



Extending the Day-Ahead Market to EIM Entities

Issue Paper

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1. Purpose

This paper summarizes the issues that the CAISO proposes to address through a stakeholder initiative to develop an approach to extend participation in the CAISO's day-ahead market to energy imbalance market (EIM) entities. This approach will enable EIM entities to participate in the day-ahead market in a framework similar to the existing EIM approach for the real-time market, rather than requiring full integration into the CAISO balancing area as participating transmission owners (PTO). The extended day-ahead market (EDAM) will improve market efficiency and more effectively integrate renewable resources by optimizing day-ahead unit commitment and scheduling across a larger footprint.

The CAISO requests written comments from all interested stakeholders on the proposed scope of the EDAM initiative and initial design considerations for the general components outlined in this paper. As indicated in the following sections, there are many complex components that need to be considered in the development of EDAM. Please provide as much detail as possible, knowing that stakeholders will have opportunities for education, discussion and comment at several points along this public, iterative process. The CAISO looks forward to and encourages robust participation in the initiative.

The same principles of the Western EIM will be maintained: voluntary participation, low-entry cost, no exit fees, and balancing authorities retain operational control over their resources and transmission. Participation in EDAM will be optional for EIM entities such that EIM entities may still elect to only participate in the CAISO's real-time market. However, participating in the EDAM requires participation in the EIM.

EIM entities that elect to participate in the day-ahead market will retain flexibility and independence, including retaining their balancing authority and planning functions. The EDAM approach will bring many of the benefits of day-ahead market participation, notably, increased ability to integrate renewable resources and optimized unit commitment over a larger footprint. Resource adequacy will be the responsibility of each EIM entity and their state and local regulatory authority, although a resource sufficiency evaluation similar to the EIM will have to be considered for the day-ahead market.

The EDAM will not change state or local control over integrated resource planning. The decisions regarding forward procurement of capacity for resource adequacy will remain with the utility in coordination with their state and local regulatory authorities. Likewise, transmission planning and investment decisions remain with each balancing authority area, state and local regulatory authority.

As discussed below, the EDAM initiative covers a variety of market design and policy decisions. It should be noted, EDAM design changes may result in corresponding changes to the EIM design to maintain consistency between the day-ahead and real-time markets.

The primary market design and policy considerations include:

Transmission Provision: In EIM, transmission is made available to support energy transfers through contributions by interchange rights holders or available transmission capacity provided by EIM entities. This transmission supports energy transfers between balancing authority areas at no transmission usage

rate. Interchange rights holders have procured transmission and on a voluntary basis have chosen to allow the transmission to be used for transfers. Available transmission capacity is residual transmission, i.e. unused after the T-20 tagging deadline, with EIM transfers as the lowest priority use of the transmission. That is, if in real-time the transmission is used bilaterally, the market will re-dispatch participating resources to ensure EIM transfers stay within the unused portion. EDAM will require a different approach than EIM. Since transmission customers can use transmission up until just prior to the operating hour, EDAM cannot assume transmission will be unused. As a result, this initiative will develop rules and approaches for making transmission available in the day-ahead timeframe to support transfers between balancing authority areas.

Distribution of Congestion Rents: Congestion occurs in the day-ahead market when generation that is economic cannot be fully dispatched to serve load because it is located in a transmission constrained area. As a result, load pays a higher locational marginal price (LMP) than what the generation is paid. The CAISO market's financial settlement must allocate this over-collection of market revenue (i.e. congestion rent) to market participants. In the current CAISO day-ahead market, congestion revenue rights (CRRs) are the primary mechanism to distribute congestion revenue. This initiative will evaluate approaches to distribute day-ahead market congestion rents collected in balancing authority areas other than the CAISO.

Resource sufficiency evaluation: Since resource participation in EDAM will be voluntary, i.e. there will not be an obligation to offer specific resources into the day-ahead market, this initiative must develop resource sufficiency evaluation criteria and related rules. Similar to the existing criteria and rules in the EIM, EDAM resource sufficiency rules must ensure that balancing authority areas do not inappropriately lean on the capacity, flexibility, or transmission of other balancing authority areas. As part of this, this initiative will explore potential mechanisms to trade resource flexibility and/or balancing authority area obligations needed to pass the resource sufficiency evaluation between EDAM balancing authority areas.

Ancillary services: The current CAISO day-ahead market co-optimizes energy and ancillary services. Most EIM entities participate in reserve sharing groups. This initiative will assess if day-ahead market ancillary services could complement existing reserve sharing groups and whether to enable trading of ancillary services between balancing authority areas. If ancillary services procurement were included in the EDAM, a secondary question regarding how such reserves are deployed would also need to be addressed.

Modeling of non-EDAM imports and exports: In the EIM and the existing day-ahead market, CAISO imports and exports are modeled as injections or withdrawals at the intertie scheduling point while EIM entities' imports and exports are modeled at the source/sink balancing authority areas. In light of other market modeling enhancements, this initiative will look to align the modeling approach of CAISO imports and exports to the approach currently used for EIM entities. In doing so, it will be necessary to consider the potential use of "scheduling hubs" as representations of import and export sources and sinks, e-tagging or settlement rule refinements, and remapping of congestion revenue rights to scheduling hubs.

External Resource Participation: The EIM entity communicates its bilateral imports/exports through hourly base schedules. The EDAM design will also need to accommodate bilaterally contracted imports and exports in the day-ahead market and rules around how bilaterally contracted external resources can help a balancing authority area pass its resource sufficiency evaluation will also need to be developed. Currently, resources not operating within EIM entity balancing authority areas, e.g. external resources, do not economically participate in the EIM. This initiative will also explore the rules needed for economic participation of external resources in EDAM.

Accounting for greenhouse gas (GHG) costs: The current EIM approach limits the potential GHG obligation attribution quantity to an EIM participating resource to the dispatch capability above its hourly base schedule. Imposing limitations on the amount of GHG awarded to an external participating resource was a recent market enhancement that sought to more accurately account for the emissions resulting from serving California (e.g., CAISO, SMUD) load. Assuming no base schedules in EDAM, a different approach will be needed to determine which resources are serving load within regions for which there are obligations for GHG costs. The EDAM GHG solution should also explore other unintended effects of remaining potential secondary dispatch effects and how to avoid them. In addition, the current paradigm defines GHG compliance regions by balancing authority area. Since other states in the West are looking at potential GHG programs, this initiative will look to define GHG compliance regions based upon a different approach, such as state boundaries.

