Background

During the April 11, 2008 joint MSC/CAISO Stakeholder meeting on IBAA issues, the parties discussed how transmission losses are incurred and accounted for within the CAISO and SMUD/Western Balancing Authority Areas. MSC Chairman Wolak suggested that SVP develop examples to illustrate the issues. The examples are described below.

Summary

Under the agreements governing the coordinated operation of the three-line California-Oregon Intertie, the PACI and COTP owners are not allowed to charge each other for costs resulting from any unscheduled flows caused by the other party. CAISO covers the costs associated with flows over the PACI. Western covers the costs associated with flows over COTP.

We provide some examples below, which show that the CAISO will fully recover the marginal losses from all PACI flows (including those caused by COTP injections) from the Malin LMPs, if it models all COTP injections (including those associated with non-CAISO loads). If the CAISO prices COTP imports to the CAISO at Captain Jack, the CAISO will over-collect for losses experienced on the CAISO grid (including those caused by COTP injections).

So, charging COTP imports for CAISO losses associated with PACI flows is unnecessary, in addition to violating the agreements governing the coordinated operation of the COI.

Contractual Issues

Tracy 500 kV is the contractual interconnection point between the CAISO BAA and SMUD/Western BAA for the COTP.

The PACI and COTP owners are not allowed to charge each other for costs resulting from any unscheduled flows caused by the other party. The PACI owners and the COTP owners agreed to a cooperative environment whereby each would schedule to their allocated capability and the resulting flows would not have a financial impact on each other -- no charges can be demanded between the owners to compensate for unscheduled flows.

Since the COTP is in the SMUD/Western Sub BAA, Western is responsible for covering losses on the COTP. Similarly, since the PACI is in the CAISO BAA, CAISO is responsible for covering losses on the PACI. Western does not charge CAISO for unscheduled flow on the COTP resulting from PACI schedules. CAISO cannot charge Western (COTP participants) for unscheduled flow on the PACI resulting from any COTP schedules.

BAA Losses

For any given pattern of generation and loads within the CAISO and IBAA, the actual losses incurred by each BAA will be independent of the net interchange schedules between the CAISO and the IBAA. The losses are a function of the system generation dispatch and the distribution of loads, and not a function of the power accounting between the BAAs. Only if one or the other BAAs changes the generation dispatch within its system would the actual losses change.

Western covers losses within its BAA by forecasting losses using actual loss information from recent similar days. Western's loss experience includes losses on the COTP resulting from unscheduled flows from the PACI. Western subtracts the forecast losses from the amount of power it will have available as a result of the water delivery schedule provided by the US Bureau of Reclamation. After covering its obligations to its pumping loads, Western schedules the remaining energy to its power customers, some of whom are located within the CAISO BAA, others are not. Any difference between Western's forecast losses and actual losses are made up in real-time by Western via purchases, sales or changes to its generation schedules. The losses covered by Western include losses resulting from flows on the COTP, some of which are caused by scheduled COTP transmission, and some of which results from unscheduled flows from PACI scheduled transmission.

For example, Table A shows that with 4,500 MW of COI flow, if COTP and PACI losses are each 4%, Western incurs 60 MW of losses on the COTP facilities, 40 MW of which are caused by the unscheduled flow from the Malin schedules. Western allocates 57 MW of those losses to the 1,500 MW of COTP schedules, using the contract loss factor of 3.8%. Western will recover the remaining 3 MW of COTP losses from its power customers (the largest of whom are also COTP participants). None of Western's COTP

