in October 2014.

As shown in Figure 3, the initial scheduling limit into the PacifiCorp East BAA from PacifiCorp West BAA during any 15-minute interval is 0 MW. This would preclude any energy being scheduled from the ISO into PacifiCorp East, even when scheduling capacity exists from the ISO into PacifiCorp West. However, DMM understands that scheduling limits shown in Figure 3 represent limits before consideration of any net schedules between these BAAs incorporated in base schedules. For example, DMM understands that if base EIM schedules included a net 75 MW schedule from PacifiCorp East to PacifiCorp West, this could create the potential for incremental schedule changes in the EIM of up to 75 MW into PacifiCorp East from the ISO through PacifiCorp West.

As shown in Figure 3, the amount of additional energy that may be scheduled into the PacifiCorp West BAA from the ISO during any 15-minute interval be up to 470 MW. In practice, however, DMM understands that this scheduling limit may be lower during any time period for at least three reasons:

- PacifiCorp Energy (which is the PacifiCorp Interchange Right's Holder for the scheduling rights being used for EIM scheduling) will make an hourly determination as to how much of its firm transmission capacity to make available for EIM transfers.
- As is the case today, the California Oregon Interface (COI) can be derated for operational reasons which could lead to curtailments of PacifiCorp Energy's scheduling rights which are being used for EIM scheduling.
- PacifiCorp will also be required to abide by any additional transfer limitations for dynamic transfers imposed by BPA as the path operator.

Figure 3. Potential EIM Inter-BAA scheduling limit constraints



Two other provisions included in the ISO’s proposal could reduce the actual scheduling limit into PacifiCorp West from the ISO.

- If it is determined that there is insufficient ramping capability within an EIM BAA or combination of BAAs to meet the ramping requirement of a BAA or group of BAA’s, the amount of energy scheduled into the EIM may be frozen.
- The EIM design also includes a provision to freeze transfers between the EIM BAAs and the ISO system in the event of an EIM disruption (Section 29.7 j(2)). PacifiCorp

Thus, the amount of transfer capacity available in the EIM between the ISO and the two PacifiCorp BAAs also remains uncertain at this time and may be somewhat dynamic from hour to hour.

3.4 Non-PacifiCorp Generation

Based on information submitted to the ISO for generating resources being registered to be eligible to participate in the EIM, there may be a substantial amount of total generation within the PacifiCorp BAAs relative to the potential demand of imbalance energy. Table 1 summarizes the maximum capacity of resources that may participate in the PacifiCorp BAAs based on currently available information.

As shown in Table 1, the total amount of coal, gas and hydro capacity that may participate in EIM to meet demand for incremental imbalance energy exceeds 4,100 MW in PacifiCorp East and 1,400 MW in PacifiCorp West. In addition, there are over 1,000 MW of wind capacity that may participate in these two BAAs. Wind resources will presumably only submit offers for decremental capacity below their base schedules.

However, the amount of generation owned or controlled by entities other than PacifiCorp that will participate in EIM remains uncertain at this time. In addition, the portion of capacity from participating EIM resources that will actually be offered into the EIM cannot be determined for several reasons:

- These resources may submit base schedules for any portion of their capacity that they may utilize to meet load obligations, day-ahead sales into the ISO market or bilateral sales outside these BAAs.
- Entities controlling these resources may also choose to reserve this capacity to serve as potential sources of supply for inter-tie bids submitted to the ISO's 15-minute market.
- Finally, entities participating in EIM are under no obligation to bid all their available capacity into the EIM.

As EIM is implemented, additional information may become available which may provide a basis for projecting the amount of other supply that may be offered in the EIM and the competitiveness of this supply.

Table 1. Maximum Capacity of Resources Potentially Participating in PacifiCorp EIM BAAs

Type	Maximum MW		
	East	West	Total
Coal	2,287	0	2,287
Natural gas	1,885	977	2,862
Hydro	0	431	431
Subtotal	4,172	1,408	5,580
Wind	---	---	1,013
Total	---	---	6,593

4 Conclusions and Recommendations

As indicated in this report, historical data indicates the potential demand for imbalance energy from non-PacifiCorp load and generation deviations may be relatively low. This data also provide a basis for projecting the upper end of demand that might be expected. However, the amount of non-PacifiCorp supply available to meet this demand remains uncertain and may vary under different market and system conditions.