Convergence bidding: Convergence bidding can potentially improve market efficiency by providing greater day-ahead market liquidity that can potentially produce better convergence between day-ahead and real-time prices. Convergence bids that clear the day-ahead market are settled at the day-ahead price and liquidated in the real-time market at the 15-minute market price. For the EDAM, it will be necessary to determine if convergence bidding is universal across the EDAM footprint or enabled by individual balancing authority areas.

Price formation: In the EIM entities' September 16, 2019 letter to the CAISO Board of Governors and EIM Governing Body, it was requested that the CAISO review price formation. This is a broad ranging topic with relevant day-ahead and real-time markets considerations. The EIM entities specifically requested the CAISO to evaluate fast-start pricing and scarcity pricing so consideration of these design elements is included in this initiative.

EDAM administrative fee: In the EIM, the EIM administrative fee is determined based upon the services EIM entities and EIM participating resources receive through the EIM. This initiative will examine a similar approach for an EDAM administrative fee based upon the services provided through the EDAM.

Governance: The EIM Governing Body and the CAISO Board of Governors have recently commenced a process to consider potential refinements to the current governance of the EIM, and for that purpose have established a Governance Review Committee (GRC) that is charged with leading a stakeholder initiative to develop a proposal. The GRC's review includes any potential governance changes that may be necessary in light of EDAM. EDAM-related governance issues will be addressed in that initiative that

will occur in parallel with this initiative. Likewise questions or comments regarding governance should be directed to the GRC process.

2. References

Addressing the topics described above will require a high-level understanding of the current day-ahead market, energy imbalance market, and related stakeholder initiatives. The CAISO plans to hold workshops on October 29 and November 12 to provide an overview of the existing day-ahead market for any interested stakeholder. The same material will be presented at each workshop. Based on the popularity of these sessions, the CAISO may also consider adding other venues, such as a webinar, to provide additional training to stakeholders. These opportunities will be noticed and posted through the CAISO website and notifications systems.

The following documents provide foundational information regarding these topics:

Computer Based Training

Day-Ahead Overview

http://www.caiso.com/CBT/NEW-Day-Ahead%20Overview/story_html5.html

Congestion Revenue Rights

<http://www.caiso.com/participate/Pages/LearningCenter/CongestionRevenueRights.aspx>

Convergence Bidding

<http://www.caiso.com/Pages/documentsbygroup.aspx?GroupID=F7829260-7B10-4571-9261-EDFE14FA1F98>

Western Energy Imbalance Market

<http://www.caiso.com/participate/Pages/LearningCenter/WesternEnergyImbalanceMarket.aspx>

Business Practice Manuals

Market Instruments

<https://bpmcm.caiso.com/Pages/BPMDetails.aspx?BPM=Market%20Instruments>

Market Operations

<https://bpmcm.caiso.com/Pages/BPMDetails.aspx?BPM=Market%20Operations>

Congestion Revenue Rights

<https://bpmcm.caiso.com/Pages/BPMDetails.aspx?BPM=Congestion%20Revenue%20Rights>

Energy Imbalance Market

<https://bpmcm.caiso.com/Pages/BPMDetails.aspx?BPM=Energy%20Imbalance%20Market>

Current Stakeholder Initiatives

Day-Ahead Market Enhancements

<http://www.caiso.com/informed/Pages/StakeholderProcesses/Day-AheadMarketEnhancements.aspx>

Order 831 and Import Bid Cost Verification

<http://www.caiso.com/informed/Pages/StakeholderProcesses/ImportBidCostVerification.aspx>

System Market Power Analysis

<http://www.caiso.com/Pages/documentsbygroup.aspx?GroupID=3610A9E6-827A-4768-A1A0-0422704E3F39>

Transmission Access Charge Structure Enhancements

<http://www.caiso.com/informed/Pages/StakeholderProcesses/TransmissionAccessChargeStructureEnhancements.aspx>

3. Alignment with Day-Ahead Market Enhancement Initiative

The day-ahead market enhancement (DAME) initiative will run in parallel to this initiative. The imbalance reserves being considered in the DAME are needed for the CAISO to commit resources to meet ramping granularity differences and uncertainty that materializes between the day-ahead market and real-time market. Given the critical importance of the DAME to the CAISO's ability to reliability integrate renewables, the CAISO intends to pursue the DAME even if the EDAM does not ultimately move forward. However, the CAISO recognizes that imbalance reserves and other design aspects of the DAME are also fundamentally important to EDAM. As a result, the CAISO plans to align the schedules of the DAME and EDAM initiatives since both initiatives will be of interest to the same group of stakeholders.

The DAME will also need to address the deliverability of imbalance reserves. The recently published price performance analysis report¹ highlighted that the real-time flexible ramping product, in many instances, is not deliverable. This occurs because the market awards the upward flexible ramping product to resources that are not fully dispatched due to congestion. In the subsequent market run if uncertainty materializes the upward flexible ramping product cannot be converted to energy because the generator cannot increase output due to congestion. A similar phenomenon occurs for the downward flexible ramping product when awards are made to resources providing counter flows to

¹ The final report is available at <http://www.caiso.com/Pages/documentsbygroup.aspx?GroupID=0FAC8E88-4F16-4673-B270-A996C555E97A>

resolve congestion. The CAISO is prioritizing a new initiative to improve the flexible ramping product market design to limit instances where the market awards flexible ramping product up to resources behind binding constraints and flexible ramping product down to resources providing counter flows to resolve congestion. A similar approach to improving deliverability will be considered in the DAME initiative for imbalance reserves.

3.1 Imbalance Reserves

EDAM can provide the benefit of trading imbalance reserves across balancing areas to reduce cost. Imbalance reserves will secure sufficient ramp capability in the day-ahead market to address granularity differences and uncertainty that materializes between the day-ahead and real-time markets. Under EDAM, the market will co-optimize energy, ancillary services, and imbalance reserves across the EDAM footprint. As a result, one balancing authority area can avoid committing additional resources to cover day-ahead to real-time uncertainty by having another balancing authority carry its imbalance reserve needs. Since each balancing authority remains responsible for its reliability requirements, it is necessary to assure the deliverability of imbalance reserves carried in another balancing authority area; otherwise, additional units may need to be committed because the imbalance reserves cannot be relied upon in real-time to meet the reliability needs of the receiving balancing authority area.

