



Intertie Deviation Settlement

Draft Final Proposal

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1. Purpose

The purpose of this initiative is to incentivize delivery of awarded energy on interties to improve operational awareness and grid reliability. Intertie resources that do not meet their cleared market schedules cause impacts on market pricing and grid stability. The *Intertie Deviation Settlement* initiative will analyze the existing Intertie Decline Charge and ultimately propose a new settlement methodology for undelivered intertie resources. The desired outcome of this initiative is to provide economic incentives for the delivery of intertie resources. The ISO expects this initiative to lead to more accurate estimates of the net scheduled interchange, increased grid reliability, and accurate market pricing.

What is the problem we aim to solve? When market participants fail to deliver intertie resources, grid operators and the ISO markets face operational challenges that can result in high prices, manual processes, and sub-optimal market solutions. The ISO's *Intertie Deviation Settlement* initiative aims to reduce the amount of declined and undelivered intertie resources.

What expectations guide our decision making? The primary objective of the ISO as a balancing authority operator is to maintain operational reliability of the bulk electric grid. The ISO's security constrained economic dispatch allows for optimal dispatch of resources to serve load across the balancing authority area. Accurate pricing signals are critical to provide economic incentive to participants in the ISO markets.

1.1 Response to Stakeholder Comments

The ISO appreciated stakeholder comments in response to the *Intertie Deviation Settlement* straw proposal. In the previous proposal, the ISO presented data identifying large quantities of undelivered import resources. Stakeholders recognize that undelivered import and export intertie resources are having a detrimental impact on market pricing and grid stability and therefore are generally supportive of the proposed under/over delivery charge.

This proposal includes the following changes from the previous straw proposal:

- The under/over delivery charge will be determined based on the greater of the FMM or RTD price.
- In the straw proposal, the ISO proposed a firm T-40 real-time E-Tagging deadline. Due to seams issues that were identified, the ISO is no longer proposing to implement a real-time E-Tagging deadline of T-40. Instead, the ISO's business practice manual will identify that an E-Tag with a transmission profile should be submitted prior to T-40 and the ISO expects proposed fifteen-minute market logic will incentivize submission of the E-Tag transmission profile by T-40. This

update will allow scheduling coordinators flexibility to update the energy profile on E-Tags as needed until T-20.

- In the previous straw proposal, the ISO suggested logic to determine the amount of undelivered energy for bids electing the fifteen-minute dispatchable option. This logic proposed to compare the fifteen-minute award to the final E-Tag. After further consideration, the ISO is proposing to determine the amount of underlived energy for bids electing the fifteen-minute dispatchable option by comparing the E-Tag transmission profile to the HASP schedule.
- In order to apply the under/over delivery charge at the price of the corresponding interval, the ISO will need to receive 15-minute energy and transmission profile information for OATI.
- The ISO is clarifying its authority to curtail hourly block resources for intervals in which the E-Tag energy profile is greater than the corresponding market award. This is necessary to ensure scheduling limits are not exceeded and the ISO adheres to industry standards.
- A floor of \$10/MWh will ensure a charge is still applied even when pricing is low or negative. This aligns with the floor used in the existing decline charge. This change is proposed based on stakeholder feedback; the previous proposal suggested a floor of \$0.
- The straw proposal suggested allowing ISO operators to permit the flow of energy when E-Tag energy profiles exceeded the accepted market schedule. The ISO has recognized negative impacts of this concept and therefore is removing this from the proposal. As is done today, the ISO operators will not permit the flow of energy when E-Tags are greater than the accepted award.
- Currently, the ISO business practice manuals allow scheduling coordinators to accept, partially accept, or decline awards in the automated dispatch system for up to 5-minute after the publication of the hour ahead scheduling process results. In order to provide more flexibility to scheduling coordinators, the ISO is proposing to allow scheduling coordinators to accept, partially accept, or decline awards in the ADS system until T-45.
- In the previous straw proposal, the ISO suggested a business rule to address the operational impacts that occur when a declined export resource results in the over scheduling of an intertie in the import direction. The ISO has removed this business practice from the draft final proposal because it cannot be successfully implemented. The reasons for this change are described in [Section 7.11](#).

In addition to the changes proposed above, the ISO has added clarifications to the following topics: E-Tag curtailments versus adjustments; rationale for use of the transmission profile to determine the fifteen-minute market award for hourly block resources; clarification of rules for the Hour-Ahead Scheduling Process (HASP) reversal rule; and, additional data analysis supporting the need for the over/under delivery charge.

Stakeholder comments that are outside of the scope of this proposal are addressed in [Section 8](#).

2. References

The following documents are referenced throughout the document and can be found at the respective links.

Intertie Deviation Settlement stakeholder page:

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

Business Practice Manual (BPM) for Market Operations:

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

Settlements and Billing BPM Configuration Guide Charge Code 6455 Intertie Schedules Decline Charges:

https://bpmcm.caiso.com/BPM%20Document%20Library/Settlements%20and%20Billing/Configuration%20Guides/HASP-RT/BPM%20-%20CG%20CC%206455%20Intertie%20Schedules%20Decline%20Charges_5.9.doc

Settlements and Billing BPM Configuration Guide Charge Code 6457 Intertie Schedules Decline Charges Allocation:

https://bpmcm.caiso.com/BPM%20Document%20Library/Settlements%20and%20Billing/Configuration%20Guides/HASP-RT/BPM%20-%20CG%20CC%206457%20Intertie%20Schedules%20Decline%20Charges%20Allocation_5.1a.doc

Declined Predispatched Intertie Bids – White Paper, 2007:

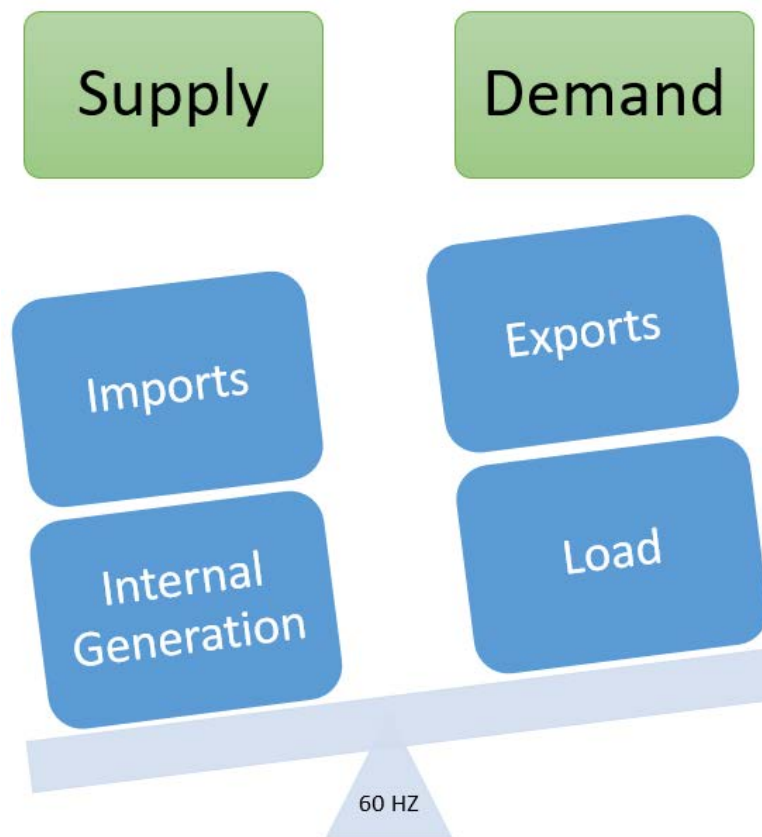
<http://www.caiso.com/Pages/documentsbygroup.aspx?GroupID=561FB99F-13BA-4B61-93EC-FAA77D134A55>

3. Background

It is the responsibility of the ISO to ensure there is enough energy supply to meet load across the balancing authority area footprint. Maintaining the balance between supply and demand will ensure stability of the bulk electric grid.

Internal supply sources and interchange, which is energy imported and exported across interties, are used to balance load across the ISO's balancing authority area. An intertie is an interconnection permitting the flow of electric power (current) between two or more balancing authority areas. **Figure 1** illustrates how a grid operator must ensure there is adequate supply to serve demand and maintain reliability.

Figure 1: Supply and demand must be balanced to maintain a grid stability. Supply is composed of internal generation and interchange (imports/exports).¹



When an intertie resource receives a market award to import energy into the balancing authority area but does not deliver the awarded energy, the grid operator must maintain system balance by increasing internal supply or finding another intertie resource to replace the undelivered energy.

¹ Internal generation includes any supply source internal to the ISO balancing authority area and includes demand response or other energy sources that do not require rotating mass.

3.1 Interties, Market Timing, and E-Tagging

Intertie resources can submit bids and receive energy awards in both the day-ahead and real-time markets. Because intertie resources can submit bids indicating a price at which they are willing to buy or sell energy, the CAISO market design assumes intertie resources that are scheduled in the day-ahead and real-time market will accept the schedule and deliver the energy.

An intertie resource is formally defined as a **system resource**, which is a group of resources, single resource, or portion of a resource located outside of the CAISO balancing authority area. System resources are categorized as dynamic or non-dynamic. A **dynamic system resource** is a type of system resource that is tied to a specific generator and has contractual agreements to respond to CAISO market dispatches every 5 minutes in the real-time dispatch. A **non-dynamic system resource** is a system resource that is not capable of submitting a dynamic schedule. It may be a collection of resources and not necessarily tied to a specific generator. Non-Dynamic System Resources are not capable of responding to 5-minute dispatches and instead participate in the ISO's real-time 15-minute market.

Henceforth, this paper will use the term *intertie resource* instead of *system resource*. Additionally, for clarification purposes, when this paper uses the term *intertie resources*, it refers to non-dynamic system resources because dynamic resources are excluded from the Decline Charge policy on the rationale that those resources behave similar to internal generators.

Scheduling Coordinators can elect one of several bid options for intertie resources. Intertie resources that are statically scheduled into the ISO (non-dynamic system resources) can bid using the following options²:

Self-scheduled hourly block. An intertie resource bid that is a price taker. A self-scheduled hourly block will be awarded in the hour-ahead scheduling process and settle at the fifteen-minute market locational marginal price. The schedule must remain constant throughout the operating hour and is unable to be dispatched on a fifteen minute basis.

Economic hourly block. An intertie resource bid that specifies a price. The economic hourly block intertie resource will only clear if the bid is economic in relation to the locational marginal price in the hour-ahead scheduling process. The schedule must remain constant throughout the operating hour and is unable to be dispatched on a fifteen minute basis. The schedule is a price taker in the fifteen-minute market and thus settles at the fifteen-minute market price.

² Additional information can be found in the BPM for Market Operations section 7.6.3.2: Treatment of System Resources.

Economic hourly block with intra-hour option. An intertie resource bid that specifies a price. The economic hourly block intertie resource will only clear if the bid is economic in relation to the locational marginal price for the balance of the operating hour. The schedule can only change one time during the operating hour. If the schedule is changed intra-hour, the resource becomes a price taker for the balance of the hour and is settled at the fifteen-minute market locational marginal price.

Economic. An intertie resource bid that specifies a price. The economic hourly block intertie resource will only clear if the bid is economic in relation to the locational marginal price. The schedule can change every fifteen-minute interval as scheduled by the fifteen-minute market.

Economic variable energy resource. A variable energy resource that is economically bid as an intertie resource. The variable energy resource submits a forecast into the scheduling infrastructure and business rules (SIBR) application. The forecast is used to determine the maximum amount that the resource can be scheduled to. The economic variable energy resource schedule can change every fifteen-minute interval as scheduled by the fifteen-minute market.

Market schedules are published at the top of the scheduling hour when a scheduling coordinator bids into the real-time market using the hourly block or intra-hour change option.³ The dispatch is published in the CAISO market results interface (CMRI) application and the automated dispatch system (ADS).⁴ Once the award is published, the scheduling coordinator has approximately five minutes to “accept”, “partially accept”, or “decline” the award. Once the award has been accepted, partially accepted, or declined, the new amount is reflected as the *automated dispatch system accepted value*.

Accept means the award is fully accepted at dispatched value.

Partially accept means the award is accepted at a value below the day-ahead and/or hour-ahead scheduling process award.

Declined means the market award is fully declined and 0 MW will be delivered.⁵

³ Here forward, the term “hourly block” will be inclusive of the intra-hour change option.

⁴ The scheduling hour is defined as the hour prior to the operating hour. For example, if the operating hour ends at 10:00AM (also known as HE10, which corresponds to 9:00AM – 10:00AM), the scheduling hour will end at 9:00AM (also known as HE9, which corresponds to 8:00AM – 9:00AM).

⁵ For the purpose of this paper, the term “decline” is inclusive of “partially accept” unless specified differently. Generally, the term “decline” refers to a scheduling coordinator not fully accepting an award in the automated dispatch system.

Figure 2: Examples for hourly block resources that accept, partially accept, and decline awards in the automated dispatch system.

Day-ahead market award	Hour-ahead scheduling process instruction	Hour-ahead scheduling process award	Scheduling coordinator action	Automated dispatch system accepted value
150 MW	No change	150 MW	Accept	150 MW
150 MW	+ 50 MW (INC)	200 MW	Accept	200 MW
150 MW	- 50 MW (DEC)	100 MW	Partially accept	125 MW
150 MW	+ 50 MW (INC)	200 MW	Partially accept	175 MW
150 MW	- 100 MW (DEC)	50 MW	Decline	0 MW

During the five-minute window, the scheduling coordinator accepts, partially accepts, or declines, the award in the automated dispatch system. If the scheduling coordinator does not respond to the dispatch, the award is automatically accepted at the end of the five-minute window. The scheduling coordinator can call the ISO operator and request the award be manually changed up until T-40.⁶ The scheduling coordinator is then responsible to submit an E-Tag to serve as confirmation of the transaction.

Information contained on an E-Tag is like a receipt. It shows the scheduled energy (in MWs) that a scheduling coordinator agrees to deliver for a specified duration of time. Additionally, an E-Tag contains a contract path detailing how energy will be delivered to a specified location based on transmission purchased by the scheduling coordinator. For example, an E-Tag may depict a 100 MW transaction, sourcing in BPA and sinking in CAISO across the MALIN500 intertie for HE10. In this example, the E-Tag has an energy profile of 100 MW to match the ISO market award; it also has a transmission profile of at least 100 MW to indicate the scheduling coordinator has procured transmission to accommodate the energy transfer. Grid operators verify the scheduling coordinator's E-Tag information to ensure the scheduled energy matches the awarded energy.

The ISO's *Business Practice Manual for Market Operations* states an E-Tag must be submitted before T-20 (20 minutes prior to the operating hour).⁷ This requirement is set forth by the North American Energy Standards Board (NAESB). However, the ISO's fifteen-minute market runs 37.5 minutes prior to the operating hour to determine the final market award. Consequently, it is ideal for hourly block E-Tags to be submitted at T-40 because E-Tag data is used as a market input. This allows time for the hourly block E-Tag to be received and processed in advance of the market run. For intertie resources that submit economic bids that can be scheduled in the fifteen-minute market, the E-Tags must be submitted prior

⁶ Reference the CAISO *Business Practice Manual for Market Operations*, Section 7.8.3.1.3: *ADS Decline Functionality for Non-Dynamic System Resource Instruction*.

⁷ The CAISO *Business Practice Manual for Market Operations* requires E-Tags be submitted no later than 20 minutes prior to the operating interval (T-20). This is in accordance with the E-Tagging specifications maintained by the NAESB. Reference the *Business Practice Manual for Market Operations*, Section 8 - *Tagging* for additional information.

to T-40 with a transmission profile that supports the intertie resources bid range. The market uses the transmission profile from the E-Tag to ensure the resource is not scheduled above the lowest external transmission path outside the CAISO.

The ISO receives E-Tags through its interchange transaction scheduler (ITS) system. The ITS system produces a receipt of E-Tags and allows ISO operators to calculate the net scheduled interchange and verify scheduling limits are not exceeded for the upcoming operating hour. The net scheduled interchange feeds directly into the area control error (ACE), which measures how well the balancing authority area is balancing load and supply. NERC standards are in place to ensure the area control error is appropriately controlled. Therefore, the net scheduled interchange (the total of all E-Tags) is a critical component in maintaining balance between supply and demand and adhering to NERC standards.

3.2 Declined Award

The ISO expects scheduling coordinators to accept hour-ahead scheduling process awards. Scheduling coordinators submit bids, and if the market clears at a price in which the bid is awarded, it is assumed the schedule should be accepted. A submitted bid should be a firm offer to deliver the offered energy at the bid price.

Occasionally, conditions prohibit a scheduling coordinator from delivering awarded energy such as transmission outages, generation outages, or occasionally economic considerations. When those instances occur, the business practice manual requires the scheduling coordinator to notify the ISO of the un-deliverable energy. Intertie declines are critical information for the ISO operator as they provide additional time for operations to resolve system balance. Scheduling coordinators may notify the ISO through the automated dispatch system or by a phone call to the ISO operator before T-40. When the scheduling coordinator notifies the ISO of the intertie decline in advance, it is more likely that the 15-minute market will have adequate time to economically schedule and/or commit replacement energy. However, insufficient notice of the intertie decline will leave the replacement energy to be resolved by the 5-minute real-time dispatch which does not have the ability to commit additional resources if needed.

Let's assume the following example:

Net scheduled interchange as awarded by the hour-ahead scheduling process = 5,000 MW

Awards accepted by scheduling coordinators = 4,500 MW

Awards declined by scheduling coordinators = 500 MW

Net scheduled interchange used as an input to the fifteen-minute market = 4,500 MW

In this scenario, the scheduling coordinator declined 500 MW at the beginning of the scheduling hour. This enabled the fifteen-minute market to recognize the 500 MW shortage and economically schedule and/or commit additional resources to make up for the discrepancy. Additionally, the balancing authority area operator had adequate time to manually dispatch resources, if necessary.