In the PacifiCorp West BAA, the non-PacifiCorp demand for imbalance energy exceeded 150 MW only about 8 hours and was over about 90 MW during only 100 hours in 2012. However, the scheduling limit for transfers from the ISO into PacifiCorp West may be 0 during all or most hours. At this time, it cannot be assumed that there will be sufficient supply from non-PacifiCorp resources to ensure a structurally competitive market.²

In the PacifiCorp East BAA, the non-PacifiCorp demand for imbalance energy was 100 MW and over about 60 MW during only 100 hours in 2012. This compares to a scheduling limit for transfers from the ISO into PacifiCorp West of up to 470 MW. While this may make PacifiCorp West structurally competitive many or most hours, the actual amount of scheduling capacity into this BAA from the ISO remains uncertain and could be below the non-PacifiCorp demand for imbalance energy (or even 0 MW) in some hours.³

Consequently, DMM continues to believe that based on currently available information it cannot conclude that the two PacifiCorp BAAs will be structurally competitive and therefore recommends that market power mitigation procedures be applied when scheduling constraints into either of these BAAs becomes binding.

As the EIM is implemented, DMM will continue to assess the structural competitiveness of the EIM BAAs and seek to develop other options that might be employed to refine the ISO's current market power mitigation provisions to the EIM. Specifically, as actual EIM data becomes available, DMM will be able to employ the pivotal supplier and residual demand index tests outlined in this report using actual data to assess the structural competitiveness of the PacifiCorp BAAs.

DMM is also working with the ISO to seek to develop a more automated dynamic approach for assessing the structural competitiveness of EIM BAAs based on actual market conditions each hour, such as the actual amount of scheduling capacity from the ISO into EIM BAAs each hour. For example, with this approach, the scheduling constraint into an EIM BAA could be deemed competitive and excluded from market power mitigation procedures if the scheduling capacity into the BAA from the ISO (or other competitive EIM BAAs) was sufficient to exceed the demand for imbalance energy by entities other than the major supplier(s) within that BAA.

² Within the framework of the pivotal supplier/residual supply index methodology outlined in Section 3.1 and Appendix A of this report, this is equivalent to assuming that during some hours there may not be any residual supply from the ISO or other non-PacifiCorp suppliers within the EIM, so that the residual supply index may equal 0.

³ Again, within the methodological framework outlined in Section 3.1 and Appendix A of this report, this is equivalent to assuming that during some hours the residual supply from the ISO or other non-PacifiCorp suppliers within the EIM will be less than non-PacifiCorp demand for imbalance energy, so that the residual supply index may be less than 1.0.

Appendix A - Background

This document provides detail on a potential test the Department of Market Monitoring (DMM) could use to assess the existence of structural market power in an EIM area. The test would assess whether or not a single dominant supplier has the incentive to exercise market power which the dominant supplier could exert unilaterally in order to increase EIM prices paid by unaffiliated entities for imbalance demand in the 15-minute and 5-minute EIM markets. The test would be conducted for each EIM transfer constraint into an EIM balancing authority area (or combination of EIM balancing authority areas, excluding ISO) prior to EIM going live for the balancing authority area. DMM would repeat the test when DMM determined that conditions affecting the assessment of structural market power, including the quality and quantity of data used in the test, may have changed materially.

If the structural market power test results indicate the existence of structural market power from an EIM transfer constraint into an EIM area, DMM would recommend that the relevant EIM transfer constraint be included in the real-time Dynamic Competitive Path Assessment. Every 15 minutes, the real-time Dynamic Competitive Path Assessment would then determine whether or not the EIM transfer constraint into the EIM area is a non-competitive path. DMM recommends that an EIM transfer constraint be included in the Dynamic Competitive Path Assessment until DMM conducts a structural market power test that indicates the constraint does not create structural market power in the EIM balancing authority area (or combination of EIM balancing authority areas).