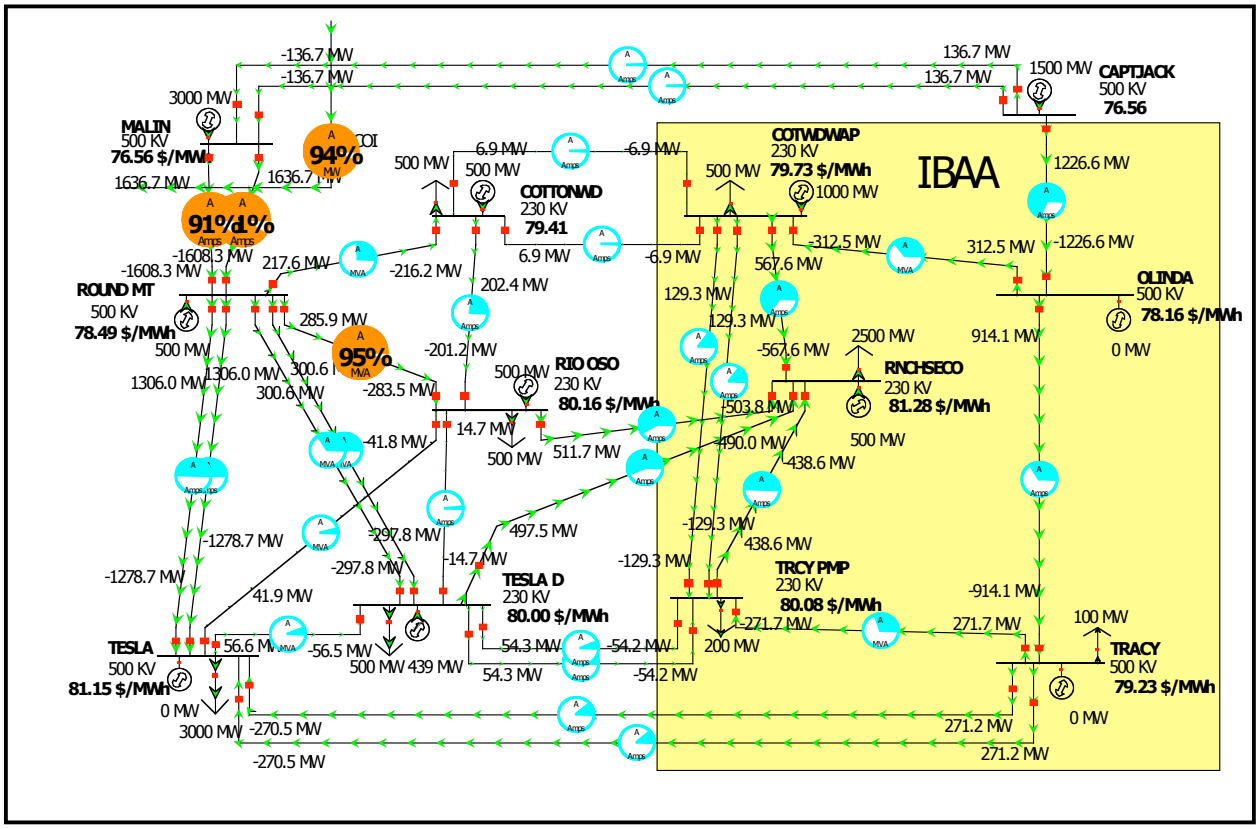
losses are recovered from the CAISO, even though 2/3rd of the COTP losses result from unscheduled flow from the PACI. CAISO will incur 120 MW of losses on the PACI facilities, 40 MW of which are caused by the unscheduled flow from the COTP schedules. CAISO should allocate the PACI losses only to the Malin schedules, even though 1/3rd of the PACI losses result from unscheduled flow from COTP; but CAISO is attempting to also collect for losses from the COTP schedules (by paying/charging the Captain Jack LMP loss component). Note that the losses on both PACI and COTP resulting from unscheduled flows from the other facilities are equal (40 MW in this example). While PACI schedules and COTP schedules won't always be proportional (2/3 vs. 1/3), over time it is reasonable to expect that the facilities will be utilized proportionally; if it is economical for parties to import energy from the Northwest into the CAISO using the PACI, it likely will be economical for parties to import energy from the Northwest into the SMUD/Western BAA (and CAISO BAA) using the COTP.