Intertie declines, particularly when they involve especially large MW values or multiple concurrent declines from multiple scheduling coordinators, can cause significant operational and reliability problems. Additionally, when a scheduling coordinator accepts an energy award but does not submit an E-Tag there are additional market inefficiencies and operational concerns.

3.3 Undelivered Energy (no E-Tag)

When energy on the interties cannot be delivered, scheduling coordinators should notify the ISO with as much notice as possible. However, not all scheduling coordinators follow the ISO's best practice of declining hourly block intertie awards by T-40. Occasionally, scheduling coordinators do not take action when awards are published in the automated dispatch system – this results in the award being auto-accepted on behalf of the scheduling coordinator. In turn, the market assumes the energy will be delivered.

Let's assume a second example:

Net scheduled interchange as awarded by the hour-ahead scheduling process = 5,000 MW

Awards accepted by scheduling coordinators = 4,500 MW

Awards *automatically* accepted by the automated dispatch system = 500 MW

Net scheduled interchange used as an input to the fifteen-minute market = 5,000 MW

In this scenario, the automated dispatch system automatically accepted 500 MW on behalf of the scheduling coordinator. However, the scheduling coordinator is unable to deliver the energy and did not submit an E-Tag. When this occurs, the fifteen-minute market assumes 5,000 MW will be delivered on the interties because a total of 5,000 MW shows as accepted in automated dispatch system. In reality, only 4,500 MW will be delivered. The undelivered intertie energy (no E-Tag) won't be recognized in the market until the real-time dispatch 5-minute market run.⁸

⁸ The fifteen-minute market will recognize the shortage during the third and fourth intervals of the operating hour. The market timing is discussed more in Section 5.2: Intertie Declines Examples.

Undelivered energy (no E-Tag) on the interties can have serious negative impacts on grid reliability. Once the grid operator recognizes the shortage, the operator is unable to schedule additional energy on the interties due to the NAESB E-Tagging timeline of T-20. It is also too late to manually schedule energy on the interties.⁹ The real-time dispatch will recognize the shortage and dispatch energy, but cannot commit additional resources. As a result, the energy may be expensive or unavailable without emergency actions and could even lead to capacity procurement mechanism (CPM) designations.

For example, if an intertie resource under-delivers by 250 MW, the fifteen-minute market has already run and thus cannot account for this energy. Therefore, the real-time dispatch must dispatch an additional 250 MW. Assuming there are limited internal supply resources available, pricing may increase in order to accommodate the need for an additional 250 MW. Therefore, the 250 MW intertie shortage directly affected pricing throughout the real-time market.

Figure 3: Difference between Intertie Decline and No E-Tag.

Name	Description	Impact
Intertie decline (or partially accept)	Energy award is declined in the automated dispatch system or via phone call before T-40	The grid operator is aware the energy will not be delivered and likely has adequate time to economically schedule and/or commit additional energy through the market systems or an exceptional dispatch.
No E-Tag	Energy award is accepted but not delivered in real time	The grid operator is <u>un</u> aware the energy will not be delivered until T-20. This energy shortage at the beginning of the ramp for the corresponding interval leaves the operator an extremely limited time to respond and there is potentially very limited resources available for dispatch. This may lead to CPM.

In summary, the ISO expects all awards be delivered and finds it optimal if there are no intertie declines at all. However, if the full dispatch cannot be delivered, it is better for scheduling coordinators to notify the ISO by T-40. When an award is accepted but an E-Tag is not submitted, there are challenges for the ISO operator and the market.

⁹ Exceptional dispatches on the interties must occur with enough time for the ISO operator to make verbal agreement and the scheduling coordinator to submit an E-Tag.

4. Issue Paper: Decline Charge Policy is Outdated

4.1 Current Decline Charge

In spring of 2007, the ISO experienced an unusually high amount of declines, which led the ISO's Department of Market Monitoring (DMM) to analyze the issue. DMM concluded that bidding behavior may have contributed to the spring event. ISO Management then determined the ISO's current tariff provisions did not provide clear guidance on expected bidding behavior or consequences for undelivered import or export bids. Consequently, the ISO conducted the *Charge for Undelivered Import or Export Bids* stakeholder initiative to make tariff provisions clearer.

The ISO determined with stakeholders that a financial charge for declines would discourage excessive declines of pre-dispatched real-time bids from imports and exports. However, because unpredictable events may occur, the decline charge only applies if the scheduling coordinator fails to deliver 10% or more of total intertie transactions (in the import and export directions separately) or 300 MWh, whichever is greater. The total undelivered value is calculated in MWh over the course of a month to determine if the 10% threshold (or 300 MWh, whichever is greater) has been exceeded. If intertie declines are less than 10% of total transactions, no charge applies. If intertie declines are greater than or equal to 10% of total transactions, the market participant is subject to the decline charge. The decline charge is equal to is the maximum of \$10.00 or 50% of the fifteen-minute market locational marginal price per MW that exceeds the 10% threshold.

At the time the policy was implemented, ISO settlement system had no way to distinguish between an intertie decline and a reliability curtailment. It only had visibility to the hour-ahead schedule process schedules and final E-Tag values. Therefore, the total amount of "declines" could have also included E-Tags that were curtailed for reliability reasons – curtailments that were not the fault of the market participant but still counted towards the decline charge. This contributed to the need to have a threshold to determine if the decline charge should apply or not.

At the time the original policy was developed, there was "widespread agreement that there should be a mechanism that discourages market participants from submitting bids that they do not have a reasonable expectation of delivering".¹⁰ Stakeholders disagreed on how the ISO would define "reasonable" through the threshold amount. Some stakeholders criticized the 10% threshold as being too high. They argued a 10% threshold would open the door for speculative behavior and reliability concerns from scheduling coordinators who were currently at a 5% decline threshold. Any threshold above 5%, they argued, would incentivize scheduling coordinators to decline more and negate the intent of the ISO's policy.

¹⁰ Declined Predispatched Intertie Bids – White Paper, 2007:
<http://www.caiso.com/Pages/documentsbygroup.aspx?GroupID=561FB99F-13BA-4B61-93EC-FAA77D134A55>

The ISO ultimately decided to use a 10% threshold because it would provide scheduling coordinators sufficient “headroom” to remain below the threshold if conditions outside their control arose.¹¹ It would be the responsibility for the market participant to track monthly their declines and remain below the threshold. Ultimately, the policy balanced limiting the number of declines and ensuring sufficient energy bids were available for reliability.

4.2 FERC Order 764 Impacts

Historically, interchange (imports and exports) bids were scheduled by ISO/RTO’s on an hourly basis. The Federal Energy Regulatory Commission (FERC) issued Order No. 764, which required all public utilities to revise their open access transmission tariffs to include the option of using intra-hour transmission scheduling at 15-minute intervals. The requirement to implement 15-minute transmission scheduling only applied to intertie transactions in organized wholesale energy markets. The California ISO implemented this requirement through the initiative, *FERC Order No. 764 Market Changes*. This initiative also introduced binding 15-minute scheduling and settlement for both internal and intertie resources.

As a result of the *FERC Order No. 764 Market Changes* initiative, the hour-ahead scheduling process no longer determines financially binding locational marginal prices. Prior to Order 764 implementation the hour-ahead scheduling process was binding because it produced a single schedule and a single price for the entire hour. With FERC 764, hourly pricing was eliminated. Now, the ISO produces prices for each 15-minute interval.

To accommodate intertie resources that cannot change schedules every 15-minutes, the ISO created an “hourly block” option. This allows intertie resources to keep the same schedule for all four 15-minute intervals. However, the schedule will be individually settled at the fifteen-minute market price for each interval.

At the time of the FERC 764 implementation, the ISO determined no changes to the decline charge were necessary. Since then, the ISO has recognized impacts of undelivered interties. Specifically, the ISO has identified that scheduling coordinators are not delivering awarded energy (no submission of an E-Tag) instead of declining awards at the beginning of the scheduling hour. The ISO analyzed the available data to understand the magnitude and impact of undelivered intertie resources. The analysis can be found in [Section 5: Impact of Intertie Declines](#).

4.3 Energy Imbalance Market

The energy imbalance market (EIM) design does not include intertie bidding. Therefore, EIM is not subject to the decline charge. Reviewing and assessing EIM’s current policy for intertie bidding is outside the scope of this initiative.

¹¹ See *Cal. Indep. Sys. Operator Corp.*, Transmittal Letter to Tariff Amendment to (Both Current and MRTU) to Implement a Charge for Undelivered Import or Export Bids, Docket No. ER8-628-000 (February 29, 2008) at p. 6.

5. Impact of Undelivered Intertie Resources

This section quantifies the magnitude of undelivered intertie schedules. Additionally, this section provides examples that explain the operational and settlement impacts of no E-Tag submitted as opposed to declined awards by T-40.

Please note, these examples have been simplified for illustrative purposes. The full settlement of an hourly-block intertie resource and the applicable decline charge (charge code 6455) is included in Appendix A.

5.1 Operational Impacts of Intertie Declines

As explained in [Section 3: Background](#), undelivered energy caused by the failure to submit an E-Tag has more significant operational impacts than declining an award in the automated dispatch system prior to the fifteen-minute market run.

Envision the following scenario:

A scheduling coordinator bids into the ISO's real-time market and receives a 500 MW award through the hour-ahead scheduling process. The scheduling coordinator does not take action when the schedule is first published and a 500 MW award is automatically accepted by the automated dispatch system. Later in the scheduling hour, the scheduling coordinator decides not to deliver the awarded energy due to economic considerations. Although the award was accepted, the scheduling coordinator does not submit an E-Tag. At this point, the ISO is still anticipating delivery of 500 MW across the interties and will not recognize the shortage until after T-20. At that point, it is too late for the fifteen-minute market to schedule additional energy on the interties. Instead, regardless of cost, the five-minute market must dispatch 500 MW of supply.

It is a significant operational burden when E-Tags are not submitted for awarded energy on the interties. Operators would prefer to receive advanced notification of the decline **before** T-40 because it would allow operators to schedule additional energy.

This paper focuses on the decline and/or failure to deliver awarded import awards on the interties. The ISO is a net importer, and therefore the decline of imports is more common than the decline of exports. However, it is important to note that the decline and/or failure to deliver awarded export awards can impact the ISO as well. When an export award is declined, the ISO ends up with more energy than the market awarded. Export declines can result in decreased prices, which makes it more expensive to dispatch internal generation down in the real-time dispatch.

5.2 Intertie Declines Examples

The ISO always expects hour-ahead scheduling process awards will be accepted. This is the best outcome for operators and the market. However, if an award cannot be delivered, there is operational benefit in having advance notification of the intertie decline. That being said, based on the current decline charge, there is an economic incentive not to provide advance notification of undeliverable energy on the interties.

Since the FERC 764 implementation, the decline charge is more severe when a scheduling coordinator declines an award in advance as opposed to not submitting an E-Tag. This settlement consequence contradicts the ISO's best practice of declining awards in advance to improve situational awareness for the operators as well as improve market outcomes. Additionally, an E-Tag that is curtailed for reliability reasons has the same impact as not delivering an E-Tag even though the scheduling coordinator is not at fault for the discrepancy. These concepts are explained further in the examples below.

5.3 Definitions

The following terms have been defined as they relate to intertie transaction, the settlement of intertie transactions, and the decline charge.

Figure 4: Settlement terms in relation to declined or undelivered intertie resources and the decline charge.

Term	Acronym	Definition
Total Expected Energy	TEE	Final dispatch instruction. For intertie resources, this is typically the fifteen-minute market binding award. ¹²
Instructed Imbalance Energy	IIE	Instructed change between market runs. For interties, this may be the difference between day-ahead and fifteen-minute market awards.
Uninstructed Imbalance Energy	UIE	Uninstructed deviation from the real-time market dispatch. Compares the meter value (what was delivered) to the total expected energy (final dispatch instruction). <u>Interties do not have metered values, therefore there is no uninstructed imbalance energy for generic intertie system resources.</u> ¹³

¹² If an intertie resource is exceptionally dispatched, the TEE will be the exceptional dispatch instruction instead of the FMM binding award.

¹³ Dynamic intertie resources are tied to metered data and therefore are settled for UIE.

Operational Adjustment	OA	Comparison of the E-Tag's final energy profile to the total expected energy. ¹⁴
Fifteen-Minute Market Undelivered Quantity		Difference between hour-ahead scheduling process and fifteen-minute market schedules that are not the result of an economic dispatch. ¹⁵
Decline Charge		A charge applied to scheduling coordinators if the total fifteen-minute market undelivered quantity over the course of the month exceeds 10% of total intertie transactions for the corresponding month.
Hour-Ahead Scheduling Process Reversal Rule		A settlement applied if the E-Tag energy profile at T-45 does not match the corresponding day-ahead market award. This is intended to prevent implicit virtual bidding on the interties and incentivize scheduling coordinators to tag day-ahead market awards prior to the hour ahead scheduling process.

5.4 Market Timing & Logic

Day-ahead market awards are published at approximately 1PM Pacific Prevailing Time (PPT) prior to the trade date. Day-ahead awards are used in the real-time market optimization; therefore, it is critical that scheduling coordinators submit an E-Tag to match their market award. Market awards that are not tagged by T-45 (45 minutes prior to the operating hour) will be subject to the hour-ahead scheduling process (HASP) clawback. The HASP clawback ensures that day-ahead awards that are bought back in the HASP are backed by physical resources; it is intended to prevent virtual bidding on the interties.

Hour-ahead scheduling process awards are published at the top of the scheduling hour. It is expected that energy awarded in the hour-ahead scheduling process will be accepted by the scheduling coordinator. If the scheduling coordinator is unable to deliver the scheduled value, it is his responsibility to partially accept or decline the award in the automated dispatch system. The accepted award is used as an input to the fifteen-minute market. This value is used to clear the fifteen-minute market and determine the appropriate award, which is used for settlement purposes. The fifteen-minute market runs approximately 37.5 minutes prior to the corresponding interval and the results are published approximately 10 minutes after the market run starts.

The fifteen-minute market uses the following logic to determine awards for hourly block intertie resources. It assumes market participants will deliver what has been accepted in the automated

¹⁴ OA is settled under IIE. Even though the E-Tag may differ from the FMM instruction at the fault of the scheduling coordinator (could be considered "uninstructed"), there was originally no way to distinguish between instructed and uninstructed changes. Because an E-Tag may be curtailed for reliability reasons by the grid operator, the ISO elected to categorize OA as Instructed Imbalance Energy.

¹⁵ For economic hourly blocks, clearing HASP is economic over the hour. Therefore, any changes that result in the FMM are due to tagging changes and are considered the Undelivered Quantity.

dispatch system for the first two intervals of the operating hour. (The E-Tag deadline twenty minutes prior to the operating hour is too late for this E-Tag information to be incorporated into the first two intervals). The ADS accepted schedule will become the binding award for interval 1 & 2. For the last two intervals of the operating hour, scheduling coordinators cannot make E-Tag changes. Therefore, the E-Tag value will become the binding award for interval 3 & 4.

Figure 5: Market logic used to determine awards for hourly block intertie resources.¹⁶

FMM Binding Interval of Operating Hour	Time of Operating Hour	RTPD # ¹⁷	Logic Used to Determine Binding Award
1	00 – 15	5	ADS Accepted Award
2	15 – 30	4	ADS Accepted Award
3	30 – 45	7	E-Tag energy profile
4	45 – 00	6	E-Tag energy profile

Based on this logic, if an award is automatically accepted by the automated dispatch system, the fifteen-minute market will assume the award will be delivered for the first two 15-minute intervals of the operating hour. If in reality the E-Tag is not submitted, it is too late to schedule additional energy through the fifteen-minute market for those intervals. Thus, the real-time dispatch is forced to make up for the shortage with internal supply and/or dynamic (or pseudo-tie) generators, dispatching more than it otherwise would have and increasing real-time dispatch prices. The acceptance of an award on the interties combined with the failure to submit an E-Tag directly impacts the real-time market prices.

Additional information related to the existing Decline Charge can be found in the *Settlements and Billing Configuration Guide - Intertie Schedules Decline Charges CC 6455*:

https://bpmcm.caiso.com/BPM%20Document%20Library/Settlements%20and%20Billing/Configuration%20Guides/HASP-RT/BPM%20-%20CC%206455%20Intertie%20Schedules%20Decline%20Charges_5.9.doc

¹⁶ Intertie resources with contract rights or transmission operating rights (TOR) can submit an E-Tag any time before T-20 even if there is no bid or market award. Therefore, the fifteen-minute market logic will use the E-Tag value for intertie E-Tags tied to a TOR even if a market award does not exist.

¹⁷ The real-time pre dispatch (RTPD) is the security constrained economic dispatch (SCED) for the fifteen-minute market. It consists of 7 forward looking runs. It starts with RTPD 7, which coincides with the hour-ahead scheduling process run. Each RTPD run gets closer to real-time up until RTPD 1.

5.5 Examples

Examples 1 – 6 are provided for illustrational purposes. The examples explain the settlement implications for declining before T-40 as opposed to not submitting an E-Tag. While the ISO maintains that all awarded energy should be tagged and delivered, the failure to submit an E-Tag to match a corresponding award creates more operational challenges than declining an award in advance.

The decline charge only applies when the difference between the hour-ahead scheduling process award and the E-Tag energy profile exceed 10% of total transactions. When an award is declined, the total MWh that counts towards the threshold for the month equals the declined value for the entire operating hour. In comparison, when an award is not tagged the total MWh that counts towards the threshold for the month is only effective for half of the operating hour. As a result, scheduling coordinators are less likely to exceed the 10% threshold and be subject to the decline charge when they elect to not tag as opposed to decline before T-40. This outcome is contrary to the operational need to notifying the ISO in advance when energy cannot be delivered.

