California Independent
System Operator Corporation

September 22, 2014

The Honorable Kimberly D. Bose
Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20426

Re: California Independent System Operator Corporation
Informational Report and Request for Privileged Treatment
Under 18 C.F.R. § 388.112

Docket No. ER14-2017-___

Dear Secretary Bose:

The California Independent System Operator Corporation (CAISO) submits the attached informational report pursuant to the Commission order issued in this proceeding on July 31, 2014.[1] The CAISO requests privileged treatment for the appendix to the informational report which includes detailed confidential data.

I. Background

On May 22, 2014, the CAISO filed revisions to its tariff to implement modeling enhancements that included the authority to model unscheduled flow in the CAISO's day-ahead market, the enforcement of power flow constraints in the day-ahead market, and the expansion of the full network model topology to include information on resources, load, and interchange schedules in other balancing authority areas (May 22 Tariff Filing). The CAISO requested a September 8, 2014, effective date for its proposed tariff revisions to reflect improvements in the CAISO's base market model and use of transaction identifiers, and requested an October 1, 2014, effective date for the balance of the tariff revisions.

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[1] *Cal. Indep. Sys. Operator Corp.*, 148 FERC ¶ 61,089 (2014) (July 31 Order). The CAISO is sometimes referred to in this filing as the ISO.

The CAISO committed to analyze the results of its approach to estimating unscheduled flow on the CAISO interties, including the CAISO's methodology for creating base schedules, and demonstrate its accuracy prior to implementing the modeling of unscheduled flows and enforcement of physical constraints in the day-ahead market. The CAISO explained that it would report the results of this pre-implementation analysis to stakeholders and to the CAISO Governing Board (Board) at its September 18-19, 2014, meeting. The CAISO would then submit the results of the pre-implementation analysis to the Commission for informational purposes prior to the planned October 1 go-live date for implementing the modeling of unscheduled flow and enforcement of power flow constraints in the day-ahead market.[2]

In the July 31 Order, the Commission accepted the May 22 Tariff Filing subject to a compliance filing due within 30 days after the Order was issued and to the CAISO's submittal of "its offered informational report concerning its pre-implementation activities with the Commission prior to implementation."[3]

On September 9, 2014, the CAISO issued a market notice announcing that it would post the results of the pre-implementation analysis on its website on September 11, 2014, and would host a stakeholder conference call to discuss those results on September 17, 2014.[4] The attached informational report was posted on September 11, 2014.

The CAISO reported the results of its pre-implementation analysis to the Board at its September 18-19 meeting.[5] No party raised any opposition to the implementation of the modeling of unscheduled flow and enforcement of power flow constraints as planned.

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2 Transmittal letter for May 22 Tariff Filing at 38-39.

3 July 31 Order, 148 FERC ¶ 61,089, at P 59. The CAISO timely submitted the compliance filing on September 2, 2014. The compliance filing included a transitional accuracy metric to provide a further safeguard against inaccurate modeling once the consideration of unscheduled flows is implemented.

4 The market notice, materials related to the stakeholder conference call, and the pre-implementation report are available on the CAISO website at http://www.caiso.com/informed/Pages/StakeholderProcesses/FullNetworkModelExpansion.aspx.

5 Materials related to the September 18-19 Board meeting are available on the CAISO website at http://www.caiso.com/informed/Pages/BoardCommittees/Default.aspx.

II. Informational Report

The informational report is contained in Attachment A to this submittal and sets forth the results of the CAISO's pre-implementation analysis as provided to stakeholders and the Board. To summarize, the informational report concludes that:

> The ISO performed consistently well on the overall accuracy metric for the days analyzed. The results show that the ISO's proposed methodology is sound and that it will help the ISO reasonably estimate in the day-ahead the external unscheduled flow that will materialize in the real-time. This is an improvement over today's practice which does not model these flows. The analysis is also an improvement over the previously described methodology because it produced results for every intertie in addition to selected internal constraints, and provides insight into the ISO's projected performance under the post-implementation accuracy metric before the obligation starts.[6]

II. Request for Privileged Treatment

Pursuant to 18 C.F.R. § 388.112, the CAISO respectfully requests privileged treatment for the appendix to the attached informational report. As the informational report explains, the appendix contains confidential data, including detailed hourly and intertie results.[7] Therefore, the appendix should be withheld from public disclosure.

