TECHNICAL BULLETIN

Pricing Logic for Scheduling Point –Tie Combination

March 2, 2015

Revision History

Date	Version	Description	Author
March 2, 2015	1.0	Description of SP-TIE pricing logic	Guillermo Bautista Alderete

Contents

Executive Summary

The implementation of the Full Network Model Expansion (FNM) on October 15, 2014 increased the accuracy of the transmission grid modeling from neighboring balancing authority areas, and also allowed for better representation of unscheduled flows effects into the CAISO system. In addition, the implementation of the Energy imbalance Market (EIM) on November 1, 2014, further enabled the California ISO to co-optimize resources across the various areas of the EIM. Since the FNM Expansion deployment on October 15, 2014, interchange (import/export) schedules are settled at the relevant locational marginal prices (LMP) of Scheduling Point (SP) – Intertie (TIE) combination. For registered system resources, the SP is the registered PNode/APNode and the TIE is the registered primary intertie. For Intertie Transactions, the SP and the TIE are declared by the scheduling coordinator in the bid and they are included in the corresponding transaction. Due to this data structure change, the LMP for the scheduling point generally may be different than the locational marginal price for the combination of scheduling point-intertie. When the FMM was effective as of October 15, 2014, the Open Access Same-Time Information (OASIS) display for LMPs could not support this new logic. Effectively, the price displayed for the MALIN scheduling point on OASIS did not reflect congestion arising from MALIN500 constraint. From the point of view of CAISO resource pricing, these data structure changes impacted the treatment and posting of three specific locations, namely MALIN (MALIN_5_N101), MONA (MONA_3_N501) and CRAG (CRAGVIEW_1_GN001) scheduling points. For the sake of organizing this report, the description of the MALIN scheduling point is separated from the description of the MONA and CRAG scheduling points given the different interplays impacting each of these scheduling points.

Acronyms

Acronym	Definition
CISO	California area
CMRI	Customer market results interface
CRAG	CRAGVIEW_1_GN001 pricing location
CRR	Congestion revenue right
EIM	Energy imbalance market
GHG	Green-House gas
IFM	Integrated forward market
ISL	Interchange scheduling limit
LMP	Locational marginal price
LPF	Loss penalty factor
MCC	Marginal congestion component
MLC	Marginal loss component
MONA	MONA_3_N501 pricing location
OASIS	Open Access Same-Time Information System
PAC, PACE, PACW	PacificCorp, Pacific East or Pacific West area
RTM	Real-time market
SMEC	System marginal energy component
SP	Scheduling point
SP-TIE	Scheduling point, intertie combination
TIE	Intertie

Scope of Document

This document explains the expected pricing logic for CAISO's transactions at scheduling points and the pricing display in OASIS to support it. Specifically, this technical bulletin explains the pricing logic and displays applicable to the MALIN (MALIN_5_N101), MONA (MONA_3_N501) and CRAG (CRAGVIEW_1_GN001) scheduling points. It also elaborates on some of the issues the ISO has identified that has deviated from the intended publishing and processing of such prices. This first version of the technical bulletin does not elaborates on the impact assessment for the issues that the ISO has identified. The ISO intends to publish a subsequent market issues technical bulletin at a subsequent date to include an impact assessment and next steps.

Treatment and Pricing of MALIN Scheduling Point

The MALIN500 intertie scheduling limit (ISL) is a constraint introduced with the implementation of the full network model on October 15, 2014. The associated scheduling point is MALIN_5_N101. This constraint replaced the PACI ITC constraint. Since the FNM Expansion deployment on October 15, 2014, interchange (import/export) schedules are settled at the relevant Scheduling Point (SP) – Intertie (TIE) combination. For registered System Resources, the SP is the registered PNode/APNode and the TIE is the registered primary intertie. For Intertie Transactions, the SP and the TIE are declared by the scheduling coordinator in the bid and they are included in the corresponding transaction. Due to this data structure change, the locational marginal price for the scheduling point generally may be different than the LMP for the combination of scheduling point-intertie combination. When the FMM was effective as of October 15, 2014, the OASIS display for LMPs could not support this new scheduling point-intertie logic. Effectively, the price displayed for the MALIN scheduling point on OASIS did not reflect congestion arising from MALIN500 constraint.