Example 7 explains a related problem of declining market awards. Due to the nature of net scheduling in the ISO markets (the summation of imports plus exports cannot exceed intertie limits), the decline of an export schedule in combination with the acceptance of import schedules can result in the over-scheduling of an intertie. When this happens, the import schedules are cut but the export schedule flows.

The *Intertie Deviation Settlement Worksheet* is provided as an attachment and can be used to understand pricing impacts and settlement across markets for intertie declines.

Example #1 – Day-ahead market import resource declined

Setup: A resource receives a 100 MW award in the day-ahead market. The scheduling coordinator does not bid into the real-time market, therefore, the award remains at 100 MW. The 100 MW award is *declined* in the automated dispatch system.

	Interval 1	Interval 2	Interval 3	Interval 4
DA Award	100 MW	100 MW	100 MW	100 MW
HASP schedule	100 MW	100 MW	100 MW	100 MW
FMM award	0 MW	0 MW	0 MW	0 MW
E-Tag	0 MW	0 MW	0 MW	0 MW

Settlement: The fifteen-minute market undelivered quantity is 100 MW for intervals 1 – 4. Therefore, 100 MWh is applied towards the end-of-month summation to determine if the 10% threshold is exceeded and the decline charge should be applied. The operational adjustment is 0 MW for all intervals because the E-Tag matches the total expected energy.

Settlement	Quantity	Intervals	MWh
Instructed Imbalance Energy = DA – FMM award at FMM LMP	100 MW	1 – 4	100 MWh
FMM Undelivered Quantity (Decline Charge*) = HASP schedule – FMM award at 50% FMM LMP	100 MW	1 – 4	100 MWh
Operational Adjustment = FMM award – E-Tag at RTD LMP	0 MW	N/A	0 MWh

*Decline charge only applies if FMM Undelivered Quantity exceeds 10% of total transactions

Summary: The scheduling coordinator notified the ISO in advance of the undeliverable energy. Although any undeliverable energy has adverse operational and market impacts, both the operator and the market are aware of the change and may have time to re-commit internal supply or intertie resources. The scheduling coordinator has 100 MW applied toward the decline charge threshold.

Example #2 – Day-ahead market import resource not tagged

Setup: A resource receives a 100 MW award in the day-ahead market. The scheduling coordinator does not bid into the real-time market, therefore, the award remains at 100 MW. The 100 MW award is *accepted* in the automated dispatch system, but no E-Tag is submitted.

	Interval 1	Interval 2	Interval 3	Interval 4
DA Award	100 MW	100 MW	100 MW	100 MW
HASP schedule	100 MW	100 MW	100 MW	100 MW
FMM award	100 MW	100 MW	0 MW	0 MW
E-Tag	0 MW	0 MW	0 MW	0 MW

Settlement: The fifteen-minute market undelivered quantity is 100 MW for the intervals 3 and 4. Therefore, 50 MWh will be applied towards the end-of-month summation to determine if the 10% threshold is exceeded and the decline charge should be applied. The operational adjustment is 100 MW for intervals 1 and 2 because the E-Tag does not match the total expected energy. This totals 50 MWh of operational adjustment at the real-time dispatch locational marginal price.¹⁸

Settlement	Quantity	Intervals	MWh
Instructed Imbalance Energy = DA – FMM award at FMM LMP	100 MW	3 – 4	50 MWh
FMM Undelivered Quantity (Decline Charge*) = HASP schedule – FMM award at 50% FMM LMP	100 MW	3 – 4	50 MWh
Operational Adjustment = FMM award – E-Tag at RTD LMP	100 MW	1 – 2	50 MWh

*Decline charge only applies if FMM Undelivered Quantity exceeds 10% of total transactions

Summary: The scheduling coordinator did not notify the ISO in advance of the undeliverable energy. Undelivered intertie resources are never beneficial for the ISO, but the failure to submit an E-Tag is even worse than declining an award by T-40. Neither the operator nor the market are aware of any shortage for the first two intervals of the operating hour. The scheduling coordinator has 50 MW applied toward the decline charge threshold. In comparison to Example #1, the MWh applied toward the decline charge is less even though the behavior of not tagging creates operational challenges for the ISO.

¹⁸ MW is the unit of instantaneous power at any given moment in time. MWh is a unit of energy, which is defined as power over a specified time – in this case an hour. MWh can be calculated by determining the power (MW) for each 15-minute interval. For example #2, 100 MW was generated for two 15-minute intervals and 0 MW was generated for two 15-minute intervals. Therefore, $100 \times (1/4) + 100 \times (1/4) + 0 \times (1/4) + 0 \times (1/4) = 50$ MWh.

Example #3 – Real-time market import resource declined

Setup: A resource receives no award in the day-ahead market. The scheduling coordinator bids into the real-time market and is awarded 100 MW. The 100 MW award is *declined* in the automated dispatch system.

	Interval 1	Interval 2	Interval 3	Interval 4
DA award	0 MW	0 MW	0 MW	0 MW
HASP schedule	100 MW	100 MW	100 MW	100 MW
FMM award	0 MW	0 MW	0 MW	0 MW
E-Tag	0 MW	0 MW	0 MW	0 MW

Settlement: The fifteen-minute market undelivered quantity is 100 MW for intervals 1 – 4. Therefore, 100 MWh will be applied towards the end-of-month summation to determine if the 10% threshold is exceeded and the decline charge should be applied. The operational adjustment is 0 MW for all intervals because the E-Tag matches the total expected energy.

Settlement	Quantity	Intervals	MWh
Instructed Imbalance Energy = DA – FMM award at FMM LMP	0 MW	N/A	0 MWh
FMM Undelivered Quantity (Decline Charge*) = HASP schedule – FMM award at 50% FMM LMP	100 MW	1 – 4	100 MWh
Operational Adjustment = FMM award – E-Tag at RTD LMP	0 MW	N/A	0 MWh

*Decline charge only applies if FMM Undelivered Quantity exceeds 10% of total transactions

Summary: The scheduling coordinator notified the ISO in advance of the undeliverable energy. The decline of an intertie award is never beneficial for the ISO, but in this case both the operator and the market are aware of the shortage in advance of the fifteen-minute market run. The scheduling coordinator has 100 MW applied toward the decline charge threshold. Declining an award has the same impact and settlement (with the exception of the hour-ahead scheduling process reversal rule) regardless if the award was from the day-ahead or real-time market.

Example #4 – Real-time market import resource not tagged

Setup: A resource receives no award in the day-ahead market. The scheduling coordinator bids into the real-time market and is awarded 100 MW. The 100 MW award is *accepted* in the automated dispatch system, but no E-Tag is submitted.

	Interval 1	Interval 2	Interval 3	Interval 4
DA Award	0 MW	0 MW	0 MW	0 MW
HASP schedule	100 MW	100 MW	100 MW	100 MW
FMM award	100 MW	100 MW	0 MW	0 MW
E-Tag	0 MW	0 MW	0 MW	0 MW

Settlement: The fifteen-minute market undelivered quantity is 100 MW for intervals 3 – 4. Therefore, 50 MWh will be applied towards the end-of-month summation to determine if the 10% threshold is exceeded and the decline charge should be applied. The operational adjustment is 100 MW for intervals 1 -2 because the E-Tag does not match the total expected energy. This totals 50 MWh of operational adjustment at the real-time dispatch locational marginal price.

Settlement	Quantity	Intervals	MWh
Instructed Imbalance Energy = DA – FMM award at FMM LMP	100 MW	1 – 2	50 MWh
FMM Undelivered Quantity (Decline Charge*) = HASP schedule – FMM award at 50% FMM LMP	100 MW	3 – 4	50 MWh
Operational Adjustment = FMM award – E-Tag at RTD LMP	100 MW	1 – 2	50 MWh

*Decline charge only applies if FMM Undelivered Quantity exceeds 10% of total transactions

Summary: The scheduling coordinator did not notify the ISO in advance of the undeliverable energy. By failing to submit an E-Tag neither the operator nor the market are aware of the change. However, in comparison to Example #3, the scheduling coordinator only has 50 MW applied toward the decline charge threshold. The scheduling coordinator has a smaller MW amount applied towards the decline charge even though the behavior of not tagging is less desirable than declining an award in advance of the fifteen-minute market run. Not submitting an E-Tag has the same impact and settlement (with the exception of the hour-ahead scheduling process reversal rule) regardless of the award was from the day-ahead or the real-time market.

Example #5 – Tag submitted for partial amount of award

Setup: A resource receives a 100 MW award in the day-ahead market. The scheduling coordinator bids into the real-time market and is awarded an additional 20 MW. The 120 MW award is *accepted* in automated dispatch system, but an E-Tag is submitted for only 80 MW.

	Interval 1	Interval 2	Interval 3	Interval 4
DA Award	100 MW	100 MW	100 MW	100 MW
HASP schedule	120 MW	120 MW	120 MW	120 MW
FMM award	120 MW	120 MW	80 MW	80 MW
E-Tag	80 MW	80 MW	80 MW	80 MW

Settlement: The fifteen-minute market undelivered quantity is 40 MW for intervals 3 – 4. Therefore, 20 MWh will be applied towards the end-of-month summation to determine if the 10% threshold is exceeded and the decline charge should be applied. The operational adjustment is 40 MW for intervals 1 - 2 because the E-Tag does not match the total expected energy. This totals 20 MWh of operational adjustment at the real-time dispatch locational marginal price.

Settlement	Quantity	Intervals	MWh
Instructed Imbalance Energy = DA – FMM award at FMM LMP	+20 MW	1 – 2	0 MWh
	-20 MW	3 – 4	
FMM Undelivered Quantity (Decline Charge*) = HASP schedule – FMM award at 50% FMM LMP	40 MW	3 – 4	20 MWh
Operational Adjustment = FMM award – E-Tag at RTD LMP	40 MW	1 – 2	20 MWh

*Decline charge only applies if FMM Undelivered Quantity exceeds 10% of total transactions

Summary: The scheduling coordinator did not notify the ISO in advance that a portion of the energy was undeliverable. This is not beneficial for the ISO; neither the operator nor the market are aware of the change. The scheduling coordinator has a smaller MW amount applied towards the decline charge even though the behavior of not tagging is less desirable than declining an award. Submission of an E-Tag that is only a portion of the accepted award still has operational and settlement impacts.

Example #6 – Tag curtailed for reliability reasons

Setup: A resource receives a 100 MW award in the day-ahead market. The scheduling coordinator bids into the real-time market and is awarded an additional 20 MW. The 120 MW award is *accepted* in the automated dispatch system, an E-Tag is submitted, but the E-Tag is curtailed to 80 MW for reliability reasons.

	Interval 1	Interval 2	Interval 3	Interval 4
DA Award	100 MW	100 MW	100 MW	100 MW
HASP schedule	120 MW	120 MW	120 MW	120 MW
FMM award	120 MW	120 MW	80 MW	80 MW
E-Tag	80 MW	80 MW	80 MW	80 MW

Settlement: The fifteen-minute market undelivered quantity is 40 MW for intervals 3 – 4. Therefore, 20 MWh will be applied towards the end-of-month summation to determine if the 10% threshold is exceeded and the decline charge should be applied. The operational adjustment is 40 MW for intervals 1 - 2 because the E-Tag does not match the total expected energy. This totals 20 MWh of operational adjustment at the real-time dispatch locational marginal price.

Settlement	Quantity	Intervals	MWh
Instructed Imbalance Energy = DA – FMM award at FMM LMP	+20 MW - 20 MW	1 – 2 3 – 4	0 MWh
FMM Undelivered Quantity (Decline Charge*) = HASP schedule – FMM award at 50% FMM LMP	40 MW	3 – 4	20 MWh
Operational Adjustment = FMM award – E-Tag at RTD LMP	40 MW	1 – 2	20 MWh

*Decline charge only applies if FMM Undelivered Quantity exceeds 10% of total transactions

Summary: The scheduling coordinator correctly accepted the market award and submitted an E-Tag. However, the E-Tag was curtailed for reliability reasons. In comparison to Example #5, this example has the same settlement implications. The scheduling coordinator is impacted and has 20 MWh applied towards the decline charge threshold even though the scheduling coordinator was not at fault.

Example #7 – Real-time market export resource partial accepted

Setup: An intertie resource bids into the real-time market as an export (exporting energy out of the CAISO balancing authority area) and is awarded 50 MW. The export resource partially accepts the award to 25 MW. The ISO net schedules intertie resources meaning the summation of import and export resources cannot exceed the scheduling limit. Therefore, an increase of an export enables additional import resources to be dispatched. Because the export resource only partially accepts the award but the import resources fully accept their awards, the ISO exceeds the scheduling limit and must pro-rata curtail all import resources.

	eTag	DA	HASP	Accepted DOT	Curtailed MW	Final eTag
Accepted incremental dispatch	Import_1	50	50	50	5	45
	Import_2	100	100	100	10	90
	Import_3	0	25	25	2	23
	Import_4	50	75	75	8	67
Partial accepted decremental dispatch	Export_1	0	(50)	(25)	0	(25)
	LIMIT	200	200	200	200	200
	TOTAL	200	200	225	25	200

Summary: In this scenario, the partially accepted export in combination with the fully accepted imports resulted in the intertie being net scheduled over its limit. The ISO always expects hour-ahead scheduling process awards to be accepted. Based on that assumption, the partially accepted export resource has caused the intertie to be over scheduled. This results in curtailments to all import resources – even import resources that were scheduled in the day-ahead market and have not made any bidding and/or tagging changes. The curtailment negatively impacts all import resources but does not negatively impact the export resource. The ISO requests stakeholder feed to discuss possible solutions to address this problem.

6. Data Analysis

This section includes data analysis to quantify the root cause of intertie declines and the magnitude of the decline charge in comparison to total deviations.

6.1 Root Cause for Intertie Declines

Many stakeholders requested root-cause analysis to determine why scheduling coordinators are either declining or not tagging intertie resources. When an hour-ahead scheduling process schedule is partially accepted or declined, the automated dispatch system requires the scheduling coordinator input a reason.

The scheduling coordinator can select one of the following options to decline an intertie award:

- Bad Bid Submitted
- Economic Consideration
- Line Down
- No Available Transmission
- Unit Derate

Data analysis has been completed and summarizes the reasons for intertie declines. This data summarizes declined and partially accepted awards, categorized by reason, from July 2017 – June 2018.

Figure 6: Declined imports and exports categorized by reason for July 2017 – June 2018.

Reason for Decline	% of Total Declines, Imports	% of Total Declines, Exports
Bad Bid Submitted	50.38%	53.76%
No Available Transmission	19.68%	-0.61% ¹⁹
Economic Consideration	16.89%	44.96%
Unit Derate	8.60%	1.89%
Line Down	4.45%	0.00%

For intertie imports and exports, the majority of declines occur due to “Bad Bid Submitted”. The intent of this option is to indicate that a bid was incorrectly submitted into the ISO market. However, based on the frequency with which this option is selected, it may also mean that although the bid has cleared, the scheduling coordinator is no longer satisfied with the clearing price of the bid. The reason the scheduling coordinator selects “Bad Bid Submitted” is subjective.

It is significant to note that “Bad Bid Submitted”, “Economic Considerations” and “No Available Transmission” are all within control of the scheduling coordinator. Only “Line Down” and “Unit Derate” indicate a forced outage is the reason for the decline – these are outside control of the scheduling

¹⁹ The negative percent occurs when intertie schedules accept a value greater than the HASP schedule. This occurs when an import resource declines a decremental award, or when an export resource declines an incremental award.

coordinator. For import resources, only 13.05% of declines (4.45% due to “Line Down” + 8.60% due to “Unit Derate” = 13.05%) occur due to reasons beyond control of the scheduling coordinator. For export resources, only 1.89% of declines occur due to reasons beyond control of the scheduling coordinator.

The ISO has provided data regarding declined and partially accepted awards, but is unable to produce concrete data for the reason scheduling coordinators choose not to tag accepted awards. Scheduling coordinators may choose not to submit an E-Tag for a corresponding market award for many reasons that are unknown to the ISO.

Powerex has summarized why this may occur in their written comments in response to the *Intertie Deviation Settlement* issue paper.²⁰ Powerex explains that scheduling coordinators may fail to tag and deliver award energy for three reasons: (1) energy cannot be delivered due to a forced outage, (2) energy is not delivered because seller elects to deliver the energy elsewhere, and (3) speculative energy supply was bid into the market but is not tied to a physical generator or transmission. These items are summarized in Figure 7: Powerex summary for intertie delivery failures.

The first item is completely beyond control of the scheduling coordinator. Forced outages are unpredictable and unavoidable – they also are not correlated to low supply conditions that may result in high prices in the ISO’s markets.

The second two items, however, are in control of the market participant. If prices are higher outside of the ISO, a seller can choose to deliver the energy elsewhere in hopes of economic gains or, a seller may not have physical generation available when bidding into the real-time market. If the bid clears at a favorable price, the seller will attempt to locate physical generation and transmission. If this cannot be complete, the seller likely faces no consequences as long as the 10% decline charge threshold has not been exceeded.

²⁰ See Powerex written comments in response to the *Intertie Deviation Settlement* issue paper, page 5: <http://www.caiso.com/Documents/PowerexComments-IntertieDeviationsSettlement-IssuePaper.pdf>

Figure 7: Powerex summary for intertie delivery failures.