Table A: Path 66 Losses at 4,500 MW Flow			
CAISO			
Category/Source	**PACI Losses (Malin scheduled flow)**	**PACI Losses (Unscheduled flow from COTP)**	**PACI Losses (Total)**
Actual Loss (%)	4.0%	4.0%	4.0%
Actual Loss to Tesla/Tracy (MW)	80.0	40.0	120.0
Western			
	COTP Losses (COTP Scheduled Flow)	**COTP Losses (Unscheduled flow from Malin)**	**COTP Losses (Total)**
Actual Loss (%)	4.0%	4.0%	4.0%
Actual Loss to Tesla/Tracy (MW)	20.0	40.0	60.0
Western Losses Allocated to DA COTP Schedule (%)	3.8%	3.8%	3.8%
Western Net Loss MWs	19.0	38.0	57.0
Western Losses Allocated to Western Power Customers	1.0	2.0	3.0
Western Loss MW	**20.0**	**40.0**	**60.0**

Base Case: Complete Model of IBAA Loads and Resources

Shown below in Figure 1 are the modeled flows and prices using the 12-bus PowerWorld case posted by the CAISO on April 16, 2008,[1] but with the scheduling limit at Malin increased from 3,000 MW to 3,200 MW so that the Malin scheduling constraint is not binding. This case includes a "complete" representation of the IBAA loads and resources, including the COTP injections, and represents the actual flows and prices that would result in real-time.

Figure 1: Base Case: Complete Model of IBAA Loads and Resources

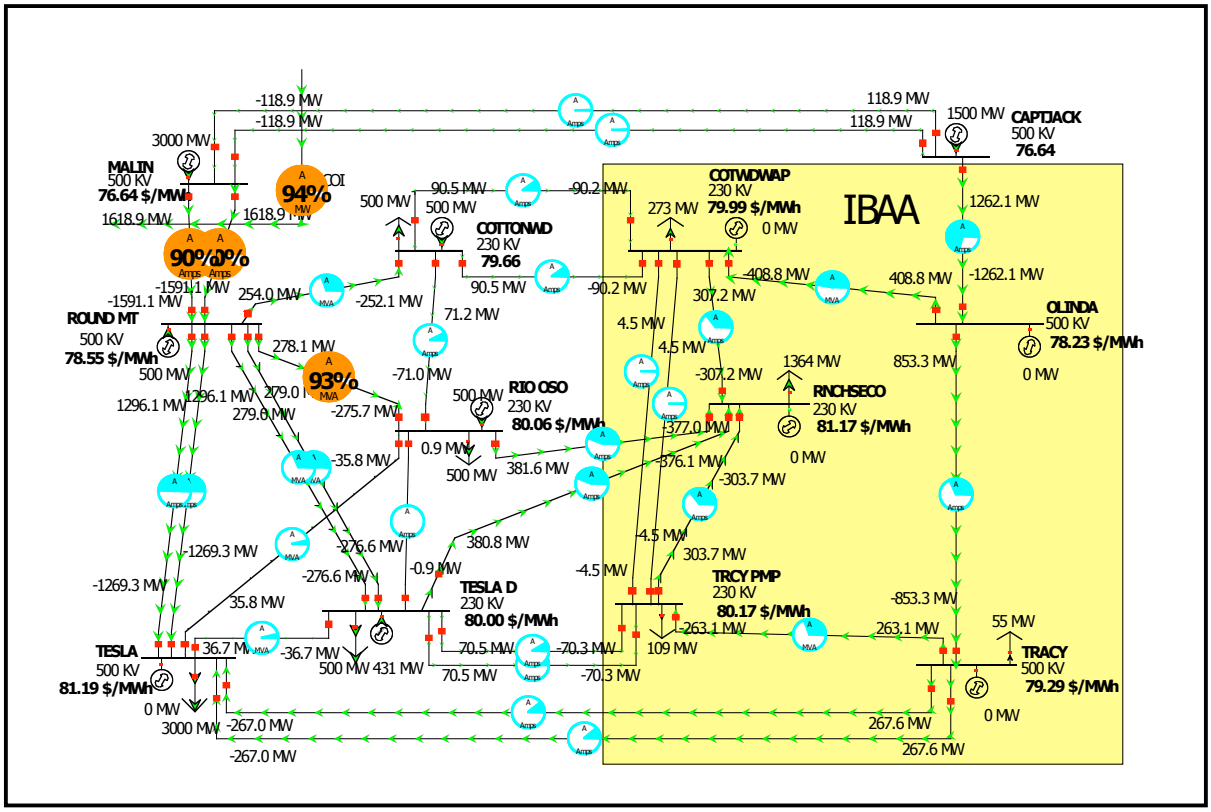


[1] These examples utilize the CAISO's PowerWorld case for comparison purposes. SVP reserves its comments on potential problems with the PowerWorld case used by CAISO.