If the structural market power test results indicate that the EIM transfer constraint does not create structural market power in the EIM area, DMM would recommend that the EIM transfer constraint in the direction into the EIM area not be included in the real-time Dynamic Competitive Path Assessment. DMM would recommend the EIM transfer constraint be deemed a competitive path for each 15-minute and 5-minute EIM market run. DMM would recommend that such an EIM transfer constraint be excluded from the Dynamic Competitive Path Assessment until DMM conducted a structural market power test that indicated the EIM transfer constraint created structural market power in the EIM area.

A.1 Methodology definition

In many cases, DMM expects that it will be appropriate to perform a structural market power test to assess if one dominant supplier in an EIM balancing authority area has incentive to unilaterally exert market power in order to raise the EIM prices paid by unaffiliated entities for real-time energy demand imbalances. In order to make this assessment, the test determines if the supply of real-time power⁴ whose price cannot be unilaterally set by the dominant supplier (or its affiliates) is sufficient to meet unaffiliated entities' real-time demand imbalances⁵ that settle on EIM prices.

⁴ Power supplied in real-time is either an increase in power injections relative to base schedules of imports or internal generation, or a decrease in power withdrawals relative to base schedules of exports or internal load.

⁵ Power demanded in real-time is either an increase in power withdrawals relative to base schedules of exports or internal load, or a decrease in power injections relative to base schedules of imports or internal generation.

In particular, DMM proposes to calculate the following structural market power ratio to test for structural market power held by entity, c , due to an EIM transfer constraint governing schedules into an EIM balancing authority area (or combination of EIM balancing authority areas), a , for each time period, t :

$$SMPR_{c,a,t} = \frac{\sum_{b \in \{B\}} Tr_{b,a,t}^{cap} + \sum_{e \neq c} [L_{e,a,t}^{dec,bid} + E_{e,a,t}^{dec,bid} + G_{e,a,t}^{inc,bid}] + \sum_{s \in \{S_a\}} \max \left(Lim_s^{imp}, \sum_{e \neq c} I_{e,s,t}^{inc,bid} \right)}{\left(\sum_{e \neq c} [L_{e,a,t}^{inc,clear} + E_{e,a,t}^{inc,clear} + G_{e,a,t}^{dec,clear} + I_{e,a,t}^{dec,clear}] \right)} \quad (1)$$

Where:

- $\{B\}$ is the set of EIM balancing authority areas not in area, a , in which entity, c , has been deemed to not have structural market power.
- $Tr_{b,a,t}^{cap}$ is the incremental (relative to base schedules) EIM transfer capacity from EIM balancing authority area, b , into the EIM area, a , during period, t , $Tr_{b,a,t}^{cap} \geq 0$.
- $L_{e,a,t}^{dec,bid}$ is the quantity of load reduction relative to base schedule offered by entity, e , in area, a , in period, t . For load resources that do not submit economic decremental offers into EIM but instead self-schedule at the load forecast (ie, the majority of current load resources), $L_{e,a,t}^{dec,bid}$ will simply be entity e 's scheduled quantity of load reduction relative to its base schedule in area a for period t . Note that $L_{e,a,t}^{dec,bid}$ does not include the decremental imbalance load from the entity, c , or affiliates of c . Because incremental load is a withdrawal, and hence a negative injection, $L_{e,a,t}^{dec,bid} \geq 0$.
- $E_{e,a,t}^{dec,bid}$ is the quantity of entity e 's base scheduled exports at External EIM Intertie scheduling points into area, a , that are bid into the 15-minute EIM market not as self-schedules. These are decremental export bids. Note that $E_{e,a,t}^{dec,bid}$ does not include decremental exports offered from the entity, c , for whom structural market power is being assessed, or affiliates of c . Because an incremental export is a withdrawal, and hence a negative injection, $E_{e,a,t}^{dec,bid} \geq 0$.
- $G_{e,a,t}^{inc,bid}$ is the quantity of internal generation offered from entity, e , in area, a , that is incremental to e 's base schedules from internal generation in a . Note that $G_{e,a,t}^{inc,bid}$ does not include supply offered from the entity, c , for whom structural market power is being assessed, or affiliates of c . $G_{e,a,t}^{inc,bid} \geq 0$.
- $\{S_a\}$ is the set of all External EIM Interties into EIM area, a .
- Lim_s^{imp} is the import scheduling limit on the External EIM Intertie, s , into EIM balancing authority, a . $Lim_s^{imp} \geq 0$.