3.2 Market Formulation

The CAISO has reviewed two options for implementing imbalance reserves: (1) Financial and (2) Financial + Forecast with stakeholders. The CAISO plans to publish a straw proposal in late January 2020 which will provide additional information on the Financial + Forecast option. This option clears financial energy based upon bid-in demand and physical energy based upon the CAISO net load forecast. The straw proposal will also discuss how the flexible ramping product deliverability improvements can be used to ensure imbalance reserve deliverability. Addressing the imbalance reserve deliverability may result in modifications to the Financial and Forecast option discussed in the August 13, 2019 technical workshop.

4. Transmission Provision

The CAISO and stakeholders will need to address transmission provision and compensation. The Open Access Transmission Tariff (OATT) framework provides different scheduling priorities under which transmission users secure transmission. In EIM, transmission usage within a balancing authority area is settled according to each individual EIM balancing authority area's OATT. For EIM transfers of energy between balancing authority areas, the EIM uses two methods to make transmission available without a hurdle rate: (1) interchange rights holder and (2) available transmission capacity. The interchange rights holder approach uses transmission that has already been purchased and voluntarily made available for EIM transfers. This approach for interchange rights holders is workable in the day-ahead market timeframe. However, transmission that is available in the day-ahead timeframe cannot be considered "residual" transmission. This is because it can be used to schedule energy until just prior to

the operating hour. As a result, the residual available transmission capacity approach needs to be reconsidered in the day-ahead market time frame.

This initiative will need to develop a mechanism to make transmission available to support EDAM energy transfers between balancing authority areas. Potential mechanisms include:

1. Transmission needed to use external resources to fulfill bilateral contracts or pass the day-ahead resource sufficiency evaluation. This transmission has been procured prior to the day-ahead market and is a sunk cost that does not have a marginal cost in the day-ahead timeframe.
2. Transmission that a balancing authority sets aside to capture the downward imbalance reserve diversity benefit. In order for a balancing authority area to benefit from the downward diversity benefit, the balancing authority area must have sufficient export transmission to support transfers into another balancing authority area. Likewise, sufficient import transmission is needed to capture the upward diversity benefit.
3. Transmission that a transmission customer makes available for EDAM use in return for congestion revenue on the EDAM transfer. A transmission customer would utilize this approach if it procured transmission to facilitate additional economic displacement utilizing its resources. The congestion revenue compensates the transmission customer for the price difference from source to sink.
4. Transmission that a transmission customer makes available for EDAM use in return for compensation through a transmission charge. A transmission customer would utilize this approach if it procured transmission but does not plan for its resources to participate in the market in a given hour.
5. Transmission that a transmission service provider makes available for use at a tariff approved transmission rate. It will be necessary to discuss the scheduling priority of this transmission since it can be scheduled for either day-ahead energy or imbalance reserves which must be available for use in real-time.

As the footprint of the Western EIM grows and continues to change, wheel-through transfers may become more common. Currently, an EIM entity facilitating a wheel-through receives no direct financial benefit for facilitating the wheel; only the sink and source directly benefit. As part of the CAISO's Western EIM Consolidated Initiatives stakeholder initiative², the CAISO committed to monitoring the wheel-through volumes to assess whether, after the addition of new EIM entities, there is a potential future need to pursue a market solution to address the equitable sharing of wheeling benefits. In the Q2 2019 EIM quarterly benefit report³, both APS and NV Energy had net wheels that exceeded their combined imports and exports. The potential mechanisms discussed above, for example number 5, could be considered to address the wheeling compensation in the EIM as well.

² Additional information regarding this initiative is available at <http://www.caiso.com/informed/Pages/StakeholderProcesses/CompletedClosedStakeholderInitiatives/ConsolidatedEnergyImbalanceMarketInitiatives.aspx>

³ The Q2 2019 quarterly benefit report is available at <https://www.westerneim.com/Documents/ISO-EIMBenefitsReportQ2-2019.pdf>

Currently in the EIM, there is no economic participation by imports and exports at intertie scheduling points with EIM entities. EIM entities charge imports/exports transmission based upon their OATT. The CAISO does allow economic participation at its intertie scheduling points. The CAISO charges exports a per MWh transmission charge. In the event EDAM allows economic participation of external resources in a non-EDAM balancing authority area through the external resource participation method, it may be necessary to develop an EDAM transmission charge for non-EDAM resource schedules and a mechanism to distribute the collected transmission revenue among the balancing authority areas in the EDAM.

5. Distribution of Congestion Rents

Congestion revenue rights (CRRs) pay holders the difference in congestion between the source node and the sink node in the day-ahead market. CRRs are allocated to load serving entities through an annual and monthly process. Load serving entities receive these CRRs at no cost because they pay the transmission access charge. The current market design also includes an auction where residual transmission capacity can be procured by any certified CRR bidder. The revenue collected from the auction, less payments to Existing Transmission Contracts (ETC) holders for the perfect hedge, and settlement difference between CRR payments and actual congestion collection are included in a balancing account which is allocated to load serving entities. This initiative will consider extending appropriate elements of the CRR market design, if any, to EIM entities to facilitate the distribution of congestion revenues within its balancing authority area and will consider other distribution options as well.

6. EDAM Resource Sufficiency Evaluation

The day-ahead resource sufficiency evaluation is intended to ensure that each EIM entity and the CAISO have sufficient bid range from participating resources to individually meet their bid-in demand, ancillary services requirement, share of imbalance reserves and their net demand forecast. This proposed design would seek to ensure that EIM balancing authority areas and the CAISO do not lean on other balancing authority areas to avoid incurring costs for capacity, flexibility, or transmission in the forward bilateral markets. The hourly EIM resource sufficiency evaluation freezes transfers in a given 15-minute interval when the balancing authority area fails the test. This initiative will evaluate if the freezing transfers for failure or other alternative repercussions are needed for failing the day-ahead resource sufficiency evaluation.

Currently in the EIM, it is assumed that resources located in a balancing authority area and imports/exports with a balancing authority area should count towards passing the resource sufficiency evaluation of that balancing authority area. Under the EDAM, it may be necessary to change the the resource sufficiency evaluation to only count resources whose capacity is contracted to an EDAM balancing authority area on a forward basis.

6.1 Forward Planning and Procurement

EDAM does not require changes in forward planning and procurement. The CAISO will continue to use its resource adequacy program. EIM entities will continue to use their existing process for developing their integrated resource plan. As illustrated in Figure 1, the CAISO resource adequacy program results in a day-ahead must offer obligation for CAISO resources which enables the CAISO to pass the EDAM resource sufficiency evaluation. The EIM entity's integrated resource plan results in sufficient capacity that voluntarily bids or is self-scheduled into the day-ahead market which enables the EIM entity to pass the day-ahead resource sufficiency evaluation.