In early November, the ISO communicated this data SP-TIE data structure change and its implications on the prices displayed on OASIS;[1] this communication to the market was done through the market update calls, including the call on November 13, 2014, and in the market performance and planning forums. The CAISO informed participants in these forums, that prices

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[1] The minutes of the market update calls are available at
http://www.caiso.com/Pages/documentsbygroup.aspx?GroupID=0F3C7EDB-0EA6-4D07-A116-D302B418FFB0

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displayed in CMRI provided the more granular transaction based pricing. The CAISO explained that while the OASIS pricing display was more limited, it believed at the time that the prices as displayed were correct, and explained that the price at the MALIN scheduling point did not reflect the congestion arising from the MALIN500 ISL constraint. The CAISO also responded to comments at FERC regarding the OASIS displays and explained that while it did not believe the prices on OASIS were incorrect, it believed the display of the prices on the OASIS was, in fact, limited. The CAISO committed to enhance the display going forward, and also back fill the OASIS display going back to November 1.[2]

There have been several inquiries and concerns about what prices are displayed on OASIS and CMRI, and used for settlements of energy (intertie resources) and congestion revenue rights (CRRs). In order to mitigate for the limitation of the existing LMP display on OASIS, the ISO created a new OASIS display to show LMPs for specific SP-TIE combinations. On December 23, 2014, the ISO posted a market notice with the technical specifications of these new SP-TIE prices and the new display was deployed the afternoon of January 8, 2015.[3]

Consider the following description to illustrate the expected pricing of the MALIN scheduling point. For this purpose, consider the following nomenclature and definitions:

- If the MALIN500 ISL constraint is binding then it will be at a shadow price denoted by μ.

- Consider a generic marginal congestion component (MCC) from any transmission constraint (flowgate, transmission corridor, nomogram) for which the MALIN scheduling point has a shift factor; the MALIN scheduling point in particular does not have an effectiveness with respect to any other CISO interties, so this congestion will be representative of only internal transmission constraints and be denoted with the symbol MCC_{flow}.

- The marginal congestion component from any other intertie (but MALIN500) will be represented generically with MCC_{ITC}. Again, the MALIN scheduling point in particular does not have any effectiveness over other interties.

- The system energy marginal component, the marginal loss component and the greenhouse gas emission component are defined with the symbols SMEC, MLC and GHG, respectively. For the day-ahead market and for the MALIN scheduling point, the

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[2]   *See* California ISO Answer filed on November 19, 2014 in FERC Docket No. ER15-402, http://www.caiso.com/Documents/Nov19_2014_AnswetoComments_EIMWaiverRequest_ER15-402.pdf
[3] The market notice is available at http://www.caiso.com/Documents/January2015OASISApplicationReleaseVersion661TechnicalSpecifications.htm

GHG concept and component do not apply. This term will not be present in any prices of MALIN for the day-ahead market.

- Finally, if any EIM transfer constraints are binding, their shadow prices of such constraints will be generically denoted with φ, and it can stand for PAC West, PAC East or PAC EIM transfers or any combination. They are not binding in the day-ahead market.

Using the nomenclature described above, the pricing logic applicable to the MALIN scheduling point (MALIN_5_N101) in both the day-ahead and real-time markets is as follows:

- The MCC price shown in the OASIS locational marginal price view is

$$MCC = MCC_{flow}$$

- The LMP shown in the OASIS locational marginal price view is composed as follows:

$$LMP = SMEC + MLC + MCC_{flow}$$

- The MCC price shown in the new OASIS SP-TIE view is:

$$MCC = (MCC_{flow} + \mu)$$

- The LMP shown in the new OASIS SP-TIE view is

$$LMP = SMEC + MLC + (MCC_{flow} + \mu)$$

- The MCC displayed in the CMRI Import-Export commodity prices view is:

$$MCC = (MCC_{flow} + \mu)$$

- The LMP displayed in the CMRI Import-Export commodity prices view is:

$$LMP = SMEC + MLC + (MCC_{flow} + \mu)$$

- Import/Exports associated with transactions for the CA BAA at the MALIN scheduling point will be settled at the following LMP

$$LMP = SMEC + MLC + (MCC_{flow} + \mu)$$

- Congestion and congestion revenue rights from or to the MALIN scheduling point will be settled at the following marginal congestion component.

$$MCC = (MCC_{flow} + \mu)$$

- MALIN SP is not subject to losses adjustments therefore the MLC price remains unchanged.