Category	Factors Driving Delivery Failure	Risk to CAISO (and EIM)
Physical supply, delivery according to final award	Forced outages or de-rates at source BAA; transmission curtailment	Risk generally not correlated to alternative supply conditions; comparable to risks for internal resources
Physical supply, but seller elects non-delivery to CAISO in order to sell in other markets	Risk that more attractive market opportunities exist outside CAISO	Risk is elevated during tight regional supply conditions; Consequences are also likely more severe , as CAISO faces fewer or more costly alternative supply options
Speculative energy supply (non-RA)	Risk that external supply is not available, or price makes physical delivery uneconomic for seller	

Source: Powerex comments on Intertie Deviation Settlement issue paper, page 5.

In summary, the ISO has determined intertie declines occur most commonly due to the submission of bad bids. The ISO is unable to explicitly state why under-tagging occurs but believes it is likely due to economic reasons or because the seller is unable to purchase generation at a favorable price. The ISO plans to address intertie declines and under-tagging with the new under/over delivery charge that is explained in [Section 7](#).

6.2 Decline Charge Settlement Data

The decline charge is calculated by summing the total fifteen-minute market undelivered quantity (in MWh) over the course of a month. If the total exceeds 10% of total transactions (in the import and export direction individually) the decline charge applies. The price applied is the maximum of \$10.00 or 50% of the fifteen-minute market locational marginal price for each MWh that exceeds the threshold.

The data below summarizes the total decline charge applied to all scheduling coordinators from July 2017 - June 2018 by month in the import and export direction.

- **Decline Charge (\$)** is the total charge applied to all scheduling coordinators in the import and export direction respectively for a given month
- **Potential Decline Charge (\$)** is the total cost of the decline charge if it were applied by interval and without a threshold
- **Declined Quantity (MWh)** is the total amount of undelivered intertie resources including declined, under-tagged, and curtailed resources for all scheduling coordinators in the import and export direction respectively for a given month

Figure 8 and Figure 9: Total applied decline charge (\$) due to undelivered imports for all scheduling coordinators for January 2017 – June 2018 by month.

IMPORTS Date	Decline Charge (\$)	Decline Charge as % of Potential	Potential Decline Charge (\$)	Declined Quantity (MWh)
2017	\$ 5,886	0.26%	\$ 2,265,863	92,706
Jul-17	\$ -	0.00%	\$ 263,560	15,827
Aug-17	\$ 5,886	2.55%	\$ 231,042	8,812
Sep-17	\$ -	0.00%	\$ 309,106	12,772
Oct-17	\$ -	0.00%	\$ 487,151	23,800
Nov-17	\$ -	0.00%	\$ 853,499	25,258
Dec-17	\$ -	0.00%	\$ 121,505	6,237
2018	\$ 7,815	0.52%	\$ 1,495,763	73,867
Jan-18	\$ -	0.00%	\$ 91,105	5,346
Feb-18	\$ -	0.00%	\$ 562,312	11,302
Mar-18	\$ -	0.00%	\$ 208,247	12,507
Apr-18	\$ -	0.00%	\$ 225,683	14,055
May-18	\$ 7,815	3.87%	\$ 201,958	15,954
Jun-18	\$ -	0.00%	\$ 206,458	14,704
Grand Total	\$ 13,701	0.36%	\$ 3,761,626	166,573

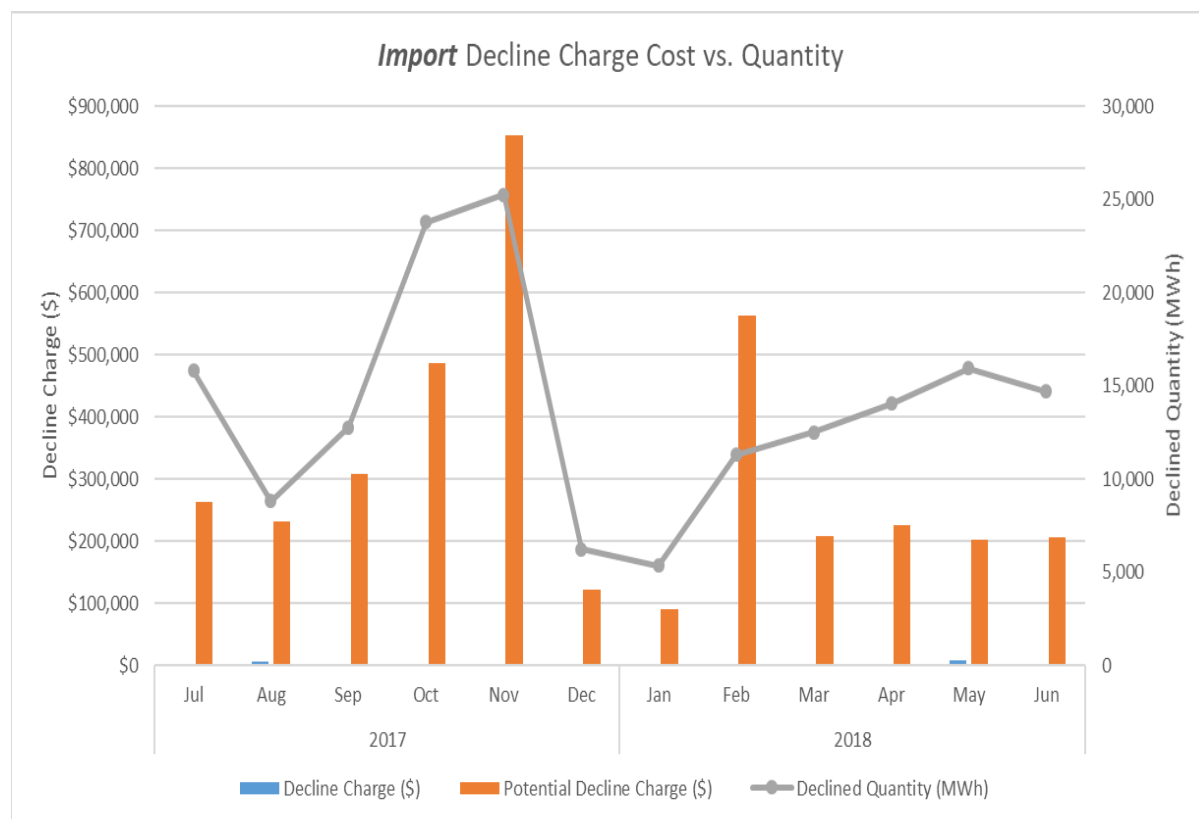
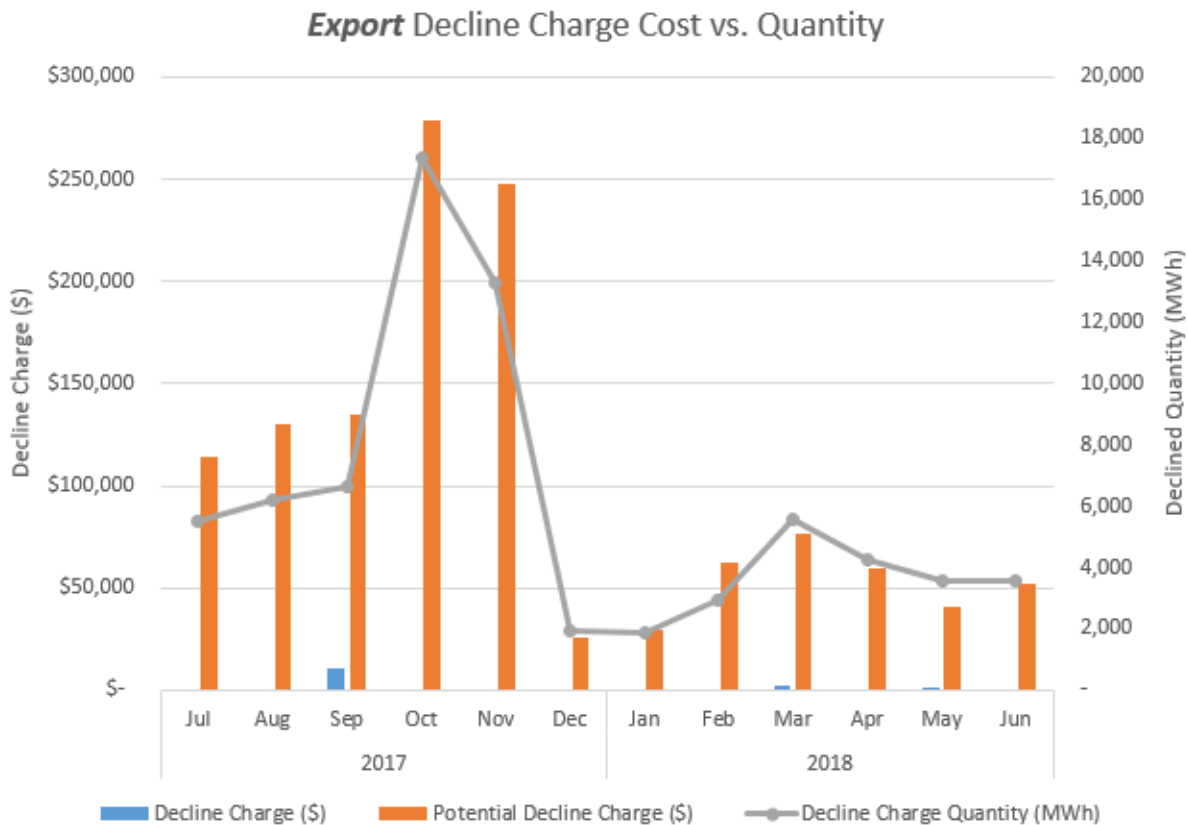


Figure 10 and Figure 11: Total applied decline charge (\$) due to undelivered exports for all scheduling coordinators for January 2017 – June 2018 by month.

EXPORTS Date	Decline Charge (\$)	Decline Charge as % of Potential	Potential Decline Charge (\$)	Decline Charge Quantity (MWh)
2017	\$ 10,809	1.16%	\$ 930,630	50,901
Jul	\$ -	0.00%	\$ 113,811	5,507
Aug	\$ -	0.00%	\$ 130,402	6,182
Sep	\$ 10,809	8.03%	\$ 134,579	6,662
Oct	\$ -	0.00%	\$ 279,018	17,340
Nov	\$ -	0.00%	\$ 247,447	13,286
Dec	\$ -	0.00%	\$ 25,372	1,925
2018	\$ 2,995	0.93%	\$ 321,397	21,785
Jan	\$ -	0.00%	\$ 29,706	1,900
Feb	\$ -	0.00%	\$ 62,521	2,945
Mar	\$ 2,225	2.90%	\$ 76,742	5,566
Apr	\$ -	0.00%	\$ 59,528	4,268
May	\$ 770	1.89%	\$ 40,796	3,547
Jun	\$ -	0.00%	\$ 52,105	3,558
Grand Total	\$ 13,804	1.10%	\$ 1,252,026	72,687



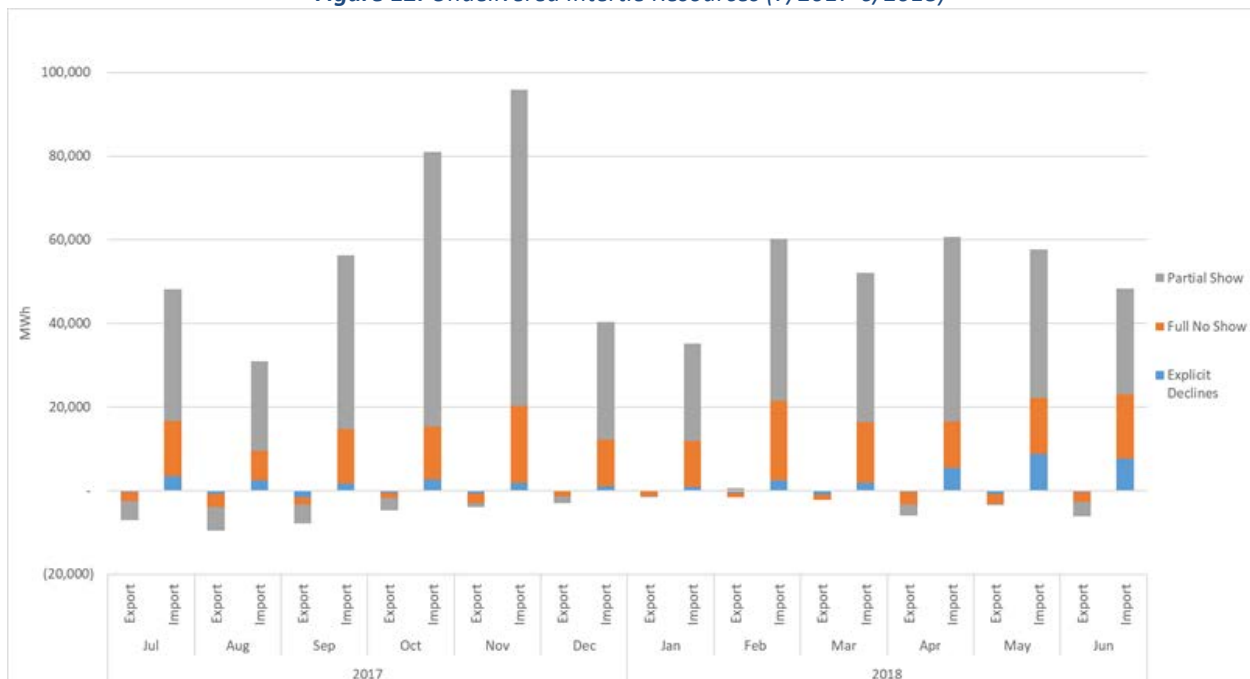
6.3 Frequency of Declines and Under-Tagging of Intertie Resources

This section includes data analysis to summarize the historical volume in MWh of undelivered intertie resources for July 2017 through June 2018. The causes for undelivered intertie resources fall into three categories:

1. **Explicit declines** = HASP schedule is declined in the ADS system
2. **Full no-show** (no E-Tag submitted) = HASP schedule is accepted in the ADS system but no E-Tag is submitted
3. **Partial show/accept**²¹ = HASP schedule is accepted in the ADS system but the E-Tag that is submitted does not match the ADS accepted schedule.

The volume of MWh depicted in **Figure 12** through **Figure 15**: Range of Hourly Undelivered Intertie Resources – Import Direction (8/28/2017 – 9/3/2017) is representative of HASP awards minus actual RTD awards. For this analysis, curtailments have been removed from the data set. The majority of undelivered intertie resources are due to partially accepted awards as opposed to explicitly declined awards. The data shows the majority of awarded but undelivered energy occurs because the scheduling coordinator fails to submit an E-Tag on time rather than decline the award prior to T-40 in the automated dispatch system. Failure to submit an E-Tag results in decreased situational awareness and leaves market resolution to the 5-minute real-time dispatch.

Figure 12: Undelivered Intertie Resources (7/2017-6/2018)



²¹ See Section 3.1 for definition of Partial Accept.

Figure 13 examines the range of total undelivered intertie resources in the import direction on an hourly granularity. The total amount of undelivered interties is represented by combining the MWh quantities of explicit declines, full no show and partial show/accepted awards. Each hour of the year (July 2017- June 2018) analyzed has three corresponding points: the minimum, maximum, and average undelivered intertie quantity that occurred during that specific hour. The range of undelivered intertie quantities is noticeably greater during the evening peak hours. The maximum points during these hours highlight there is a greater amount of uncertainty during this time as the potential amount of undelivered intertie resources reaches up to 2,331 MWh in hour ending 18. In order to maintain stable grid conditions, the ISO operators may be prepared to cover the maximum amount of potential undelivered energy on the interties across all hours.

Figure 13: Range of Hourly Undelivered Intertie Resources – Import Direction (7/2017 - 6/2018)

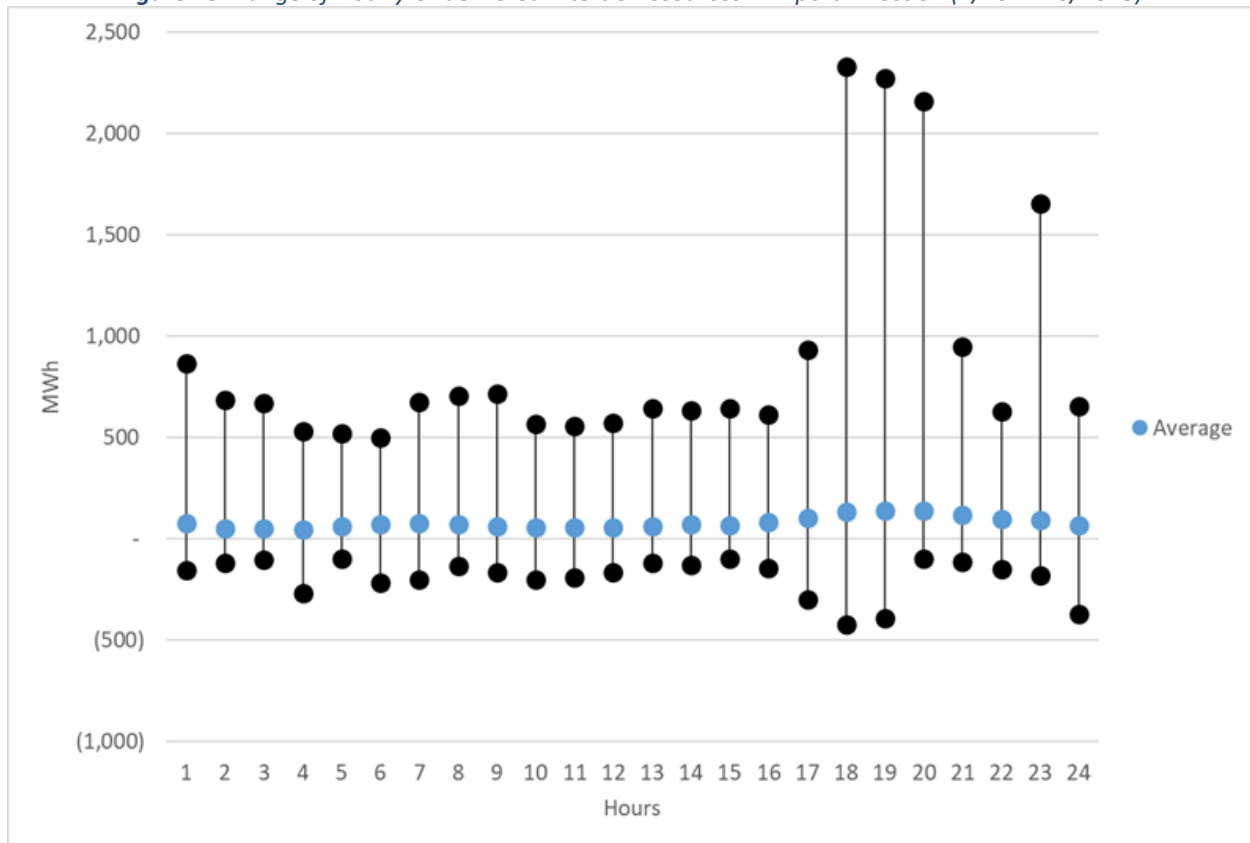


Figure 14 quantifies the undelivered intertie awards during the critical period of the September 1-2, 2017 heat wave. It is evident that the amount of undelivered interties was more prevalent during the warmest days of the week of August 28 – September 3, 2017.