On a forward basis, two balancing authority areas in the EDAM may enter into a contract to trade capacity. The rules on how this capacity is scheduled and reflected in each balancing authority area's resource sufficiency evaluation will need to be developed.

On a forward basis, balancing authority areas may contract with supply in balancing authority areas outside the EDAM footprint. In the EIM, prior to the operating hour, balancing authority areas can adjust import and export hourly base schedules to position the bid range from EIM participating resources that allows the balancing authority area to pass the EIM resource sufficiency evaluation. In the day-ahead market, this supply should contribute to the balancing authority area passing its day-ahead resource sufficiency evaluation. The rules for how these imports/exports are scheduled, either through a self-schedule or economic bid, will need to be developed.

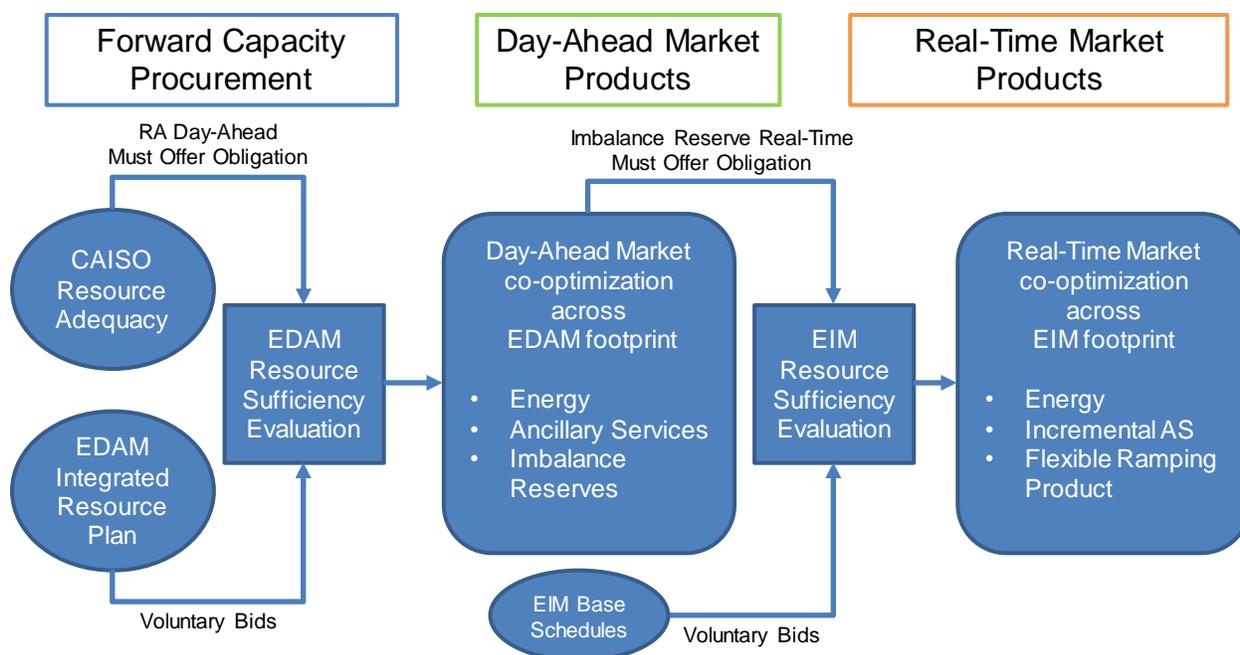


Figure 1 – Conceptual Forward Procurement, Day-Ahead Market and Real-Time Market Relationships

6.2 Trading Imbalance Reserves and Capacity

The resource sufficiency evaluation ensures that each balancing authority area can individually meet their own load through their intertie schedules and generation. This part of the initiative would allow parties to bilaterally trade bid range prior to the operating month, day, and/or hour. Currently, only if a resource is pseudo-tied would its bid range transfer between two balancing areas. In order for the bid range to transfer from one EIM balancing authority area to another EIM balancing authority area, transmission would need to be procured to ensure that the bid range is available to the receiving balancing authority area. The ability to transact bid range and a robust day-ahead resource sufficiency evaluation will seek to address concerns that EIM entities rely on the EDAM and EIM to meet their energy and flexibility needs without incurring transmission charges from the source and intermediary balancing authority areas in the footprint.

The initiative will consider the need to support multiple approaches for trading imbalance reserves. For example, at the resource level the bid range of the resource could be specified for a given balancing authority area. The resource would then be included in that balancing authority area's resource sufficiency evaluation. Another approach would be to not identify the specific resource. In this case the imbalance reserve obligation will transfer between balancing authority areas. For example, if balancing authority area #1 sold 100MW of imbalance reserves up to balancing authority area #2, the imbalance reserve up requirement in balancing authority area #1 would be increased by 100MW and reduced by 100MW in balancing authority area #2 when performing the resource sufficiency evaluation.

6.3 EIM Resource Sufficiency Evaluation

As shown in Figure 1, an EIM entity participating in EDAM does not submit EIM base schedules. This is because the balanced day-ahead schedules are the reference point for imbalance settlement. As a result, entities in the EDAM will not be subjected to the balance test in real-time. The balance test is performed to determine if the EIM entity will be subject to over/under scheduling penalties. Thus, EIM entities that participate in the EDAM will not be subject to over/under scheduling penalties.

Also, resources awarded imbalance reserves have a must offer obligation into the real-time market. These economic bids will enable the balancing authority areas to pass the EIM resource sufficiency evaluation unless there is a significant change in system conditions. While passing the real-time evaluation should be routine, the real-time flexibility and capacity tests will still be performed to ensure that the balancing authority addresses any outages or significant changes in system conditions prior to the operating hour.

7. Ancillary Services

The current CAISO day-ahead market co-optimizes energy and ancillary services. Most EIM Entities participate in reserve sharing groups. This initiative will assess if day-ahead market ancillary services could complement existing reserve sharing groups and whether to enable trading of ancillary services between balancing authority areas. If ancillary services procurement were included in the EDAM, a secondary question regarding how such reserves are deployed would also need to be addressed.

In addition to capacity bids, regulation up and regulation down also bid for mileage. The market clears resources based upon the capacity requirement and expected mileage. Mileage is the 4 second movement in response to the automated generation control signal. In order to settle mileage, including the performance evaluation, a balancing authority area would need to provide 4 second data for its regulating resources. This initiative will consider if both capacity and mileage bids are needed if the decision is to include ancillary services procurement across the EDAM footprint.