- $I_{e,s,t}^{inc,bid}$ is the quantity of imports offered into the 15-minute EIM market from entity, e , at External EIM Intertie scheduling point, s , into area, a , that is incremental to e 's base scheduled imports at s . Note that $I_{e,s,t}^{inc,bid}$ does not include imports offered from the entity, c , for whom structural market power is being assessed, or affiliates of c . $I_{e,s,t}^{inc,bid} \geq 0$.
- $L_{e,a,t}^{inc,clear}$ is the quantity of real-time imbalance load energy of entity, e , in area, a , that is incremental to e 's base scheduled load. Note that $L_{e,a,t}^{inc,clear}$ does not include the incremental imbalance load from the entity, c , or affiliates of c . Because incremental load is a withdrawal, and hence a negative injection, $L_{e,a,t}^{inc,clear} \leq 0$.
- $E_{e,a,t}^{inc,clear}$ is the quantity of real-time scheduled exports of entity, e , at External EIM Intertie scheduling points into area, a , that are incremental to e 's base scheduled exports. Note that $E_{e,a,t}^{inc,clear}$ does not include real-time incremental exports scheduled by the entity, c , for whom structural market power is being assessed, or affiliates of c . Because an incremental export is a withdrawal, and hence a negative injection, $E_{e,a,t}^{inc,clear} \leq 0$.
- $G_{e,a,t}^{dec,clear}$ is the quantity of decremental real-time energy cleared by the internal generation of entity, e , in area, a . In other words, $G_{e,a,t}^{dec,clear}$ is the reduction in energy from e 's base scheduled generation to e 's real-time generation schedules. Note that $G_{e,a,t}^{dec,clear}$ does not include real-time decremental supply from the entity, c , for whom structural market power is being assessed, or affiliates of c . Because a decremental supply is a withdrawal, and hence a negative injection, $G_{e,a,t}^{dec,clear} \leq 0$.
- $I_{e,a,t}^{dec,clear}$ is the quantity by which e 's 15-minute market scheduled imports at External EIM Interties into a were reduced relative to e 's base scheduled imports into a . Note that $I_{e,a,t}^{dec,clear}$ does not include real-time decremental imports from the entity, c , for whom structural market power is being assessed, or affiliates of c . Because a decremental import is a withdrawal, and hence a negative injection, $I_{e,a,t}^{dec,clear} \leq 0$.

DMM will assess the extent to which the ratio (1) exceeds 1.0 over an appropriate period of time in order to determine if entity, c , has structural market power in the area, a , defined by the EIM transfer constraint under consideration. If any entity, c , is found to have structural market in the area, a , then DMM would recommend the EIM transfer constraint that defines the area, a , be included in the real-time Dynamic Competitive Path Assessment.

A.2 Methodology discussion

The structural market power ratio (1) tests, for each time period t , if the supply of power whose price cannot be unilaterally set by the dominant supplier (or its affiliates) in a balancing authority area (or combination of balancing authority areas) is sufficient to meet the real-time energy demand imbalances from all entities other than the dominant supplier. The area being assessed for structural market power is a . It is DMM's current understanding that a net scheduled interchange constraint will be enforced not

only for each BAA, but also for each subset of BAAs (excluding CAISO). This constraint will limit the net injections (supply plus load, where load is a negative injection) from all nodes within the defined area to stay within the total EIM transfer capacity into (or out of) the area from (or to) all EIM BAAs not included in the area. The market power test is therefore testing for the market power created by the net scheduled interchange constraint that defines the area, a . It is not simply testing for market power in each specific EIM BAA. The entity or group of entities being assessed for possessing market power is entity c . The numerator of ratio (1) is the sum of sources of real-time supply offered into area a , whose prices cannot be unilaterally set by c . The denominator is the sum of real-time energy demanded by entities other than the dominant supplier in area a .