Below is an illustration of these pricing definitions in actual displays for the IFM market for February 13, 2015 HE18. The ISO has reviewed this day and interval and verified that it was available and consistent with these definitions when reviewed on February 26, 2015.

The shadow price for MALIN500 posted on OASIS is

Intertie Constraint Shadow Prices

Market	Opr Date	Opr Interval	Transmission Interface ID	Direction	HE16	HE17	HE18	HE19	HE20
DAM	02/13/2015	0	IPPUTAH_ITC	Import	-0.90817	-4.74470	-4.88310	-9.98156	-3.77192
DAM	02/13/2015	0	MALIN500	Import	-5.10697	-9.35138	-2.31692	-13.66913	-9.73157

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The LMP as displayed in the old locational marginal price view in OASIS is

Locational Marginal Prices (LMP)

Market	Opr Date	Node	LMP Type	HE16	HE17	HE18	HE19	HE20
DAM	02/13/2015	MALIN_5_N101	LMP	31.10697	35.35138	40.81692	48.66913	39.62157
DAM	02/13/2015	MALIN_5_N101	Congestion	-1.17095	-0.71836	-0.68729	-0.56627	-0.55958
DAM	02/13/2015	MALIN_5_N101	Energy	35.03899	39.10423	45.09367	53.58664	43.57098
DAM	02/13/2015	MALIN_5_N101	Loss	-2.76107	-3.03449	-3.58946	-4.35124	-3.38982

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The new SP-TIE view on OASIS shows

Scheduling Point/Tie Combination Locational Marginal Prices (LMP)

Market	Opr Date	Node	Tie	LMP Type	HE16	HE17	HE18	HE19	HE20
DAM	02/13/2015	MALIN_5_N101	MALIN500	LMP	26.00000	26.00000	38.50000	35.00000	29.89000
DAM	02/13/2015	MALIN_5_N101	MALIN500	Congestion	-6.27792	-10.06974	-3.00421	-14.23541	-10.29116

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CMRI view for resources using the MALIN scheduling point show the following prices:

Day-Ahead Import-Export Commodity Prices

Trade Date	SC ID	Resource	Schedule Point	Direction	Price Type	HE16 [$]	HE17 [$]	HE18 [$]	HE19 [$]	HE20 [$]
02/13/2015			MALIN500	Import	LMP	26.00	26.00	38.50	35.00	29.89
02/13/2015			MALIN500	Import	Congestion	-6.28	-10.07	-3.00	-14.24	-10.29
02/13/2015			MALIN500	Import	Energy	35.04	39.10	45.09	53.59	43.57
02/13/2015			MALIN500	Import	Loss	-2.76	-3.03	-3.59	-4.35	-3.39

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There are a few points to consider when cross checking these displays:

1. The prices shown in CMRI match the prices available in the new SP-TIE OASIS display, these displays reflect the prices intended to use for settlements of resources scheduled at the MALIN scheduling point.

2. The marginal congestion component of -$0.687 displayed in the locational marginal price view of OASIS accounts for any internal congestion associated with the MALIN scheduling point, but it does not include the congestion from the MALIN500 ISL.

3. By comparing the displays from OASIS, one can verify that the difference in the LMPs between OASIS displays ($38.5-$40.81=-$2.31) equals the difference in the of MCCs between OASIS displays (-$3.004+6.687=-$2.31), and such difference amounts to the shadow price of the MALIN500 ISL constraint of -$2.31.

4. By the previous point, the difference between the locational marginal price view and the new SP-TIE view is only the inclusion of the MALIN500 ISL shadow price. When this ISL constraint is not binding, the LMPs and MCCs in both displays are expected to be the same.

5. Effectively, only the data in the new SP-TIE view is necessary to see what prices are used for settlements of resources scheduled at the MALIN scheduling point. With the introduction of the new SP-TIE OASIS display, the participant does not need to compare or calculate congestion between the LMP and SP-TIE views of OASIS to derive the financially binding prices.

6. For congestion revenue rights, the expectation is that CRRs defined at the MALIN scheduling point will be settled at the same congestion prices used to settle CISO tie resources. For the illustration described above, any CRR defined with the MALIN scheduling point, the source or sink for a CRR should be settled at a marginal congestion component of   -$3.004, which accounts for both internal CAISO congestion of -$0.687 and congestion from the MALIN500 ISL constraint of -$2.317.