8. Modeling of Non-EDAM Imports/Exports

In the EIM, CAISO imports and exports are modeled as injections at the intertie scheduling point while EIM entities' imports and exports are modeled at the source/sink balancing authority area. This initiative will look to align the modeling approach of CAISO imports and exports to the approach currently used for EIM entities.

This initiative would be the second phase of the Full Network Mode Expansion initiative implemented in Fall 2014. That initiative provided reliability and market efficiency benefits by enhancing the CAISO's modeling capabilities to account for unscheduled flows and enforce intertie power flow constraints in the day-ahead market. As part of this, the full network model topology was expanded to include information on resources, load, and interchange schedules in other balancing authority areas.

Phase 2 would explore modeling imports and exports into the CAISO balancing authority area at their actual source and sink to improve the CAISO market's modeling of actual power flow. Although the CAISO market currently uses an approximation of this for imports and exports to and from EIM areas, it currently models imports and exports to and from the CAISO balancing areas as injections and withdrawals at the relevant intertie scheduling point. Consistent modeling across the CAISO and EIM balancing areas would improve the market's accuracy. For both the CAISO and EIM balancing areas, the initiative would likely consider the use of "scheduling hubs" as representations of import and export sources and sinks in non-EDAM balancing authority areas, e-tagging or settlement rule refinements, and remapping congestion revenue rights to the new scheduling hubs.

9. External Resource Participation

The EIM entity communicates its bilateral imports/exports through hourly base schedules. The EDAM design will also need to accommodate bilaterally contracted imports and exports in the day-ahead market and rules around how bilaterally contracted external resources can help a balancing authority area pass its resource sufficiency evaluation will also need to be developed. Currently, resources not operating within EIM entity balancing authority areas, e.g. external resources, do not economically participate in the EIM. This initiative will also explore the rules needed for economic participation of external resources in EDAM.

10. Accounting for Greenhouse Gas Costs

The current EIM approach limits the potential attribution quantity to an EIM participating resource to the dispatch capability above its hourly base schedule. This limitation in the potential GHG awards sought to more accurately account for the emissions resulting from serving CAISO and SMUD load. Assuming no base schedules in EDAM, a different approach will be needed to determine which resources are serving load within a GHG compliance region. In addition, the current paradigm defines GHG compliance regions by balancing authority area. Since other states in the West are looking at potential GHG programs, this initiative will look to define GHG compliance regions based upon state boundaries. Ideally, different state GHG programs will be linkable at least within electric sector such that there is one GHG region versus multiple GHG regions with different but not linkable policies⁴.

In the EIM, the CAISO developed a mechanism to reflect GHG compliance costs within locational marginal prices for resources serving CAISO and SMUD load. Inside the CAISO and SMUD balancing authority areas, the price for energy includes the cost of GHG compliance. Outside the CAISO and SMUD, the energy price does not include GHG compliance costs when external resources are serving load outside CAISO and SMUD. However, external resources do receive a payment for GHG compliance costs when they are dispatched to serve CAISO and SMUD load. The market optimization can identify the price difference because resources outside the CAISO and SMUD balancing authority areas bid a

⁴ This was discussed at the June 18, 2019 EIM regional issues forum workshop. Material from the workshop is available at <https://www.westerneim.com/Pages/documentsbygroup.aspx?GroupID=F1A04C08-4619-4287-A00C-940A20CC6384>

GHG compliance cost adder separately from their energy bids. When dispatching resources to serve load outside the CAISO and SMUD, the market optimization considers only the energy bid. When dispatching resources to serve load inside the CAISO and SMUD, the market optimization considers the energy bid plus the GHG compliance cost adder.

In 2018, the CAISO improved the accuracy of the GHG attribution of the market optimization to address secondary dispatch. Secondary dispatch occurs when a resource is attributed to serve California load, but other resources have moved relative to their base schedule to support the EIM transfer. The enhancement built on the existing market design optimization algorithm. Specifically, the change limited EIM participating resources' GHG bid quantity to help mitigate and track the atmospheric effects of secondary dispatch. Under the approach, the resource's GHG bid quantity is limited to the MW value between the EIM participating resource's base schedule and the resource's upper economic level. By limiting the GHG bid quantity, the proposal reduced the potential magnitude of secondary dispatch which improved the accuracy of the market attribution. While this change reduced the amount of secondary dispatch, the enhancement did not eliminate the potential for secondary dispatch and other unintended effects on EIM entities that are using Asset Controlling Supplier for GHG accounting of non-EIM transactions⁵.

The GHG approach under EDAM must be reconsidered assuming there are no base schedules in the EDAM. As a result the total output of a non-California resource could be attributed to serving California load. The least cost dispatch will prioritize non-emitting resource for attribution because of their zero GHG bid cost. Since a new GHG approach is needed for EDAM, this will lead to corresponding changes to the EIM to maintain market design consistency between the day-ahead and real-time markets. It will be necessary to work with California ARB and other states to align the market design and carbon accounting rules.

Potential changes to consider under a new GHG market approach include, but are not limited to, the following:

- Is resource specific attribution and compliance obligation appropriate if there are no base schedules?
- Imports into CAISO, not through EIM transfers, have a GHG compliance obligation based on one of three alternative: (1) resource specific, (2) default emission rate, and (3) asset controlling supplier rate. Can this approach be leveraged to address EDAM transfers and EIM transfers?
- Are there approaches to identify which external resources are planned to support load in a sink balancing authority area? Can a similar approach to mapping external resource to a specific balancing authority in the EDAM as used in the resources sufficiency evaluation be leveraged?

⁵ See slides 10-12 from the Q1 19 briefing on western energy imbalance markets and benefits at <https://www.westerneim.com/Documents/BriefingonWesternEnergyImbalanceMarketandBenefits-Presentation-Jun2019.pdf>

- Should external resources that are contracted to a GHG compliance region still bid a GHG adder so that the resource can serve load outside the GHG region without including the GHG compliance cost?

As with the current GHG design, the accuracy of GHG accounting for compliance purposes must be weighed against market efficiency and implementation complexity. The goal is to find the right balance between efficient dispatch of emitting and non-emitting resources to serve load inside and outside a GHG compliance region while providing sufficiently accurate emissions accounting for the state carbon program to successfully meet its carbon reduction targets.

11. Convergence Bidding

The purpose of convergence bidding is to improve price convergence between the day-ahead market and the real-time 15-minute market. Convergence bidding is also known as virtual supply and virtual demand. Virtual supply that clears the day-ahead market is paid the day-ahead price and is then automatically charged the 15-minute market prices for the same hour. If day-ahead prices are higher than 15-minute market prices, virtual supply is profitable. Virtual demand that clears the day-ahead market is charged the day-ahead price and is then automatically paid the 15-minute prices. If day-ahead prices are lower than 15-minute market prices, the virtual demand is profitable. Scheduling coordinators can also bid virtual supply at one location and virtual demand at another location to seek to converge differences in congestion patterns between the day-ahead market and 15-minute market.