The first term in the numerator is the incremental (relative to base schedule transfers) EIM transfer capacity into area a from all EIM balancing authority areas not in area a . For example, consider the assessment of the area comprising of the combination of balancing authority areas PACW and PACE for unilateral market power held by the group of affiliated entities under MidAmerican Holdings. The incremental EIM transfer capacity from CAISO into PACW and from CAISO into PACE will be included in the numerator of (1) in this assessment. Assume the total EIM transfer capacity into PACW and PACE from CAISO is 300 MW for a particular interval, and there were IFM schedules over PacifiCorp transmission from PACW into CAISO of 60 MW (and 0 MW of such IFM schedules between PACE and CAISO). The incremental EIM transfer capacity into area a , that would be included in the numerator of (1) would be 360 MW. If, instead, there were net IFM schedules over PacifiCorp transmission from CAISO into PACW of 170 MW, the incremental EIM transfer capacity into a , that would be included in the numerator of (1) would only be 130 MW.

The rest of the numerator of (1) represents the power supply offered into area, a , during interval, t , that can compete with the dominant supplier for meeting the real-time demand imbalances of entities other than the dominant supplier. Only the bids from internal generation and imports (on external EIM interties) that are incremental to an entity's base schedules can be used to meet incremental real-time demand imbalances. Therefore, we do not count the bids of internal generation or imports up to the base schedule quantity in the numerator of (1). On the other hand, only the bids from exports and internal load that are decremental to an entity's base schedules can be used to meet incremental real-time demand imbalances. Therefore we do not count bids for exports and load in excess of the base export and load schedules in the numerator of (1). Note that incremental import bids are capped at the import scheduling limit of the relevant external EIM intertie to reflect the limit on the actual supply that can be provided at each intertie.

The denominator is the real-time demand imbalance from all entities other than the dominant supplier during hour, t . Real-time demand imbalance consists of any quantity that is a withdrawal relative to the base schedule. Real-time demand therefore consists of increases in the cleared quantity of internal load and exports relative to base scheduled load and exports. However, decreases in supply in real-time relative to base schedules are also withdrawals. Therefore, real-time demand also includes decreases in the cleared quantity of internal generation and imports at external EIM interties relative to base scheduled generation and imports.

If the real-time supply offered by entities other than c (i.e., the numerator) exceeds these entities' demand for real-time withdrawals (i.e., the denominator), then c is not unilaterally pivotal in setting the real-time price for power in area a . If, on the other hand, the real-time supply offered by entities other than c is not sufficient to meet these entities' demand for real-time withdrawals in area a , then the dominant supplier is pivotal in meeting the area's demand for real-time withdrawals, and therefore has market power via the constraint defining area, a .

This methodology can be easily extended to test for market power by any combination of entities. This can be accomplished by considering the combination of entities being tested for market power in area a as one entity, c . The ratio would then be applied in the same way as it would be applied for one entity.

Note that ratio (1) may be insufficient for assessing structural market power in the 5-minute market. DMM will continue to consider options for assessing structural market power in the 5-minute market prior to recommending that a particular EIM transfer constraint be deemed competitive and therefore automatically excluded from the real-time Dynamic Competitive Path Assessment.

A.3 Methodology applied to PacifiCorp prior to EIM go-live

Prior to EIM going live for PacifiCorp, DMM will not have sufficient historical data to completely perform the above methodology. DMM has instead relied on hourly imbalance energy data provided by PacifiCorp and conservative assumptions about the supply that can be expected to be offered into EIM by non-PacifiCorp entities.

In particular, DMM's understanding is that PacifiCorp the EIM transfer capacity into the PAC balancing authority areas may be 0 for any given hour, due to either a decision by PacifiCorp Energy or factors beyond PacifiCorp Energy's control that may limit these scheduling rights. In its analysis, DMM will therefore set the transfer capacity in the numerator of (1) to 0.

Similarly, DMM's understanding is that PacifiCorp is proposing to not allow imports or exports at any external EIM interties in the EIM 15-minute market. In its analysis, DMM will therefore set the incremental import offers and decremental export offers in the numerator of (1) to 0.

The analysis is therefore by necessity a simplified assessment of the extent to which the incremental non-PacifiCorp internal generation capacity likely to be offered into EIM in real-time is sufficient to meet the non-PacifiCorp incremental load during hours when that real-time load imbalance was an increase relative to its base schedules.