7. The logic just described and illustrated with a day-ahead case applies the same way to the real-time market.

Treatment and Pricing of MONA and CRAG Scheduling Points

For the CRAG and MONA scheduling points, the CAISO had to account for the fact that schedules can be submitted at the locations for purposes of CAISO only transactions or Energy Imbalance Market only transactions. The CRAG location is the scheduling point for the Cascade intertie; the MONA location serves as a scheduling point for various southern interties, such as IPPUTAH and Adelanto interties. Prior to the implementation of the full network model, these two scheduling points were modeled with the standard radial link and were considered part of the CAISO balancing authority area. With the implementation of the full network model expansion, this definition changed and with the implementation of the Energy Imbalance Market the prices at these locations changed notably as the CAISO began accounting for Energy Imbalance Market related congestion.

CRAG and MONA scheduling points are physically located within the PacifiCorp Balancing Authority Areas (BAA) instead of the CAISO BAA. MONA is located inside PAC East, and CRAG is located inside PAC West. However, these locations continue to serve as scheduling points for imports and exports transacted with the CAISO balancing authority area. This situation requires specific treatment for balancing and pricing calculations and leads to a special prices posted on OASIS. The pricing at these locations is based on the concept of mirror resources to implement the special treatment of CAISO scheduling points CRAG/MONA interchanges into the balance and price calculations of CAISO and PAC East/PAC West balancing authority areas.

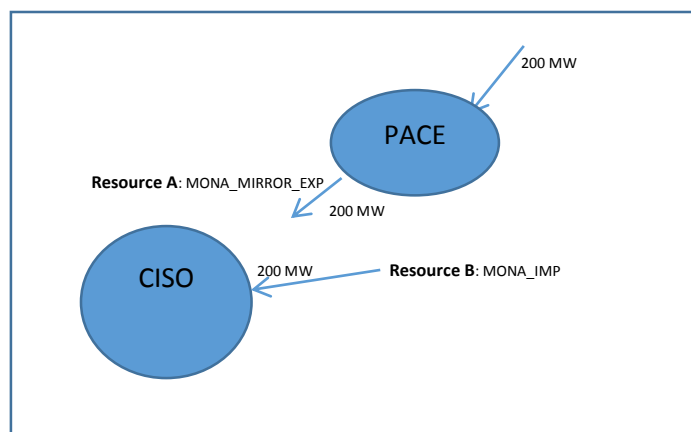Figure 1: Illustration of MONA Pricing

Figure 1 illustrates how an import at MONA scheduling point is mirrored by an export from the PACE balancing authority area with equal megawatt value. The reason for this mirroring is to allow the accounting for the import and associated offsetting export for each BAA separately while the supporting resource(s) for the transaction is modeled at the physical location within PACE BAA or as a separate import to PACE BAA from another balancing authority area.

The CAISO detected that the pricing at CRAG and MONA over the first few days of implementation were subject to a software defect that resulted in the pricing to include some of the LMP components pertaining to the mirror resource. The ISO fixed this issue on November 5, 2014.

The description and example below illustrate the expected pricing of the MONA scheduling point and uses the following nomenclature:

- If the MALIN500 ISL is binding then it will be at a shadow price denoted with μ.

- Consider a generic marginal congestion component from any transmission constraints (flowgate, transmission corridor, nomogram) within the CA BAA for which the MONA scheduling point has a shift factor, so this congestion will be representative of only internal CA BAA transmission constraint and be denoted with the symbol MCC_{flow}.

- The marginal congestion component from any CA BAA intertie (but MALIN500) will be represented generically with MCC_{ITC}. For instance, congestion on the IPPUTAH ITC which is associated with the MONA scheduling point or Cascade ITC that is associated with the CRAG scheduling point would be captured in this term.

- The system energy marginal component, the marginal loss component and the greenhouse gas emission component are defined denoted with SMEC, MLC and GHG, respectively.

- Finally, if any EIM transfer constraints are binding, the shadow prices of such constraints will be generically denoted with φ, and it can stand for PAC West, PAC East or PAC EIM transfers or any combination of them.

Day Ahead Market

The pricing logic applicable to the MONA and CRAG scheduling points (MONA_3_N501 and CRAGVIEW_1_N101) in the day-ahead market is described in this section. Since the logic is the same for these two scheduling points, the description will referred only to MONA scheduling point.