Example 1a IBAA Case: All COTP Injections Modeled, No COTP Schedules Sinking to CAISO

This example revises the representation of the IBAA loads and resources to approximate the CAISO's proposed approach of modeling only the net load or net resources of the IBAA. Instead of modeling 3,300 MW of IBAA load and 1,500 MW of IBAA resources, 1,800 MW of net load is modeled, spread to the IBAA nodes in the same proportion as was the IBAA load in the Base Case[2]. This example assumes that the CAISO continues to model the 1,500 MW Captain Jack injection, as in the Base Case. Figure 2 shows flows and prices that are very similar to the flows and prices in the Base Case. The nodal LMPs are within 1/3rd of one percent of the Base Case Complete Model prices at all nodes. The relatively minor differences are due to the IBAA modeling approximation of the net IBAA load, rather than the complete IBAA loads and resources.

Figure 2: Example 1a IBAA Case: All COTP Injections Modeled, No COTP Schedules Sinking to CAISO



[2] CAISO proposed an approach that combines the distribution factors for generation and loads. This example uses a simplified approach based only on the load distribution factors.

In this example, all of the COTP injections are sinking to the IBAA and all of the Malin injections are sinking to the CAISO BAA. Assume that the CAISO models the scheduled COTP injections using information from Malin schedules, COTP schedules sinking in the CAISO and/or historical scheduling and flow information[3] or by reaching agreement with the non-CAISO COTP participants to share COTP and PACI scheduling data. This example assumes that the COTP Participants with load within the CAISO (e.g., SVP, NCPA) are meeting their load-serving obligations with internal generation and a 100 MW purchase from the NP15 EZ Gen Hub (modeled as the generation-weighted average of the CAISO BAA generation).

As illustrated in Table 1a below, because the loss components at the sources are negative, the CAISO will charge the Malin importers $10,080 for the Malin loss component, covering PACI losses. The CAISO will charge the associated load $2,287, assuming the imports sink at the PG&E Default LAP (modeled as the load-weighted average of the CAISO BAA load loss components). The CAISO will also charge $45 for the loss component associated with 100 MW EZ Gen Hub generation sinking to a COTP participant within the CAISO, and charge $76 to the load for the associated LAP losses. The combined difference of $12,488 is the marginal loss surplus for the Malin and EZGen Hub injections serving LAP load, and would be credited to CAISO metered load plus exports. The total amount paid (collected) from sources and sinks represents the marginal cost of serving the CAISO loads and is consistent with an optimal dispatch. Note that the CAISO makes no payments and collects no charges for the COTP injections.

[3] Even a simple decision rule that COTP injections would be equal to 50% of Malin injections might yield a reasonable approximation of COTP injections. CAISO possesses many years of PACI and COTP scheduling and flow data and should be able to develop reasonable approximations of COTP injection modeling using existing data.

Loss Example 1a: No COTP MW Scheduled to CAISO				
Category/Source	**NP15 EZ Gen**	**Malin (PACI)**	**Capt Jack (COTP)**	**Total**
IBAA Sinks Served by Source (MW)	-	-	1,500	**1,500**
COTP Participant Load Sinking in ISO (MW)	**100**			**3,100**
Non-COTP Participant Load Sinking in ISO (MW)		**3,000**		
CAISO Loss Payment to Source ($) (A)	($45)	($10,080)	$0	**($10,125)**
CAISO Loss Revenue from Sink ($) (B)	$76	$2,287	$0	**$2,363**
Net Loss Collections ($) (B-A)	$121	$12,367	$0	**$12,488**

* Underlying LMP loss components are based on the Modified version of the ISO's *PowerWorld Modeling and Pricing for IBAA Load Flow* Examples posted April 16, 2008.