The informational report also explains that signatories to the Western Electricity Coordinating Council's (WECC) Universal Non-Disclosure Agreement, which is officially named the WECC Synchrophasor and Operating Reliability Data Sharing Agreement, may ask the CAISO to provide them with confidential data contained in the appendix.[8] The CAISO will provide such data on that basis. This approach is consistent with the CAISO's proposal, accepted in the July 31 Order, that the CAISO will only provide unscheduled flow data to parties that have signed the WECC Universal Non-Disclosure Agreement.[9]

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6 Attachment A, informational report at 9.

7 *Id.* at 2, 9.

8 *Id.*

9 July 31 Order, 148 FERC ¶ 61,089, at PP 43, 63.

III. Conclusion

If there are any questions regarding this submittal, please contact the undersigned.

Respectfully submitted,

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Attachment A

Full Network Model Expansion

Pre-implementation Analysis

September 11, 2014

1. Executive summary

As a condition of approving the Full Network Model Expansion initiative, the ISO Board of Governors requested a pre-implementation analysis that demonstrates the ISO's ability to model in the ISO market unscheduled flow from balancing areas outside the ISO. This document provides the analysis results which show that the ISO's modeling is an improvement over its existing practice of not modeling this unscheduled flow. The Federal Energy Regulatory Commission also requires that the ISO provide this analysis to it before implementing the market changes resulting from the Full Network Model Expansion initiative.

2. Background

In February 2014, the ISO Board of Governors approved the Full Network Model Expansion initiative, which FERC subsequently approved on July 31, 2014. This initiative includes the following market enhancements:

1. Expanding the model of the physical electric network used by the ISO market to include the other balancing areas in the Western Electricity Coordinating Council area.

2. Modeling in the ISO market forecasted unscheduled power flows within the ISO balancing area based on an expanded network topology and caused by the load, generation, and interchanges forecasted for other balancing areas in the western interconnection.

3. Modeling unscheduled flow to produce feasible ISO market schedules and incorporating the unscheduled flow into ISO market prices. This includes incorporating physical flow limits over certain ISO interties into the ISO markets, where currently the ISO markets only enforce limits on scheduled flow.

The modeling enhancements improve reliability because expanding the full network model will allow the ISO to more accurately model expected real-time conditions in the day-ahead timeframe by including unscheduled loop flow, outages, and contingencies. This aligns with Federal Energy Regulatory Commission and North American Electric Reliability Corporation recommendations after the September 8, 2011 southwest blackout that stated the ISO and other balancing areas should better coordinate their day-ahead planning.

The market changes will also provide more accurate pricing by incorporating congestion caused by unscheduled loop flow and respecting the physical limits of the ISO's interties in the day-ahead market. They will reduce infeasible schedules in the day-ahead market that result in re-dispatch of resources in the real-time market that contribute to uplift costs. The modeling of the external network also supports the feasibility of energy imbalance market schedules.

3. Purpose

As part of the Board's approval of the Full Network Model initiative, the ISO committed to present a pre-implementation analysis so the Board can assess the accuracy of the ISO's modeling of unscheduled flow. The pre-implementation analysis will be presented at the September 2014 Board of Governors meeting. Specifically, the pre-implementation documentation states:

> *The goal of this activity is to show that the calculated unscheduled flows provide a reasonable estimate for the actual unscheduled flows that materialize in real time and [is] ignored in the existing day-ahead market solution.*[1]