- The MCC price shown in the locational marginal price view is

$$MCC = MCC_{flow} + MCC_{ITC}$$

- The LMP shown in the OASIS locational marginal price view is composed as follows:

$$LMP = SMEC + MLC + (MCC_{flow} + MCC_{ITC})$$

- The MCC price shown in the new OASIS SP-TIE view is

$$MCC = (MCC_{flow} + MCC_{ITC})$$

- The LMP shown in the new OASIS SP-TIE view is

$$LMP = SMEC + MLC + (MCC_{flow} + MCC_{ITC})$$

- The MCC displayed in the CMRI Import-Export commodity prices view is

$$MCC = (MCC_{flow} + MCC_{ITC})$$

- The LMP displayed in the CMRI Import-Export commodity prices view is

$$LMP = SMEC + \widehat{MLC} + (MCC_{flow} + MCC_{ITC})$$

- Import/Exports associated with transactions for CA BAA at the MONA or CRAG scheduling points will be settled at the following LMP

$$LMP = SMEC + \widehat{MLC} + (MCC_{flow} + MCC_{ITC})$$

The MONA scheduling point is subject to the marginal loss adjustment and, therefore, the marginal loss component will be different (denoted with $\widehat{MLC}$) in CMRI view as well as in the import/export settlements with respect to the value provided in the LMP pnode OASIS display. This adjustment is made after the fact through an internal post-

process.[4] The CRAG scheduling point is not subject to this adjustment and its MLC component should remain the same across the various displays.

- Congestion revenue rights from or to the MONA or CRAG scheduling points will be settled at the marginal congestion component calculated only from congestion arising from the CISO,

$$MCC = (MCC_{flow} + MCC_{ITC})$$

Below is an illustration to this pricing using the actual day displays for February 13, 2015 for Mona scheduling point. The shadow price for MALIN500 ISL and IPPUTAH ITC as posted on OASIS are

Intertie Constraint Shadow Prices

Market	Opr Date	Opr Interval	Transmission Interface ID	Direction	HE16	HE17	HE18	HE19	HE20
DAM	02/13/2015	0	IPPUTAH_ITC	Import	-0.90817	-4.74470	-4.88310	-9.98156	-3.77192
DAM	02/13/2015	0	MALIN500	Import	-5.10697	-9.35138	-2.31692	-13.66913	-9.73157

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The LMP as displayed in the old locational marginal price view in OASIS is

Locational Marginal Prices (LMP)

Market	Opr Date	Node	LMP Type	HE16	HE17	HE18	HE19	HE20
DAM	02/13/2015	MONA_3_N501	LMP	28.00000	30.00000	35.31000	38.50000	36.60000
DAM	02/13/2015	MONA_3_N501	Congestion	-5.01374	-6.96523	-7.29901	-11.93039	-4.53972
DAM	02/13/2015	MONA_3_N501	Energy	35.03899	39.10423	45.09367	53.58664	43.57098
DAM	02/13/2015	MONA_3_N501	Loss	-2.02525	-2.13900	-2.48466	-3.15625	-2.43126

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The new SP-TIE view on OASIS shows

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[4] The marginal loss components calculated for locations within the CAISO Balancing Authority Area shall not reflect the cost of Transmission Losses on Subject Facilities. Because of this requirement, the CAISO calculates the LMPs for such transactions by zeroing out the resistive component for power flows on the Subject Facilities. This provision does not preclude the CAISO from applying the MCLs attributed to such power flows on the CAISO Controlled Grid that is within the CAISO BAA. Therefore, the Marginal Cost of Losses of the LMP for transactions using the Subject Facilities is based on the same "border location" approach. In summary, the CAISO calculates an LMP that includes a MCL based on the assumption that the power is physically injected at the ISO border with the neighboring BAA who is owed the losses. This is accomplished by calculating an LMP that is derived by replacing the MLC component of the original LMP, with a MLC component from the LMP at the injection location on the border of the CAISO BAA. More details are provided in the technical bulletin for loss adjustments available at http://www.caiso.com/Documents/TechnicalBulletin-Losses_TransmissionLossesMarginalCostImplementation_FacilitiesOutsideISOBalancingAuthorityArea.pdf

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Scheduling Point/Tie Combination Locational Marginal Prices (LMP)