Example 1b: All COTP Injections Modeled, 100 MW COTP Schedules Sinking to CAISO, Priced at Captain Jack

Now assume that a COTP participant within the CAISO schedules 100 MW of COTP imports sinking at the PG&E Default LAP; this 100 MW displaces the 100 MW of the COTP participant's EZGen Hub Purchases in Example 1a. To keep the loads and resources balanced, assume that the IBAA is now scheduling a 100 MW EZGen Hub purchase and exporting from the CAISO to the IBAA. The total injections for COTP and PACI are unchanged. The total load (and the distribution of that load) within both the CAISO and the IBAA are unchanged. Therefore, the actual losses within both the CAISO and the IBAA will be unchanged; the modeled losses will be unchanged as long as the CAISO uses the same distribution factors to model the IBAA Exports as it used to model the COTP schedules sinking to the IBAA in Example 1a. Thus, the flows and prices will be the same as shown in Figure 2: Example 1a IBAA Case.

Western's losses and its loss recovery remain unchanged.

The CAISO's incurred losses are unchanged, and its recovery of the cost of the PACI losses from the Malin schedules is unchanged. The CAISO's loss payments (charges) for the EZGen Hub injections are unchanged, as are its charges to the COTP participant load within the CAISO. The only things that are changed are that the CAISO charges the 100 MW of COTP imports losses of $335 (Captain Jack Price) and charges the 100 MW of IBAA exports losses of $88 (IBAA Hub price), netting an additional $423 (=$12,911 - $12,488) while incurring no additional losses as compared to Example 1a (See Table 1b).

Loss Example 1b: 100 COTP MW Scheduled to CAISO, Priced at Captain Jack				
Category/Source	**NP15 EZ Gen**	**Malin (PACI)**	**Capt Jack (COTP)**	**Total**
IBAA Sinks Served by Source (MW)	**100**	-	1,400	**1,500**
COTP Participant Load Sinking in ISO (MW)			**100**	**3,100**
Non-COTP Participant Load Sinking in ISO (MW)		**3,000**		
CAISO Loss Payment to Source ($) (A)	($45)	($10,080)	($335)	**($10,460)**
CAISO Loss Revenue from Sink ($) (B)	$88	$2,287	$76	**$2,451**
Net Loss Collections ($) (B-A)	$133	$12,367	$411	**$12,911**

Example 1c: All COTP Injections Modeled, 100 MW COTP Schedules Sinking to CAISO, Priced at Tracy

Same assumptions as in Example 1b, but now assume that the COTP imports to the CAISO are priced at Tracy, rather than at Captain Jack. The flows and prices will be the same as shown in Figure 2: Example 1a IBAA Case.

Again, the CAISO's incurred losses are unchanged, and its recovery of the cost of the PACI losses from the Malin schedules is unchanged. The CAISO's loss payments (charges) for the EZGen Hub generation are unchanged, as are its charges to the COTP participant load within the CAISO. As shown in Table 1c, the CAISO will charge the 100 MW IBAA Export the same losses of $88 as in Example 1b. The only change is that the

CAISO will charge the 100 MW of COTP imports losses of $71 instead of $335. The CAISO nets an additional $159 (=$12,647 - $12,488) while incurring no additional losses as compared to Example 1a (and netting $264 less than in Example 1b).

Loss Example 1c: 100 COTP MW Scheduled to CAISO, Priced at Tracy				
Category/Source	**NP15 EZ Gen**	**Malin (PACI)**	**Tracy (COTP)**	**Total**
IBAA Sinks Served by Source (MW)	**100**	-	1,400	**1,500**
COTP Participant Load Sinking in ISO (MW)			**100**	**3,100**
Non-COTP Participant Load Sinking in ISO (MW)		**3,000**		
CAISO Loss Payment to Source ($) (A)	($45)	($10,080)	($71)	**($10,196)**
CAISO Loss Revenue from Sink ($) (B)	$88	$2,287	$76	**$2,451**
Net Loss Collections ($) (B-A)	$133	$12,367	$147	**$12,647**

Conclusion

The examples show that the CAISO will fully recover the marginal losses from all PACI flows (including those caused by COTP injections) from the Malin LMPs, if it models all COTP injections (including those associated with non-CAISO loads). If the CAISO prices COTP imports at Captain Jack, the CAISO will not only violate the agreements governing the coordinated operation of the COI, it will also over-collect for losses experienced on the CAISO grid (including those caused by COTP injections). So, charging COTP imports for CAISO losses associated with PACI flows is unnecessary, in addition to violating the agreements governing the coordinated operation of the COI.