The Board also authorized the ISO to file any tariff changes with the Federal Energy Regulatory Commission to implement the requested modeling enhancements. The ISO did so and on July 31, 2014, the Commission conditionally approved the ISO's tariff amendments.[2] The Commission found the ISO's proposal just and reasonable but conditioned its acceptance on a compliance filing. The compliance filing includes the requirement to submit information on the calculation of an accuracy metric.[3] The accuracy metric compares the modeled versus actual unscheduled flow due to the modeling of other balancing areas in the Western Electricity Coordinating Council area in the ISO's expanded full network model. The accuracy metric assesses the accuracy of the ISO's modeling of external unscheduled flow over the ISO interties because of non-ISO balancing area load, generation, and interchanges (imports and exports). The metric will be calculated for the ISO as a whole and will determine whether the ISO continues to model external unscheduled flow in its day-ahead market.

Though the accuracy metric specified in the compliance filing only applies post-implementation, it captures the same intent as the ISO's proposed pre-implementation analysis. Given the Federal Energy Regulatory Commission's required compliance filing, the ISO can more efficiently address both the pre-implementation analysis and post-implementation metric by aligning the two processes. This allows the Board, stakeholders, and the ISO to preview the results of the post-implementation accuracy metric during the pre-implementation phase.

Section 4 describes the methodology used to calculate the accuracy metric for the pre-implementation analysis and Section 5 discusses the results. Section provides concluding thoughts and next steps. The Appendix includes detailed confidential data and is available subject to signing the WECC Universal Non-Disclosure Agreement.

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[1] California ISO, *Full Network Model Expansion, Addendum: Pre-implementation Analysis*, January 23, 2014, pg. 2.
[2] *Ca. Indep. Sys. Operator Corp.* 148 FERC ¶ 61,089 (2014), Docket No. ER14-2017-000.
[3] Other compliance filing requirements include: a triggering mechanism based on the accuracy metric which will require that the ISO not enforce physical flows on its interties in the day-ahead market, filing with the Commission the ISO's pre-implementation analysis provided to the Board prior to implementation, and minor tariff revisions agreed to by the ISO.

4. Methodology

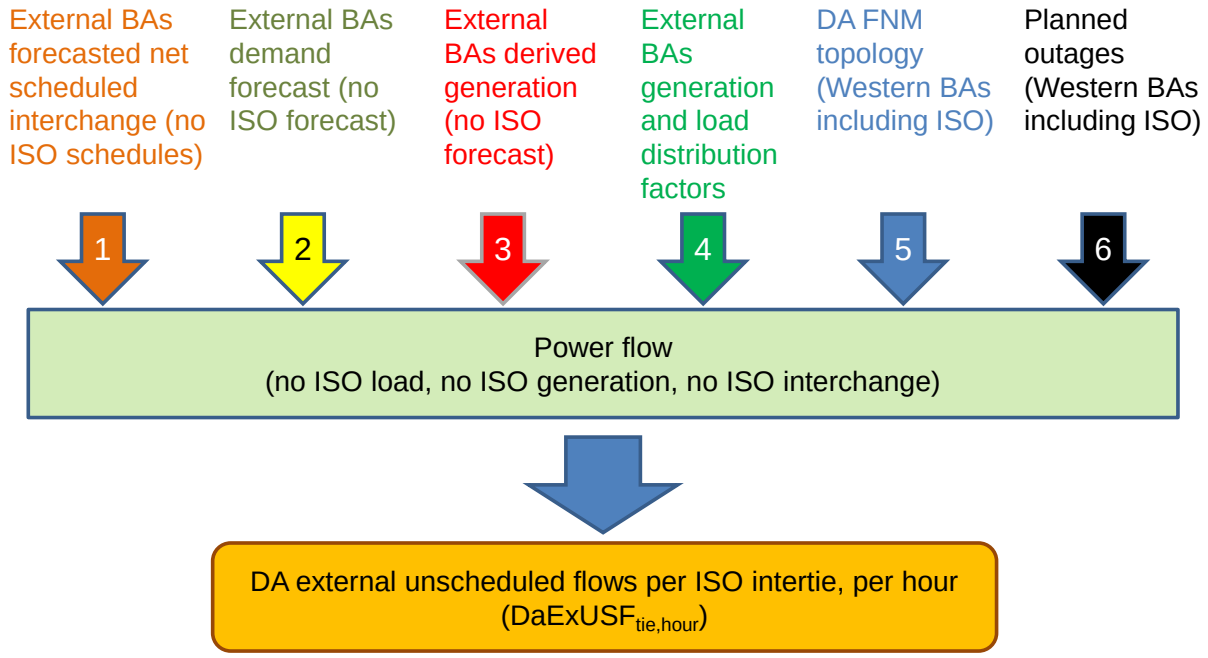
The accuracy metric compares the ISO's day-ahead modeling of external unscheduled flows to the actual external unscheduled flow under two scenarios:

> **Scenario 1**: The ISO models external unscheduled flow impacts in the day-ahead
>
> **Scenario 2**: The ISO does not model external unscheduled flow impacts in the day-ahead

For the purpose of this analysis, the ISO calculates day-ahead external unscheduled flow based on a power flow run that uses the same inputs as the solved day-ahead case as shown in Figure 1 below.[4] These inputs are calculated per external balancing area and include: the forecast net interchange (arrow 1 in Figure 1), demand forecast from the Reliability Coordinator (arrow 2), derived generation from the first two terms (arrow 3), and generation and load distribution factors (arrow 4). By using a solved day-ahead case, the ISO will also have the day-ahead expanded full network topology (arrow 5) and planned outages (arrow 6) for the external balancing authorities and the ISO. The ISO then runs a power flow with these hourly inputs but excludes the ISO load, generation, and interchange. The output is the day-ahead external unscheduled flow impact per ISO intertie, per hour ($DaExUSF_{tie,hour}$).

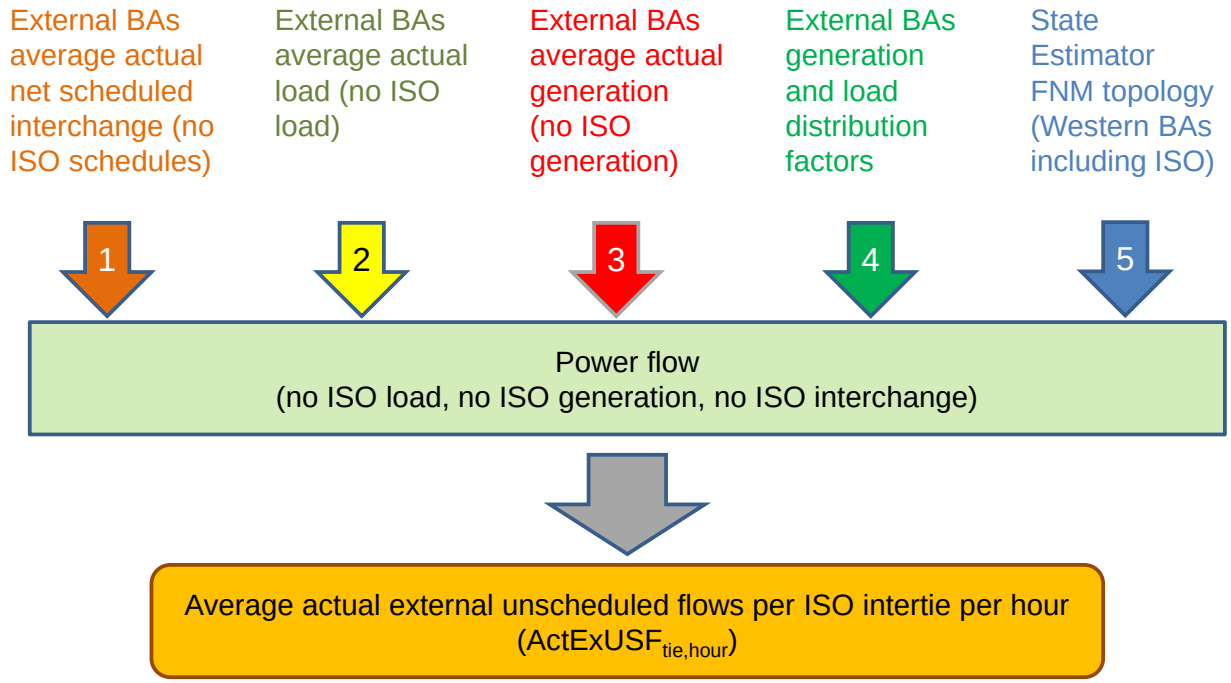
[4] Inputs for the day-ahead case are described in the draft final proposal and addendum to the draft final proposal available at:
http://www.caiso.com/informed/Pages/StakeholderProcesses/FullNetworkModelExpansion.aspx