Figure 14: Undelivered Intertie Resources (8/28/2017 - 9/3/2017)

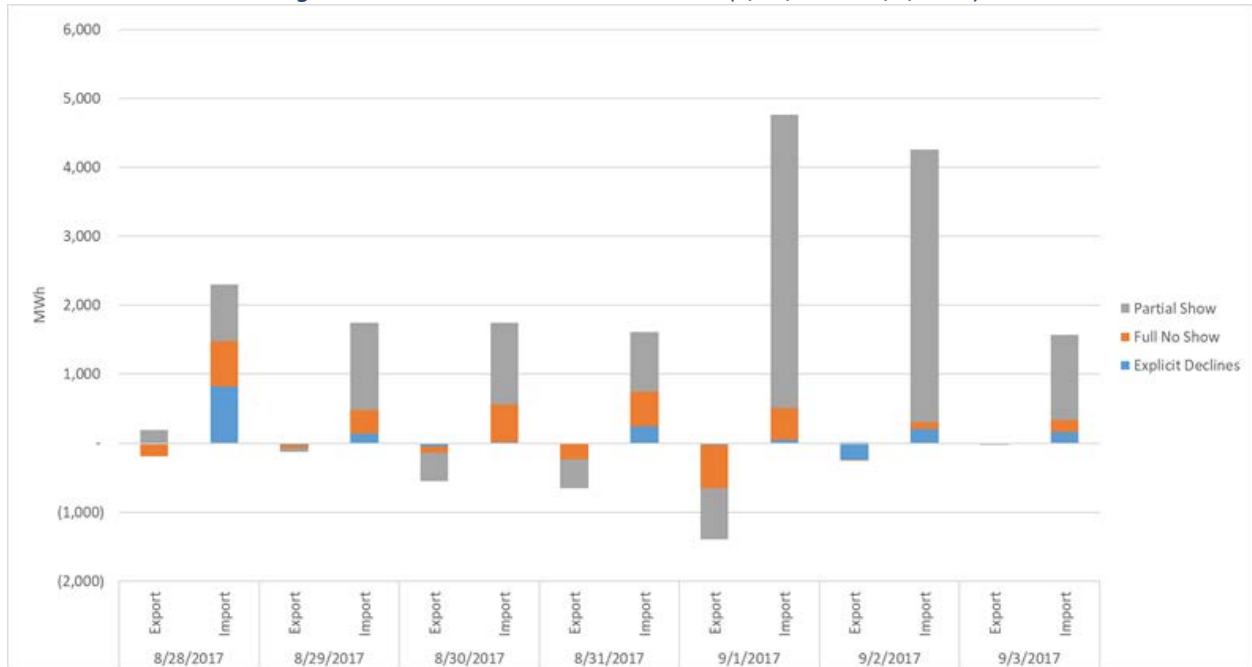
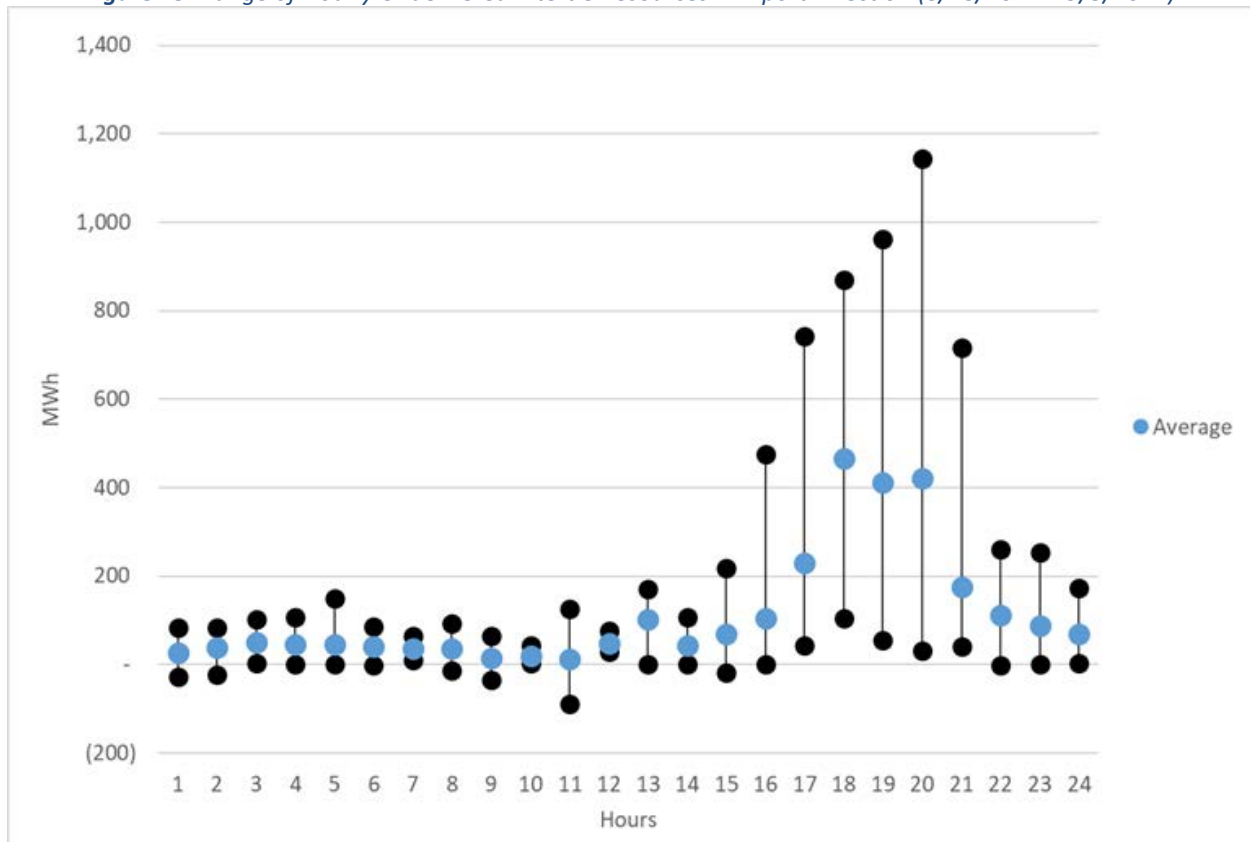


Figure 15 examines the range of total undelivered intertie resources in the import direction on an hourly granularity during the critical period of the September 1-2, 2017 heat wave. Similar to **Figure 13**, the range of total undelivered interties is the greatest during the evening peak hours. Even while the system is stressed due to high temperatures throughout the West, it is vital that the potential amount of undelivered interties is accounted for.

Figure 15: Range of Hourly Undelivered Intertie Resources – Import Direction (8/28/2017 – 9/3/2017)



7. Under/Over Delivery Charge Proposal

The purpose of the decline charge is to incentivize delivery of awarded energy. The existing framework of the decline charge is not effective because (1) the monthly threshold is too high, (2) the charge does not apply to 15-minute resources, (3) the charge does not account towards import resources that decline a decremental dispatch between the day-ahead and real-time market (or export resources that decline an incremental dispatch) between the day-ahead and real-time market.

If a scheduling coordinator is subject to the existing decline charge (total deviations exceed 10% of total transactions for the month), the scheduling coordinator is charged at 50% of the fifteen-minute market locational marginal price per MWh. The fifteen-minute market price, however, does not accurately reflect that the energy was undelivered. By the time the deviation occurs, the fifteen-minute market is not necessarily able to dispatch additional energy on the interties. Therefore, the real-time dispatch is used to address the shortage. This may result in an unnecessary increase in the real-time market price because the market had to clear at a higher bid than it would have if the intertie had been delivered.

The ISO proposes to eliminate the decline charge and replace it with a new settlement mechanism henceforth known as the under/over delivery charge. This proposal applies to all import and export intertie resources, excluding dynamic intertie resources. Explicitly, the proposed under/over delivery charge will apply to intertie resources awarded in the:

- Day-ahead market
- Hour-ahead scheduling process
- Incremental and decremental changes between the day-ahead market and hour-ahead scheduling process
- Fifteen-minute market

The objective of this initiative is to decrease the number of undelivered intertie resources that occur due to declines and under-tagging. Therefore, the purpose of the new charge is to incentivize acceptance and delivery of market awards – if an award is either declined or not tagged, the market participant will be charged based on the price implications to the real-time market. The ISO proposes the framework summarized in the subsections below for the under/over delivery charge.

7.1 Determination of Fifteen-Minute Binding for Hourly Block Resources

As explained in [Section 4.2: FERC Order 764 Impacts](#), the ISO no longer settles intertie schedules on an hourly basis. Instead, the ISO settles for every fifteen minute interval based on the fifteen-minute locational marginal price. In order to accommodate hourly-block scheduling, which is a common practice in the western interconnection, the ISO agreed to continue to allow hourly intertie transactions but would settle them for each fifteen-minute interval.

The following terms are related to hourly-block scheduling and used in the sections below. They are defined here so stakeholders have a compressive overview of the proposal and understand the correlation between the terms.

Hourly-block bid option. A bid indicating the scheduling coordinator is choosing to keep the intertie schedule (i.e. energy profile) at the same value for the entire operating hour.

Hour-ahead scheduling process (HASP) schedule. The schedule that has cleared the ISO market based on the hourly-block bid. This is the value is published roughly sixty minutes prior to the operating hour (T-0) and is the amount of energy the scheduling coordinator should tag. The HASP schedule is not used directly for settlement purposes.

Fifteen-minute market binding award. Award used for settlement purposes. The award value may differ for each interval and is based on logic that considers the energy and/or transmission profile on the E-Tag. Although the fifteen-minute market award may change, the energy schedule for the hourly-block resource will stay the same during the hour. Differences between the fifteen-minute market award and the hourly-block energy profile are subject to imbalance energy settlement and under/over delivery charge.

The fifteen-minute market binding award for hourly block intertie resources is currently equal to the hour-ahead scheduling process award accepted in the automated dispatch system (under typical circumstances) for the first two intervals of the operating hour. This is problematic because the fifteen-minute market assumes a tag will be submitted to match the market award even though there is no guarantee of the tag submission. For additional information about the current fifteen-minute market logic reference [Section 5.2: Intertie Declines Examples, Market Timing & Logic](#).

If a scheduling coordinator fails to submit an E-Tag, it is too late for the hour-ahead scheduling process to schedule additional energy. In this situation, the ISO is not only short energy (or in an energy surplus if an export is not tagged), but the ISO has also reserved transmission capacity for that resource which will go unused. Untagged energy can result in the fifteen-minute market prices being lower than they should have been, and real-time dispatch prices higher than they should have been. The FMM should have cleared at a lower price if the awarded energy was not going to be delivered (market would have cleared lower on the bid stack). Replacing the energy results in a price increase in the real-time market. If the real-time market is unable to replace the energy, the ISO may experience reliability problems.

Therefore, instead of assuming the accepted award will be delivered, the ISO proposes to determine the fifteen-minute binding award for hourly blocked resources based on the E-Tag at T-40. The fifteen minute market binding award will equal the lower of the HASP schedule, HASP accepted award (ADS accepted value), or E-Tag transmission profile.

Figure 16: Proposed market logic used to determine awards for hourly block intertie resources.

FMM Binding Interval of Operating Hour	Time of Operating Hour	RTPD #	Logic Used to Determine Binding Award
1	00 – 15	5	MIN(HASP schedule, ADS accepted value, E-Tag transmission profile)
2	15 – 30	4	MIN(HASP schedule, ADS accepted value, E-Tag transmission profile)
3	30 – 45	7	E-Tag energy profile
4	45 – 00	6	E-Tag energy profile

For example: if an hourly blocked schedule is accepted in the automated dispatch system but no E-Tag is submitted in advance of the fifteen-minute market run, the binding award will equal 0 MW. Contrarily, if an E-Tag is submitted but is greater than the market award, the fifteen-minute market binding award will still equal the HASP schedule.

The CAISO proposes to use the E-Tag transmission profile as opposed to the E-Tag energy profile for determination of the fifteen-minute market binding award. If an E-Tag with a transmission profile is submitted, the ISO believes this is an adequate indicator that the scheduling coordinator intends to deliver the awarded energy. As such, it is appropriate that the fifteen-minute market makes the assumption and recognizes that the energy will most likely be delivered. This aligns with the logic that is used for the determination of awards for fifteen-minute dispatchable resources.

This logic aligns with the fifteen-minute dispatchable intertie resources which are required to submit an E-Tag with a transmission profile prior to the fifteen-minute market run.²² If no E-Tag is submitted, the resource does not receive a binding award. Going forward, the ISO proposes to make binding award determinations for all imports and exports based on the submission of an E-Tag as opposed to the assumption that a tag will be submitted to match the market award. This allows the fifteen-minute market to schedule resources according to what is tagged, as opposed to what we assume will be tagged.

The enhanced fifteen-minute market logic also encourages scheduling coordinators to have physical generation and transmission procured when a bid is submitted. Assuming a bid clears, the ISO expects the energy to be delivered. If a scheduling coordinator is unable to tag the energy prior to the market

²² The Business Practice Manual for Market Operations (section 8.5.2) and the ISO Tariff (section 30.6.2.5) currently say fifteen-minute dispatchable resources must have an E-Tag submitted by T-37.5. The ISO proposes to change this to T-40. The market needs time to receive and process the E-Tag information so it can be used in the market run, which begins at exactly T-37.5.

run, the ISO market will no longer assume this energy will be delivered. This logic also ensures intertie schedules that are counted toward the resource sufficiency test have tagged and available transmission and a supply source.

Note: Intertie resources that receive a manual dispatch or have contract rights will be excluded from this logic. In these scenarios, the market may assume the energy will be delivered even if an E-Tag has not yet been submitted.

7.2 Removal of Tagging Deadline

In the *Intertie Deviation Settlement* Straw Proposal, the ISO proposed a real-time E-Tagging deadline of T-40. The intent behind the tagging deadline was to ensure E-Tags were submitted and approved in advance of the fifteen-minute market run that occurs at T-37.5. After further investigation, the ISO has decided to remove the E-Tagging deadline for the following reasons:

- Forecasts for variable energy resources in the Pacific Northwest are not published until T-30. Therefore, the proposed ISO tagging deadline of T-40 creates a 10 minute gap. It would be impossible for final tags to be submitted and approved 10 minutes prior to the publication of the forecast. The ISO is committed to the integration of renewable resources; the flexibility to adjust tags following the T-30 renewable forecast publication is necessary.
- The ISO strives to ensure the most accurate market inputs. While a T-40 tagging deadline would meet this objective, it fails to recognize and appreciate the flexibility that is needed to manage the grid in real-time. If a scheduling coordinator was unable to submit a 100 MW tag before T-40 due to a circumstance outside of his control, the ISO would still want the 100 MW tag to be submitted between T-40 and T-20 to ensure the energy could be delivered. The ISO would rather receive the 100 MW than not receive it at all. In this scenario, the scheduling coordinator would be subject to imbalance energy settlement for the first interval of the hour because the fifteen-minute market did not reflect the submission of the E-Tag.

The ISO will business practice manuals will identify the best practice of submitting an E-Tag with a transmission profile by T-40. This allows for the most efficiency market optimization and is an indication to the ISO that the scheduling coordinator intends to deliver the energy. Additionally, there are economic incentives in place to encourage the best-practice behavior of submitting an E-Tag by T-40.

The ISO intends to provide flexibility to scheduling coordinators by allowing the update/adjustment of energy profiles until T-20. This ensures forecasts are reflected and encourages delivery of energy even if the T-40 best-practice timeline is not met.

7.3 Exclusion of Curtailments

When the decline charge was originally developed, the ISO had no way to distinguish between operator reliability curtailments and scheduling coordinator under (or over) tagging. The existing decline charge compares the hour-ahead scheduling process award to the final E-Tag energy profile – there is no specific distinction between when an operator curtailed E-Tag and a scheduling coordinator adjusted E-Tag.

For purposes of discussion, the ISO will use the following language to distinguish between an operator and a scheduling coordinator adjustment:

Adjustment. A change to an E-Tag's energy profile that is submitted by the scheduling coordinator. When an E-Tag differs from a market award due to an adjustment, the scheduling coordinator is responsible for the difference between the tag and the award.