In the CAISO, convergence bidding is allowed at eligible internal nodes, trading hubs and load aggregation points. Convergence bidding is not allowed at intertie scheduling points. Scheduling coordinators that have been certified as convergence bidders can submit virtual supply and virtual demand bids into the day-ahead market. For the EDAM, it will be necessary to determine if convergence bidding is universal across the EDAM footprint or enabled by individual balancing authority areas. If allowed, additional consideration of eligible nodes and by whom convergence bids can be made in the EIM entity balancing authority areas will be needed.

12. Price Formation

In the EIM entities' September 16, 2019 letter to the CAISO Board of Governors and EIM Governing Body, it was requested that the CAISO review price formation. This is a broad ranging topic with relevant day-ahead and real-time markets products and pricing considerations. As marginal energy prices reduce due to increased amount of zero marginal cost resources it may be necessary that other operational attributes such as flexibility and other essential reliability services be valued and compensated. In addition, fast-start pricing and scarcity pricing are two other specific price formation topics that will be explored during EDAM stakeholder process

As discussed above, the day-ahead market enhancement initiative is evaluating the interaction between bid-in demand, virtual supply/demand, physical supply, CAISO net load forecast and imbalance reserves. The Financial + Forecast option of the market formulation that will be discussed in additional detail in a

forthcoming straw proposal. The price formation in this option results in different prices between physical supply and virtual supply because virtual supply does not provide reliability capacity which is needed to clear against the net load forecast. Additionally, the initiative will consider the appropriateness of demand curve for imbalance reserves or other relaxation parameters to trigger when meeting energy demand is a higher priority than holding imbalance reserves.

The CAISO is familiar with different price formation approaches in other ISOs/RTOs and is open to considering potential price formation enhancements, such as fast start pricing, for the EDAM and EIM. Fast-start pricing will, however, have complex interactions with other market design features that have evolved to explicitly price and compensate for other operational attributes, such as the flexible ramping product, and such interactions will need to be holistically considered.⁶

13. EDAM Administrative Fee

A similar approach to what has been used to develop the EIM administrative fee can be used for the EDAM administrative fee and will be reviewed in this process. The CAISO grid management charge is comprised of three components: market services, system operations and CRR services. The market services charge is then split into day-ahead market services and real-time market services. The system operations charges is then split into balancing authority services and real-time dispatch. Under the current EIM design, the EIM administrative fee includes the real-time market portion of the market services charge and the real-time dispatch portion of the system operations charge. These rates are charged to imbalances that are settled through the EIM.

This initiative will discuss how in EDAM, the full market services charge would be charged because both the day-ahead and real-time market services are provided. The system operations component would still only include the real-time dispatch portion. Since all load, generation, imports and exports are settled in the EDAM, the volume subject to the EDAM administrative fee will be then applied to all day-ahead and real-time settlement volume. Depending upon the approach for distributing day-ahead congestion revenues, the CRR services component may also apply in whole or part.

14. Review of Day-Ahead Settlement Charge Codes

It is anticipated that the day-ahead charge codes calculations listed in Appendix A will be impacted by this initiative. Settlements will calculate these charge code by balancing authority area and settle with the appropriate scheduling coordinator. Some of these charge codes will be assigned to EIM entity scheduling coordinators at which each balancing authority area will then need to make corresponding OATT changes through its stakeholder process to determine how to allocate to their customers. For each charge code, a brief description is provided and how the CAISO currently allocates the charge code

⁶ See CAISO's supplemental comments on the FERC fast-start pricing NOPR available at http://www.aiso.com/Documents/Aug18_2017_SupplementalComments-Fast-StartPricingNOPR_RM17-3.pdf

to its customers. The charge codes affected are grouped into three categories: EDAM Only, DAME and EDAM Joint, and Open Discussions.

15. Miscellaneous Items

This section will serve as a placeholder for miscellaneous items that will need to be considered in the stakeholder process. Currently, the CAISO has only identified Inter-SC Trades as a miscellaneous item but requests that stakeholder include in their written comments additional items that need to be consider in the EDAM initiative.

Inter-SC Trades - CAISO facilitates Inter-SC trades (IST) of energy, ancillary services, and IFM load uplift obligation through the settlement process. ISTs do not have any impact on the scheduling or dispatch of resources. They affect only the financial settlement process. Only trades that scheduling coordinators want to settle through CAISO are submitted in the IST process. All other trades are settled bilaterally between individual scheduling coordinators. The CAISO charges \$1.00 per IST to perform this service. ISTs currently are not a feature of the EIM, but may be a desired feature of EDAM.

16. Governance

As noted in Section 1 above, the EIM Governing Board and the CAISO Board of Governors have jointly established an EIM Governance Review Committee (GRC) that is charged with leading a public stakeholder process to develop proposed refinements to the current EIM governance. The GRC's role includes considering and developing any proposed changes to EIM governance that may be necessary for EDAM. The proposal would then be submitted to the EIM Governing Body and the CAISO Board of Governors for their consideration. The GRC will soon be commencing its stakeholder process, which will occur in parallel with this EDAM market design proceeding. Stakeholder comments on how the current EIM governance should evolve to accommodate EDAM should be made in the upcoming GRC initiative, rather than in this initiative.

17. Stakeholder Engagement and Next Steps

Stakeholder input is critical for developing market design policy. The schedule proposed below allows several opportunities for stakeholder involvement and feedback. Where there are public meetings, the CAISO will also try, where feasible, to align with other regional meetings, so as to minimize travel and overlap. We will need the assistance of stakeholders to keep us informed of any such opportunities or conflicts, all along the way.

17.1 Schedule

Table 1 lists the planned schedule for the EDAM stakeholder process. The proposed timeline is subject to change, in part based on stakeholder inputs or unforeseen complexities presented within the process. The CAISO will include the schedule, and any potential revisions, at each step in the process.