Figure 1
Day-ahead external unscheduled flow calculation



The ISO follows a similar process for the actual external unscheduled flow. Actual information is derived from the State Estimator and averaged to an hourly number to compare with hourly day-ahead data. The inputs are calculated per external balancing area and include: the average actual net interchange (arrow 1 in Figure 2), average actual demand (arrow 2), average actual generation (arrow 3), and generation and load distribution factors (arrow 4). By using a State Estimator solution, the ISO will also have the expanded topology and outages (arrow 5) for the external balancing authorities including the ISO. The ISO then runs a power flow with these inputs excluding the ISO load, generation, and interchange. The output is the average actual external unscheduled flow impact per ISO intertie, per hour ($ActExUSF_{tie,hour}$) as shown in Figure 2 below.

Figure 2
Average actual external unscheduled flow calculation



The outputs from the processes in Figure 1 and Figure 2 are evaluated under two scenarios: (1) the ISO models external unscheduled flow impacts in the day-ahead; and (2) the ISO does not model external unscheduled flow impacts in the day-ahead. Table 1 below shows the variables needed to calculate the accuracy metric.

Table 1
Variables for and calculation of the accuracy metric

Scenario	Day-ahead	Actual	Calculation
1. ISO models external unscheduled flow impacts in the day-ahead	Day-ahead external unscheduled flows per ISO intertie, per hour ($DaExUSF_{tie,hour}$)	Average actual external unscheduled flows per ISO intertie, per hour ($ActExUSF_{tie,hour}$)	Sum of the absolute value of the difference between day-ahead and actual external unscheduled flows per ISO intertie, per hour Scenario 1: $\lvert DaExUSF_{tie,hour} - ActExUSF_{tie,hour}\rvert$ Scenario 2: $\lvert 0 - ActExUSF_{tie,hour}\rvert$
2. ISO does not model external unscheduled flow impacts in the day-ahead	Flow is zero ($DaExUSF_{tie,hour} = 0$)	Average actual external unscheduled flows per ISO intertie, per hour ($ActExUSF_{tie,hour}$)	
Sum of Scenario 1 is less than the sum of Scenario 2 over a 3-week rolling average → **PASS** $\sum\lvert DaExUSF_{tie,hour} - ActExUSF_{tie,hour}\rvert < \sum\lvert 0 - ActExUSF_{tie,hour}\rvert$ → **PASS**			

Under Scenario 1, the variables are the day-ahead and average actual external unscheduled flow outputs shown in Figure 1 and Figure 2, respectively. The ISO calculates the sum of the absolute value difference between these two variables per ISO intertie, per hour. Under Scenario 2, the ISO does not model external unscheduled flow impacts. Therefore, the flow is zero in the day-ahead. The average actual external unscheduled flow under Scenario 2 is the same as Scenario 1 per ISO intertie, per hour. The calculation is the same.

These two calculations were made for every hour and every day of the pre-implementation analysis period.[5] The ISO passes the accuracy metric if the sum under Scenario 1 is less than the sum under Scenario 2 over a three-week rolling average.