Curtailment. A change to an E-Tag's energy profile that is submitted by a balancing authority area operator for a reliability reason. When an E-Tag differs from a market award due to a curtailment, the balancing authority area operator is responsible for the difference between the tag and the award. A curtailment can be completed by the ISO balancing authority operator, or balancing authority operator from another region but must be done for reliability reasons.

The ISO now has the ability to distinguish between curtailments and adjustments. Therefore, the ISO proposes to exclude balancing authority operator curtailments from the under/over delivery charge. Consistent with the settlement structure used today, curtailments will continue to be settled for imbalance energy. If an E-Tag is both curtailed and adjusted, the ISO will only apply the under/over delivery charge to the amount of the adjustment. The curtailed amount will be excluded from the charge.

It is critical to note that E-Tag adjustments can be denied by scheduling coordinators whereas curtailments cannot. Therefore, if the ISO is required to change an E-Tag energy profile because the energy profile exceeds the market award, the ISO can elect to curtail the E-Tag. In this scenario, the E-Tag was curtailed at the resources level for a non-reliability reason. These E-Tags will be flagged to be included in the penalty, whereas reliability curtailments by the ISO (or other BAAs/TSPs) will be excluded from the penalty.

- Curtailments by the ISO that occur at the resource level are due to the resource not tagging correctly. These resources will be flagged and are subject to the under/over delivery charge.
- Curtailments by the ISO that occur for reliability reasons (i.e. a pro-rata curtailment to multiple resources on a tie point) are due to forces beyond the SCs control. These resources will be excluded from the under/over delivery charge.

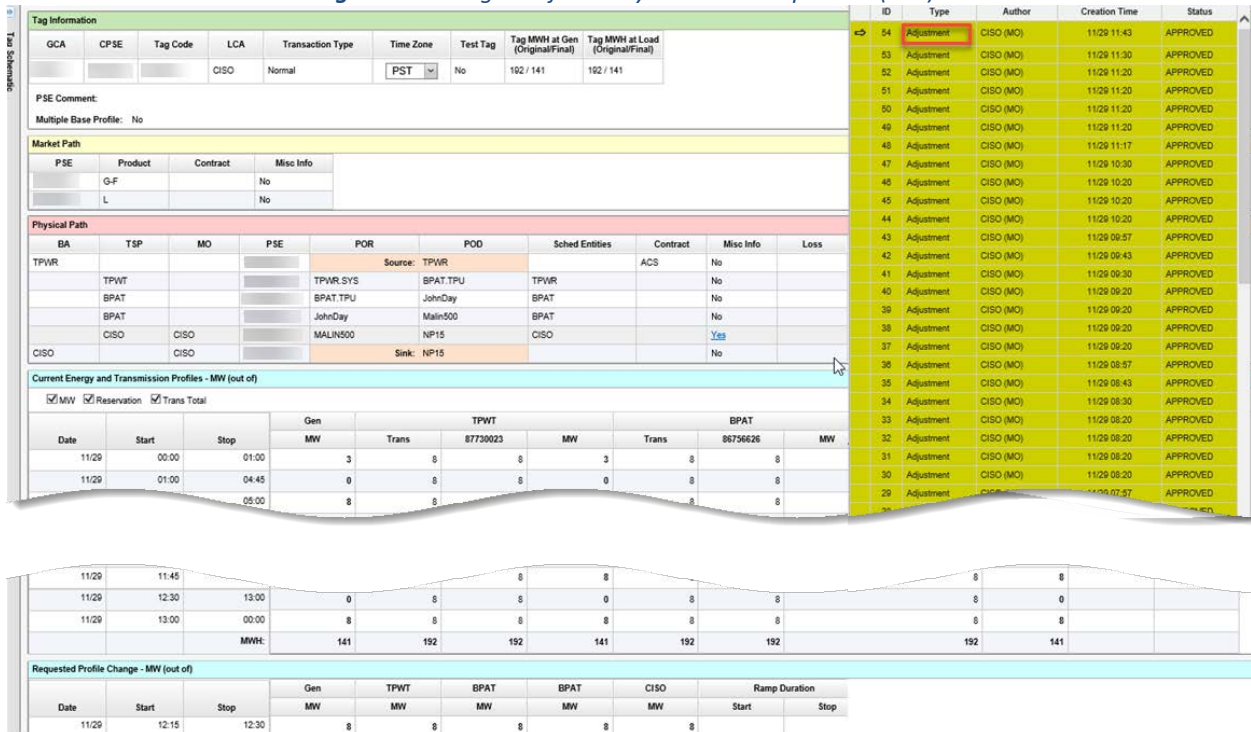
The ISO acknowledges that this business practice may result in the curtailment of hourly block resources for various 15-minute intervals. This is necessary to ensure the ISO adheres to industry standards and does not over-schedule any intertie transmission limits. Additional information is described in **Section 7.4.1 Scenario 3**.

The figures below are screen shots of E-Tags showing a curtailment (**Figure 17**) and an adjustment (**Figure 18**). Anytime an E-Tag is changed, a record is created to show the version history. Tags that are curtailed by a balancing authority (BA) or a transmission service provide (TSP) will be excluded from the under/over delivery charge. Tags that are adjusted by a market operator (MO) and result in a deviation from the HASP schedule will be subject to the under/over delivery charge.

Figure 17: E-Tag is curtailed by the balancing authority (BA).

Tag Information										ID	Type	Author	Creation Time	Status
GCA	CPSE	Tag Code	LCA	Transaction Type	Time Zone	Test Tag	Tag MWH at Gen (Original/Final)	Tag MWH at Load (Original/Final)		3	Adjustment	(PSE)	11/04 00:05	DENIED
			CISO	Normal	PST	No	300 / 298	300 / 298		2	Curtailment	CISO (BA)	11/03 23:54	APPROVED
PSE Comment: FES for San Luis Rey (PST)														
Multiple Base Profile: No														
Market Path														
PSE	Product	Contract	Misc Info											
	G-F	FESP	Yes											
	L		No											
Physical Path														
BA	TSP	MO	PSE	POR	POD	Sched Entities	Contract	Misc Info	Loss					
WALC				Source: DSWM01				No						
	WALC			PARKER101	BLYTHE101	WALC		No						
	CISO	CISO		BLYTHE101	SP15	CISO		Yes						
CISO				Sink: CISO_SP15				Yes						
Current Energy and Transmission Profiles - MW (out of)														
Show: 1 day Starting: 11/29/2018 <input checked="" type="checkbox"/> MW <input checked="" type="checkbox"/> Reservation <input checked="" type="checkbox"/> Trans Total														
Date	Start	Stop	Gen MW	Trans	WALC MW	Trans	CISO MW	Trans	MW					
11/29	00:00	01:00	1	1	1	1	1	1	1					
11/29	12:00	23:00	1	1	1	1	1	1	1					
		MWH:	12	12	12	12	12	12	12					
Requested Profile Change - MW (out of)														
Date	Start	Stop	Gen MW	WALC MW	CISO MW	Ramp Duration Start	Ramp Duration Stop							
11/04	00:00	01:00	0	0	0									
		MWH:	0	0	0									

Figure 18: E-Tag is adjusted by the market operator (MO).



7.4 Eliminate 10% Threshold

The existing decline charge only applies if the total untagged and declined MWh over the course of a month exceeds the 10% of total import or exports (calculated separately). For example: assume a scheduling coordinator has 10,000 MWh of import transactions in a month. The scheduling coordinator can have 1,000 MWh of declined (or under-tagged) intertie awards in the month without receiving a charge. As a result of this policy, the scheduling coordinator can manage when to deliver, and when not to deliver, with no decline charge as long as the total does not exceed 1,000 MWh.

The 10% threshold policy was put in place specifically to address balancing authority area operator curtailments out of the scheduling coordinator’s control. Because the ISO could not distinguish between the two, the 10% threshold was put in place to account for curtailments. Now, however, the ISO *can* distinguish between curtailments and adjustments. Therefore, the 10% threshold is no longer necessary.

The ISO proposes to eliminate the 10% threshold and instead apply the under/over delivery charge on a 15-minute interval basis. As explained in [Section 7.2](#), curtailments will be excluded from the under/over delivery charge.

7.5 Determination of Under/Over Delivery Quantity

This section explains how the amount of undelivered energy is determined by the ISO. The under/over delivery charge will apply to both hourly block and fifteen-minute dispatchable intertie resources. The subsections below identify the logic used to determine the under/over delivery quantity for each bid type respectively.

7.6 Hourly Block Resources

The ISO’s existing decline charge compares the hour-ahead scheduling process award to the fifteen-minute binding award and applies only to hourly block resources.

In order to address both declines and tagging deviations for all intertie resources, the ISO proposes to calculate the under/over delivery quantity by comparing the HASP schedule to the E-Tag. The under/over delivery quantity will equal the absolute value of the difference between the reference schedule and the after the fact E-Tag energy profile. This is summarized in *Figure 19*. This logic, in conjunction with the new fifteen-minute binding award determination logic, will incentivize awards to be accepted and awards to be tagged.

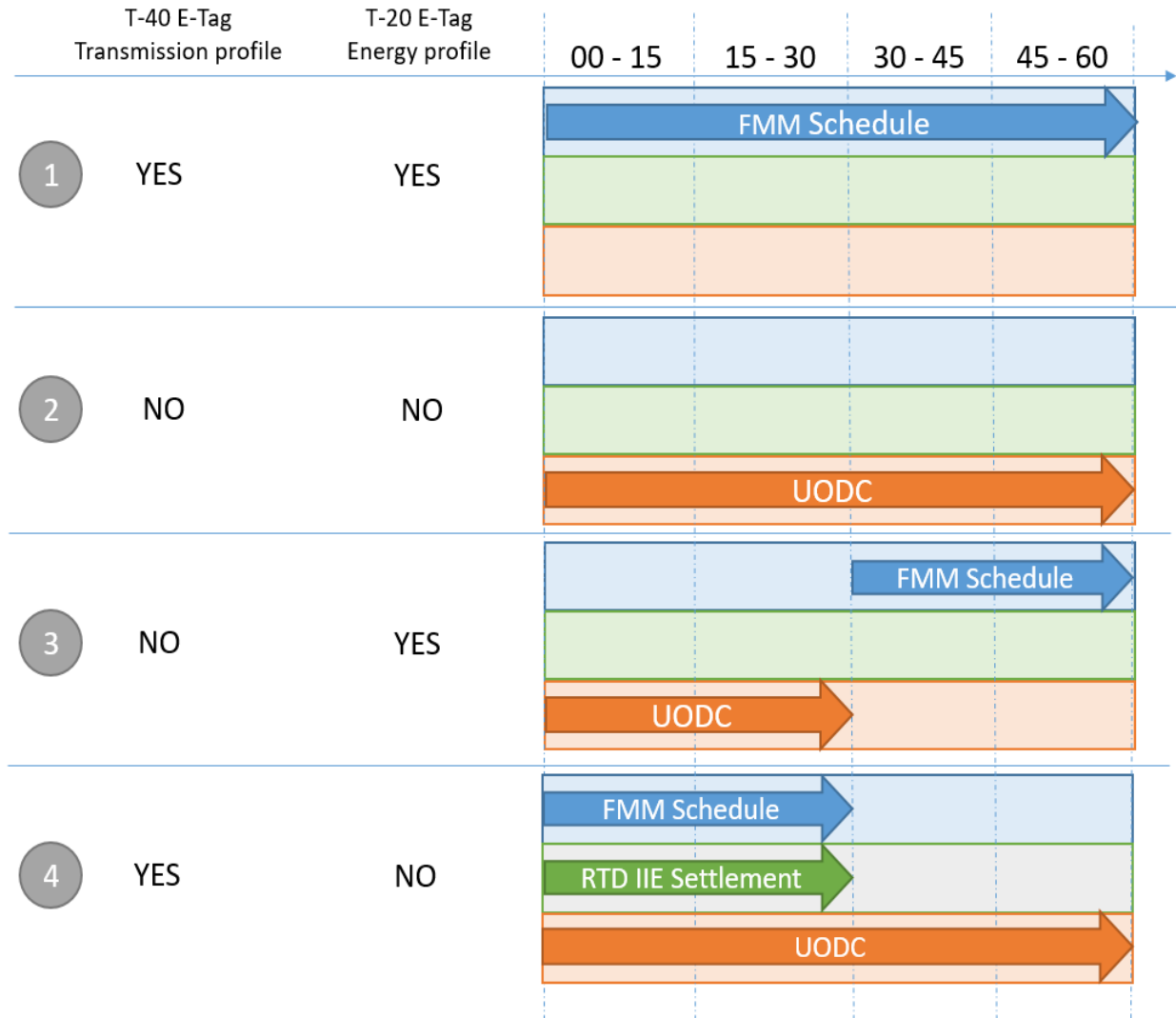
Figure 19: Proposed reference level and determination of under/over delivery quantity for intertie bid options.

Bid Option	Determination of Under/Over Delivery Quantity
Self-Schedule Hourly Block	Absolute Value (HASP Schedule – after the fact E-Tag Energy Profile)
Economic Hourly Block	

The determination of the under/over delivery quantity in conjunction with the proposed fifteen-minute binding award logic ([Section 7.1](#)) is summarized in

Figure 20 below. The blue bars indicate the fifteen-minute award value, the green bars indicate the applicable real-time dispatch instructed imbalance energy settlement, and the orange bars indicate applicable under/over delivery charges. A description is provided below the figure in Scenario 1 – 4.

Figure 20: Impacts and timeline of hourly block scheduling.



Scenario 1

A scheduling coordinator's bid clears the hour-ahead scheduling process, the award is accepted in the automated dispatch system, and an E-Tag with a transmission profile is submitted by T-40. This provides a level of assurance that the energy will be delivered. As such, the fifteen-minute market appropriately schedules the resources for the first two intervals of the operating hour. By T-20, an energy profile is submitted to support the schedule. The fifteen-minute market can now schedule the resource for the last two intervals of the operating hour.

- The E-Tag energy profile matches the FMM schedule, therefore there is no real-time imbalance energy settlement.
- The E-Tag energy profile matches the HASP schedule, therefore there is no under/over delivery charge.

Scenario 2a

A scheduling coordinator's bid clears the hour-ahead scheduling process. The award is declined in the automated dispatch system, and therefore no E-Tag is submitted. The fifteen-minute market reflects this by not scheduling the resource for any interval of the operating hour.

- The E-Tag energy profile matches the FMM schedule (both are 0 MW), therefore there is no real-time imbalance energy settlement.
- The E-Tag energy profile does not match the HSP schedule, therefore the under/over delivery charge is applied.

Scenario 2b

A scheduling coordinator's bid clears the hour-ahead scheduling process. The award is accepted in the automated dispatch system, but an E-Tag with a transmission profile is not submitted by T-40. Therefore, there is no assurance that the energy will be delivered and the fifteen-minute market reflects this by not scheduling the resource for the first two intervals of the operating hour. The scheduling coordinator fails to submit an energy profile by T-20 and as a result the fifteen-minute market reflects this by not scheduling the resource for the last two intervals of the operating hour.

- The E-Tag energy profile matches the FMM schedule (both are 0 MW), therefore there is no real-time imbalance energy settlement.
- The E-Tag energy profile (0 MW) does not match the HASP schedule, therefore the under/over delivery charge is applied.
- Because the award was accepted in the automated dispatch system but the E-Tag was never submitted, an additional 25% is added to the under/over delivery charge.

Note: The only difference between Scenario 2a and 2b is the acceptance/decline of the award in the automated dispatch system. When the scheduling coordinator declines the award ahead of time, the

grid operator has advance notification that the energy cannot be delivered. This improves operational awareness and allows the operator to manually dispatch additional energy on the interties, if needed. When an award is accepted in ADS but the energy is not delivered, the operator does not have the opportunity to manually dispatch. For this reason, an additional 25% is added to the under/over delivery charge. The intent of the 25% is to incentive declining ahead of time when energy cannot be delivered.

Scenario 3

A scheduling coordinator's bid clears the hour-ahead scheduling process. The award is accepted in the automated dispatch system but an E-Tag with a transmission profile is not submitted by T-40. Therefore, there is no assurance that the energy will be delivered and the fifteen-minute market reflects this by not scheduling the resource for the first two intervals of the operating hour. The scheduling coordinator is able to get the E-Tag with an energy profile submitted by T-20 and therefore the fifteen-minute market schedules the resource for the last two intervals of the operating hour.

- The E-Tag energy profile does not match the FMM schedule for the first two intervals of the operating hour, therefore the ISO must curtail the E-Tag so the energy profile does not exceed the market award.
- The E-Tag energy profile does not match the HASP schedule for the first two intervals of the operating hour, therefore the under/over delivery charge is applied.
- The E-Tag energy profile does match the HASP schedule for the last two intervals of the operating hour, therefore the under/over delivery charge is not applied.

In this scenario, the fifteen-minute market will have the ability to dispatch another resource for the first two intervals of the operating hour because it did not anticipate the intertie resource would be delivered (indicated by no transmission profile at T-40). If the fifteen-minute market dispatches another resource *and* the scheduling coordinator submits the energy profile for the intertie resources in question by T-20, there is a possibility that the intertie transmission limit will be exceeded for the first two intervals of the operating hour. In this scenario, which the ISO does not anticipate to occur frequently, the ISO operator will have the authority to adjust/curtail the intertie resource for the first two intervals of the operating hour to ensure scheduling limits are not exceeded. It is important to note that in this scenario the E-Tag may be curtailed for a fifteen-minute interval even though it is an hourly block resources. This logic is an extension of the exiting curtailment practice which allows operators to adjust/curtail intertie resources that exceed their market awards.