Table 1 : Proposed schedule for the EDAM stakeholder process

Item	Date
Post Issue Paper	October 10, 2019
Stakeholder Conference Call	October 17, 2019
Existing Day-Ahead Market Overview for Stakeholders	October 29, 2019
Existing Day-Ahead Market Overview for Stakeholders	November 12, 2019
Stakeholder Comments on Issue Paper Due	November 22, 2019
Flexible Ramping Product Enhancements Initiative	November 2019 – February 2020
Day-Ahead Market Enhancements Initiative Straw Proposal Posted	Late January 2020
Stakeholder Technical Workshop #1 ⁷ Transmission and CRRs	Early February 2020
Stakeholder Comments Due on Workshop #1	Middle February 2020
Stakeholder Technical Workshop #2 Resource Sufficiency Evaluation	Late February 2020
Stakeholder Comments Due on Workshop #2	Middle March 2020
Stakeholder Technical Workshop #3 Greenhouse Gas	Late March 2020
Stakeholder Comments Due on Workshop #3	Middle April 2020
Post Straw Proposal	Early June 2020
Stakeholder Meeting	Middle June 2020
Stakeholder Comments on Straw Proposal Due	Late June 2020
Post Revised Straw Proposal	Early August 2020
Stakeholder Conference Call	Middle August 2020
Stakeholder Comments on Revised Straw Proposal Due	Late August 2020
Post Draft Final Proposal	Early October 2020
Stakeholder Conference Call	Middle October 2020
Stakeholder Comments on Draft Final Proposal Due	Late October 2020
Start Tariff Stakeholder Process	Early December 2020

⁷ In the event, the material requires two days the workshop will be held on two consecutive days.

Start Development of Business Requirements Specification	Early December 2020
Post Final Proposal	Late February 2021
Stakeholder Conference Call	Early March 2021
Stakeholder Comments on Final Proposal Due	Middle March 2021
EIM Governing Body Meeting Approval	Q2 2021
Board of Governors Meeting Approval	Q2 2021

The ISO will discuss this issue paper during a stakeholder conference call on October 17, 2019. The ISO requests that stakeholders submit written comments by November 22, 2019 to InitiativeComments@caiso.com.

17.2 EIM Governing Body Role

The Charter for Energy Imbalance Market Governance (Charter) and the related Guidance for Handling Policy Initiatives within the Decisional Authority or Advisory Role of the EIM Governing Body (Guidance Document) require that the CAISO document in each policy paper CAISO management's tentative plan for obtaining approval to file tariff amendments to implement the proposal. This typically includes a tentative determination as to the role of the EIM Governing Body in that process, including whether the policy initiative, or portions of it, would fall within the EIM Governing Body's primary authority or advisory role as defined in the Charter and the Guidance Document.

Although it is unclear at this time exactly what rule changes will be needed to effectuate EDAM, many of the changes would involve revising the day-ahead market rules. Under the Charter and the Guidance Document, the EIM Governing Body's authority, whether primary authority or advisory, is focused on the real-time market rules and any generally applicable rules that apply to participation in all CAISO markets (such as credit policies and the like). Day-ahead market rules, by contrast, are not currently within the purview of the EIM Governing Body's primary authority or advisory role. Thus, absent any further action a large portion of the elements of this stakeholder initiative would be outside the EIM Governing Body's current authority to review.

Because EDAM is fundamentally about expanding the existing EIM to include an opportunity for day-ahead market participation, CAISO management believes it will be important for the EIM Governing Body to participate in the approval of all aspects of the proposed EDAM market design. Accordingly, CAISO management is proposing to request that the CAISO Board of Governors approve a one-time departure from the current decisional classification rules that would apply specifically to the process for approving the EDAM market design. In particular, management proposes to request that the CAISO Board of Governors direct the CAISO to bring all aspects of the proposed EDAM market design to both the EIM Governing Body and the CAISO Board of Governors for approval. Under this "joint authority"

construct, CAISO management would be able to move forward with tariff amendments to implement EDAM only if both the EIM Governing Body and the CAISO Board of Governors have approved the proposed market design.

The CAISO welcomes any comments from stakeholders on this initial proposal for approval of the EDAM market design.

18. Appendix A

Extended Day Ahead Market Only

* ISO Market Charge Code Number	ISO Market Charge Code Name	Current Methodology	Estimated Impact
491	Green House Gas Emission Cost Revenue	Payment to Participating SC as the sum of FMM and RTD GHG Obligation quantities and relevant GHG Price	Need to modify to account for incremental GHG Obligation from Day Ahead GHG Obligation
New	Day Ahead Green House Gas Emission Cost Revenue		Payment to Participating SC as the sum of IFM GHG Obligation quantities and relevant GHG Price
New	GMC EIM Day Ahead Transaction Charge		Charge to EIM Entity SC and Participating SC based upon Day Market Awards and Real Time Market Awards
4564	GMC-EIM Transaction Charge		Ensure SCs assessed GMC EIM Day Ahead Transaction Charge are not assessed this charge
6011	Day Ahead Energy, Congestion, Loss Settlement	Day-Ahead Energy schedule, including contract self-schedules; Congestion hedge for balanced contract quantity	Day Ahead Energy Settlement at LMP
new	Day Ahead Loss Offset		Day Ahead Energy offset allocation day ahead neutrality to EIM Entity based upon IFM MCL
new	Day Ahead Congestion Offset		Day Ahead Energy offset allocation day ahead neutrality to EIM Entity based upon IFM MCC (CRR?)
new	Day Ahead Energy Offset		Day Ahead Energy offset allocation day ahead neutrality to EIM Entity based upon IFM SMEC
6090	Ancillary Service Upward Neutrality Allocation	Pro-rata Positive Net Upward AS Obligation	Pro-rata Positive Net Upward AS Obligation by BAA
6100	Day Ahead Spinning Reserve Capacity Settlement	Awarded Spinning reserve capacity in the Day Ahead IFM market	Awarded Spinning reserve capacity in the Day Ahead IFM market by BAA