Market	Opr Date	Node	Tie	LMP Type	HE16	HE17	HE18	HE19	HE20
DAM	02/13/2015	MONA_3_N501	MDWP	LMP	28.00000	30.00000	35.31000	38.50000	36.60000
DAM	02/13/2015	MONA_3_N501	MDWP	Congestion	-5.01374	-6.96523	-7.29901	-11.93039	-4.53972

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CMRI view for resources using the MALIN scheduling point show the following prices:

Day-Ahead Import-Export Commodity Prices

Trade Date	SC ID	Resource	Schedule Point	Direction	Price Type	HE16 [$]	HE17 [$]	HE18 [$]	HE19 [$]	HE20 [$]
02/13/2015			MDWP	Import	LMP	29.49	31.63	37.30	40.86	38.46
02/13/2015			MDWP	Import	Congestion	-5.01	-6.97	-7.30	-11.93	-4.54
02/13/2015			MDWP	Import	Energy	35.04	39.10	45.09	53.59	43.57
02/13/2015			MDWP	Import	Loss	-0.54	-0.51	-0.50	-0.80	-0.57

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There are a few points to consider when cross checking these displays:

1. The prices shown in CMRI match the prices available in the new SP-TIE OASIS display; these displays reflect the prices intended to use for settlements of resources scheduled at the MALIN scheduling point.

2. The marginal congestion component of -$7.299 displayed in all the views is the same and accounts for the shadow price of IPPUTAH ITC and any congestion arising from internal constraints. It does not include the shadow price from MALIN500 ISL.

3. By comparing the displays from OASIS and CMRI, one can verify that the marginal loss component has been adjusted and, thus, is different.

4. Effectively, only the data in the new SP-TIE view is necessary to see what prices are used for settlements of resources scheduled at the MALIN scheduling point. With the introduction of the new SP-TIE OASIS display, there is no need to compare or calculate congestion between the LMP and SP-TIE views of OASIS to derive the financially binding prices.

5. For congestion revenue rights, the expectation is that CRRs defined at the MONA scheduling point will be settled at the same congestion prices used to settle CISO tie resources. For the illustration described above, any CRR defined with source or sink at the MONA scheduling point should be settled at a marginal congestion component of -$7.299, which accounts for both internal CISO congestion of -$2.419 and congestion from the IPPUTAH ITC of -$4.88.

Real-Time Market

Since the Energy Imbalance Market is a real-time market, the pricing logic applicable to both MONA and CRAG locations is slightly different than the logic described for the day-ahead market. Consider the same nomenclature used in the previous subsection to describe the real-time logic.

- The MCC shown in the OASIS locational marginal price view is

$$MCC = MCC_{flow} + MCC_{ITC} + \frac{\mu + \varphi}{LPF}$$

- The LMP shown in the OASIS locational marginal price view is

$$LMP = SMEC + MLC + MCC_{flow} + MCC_{ITC} + \frac{\mu + \varphi}{LPF} + GHG$$

The term LPF stands for loss penalty factor and is locational. This is an adjustment for marginal loss at the respective location for injection contributions to the EIM Transfer, which is subject to the EIM Transfer Limit and the MALIN500 ISL. The logic for this adjustment is derived in Appendix A.

- The MCC price shown in the new OASIS SP-TIE view for CA import/export resources is:[5]

$$MCC = MCC_{flow} + MCC_{ITC}$$

- The LMP shown in the OASIS SP-TIE view is for CAISO import/export resources is

$$LMP = SMEC + MLC + (MCC_{flow} + MCC_{ITC})$$

- The MCC displayed in the CMRI Import-Export commodity prices view is:

$$MCC = MCC_{flow} + MCC_{ITC}$$

- The LMP displayed in the CMRI Import-Export commodity prices view for CA import/export resources is:

$$LMP = SMEC + \widehat{MLC} + MCC_{flow} + MCC_{ITC}$$

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[5] Records in this SP_TIE display for prices applicable to CISO or PAC resources can be differentiated by the intertie. For CISO resources at Mona location the intertie is MDWP, whereas the MPAC intertie is used for PAC resources.

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- Import/Exports resources for transactions for CA BAA and using MONA/CRAG SP will be settled at the following LMP

$$LMP = SMEC + \widetilde{MLC} + MCC_{flow} + MCC_{ITC}$$

Similar to the day-ahead market, the MONA scheduling point is subject to the marginal losses adjustment and, therefore, the marginal loss component will be different (denoted with $\widetilde{MLC}$) in CMRI and in the import/export settlements. The CRAG scheduling point is not subject to this adjustment and therefore the MLC should remain the same.