The ISO will automate this curtailment to occur sometime after the NAESB E-Tagging deadline of T-20 and prior to the real-time dispatch market run at T-75. The exact time will be determined by implementation needs. Because the automatic curtailment will occur at the resource level and is not for reliability resources, the resource will be flagged and subject to the under/over delivery charge. This automatic curtailment will only occur when the E-Tag energy profile exceeds the market award and ensures the ISO is adhering to all industry standards.

Scenario 4

A scheduling coordinator's bid clears the hour-ahead scheduling process. The award is accepted in the automated dispatch system and an E-Tag with a transmission profile is submitted by T-40. The transmission profile provides a level of assurance that the energy will be delivered and therefore the fifteen-minute market schedules the resource for the first two intervals of the hour. However, the scheduling coordinator fails to submit an energy profile by T-20 and therefore the energy cannot be delivered. This is reflected by the fifteen-minute market with a schedule of 0 MW for the last two intervals of the hour.

- The E-Tag energy profile does not match the FMM schedule for the first two intervals of the operating hour, therefore there is real-time imbalance energy for the first two intervals.
- The E-Tag energy profile does not match the HAPS schedule, therefore the under/over delivery charge is applied.

This combination of events is the worst possibility of the scenarios presented above. The operator believes the energy will be delivered because the award was accepted and a transmission profile was submitted. Ultimately however, the energy is not delivered. It is therefore appropriate that this resource is subject to both the imbalance energy settlement and the under/over delivery charge.

7.7 Fifteen-Minute Dispatchable Resources

Fifteen-minute dispatchable resources are currently excluded from the existing decline charge. However, if a fifteen-minute dispatchable resource does not submit a transmission profile to support the HASP schedule, the fifteen-minute market is unable to award the resources and the energy cannot be delivered. The ISO proposes to calculate the undelivered quantity for fifteen-minute dispatchable resources by comparing the E-Tag transmission profile to the HASP schedule for each fifteen-minute interval. If this value is less than 0 (i.e. the transmission profile does not fully support the HASP schedule), the charge will apply to the difference between the two. If this value is greater than or equal to 0 (i.e. the transmission profile adequately supports the HASP schedule), the charge will not apply.

This logic works in conjunction with the ISO's existing functionality of automatically updated fifteen-minute dispatchable E-Tags. When the HASP schedule is submitted, the scheduling coordinator must submit an E-Tag by T-40 with a transmission profile. The fifteen-minute market energy award is published roughly 22.5 minutes prior to the applicable interval. The NAESB tagging deadline is 20 minutes prior to the interval, so there is a very short window in which the E-Tag energy profile can be updated to match the award. To remedy this, the ISO automated the adjustment process and will update E-Tag energy profiles to match the award as soon as the award is published. This process can only occur if the E-Tag has a transmission profile to support the schedule.

As a result, as long as the transmission profile is submitted, the energy profile will be adjusted to match the award. If the transmission profile is not submitted, the resources is deemed unavailable.

Figure 21: Proposed reference level and determination of under/over delivery quantity for intertie bid options.

Bid Option	Determination of Under/Over Delivery Quantity
Economic (fifteen-minute dispatchable) Economic Variable Energy Resource	E-Tag transmission profile – HASP schedule, If < 0, charge applies to amount of deviation If >= 0, charge does not apply

Examples of the existing functionality in comparison to the proposed functionality can be found in the attached *Intertie Deviation Settlement Worksheet* (detailed settlement solution) and the *UODC Proposal* (simplified settlement solution). These worksheets explain the difference between the decline charge and the proposed under/over delivery charge for both hourly block and fifteen-minute resources.

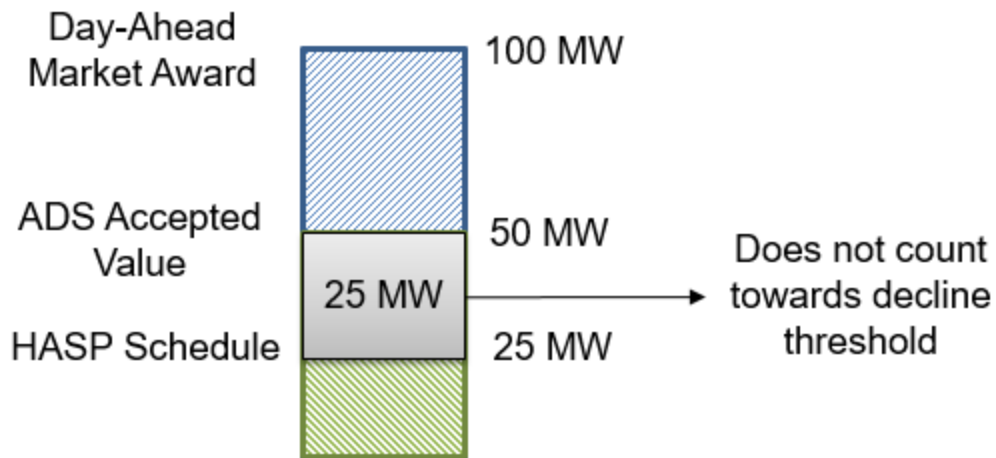
7.8 Under and Over Tagging

The ISO proposes to apply the under/over delivery charge to both under and over tagging. Currently, the decline charge only applies to under-tagged imports, or under-tagged exports. When a scheduling coordinator accepts an award and/or tags a value greater than the HASP schedule, the decline charge does not apply.

Based on today's logic, an import resource with a day-ahead market award and a decremental bid in the hour-ahead scheduling process can decline the decremental award without having the MWh count towards the decline charge threshold.²³ For example, an import resource with a 100 MW award in the day-ahead market can bid into the hour-ahead scheduling process to decrement the award down to 25 MW. The bid clears, but the scheduling coordinators accepts a schedule of 50 MW. The difference between the HASP schedule of 25 MW and the accepted schedule of 50 MW (declining the decremental dispatch) will not count towards the decline charge threshold.

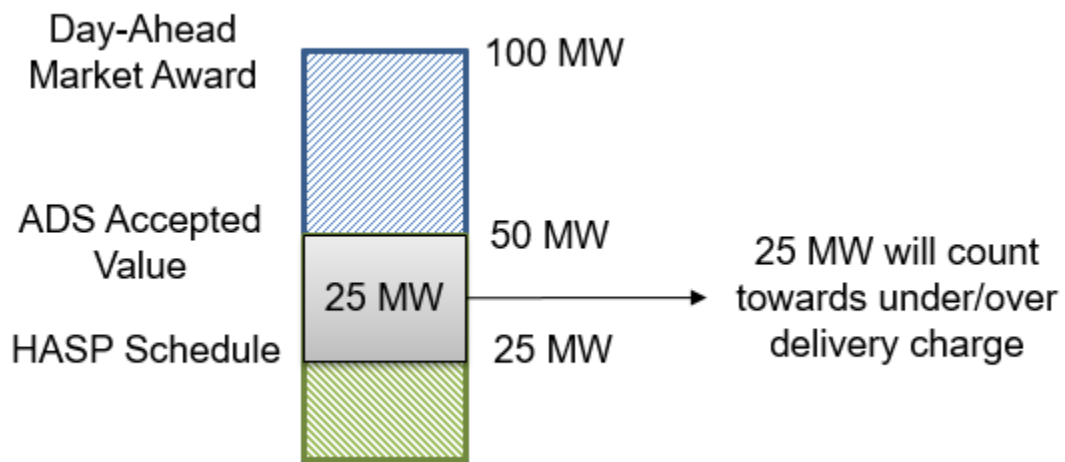
²³ Conversely, the same applies for export resources.

Figure 22: The decline of a decremental dispatch results in the ADS accepted value being greater than the HASP schedule. When this occurs, the existing decline charge does not apply.



By applying the under/over delivery charge to resources with E-Tags that are under or over-scheduled, this gap will be addressed. This is demonstrated in Figure 23.

Figure 23: Applying the new charge to both under and over scheduling (in comparison to the HASP schedule) will address a gap in the previous policy.



The Intertie Deviation Settlement straw proposal suggested a new business practice of permitting the E-Tag energy profiles that were greater than their respective market awards as long as there was no reliability concern. This ISO is removing this business practice from the draft final proposal. Allowing market participants to tag above their market awards may result in congestion and would allow

scheduling coordinators to flow energy that was not cleared by the market. The ISO agrees that this is not in the best interest of the market, the operators, or other scheduling coordinators. The ISO operators will continue to adjust E-Tags that exceed market awards prior to the operating hour. This is done at the discretion of the ISO operator.

7.9 Price and Allocation of the Under/Over Delivery Charge

The ISO generally expects prices to reflect system conditions. This would imply that when a shortage on the interties occurs, the real-time dispatch price should be higher than the fifteen-minute price. However, there are many outside factors – including operator actions that occur outside of the market – that may influence market pricing. Therefore, even if there is a shortage on the interties, the real-time price may be higher than the fifteen-minute price.

Because the ISO cannot predict whether the fifteen-minute or real-time dispatch price will be higher, the ISO believes it is appropriate that the under/over delivery charge is equal to 50% of the greater of the real-time dispatch or fifteen-minute market locational marginal price.

The ISO proposes for the charge to be applied for each interval in which an under/over delivery quantity is calculated. The ISO believes this proposal will charge the scheduling coordinator at a price dependent on the harm inflicted on the ISO market. Said differently, the charge is comparable to the impact the deviation had on the market. By eliminating the 10% threshold and applying the charge for each interval, the scheduling coordinator has incentive to deliver energy, especially when the ISO needs the energy the most.

In order to successfully implement the under/over delivery charge on an interval by interval basis, the ISO settlement systems will require E-Tag information in 15-minute granularity. Currently, the ISO settlement system receives hourly integrated data for E-Tags. As shown in **Figure 24**, even when a deviation occurs for only a portion of the operating hour, the total undelivered quantity is calculated by integrating across the entire hour.

Figure 24: Integration of hourly block E-Tags results in the undelivered quantity being calculated as an average across the hour.

TODAY	1	2	3	4	Integrated
E-Tag Energy Profile	0	0	100	100	50
Award	100	100	100	100	100
Undelivered Quantity	100 MW	100 MW	0	0	50 MWh

Using 15-minute data will ensure the under/over delivery charge is applied at the price for the corresponding interval, as opposed to calculated based on an hourly average. As shown in **Figure 25**, the MWh of deviation can now be calculated for each interval and will be subject to the price for that interval.

Figure 25: Use of fifteen-minute data will allow the undelivered quantity to be settled based on the price of the interval in which the deviation occurred.

PROPOSED	1	2	3	4
E-Tag Energy Profile	0	0	100	100
Award	100	100	100	100
Undelivered Quantity	100 MW (25 MWh)	100 MW (25 MWh)	0	0

15-minute energy profile information is needed to determine the underlived quantity for hourly block resources. 15-minute transmission profile information is needed to determine the undelivered quantity for fifteen-minute dispatchable resources. Therefore, the ISO settlement system will need to receive 15-minute energy and transmission profile data for all E-Tags.

The intent of the under/over delivery charge is to incentivize market participants to accept their hour-ahead scheduling process award and deliver the award energy. If deviations occur, the charge is applied. However, based on the logic described above, scheduling coordinators would be paid for deviations if pricing is negative. This would potentially incentivize deviations when pricing is negative – payment for deviations would contradict the purpose of the under/over delivery charge. Therefore, the ISO proposes to keep the floor of \$10 for the under/over delivery charge. This ensures a charge exists even when pricing is low or negative. The charge funds collected will be allocated to measured demand less existing transmission contracts (ETCs) and transmission operating rights (TORs). This allocation is consistent with the existing decline charge but will be changed from monthly to each interval. For additional information on the allocation, reference the Intertie Schedules Decline Charges Allocation: CC 6457 (see [References](#)).

7.10 Accept/Decline Functionality in the Automated Dispatch System

The ISO always expects energy awarded in HASP to be delivered. If, however, the energy cannot be delivered, it is beneficial for the scheduling coordinator not notify the ISO prior to the fifteen-minute market run. This enables the ISO grid operator to manually dispatch if necessary. The ISO market is most negatively impacted when a scheduling coordinator accepts an award in the automated dispatch system but fails to deliver the energy. To address this concern, the ISO proposes an additional 25% charge at the greater of the FMM or RTD LMP when the scheduling coordinator accepts an award in ADS but fails to deliver the energy. Said differently, if a scheduling coordinator fails to decline the award in ADS and subsequently does not deliver the energy, the additional 25% will apply. The additional 25% will apply to the entire portion of the under/over delivered quantity as defined in [section 7.4](#).

In order to determine the amount of energy that was accepted or declined in the ADS system, ADS will need to display the HASP schedule, the scheduling coordinator accepted value, and the difference between the two. This information will be sent to the ISO settlement system.

In order to provide additional flexibility, the ISO proposes to allow additional time for the scheduling coordinator to accept, partially accept, or decline awards in the ADS system. Currently, scheduling coordinators only have 5 minutes to accept schedules in ADS. The ISO proposes to extend this window to T-45. This provides additional time for the scheduling coordinators to review and accept schedules and allows the ISO operator a 5-minute window to review accepted schedules prior to the fifteen-minute market run that occurs at ~T-40.

7.11 Decline Resulting in Over-Scheduled Intertie

As shown in [Example 7](#), there are scenarios when over scheduling in the import direction occurs due to an export resource declining or partially accepting an award in the hour-ahead scheduling process.²⁴ When this occurs, the ISO is responsible to curtail all import resources based on their contribution to the over-schedule (also known as a *pro rata* curtailment).

The *Intertie Deviation Settlement* straw proposal originally proposed a business practice to mitigate this issue. The business practice proposed to adjust the tag of a particular scheduling coordinator if that scheduling coordinator was at fault for the net over-schedule. The ISO has recognized that this is not possible to implement. If the ISO operator made a curtailment, the tag would may be expect from the under/over delivery charge. If the ISO operator made an adjustment, the scheduling coordinator would

²⁴ The ISO balancing authority area is typically a net importer. For that reason, this paper and resulting discussion is based on an export resource partially accepting or declining award (as shown in Example 7). Please note the inverse can occur as well: the over-scheduling of an intertie in the export direction can occur due to a partially accepted or declined import resource.

have the ability to deny the adjustment and therefore the problem would not be resolved. Because of these concerns, the ISO is removing the proposed business practice from this proposal.

The ISO believes the under/over delivery charge – specifically the application of the UODC to both over and under scheduling – provides adequate incentive to eliminate the behavior of decremental imports or incremental exports. If the existing incentives no longer exist, the ISO anticipates the existing practice of declining decremental imports or incremental exports will be minimized.

8. Additional Items

8.1 HASP Reversal Rule

This ISO has identified a discrepancy between the business practice manual and the tariff related to rules for the hour ahead scheduling process reversal rule. Section 11.32 of the tariff explains the HASP reversal rule will apply when a scheduling coordinator (a) fails to submit an E-Tag to match the day-ahead schedule, or (b) withdraws the E-Tag prior to 45-minutes before the operating hour. The BPM Configuration Guide 6460 (FMM Instructed Imbalance Energy Settlement) explains the HASP reverse rule will apply if the day-ahead schedules is reduced prior to the publication of the HASP results (as opposed to T-45).

The ISO would like to clarify the tariff language to be consistent with the BPM language. The purpose of the HASP reversal rule is to address implicit virtual bidding. As long as day-ahead schedules are supported by an E-Tag up until the publication of HASP, the resource can be used in the HASP optimization and is not seen as an implicit virtual bidder. Therefore the ISO proposes an update to the tariff to state day-ahead market resources will be subject to the HASP reversal rule if the E-Tag is withdrawn prior to publication of the HASP results.

8.2 Response to Stakeholder Comments Outside Scope of Initiative

The ISO addressed stakeholder comments on the issue paper and straw proposal (published August 15 and October 8, 2018, respectively) throughout this straw proposal.²⁵ Comments that were not addressed above are included in this section.

Resource Adequacy on the Interties

Resource adequacy bidding and scheduling on the interties is outside the scope of this initiative and will be addressed in the *RA Enhancements* initiative. Additional information can be found on the RA Enhancements webpage at:

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

Market Timelines

Moving the ISO fifteen-minute market timeline closer to the NAESB E-Tagging timeline of T-20 is out of the scope of this initiative. This initiative intends to address undelivered intertie resources and does not propose changes to the market timing. Real-time market enhancements may be addressed at a later date in a separate initiative.

ISO Operating Procedures

ISO operating procedures and business practice manuals specifically explain that scheduling coordinators must submit E-Tags for accepted market awards. This responsibility to tag market awards falls solely on the scheduling coordinator. The job of the ISO operator is to reliably manage operation of the bulk electric grid – the ISO operator will not, and should not, individually call scheduling coordinators to explain financial impacts of not submitting E-Tags. The ISO balancing authority area operator is *not* a marketer and therefore will never discuss market pricing unless necessitated for reliability reasons (i.e. exceptional dispatches). Market pricing is published on OASIS, market awards are published in CMRI and ADS, bids are accessible in SIBR. This information is all accessible to the scheduling coordinator.

²⁵ Stakeholder comments can be found at www.caiso.com under the Stakeholder Processes → Intertie Deviation Settlement initiative webpage. Please reference comments in response to the Issue Paper. <http://www.caiso.com/informed/Pages/StakeholderProcesses/IntertieDeviationSettlement.aspx>

Reference ISO Operating Procedure 2510: NERC Tagging Requirements.²⁶

ISO System Operator responsibility: The ISO validate Interchange transactions and confirms them with adjacent Balancing Authorities (BA) prior to implementing them in the ACE equation. Additionally, the ISO assesses Interchange transaction for reliability purposes, adequacy of transmission rights, and ensures market awards are not exceeded prior to E-Tag implementation. The ISO uses the Interchange transaction scheduler (ITS) software to process NERC E-Tags, and when necessary, curtail E-Tags that do not pass validation or meet requirements. The ISO complies with NERC/NAESB and WECC business practices related to interchange and implements Confirmed Interchange as received from the Interchange Authority.