6124	No Pay Spinning Reserve Settlement	No Pay quantity	No Pay quantity by BAA
6170	Real Time Spinning Reserve Capacity Settlement	RT Awarded Spin Capacity	RT Awarded Spin Capacity by BAA
6194	Spinning Reserve Obligation Settlement	Net Spinning Reserve Obligation	Net Spinning Reserve Obligation by BAA
6196	Spinning Reserve Neutrality Allocation	Pro-rata Positive Spinning Obligation	Pro-rata Positive Spinning Obligation by BAA
6200	Day Ahead Non-Spinning Reserve Capacity Settlement	Awarded Non-Spinning reserve capacity in the Day Ahead market	Awarded Non-Spinning reserve capacity in the Day Ahead market by BAA
6224	No Pay Non-Spinning Reserve Settlement	No Pay quantity	No Pay quantity by BAA
6270	Real Time Non-Spinning Reserve Capacity Settlement	Awarded Non-Spinning reserve capacity in the Real-Time market	Awarded Non-Spinning reserve capacity in the Real-Time market by BAA
6294	Non-Spinning Reserve Obligation Settlement	The Net Non-Spinning Reserve Obligation	The Net Non-Spinning Reserve Obligation by BAA
6296	Non-Spinning Reserve Neutrality Allocation	Pro-rata Positive Non-Spinning Obligation	Pro-rata Positive Non-Spinning Obligation by BAA
6500	Day Ahead Regulation Up Capacity Settlement	DA Awarded Reg Up Bid Capacity	DA Awarded RegUp Bid Capacity by BAA
6524	Non Compliance Regulation Up Settlement	Charge for amount of unfulfilled regulation up capacity	Charge for amount of unfulfilled Regulation Up capacity by BAA
6570	Real Time Regulation Up Capacity Settlement	RT Awarded Reg Up Capacity	RT Awarded Reg Up Capacity by BAA
6594	Regulation Up Obligation Settlement	Regulation Up Net Obligation	Regulation Up Net Obligation by BAA
6596	Regulation Up Neutrality Allocation	Positive Regulation Up Obligation	Positive Regulation Up Obligation by BAA
6600	Day Ahead Regulation Down Capacity Settlement	DA Awarded RegDown BidCapacity	DA Awarded RegDown BidCapacity by BAA
6624	Non Compliance Regulation Down Settlement	Charge for amount of unfulfilled capacity	Charge for amount of unfulfilled capacity by BAA
New	IFM Bid Cost Recovery Settlement		Uplift payment to SCs of IFM Bid Cost Recovery by BAA

New	IFM EIM Bid Cost Recovery Allocation		Allocation of IFM Bid Cost Recovery to EIM Entity by BAA
6670	Real Time Regulation Down Capacity Settlement	RT Awarded Reg Down Capacity	RT Awarded Reg Down Capacity by BAA
6694	Regulation Down Obligation Settlement	Reg Down Oblig MW - Effective Qualified Self-Provision	Reg Down Oblig MW - Effective Qualified Self-Provision by BAA
6696	Regulation Down Neutrality Allocation	Pro-rata Positive Reg Down Obligation	Pro-rata Positive Reg Down Obligation by BAA
6800	Day Ahead Residual Unit Commitment (RUC) Availability Settlement	RUC Award	Terminated
6806	Day Ahead Residual Unit Commitment (RUC) Tier 1 Allocation	Net Negative Demand Deviations	Terminated
6807	Day Ahead Residual Unit Commitment (RUC) Tier 2 Allocation	Proportional to BA's Metered Demand	Terminated
6824	No Pay Residual Unit Commitment (RUC) Settlement	Amt of unavailable capacity	Terminated
7251	Regulation Up Mileage Payment	Regulation Up Mileage	Regulation Up Mileage by BAA
7256	Regulation Up Mileage Allocation	Allocation to Regulation Up Obligation Quantity	Regulation Up Obligation Quantity by BAA
7261	Regulation Down Mileage Payment	Regulation Down Mileage	Regulation Down Mileage by BAA
7266	Regulation Down Mileage Allocation	Allocation to Regulation Down Obligation Quantity	Regulation Down Obligation Quantity by BAA

DAME and EDAM Joint

* ISO Market Charge Code Number	ISO Market Charge Code Name	Estimated Impact
new	Imbalance Reserve Product	DAME: Configure new Charge Code EDAM: Expand the charge code to include EIM BAAs
new	Imbalance Reserve Allocation	DAME: Configure new Charge Code EDAM: Expand the charge code to include EIM BAAs
new	Imbalance Reserve Non-Compliance	DAME: Configure new Charge Code EDAM: Expand the charge code to include EIM BAAs

new	Reliability Energy Settlement	DAME: Configure new Charge Code EDAM: Expand the charge code to include EIM BAAs
new	Reliability Energy Allocation	DAME: Configure new Charge Code EDAM: Expand the charge code to include EIM BAAs
6630	IFM Bid Cost Recovery Settlement	DAME: Include Imbalance Reserve Capacity and REN in IFM BCR calculations EDAM: Extend to EIM BAAs (New CC?)

Open Discussions		
* ISO Market Charge Code Number	ISO Market Charge Code Name	Estimated Impact
4516	GMC CRR Transaction Fee	Open discussion if CRRs are extended to EIM Areas
4562	GMC CRR Services Charge	Are we allowing CRR in EDAM
6013	Convergence Bidding DA Energy, Congestion, Loss Settlement	Applies if extended to EIM BAA
6455	Interties Schedules Declined Charge	Applies if extended to EIM BAA
6457	Interties Schedules Declined Allocation	Applies if extended to EIM BAA
6473	Real Time Convergence Energy Settlement	Applies if extended to EIM BAA
6700	CRR Hourly Settlement	Should CRR1B include REN Congestion in CRR Payment/ CRR offered in EIM BAA?
6701	Monthly CRR True-up	CRR offered in EIM BAA?
6706	Monthly CRRBA Clearing	CRR offered in EIM BAA?
6710	Day Ahead Congestion - AS Spinning Reserve Import Settlement	Ancillary Services EIM Intertie?
6715	Real Time Congestion - AS Spinning Reserve Import Settlement	Ancillary Services EIM Intertie?
6720	Day Ahead Congestion - AS Non-Spinning Reserve Import Settlement	Ancillary Services EIM Intertie?
6722	CRR Prepayment Settlement	CRR offered in EIM BAA?
6725	Real Time Congestion - AS Non-Spinning Reserve Import Settlement	Ancillary Services EIM Intertie?
6727	CRR Prepayment Remainder Allocation	CRR offered in EIM BAA?
6728	CRR Monthly Clearing	CRR offered in EIM BAA?

6750	Day Ahead Congestion - AS Regulation Up Import Settlement	Ancillary Services EIM Intertie?
6755	Real Time Congestion - AS Regulation Up Import Settlement	Ancillary Services EIM Intertie?
6760	Day Ahead Congestion - AS Regulation Down Export Settlement	Ancillary Services EIM Intertie?
6765	Real Time Congestion - AS Regulation Down Import Settlement	Ancillary Services EIM Intertie?
6790	CRR Balancing Account	CRR offered in EIM BAA?
6791	CRRBA Accrued Interest Allocation	CRR offered in EIM BAA?
6798	CRR Auction Transaction Settlement	CRR offered in EIM BAA?
6799	CRR Auction Collateral Credit Settlement	CRR offered in EIM BAA?