As can be derived from the previous descriptions, the settlement of resources and CRRs at the MALIN, CRAG and MONA scheduling points uses the same logic used prior to the implementation of the FMM and the EIM. The difference afterwards is the data structure change and the additional elements included for consideration of EIM. Still, for CISO resources using these scheduling points, the congestion (and consequently the LMP) to settle on should be based only on congestion related to CISO constraints.

The prices at these scheduling points in the day-ahead market should reflect only the congestion associated with the scheduling point from either internal congestion or any associated intertie that has these scheduling points in their definition. The expectation is that both the CRAG and MONA scheduling points do not have any consideration of the MALIN500 congestion and that accordingly the locational marginal price and SP-TIE views on OASIS do not include MALIN500 congestion. For the settlement of CAISO imports and exports and CRRs, the actual price only accounts for the congestion arising from CAISO balancing authority area.

Treatment and Pricing of Other Scheduling Points

As indicated in previous sections, the changes implemented with the FNM and the EIM required a specific treatment and pricing logic for the MALIN, MONA and CRAG scheduling points. The rest of scheduling points for CISO remained unchanged. These other scheduling points are also displayed in the new OASIS view of SP-TIE combination, but the prices available in that display should match the prices available in the old LMP OASIS display. For illustration purposes, consider the case of SYLMARDC (NOB) scheduling point. The following snapshots show that the prices among displays are consistent and with no changes with respect to the pricing logic prior to the implementation of the expanded full net work model.

The only, but explainable and expected, mismatch is the MLC in CMRI that accounts for the adjustment described previously.

Intertie Constraint Shadow Prices

Market	Opr Date	Opr Interval	Transmission Interface ID	Direction	HE16	HE17	HE18	HE19	HE20
DAM	02/08/2015	0	NOB_ITC	Import		-2.34013	-8.89768	-18.59986	-10.08555

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Locational Marginal Prices (LMP)

Market	Opr Date	Node	LMP Type	HE16	HE17	HE18	HE19	HE20
DAM	02/08/2015	SYLMARDC_2_N501	LMP	22.01394	25.18000	27.63000	27.63000	27.63000
DAM	02/08/2015	SYLMARDC_2_N501	Congestion	0.00000	-2.34013	-8.89768	18.59986	-10.08555
DAM	02/08/2015	SYLMARDC_2_N501	Energy	23.23126	29.25184	38.95871	49.45428	40.29009
DAM	02/08/2015	SYLMARDC_2_N501	Loss	-1.21732	-1.73171	-2.43102	-3.22442	-2.57454

Report Generated: 02/27/2015 05:26:13

Scheduling Point/Tie Combination Locational Marginal Prices (LMP)

Market	Opr Date	Node	Tie	LMP Type	HE16	HE17	HE18	HE19	HE20
DAM	02/08/2015	SYLMARDC_2_N501	NOB	LMP	22.01394	25.18000	27.63000	27.63000	27.63000
DAM	02/08/2015	SYLMARDC_2_N501	NOB	Congestion	0.00000	-2.34013	-8.89768	-18.59986	-10.08555

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Day-Ahead Import-Export Commodity Prices

Trade Date	SC ID	Resource	Schedule Point	Direction	Price Type	HE16 [$]	HE17 [$]	HE18 [$]	HE19 [$]	HE20 [$]
02/08/2015			NOB	Import	LMP	22.55	26.09	28.96	29.44	29.12
02/08/2015			NOB	Import	Congestion	0.00	-2.34	-8.90	-18.60	-10.09
02/08/2015			NOB	Import	Energy	23.23	29.25	38.96	49.45	40.29
02/08/2015			NOB	Import	Loss	-0.68	-0.82	-1.10	-1.41	-1.08

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Issues Impacting Prices at MALIN, MONA and CRAG Scheduling Points

The ISO has been validating the quality and correctness of the data related to the SP-TIE combination. There are in general two sets of issues; the first one is related to production of incorrect data due to software defects, and the second reason is due to faulty post-process updates that modified the original prices. Some of these issues may be visible through the OASIS and CMRI displays and may create inconsistencies between these displays. Some of these issues may also be impacting the settlements of intertie resources and CRRs. The ISO is currently doing an impact assessment of these issues. Depending on the time the OASIS views were checked, participants may observe instances where the SP-TIE display has inconsistencies and does not adhere to the pricing logic just described in the previous sections of this document. The ISO is evaluating the impact and based on that evaluation, will communicate its intended next steps in a subsequent market issues bulletin when the analysis is complete.