Scheduling Coordinator (SC) responsibility: SCs are entities certified by the ISO for the purposes of undertaking functions specified in the CAISO Tariff. This includes ensuring Interchange Schedules are prepared in accordance with NERC, WECC, and ISO requirements and providing E-Tags for all applicable transactions. However, SC's are not specifically identified in NERC/NAESB and WECC standards and might not meet the strict definition of a Purchasing Selling Entity (PSE) as defined in the NERC Glossary of Terms. As such, the SC is responsible for ensuring their transactions are properly tagged by a PSE, as SCs must be awarded ISO market bids and self-schedules on all tags for validation purposes. Failure to satisfy these ISO/ENRV/NAESB tagging requirements may result in refusal by the ISO to implement the Interchange Schedule, irrespective of ISO Market Awards.

Uninstructed Deviation Penalty

The ISO plans to apply the proposed under/over delivery charge to non-dynamic intertie resources. Internal generators and dynamic intertie resources will be excluded from the policy. Application of a deviation charge to internal generation is commonly known as an *uninstructed deviation penalty* (UDP) and is used in some energy markets. At this time, consideration of an UDP for CAISO internal generators is out of the scope of this initiative.

The CAISO believes it is appropriate that internal and external generation is settled differently because they are treated differently by the market. Internal generators are unit specific and are metered. Deviation between the generator dispatch and actual output is settled as uninstructed imbalance energy (UIE) but is not additionally penalized. Intertie resource (external supply) do not need to be unit specific and therefore are not necessarily metered at the generator level. This is an important distinction because the ISO markets have confirmation that internal generators are tied to physical resource whereas intertie resources may not be tied to physical supply. For that reason, the ISO needs an

²⁶ Reference the ISO's operating procedures related to interchange management – OP series 2500. <http://www.caiso.com/rules/Pages/OperatingProcedures/Default.aspx>

incentive to encourage delivery of external resources because there is no guarantee that a physical generator is backing the bid.

Another important distinction is the frequency with which internal and external generation can be dispatched. Internal generators can be dispatched every five minutes and inject directly into the ISO grid. If an internal generator is not following its dispatch, another internal generator can be dispatched in the next five-minute interval with direct injection to the grid. This process accounts for transmission congestion. In comparison, intertie resources are dispatched either hourly or every fifteen-minutes and require the procurement of transmission to allow the import or export transaction to take place. When an hourly blocked intertie resource fails to deliver, the transmission goes unused and because transmission is an hourly commodity there is no opportunity to schedule additional energy on the interties. For this reason, it is important to incentive delivery of intertie resources as awarded by the ISO market.

9. Stakeholder Engagement and Next Steps

Stakeholder input is critical for developing market design policy. The schedule proposed below allows several opportunities for stakeholder's involvement and feedback. At this time, management will only seek policy approval from the ISO Board of Governors. The EIM Governing Body may choose to provide advice on the policy to the Board of Governors.

9.1 Schedule.

Figure 26 lists the planned schedule for the *Intertie Deviation Settlement* stakeholder process. The ISO proposes to present its proposal to EIM Governing Body and the ISO Board of Governors at the respective January and February 2019 meetings.

Figure 26: Proposed schedule for the Intertie Deviation Settlement stakeholder process

Item	Date
Post Issue Paper	August 15, 2018
Stakeholder Conference Call	August 22, 2018
Stakeholder Comments Due	September 5, 2018
Post Straw Proposal	October 8, 2018
Stakeholder Meeting	October 15, 2018
Stakeholder Comments Due	October 29, 2018
Post Draft Final Proposal	December 12, 2019
Stakeholder Conference Call	December 19, 2019
Stakeholder Comments Due	January 8, 2019
EIM Governing Body Meeting	January 24, 2019
Board of Governors Meeting	February 6-7, 2019

The ISO will discuss this paper during a stakeholder call on December 19, 2018. The ISO requests that stakeholders submit written comments by January 8, 2019 to InitiativeComments@caiso.com.

9.2 EIM Governing Body Role

The EIM Governing Body has an advisory role over policies that impact the real-time market. This policy impacts the real-time market and therefore the EIM Governing Body “has the right to submit to the Board its advice on” the issue. Please note that the policy changes will be directed only toward settlement rules for intertie bidding for the ISO balancing authority area. The energy imbalance market design does not include intertie bidding and is not subject to the decline charge.

This EIM classification is temporary and may change at any time during the stakeholder process. If any stakeholder disagrees with the ISO’s initial classification, please include in your written comments a justification of which classification is more appropriate.

Appendix A: Charge Code 6455 Example

Hourly Block Example - Charge Code 6455

	Int 1	Int 2	Int 3	Int 4	Hrly Total
DA Sched	100	100	100	100	400
FMM OE	25	25	22.5	22.5	95
Deemed Delivered (Meter)	122.5	122.5	122.5	122.5	490
OA = Meter - DA - FMM OE	-2.5	-2.5	0	0	-5
Hrly HASP Advisory	125	125	125	125	500
FMM Transmission etag (T-20 minutes)	122.5	122.5	122.5	122.5	490
FMM Accept Schedule (ADS)	125	125	122.5	122.5	495
FMM LMP	\$ 25.00	\$ 30.00	\$ 20.00	\$ 15.00	
Binding Energy:					
IMPORT = min(ADS, etag)					
EXPORT = max(ADS, etag)	122.5	122.5	122.5	122.5	490
Expected Flow:					
Hrly HASP Advisory	125	125	125	125	500
Neg OA:					
IMPORT = min(0, OA)					
EXPORT = max(0, OA)	-2.5	-2.5	0	0	-5
Deviation Energy:					
Binding Energy - (Expected Flow + Neg OA)	0	0	-2.5	-2.5	-5
Undelivered Energy/Decline Quantity (basis for BQ):					
IMPORT = min(0, Deviation Energy)*(-1)					
EXPORT = max(0, Deviation Energy)	0	0	2.5	2.5	5
Decline Charge Price:					
max (\$10, FMM LMP * 50%)	\$ 12.50	\$ 15.00	\$ 10.00	\$ 10.00	
Potential Decline Charge =					
Undelivered Energy * Decline Charge Price	\$ -	\$ -	\$ 25.00	\$ 25.00	\$ 50.00
Total Hourly HASP Dispatch:					
Abs(Expected Flow + Neg OA)	122.5	122.5	125	125	495
Total HASP Dispatch MTD					600
Total Monthly HASP Dispatch					1095

Threshold Quantity: max(300 MW, Total Monthly HASP Dispatch * 10%)		300
Total Undelivered Energy MTD		400
Total Monthly Undelivered Energy		405
Ratio: max (0, (Total Monthly Undelivered Energy - Threshold Quantity)) / Total Monthly Undelivered Energy		0.25925926
Potential Decline Charge MTD		\$ 500.00
Total Monthly Potential Decline Charge		\$ 550.00
Intertie Schedules Decline Charge - CC 6455: Total Monthly Potential Decline Charge * Ratio		\$ 142.59

Appendix B: Additional Data Analysis

Similar to **Figure 13** and **Figure 15**, **Figure 27** examines the range of total undelivered intertie resources in the export direction on an hourly granularity. The total amount of undelivered interties is represented by combining the MWh quantities of explicit declines, full no show and partial show/accepted awards. Each hour of the year (July 2017-June 2018) analyzed has three corresponding points: the minimum, maximum, and average undelivered intertie quantity that occurred during that specific hour.

Figure 27: Range of Hourly Undelivered Intertie Resources – Export Direction (7/2017 – 6/2018)

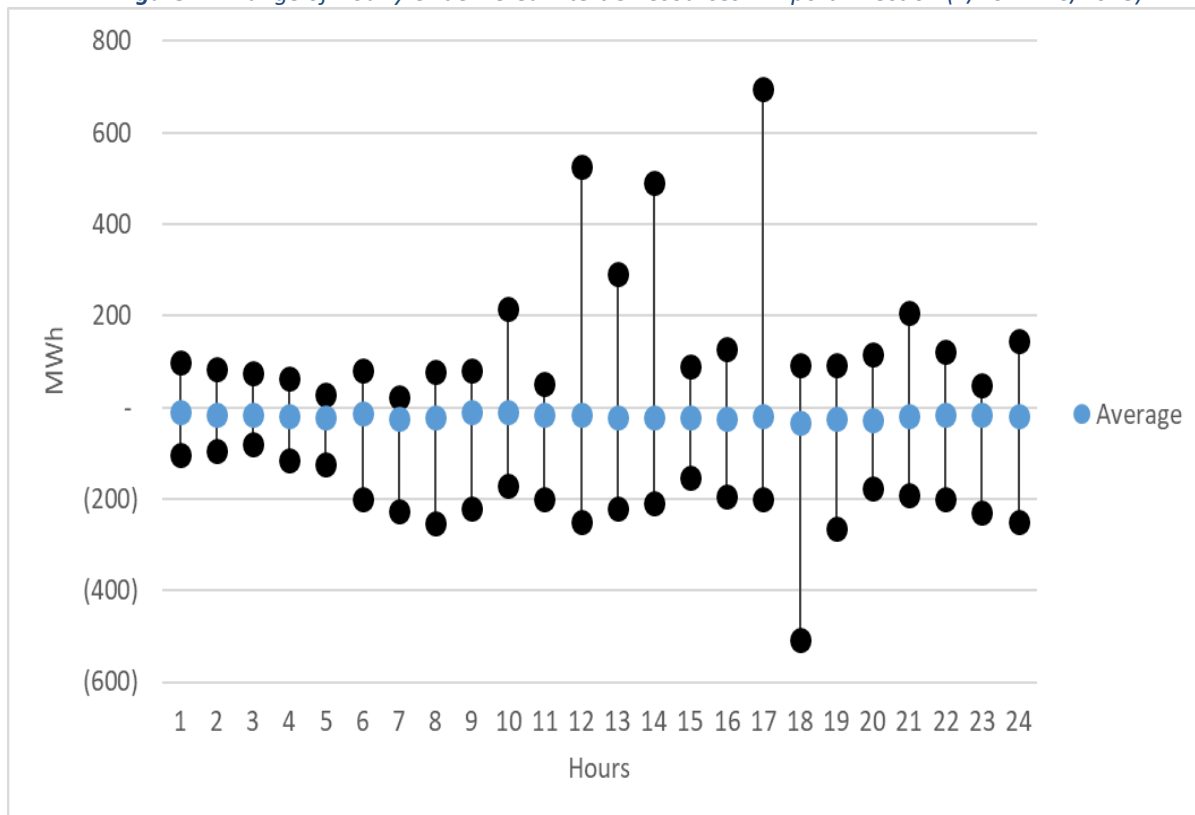
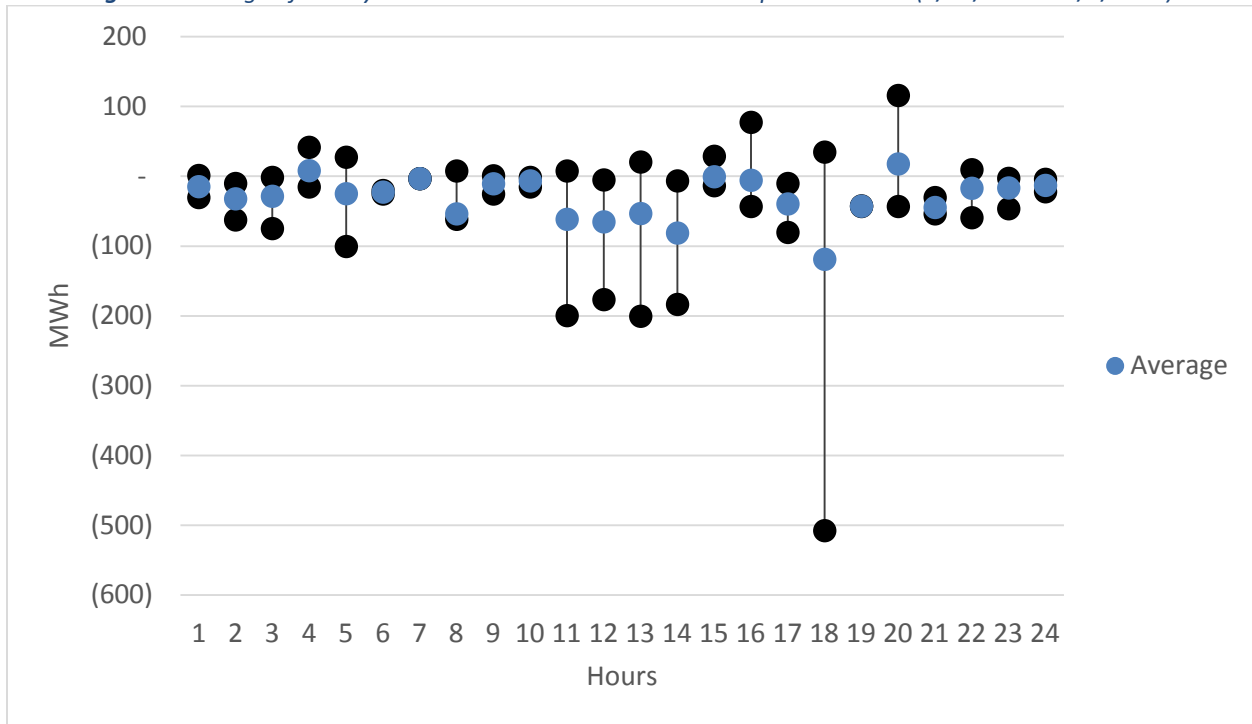


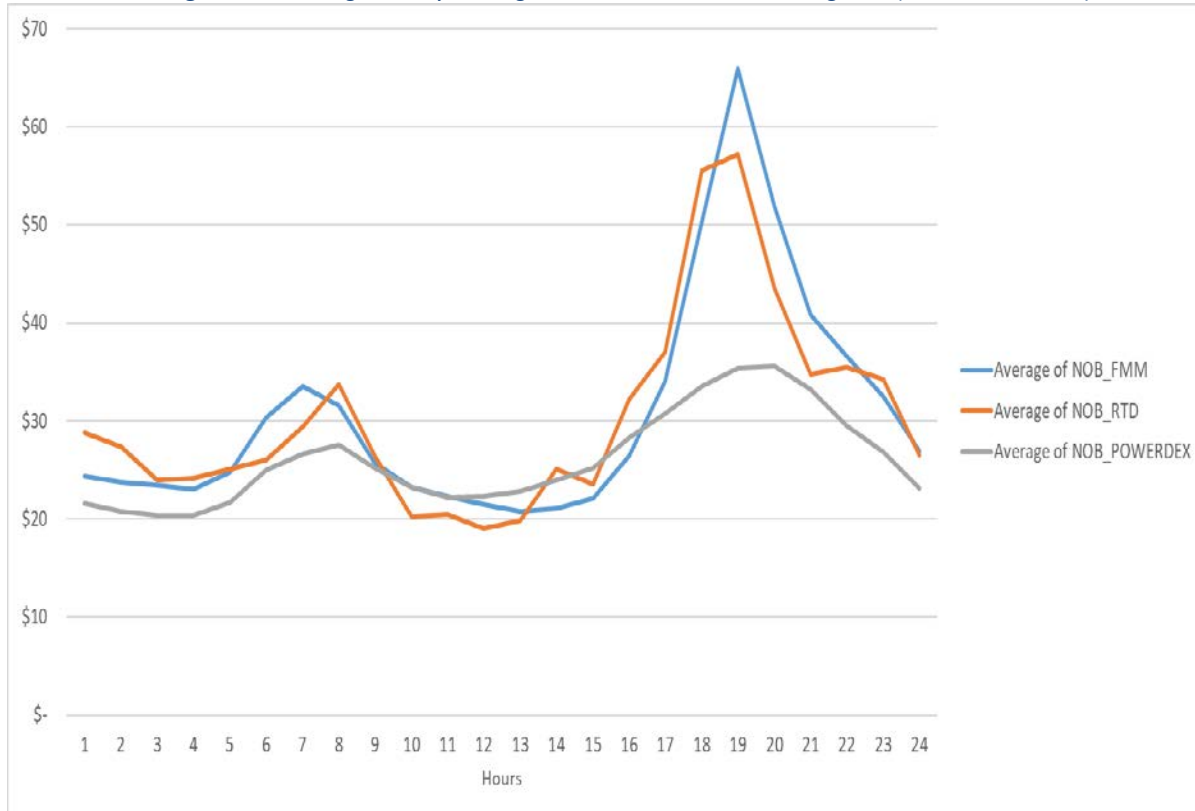
Figure 28 examines the range of total undelivered inertia resources in the export direction on an hourly granularity during the critical period of the September 1-2, 2017 heat wave.

Figure 28: Range of Hourly Undelivered Inertia Resources – Export Direction (8/28/2017 – 9/3/2017)



The ISO performed additional analysis by examining real time prices at the NOB bilateral trading hub. Average hourly ISO fifteen-minute and five-minute market prices were compared to real time average hourly Powerdex prices at the NOB trading hub. **Figure 29** highlights that prices are highest during the same evening peak hours when the range of undelivered interties is the greatest.

Figure 29: Average Hourly Pricing at the NOB Bilateral Trading Hub (6/2017 – 7/2018)



When examining average hourly prices during the critical period September 1-2, 2017 heat wave, **Figure 30** depicts similar conclusions that prices are highest during the hours when the range of undelivered intertie resources is the greatest.

Figure 30: Average Hourly Pricing at the NOB Bilateral Trading Hub (8/28/2017 – 9/3/2017)