To the extent the CAISO has identified incorrect prices or processing and publication issues within the time horizon permitted under Section 35.3 of the CAISO tariff, the ISO has corrected prices and remedied pricing issues within the appropriate time frames and has communicated such changes on the CAISO OASIS website in the section of price corrections.

The actual SP-tie combination prices started to be corrected on January 27, 2015. On February 3th, the ISO deployed a software fix for the incorrect calculation of the SP-TIE combination. Another price correction took place for February 4 and 5 where the final LMP did not reflect the proper prices for all scheduling points in the SP-TIE view. The software fix was deployed effectively for trade date February 6, 2015.

As of February 19, 2015 the ISO completed the back filling of the new SP-Tie OASIS display for prices applicable to the period of October 15, 2014 through January 8, 2015 with prices reflecting currently prices used in settlements. However, due to the aforementioned post-process data issues, the CAISO is now investigating whether the prices posted on OASIS and CMRI were impact by any software defects or flawed procedures.

Finally, there are two specific locations (AVLYSLR_7_N005 and SMD1-ASR-APND) in the SP-TIE view on OASIS where there are missing entries; these two locations are special locations because they are not strict scheduling points but they should be associated with specific ITC constraints. Currently, the OASIS SP-TIE view is not populated automatically but rather with a post process. Only entries with non-zero marginal congestion component are being populated. The ISO has an enhancement in queue to populate the entries of these two locations in full during the original posting.

Next Steps

The ISO will hold a conference call on Wednesday March 9 to discuss the content of this technical bulletin. Details of the call are provided in the market notice and are also available in the CAISO website calendar.

The ISO is currently identifying and estimating the impact of the various issues that affected the proper publishing and settlements of the MALIN, MONA and CRAG scheduling points since October 15, 2014, as well as other pricing issues. The ISO will publish a revised technical bulletin with the impact assessment and will discuss with market participants the next steps in a subsequent call.

Appendix A

This appendix provides a derivation of the adjustment done to shadow prices of EIM transfers and MALIN500 ISL constraints for calculation of the marginal congestion component in PAC areas.

The linearization of AC power flows is ubiquitous in the technical literature of power systems. The component of associated with the linearized power balance equation in its simplest form can be represented as

$$\sum_i \frac{\Delta p_i}{LPF_i}$$

Where Δp_i is the power injection change at node i, and LPF_i is the loss penalty factor at location i.

With the introduction of the energy imbalance market, the EIM transfer for a given area can be simply defined as the imbalance of the power balance of such an area limited by the transfer limit; focusing only on the term associated with the power injections, the EIM transfer can be represented as follows:

$$\sum_i \frac{\Delta p_i}{LPF_i} \leq EIM^{max}$$

With shadow price associated with the EIM transfer constraint defined with the symbol φ, the term of this constraint defined in Lagrangian function of the primal optimization problem would be as follows

$$\mathcal{L} = \cdots + \varphi \left\{ \sum_i \frac{\Delta p_i}{LPF_i} - EIM^{max} \right\} \ldots +$$

The first-order optimality condition with respect to the nodal power injection leads to the following term:

$$\frac{\partial \mathcal{L}}{\partial \Delta p_i} = \frac{\varphi}{LPF_i}$$

This expression is no more than a revised version of a standard marginal congestion component constructed from binding transmission constraints, which equates to shift factor times shadow

price. All locations within the EIM area will see the shadow price of the EIM transfer allocated 100 percent to each location but adjusted for the losses effect. This is the reason to adjust by the loss penalty factors the shadow prices as introduced in the previous section. For EIM prices, this adjustment applies to the EIM transfer shadow price. Congestion arising from the MALIN500 ISL constraint is also adjusted because the EIM transfer is included in the definition of the MALIN500 constraint, and the EIM transfer is coming through the MALIN constraint and competes with schedules south of MALIN coming into the CISO.

Again, for CISO resources this pricing logic is irrelevant because EIM transfer or the adjustment to the congestion on MALIN500 ISL constraint does not apply to the MONA, CRAG or MALIN points.