5. Results

In the pre-implementation analysis description from the addendum to the draft final proposal, the ISO proposed to analyze four interties: (1) California-Oregon Intertie; (2) Palo Verde; (3) Eldorado-Mead; and (4) Victorville-Lugo. The ISO also proposed to compare results for representative internal constraints. The original proposal was limited to four interties to balance

[5] The accuracy metric makes an exception for hours in which there are extraordinary unforeseen real-time events such as: the loss of direct current transmission lines, unexpected outages of generators over 1,000 MW, or a derate of over 1,000 MW at any intertie. These hours may be removed from the analysis.

the work load during the pre-implementation and market simulation period. However, the ISO created an efficient process to calculate the accuracy metric and produced results for all ISO interties and selected internal constraints. Consequently, they are included in the analysis presented in this report.

The ISO conducted the pre-implementation analysis using 12 operating days in August and September. This is later than the original dates proposed in the addendum because of delays in the market simulation period and the new obligation to conduct the post-implementation accuracy metric. No hours were removed from the analysis due to extraordinary real-time events. The operating days analyzed are not a continuous series of days for two reasons. Two days are not included because of spurious results produced by duplicate records in input data. The ISO modified its procedures to prevent this in the future. The ISO could not rerun the analysis for these days because of the timing of data available in its simulation systems. The other days not listed are not included because of the timing of data available in the ISO's simulation system.

Table 2 below shows results for all ISO interties for each day of the analysis period. Columns [B] and [C] are daily external unscheduled flow impacts for Scenario 1 and 2, respectively. Columns [D] through [F] are the cumulative hours and external unscheduled flow impacts for each of the 12 days of analysis. Columns [G] and [H] calculate the rolling average by dividing the cumulative external unscheduled flow by the cumulative hours. Over this three week period, the ISO passed the accuracy metric because the final row in column [G] is less than the final row in column [H]. The data shown is aggregated for the entire ISO. More granular data is available in Appendix A subject to signing the WECC Universal Non-Disclosure Agreement.

Table 2
ISO intertie accuracy metric for 12 analysis days

Date	Daily		Cumulative			Rolling average	
	Scenario 1 MWh	Scenario 2 MWh	Hours	Scenario 1 MWh	Scenario 2 MWh	Scenario 1 MW	Scenario 2 MW
[A]	[B]	[C]	[D]	[E]	[F]	[G] = [E] / [D]	[H] = [F] / [D]
8/16/2014	50,430	107,398	24	50,430	107,398	2,101	4,475
8/19/2014	47,659	97,155	48	98,089	204,553	2,044	4,262
8/20/2014	61,100	100,668	72	159,190	305,221	2,211	4,239
8/24/2014	50,656	78,616	96	209,845	383,838	2,186	3,998
8/25/2014	48,037	81,211	120	257,882	465,049	2,149	3,875
8/26/2014	49,946	84,468	144	307,828	549,517	2,138	3,816
8/27/2014	53,320	89,628	168	361,148	639,144	2,150	3,804
8/28/2014	41,340	76,911	192	402,488	716,056	2,096	3,729
8/29/2014	41,240	72,871	216	443,727	788,927	2,054	3,652
8/30/2014	14,304	66,431	240	458,031	855,358	1,908	3,564
8/31/2014	16,166	64,542	264	474,197	919,900	1,796	3,484
9/3/2014	11,882	75,318	288	486,079	995,218	1,688	3,456

Table 3 below shows results for selected ISO internal constraints for each day of the analysis period. Columns [B] and [C] are daily external unscheduled flow impacts for Scenario 1 and 2, respectively. Columns [D] through [F] are the cumulative hours and external unscheduled flow impacts for each of the 12 days of analysis. Columns [G] and [H] calculate the rolling average by dividing the cumulative external unscheduled flow by the cumulative hours. Over this three week period, the ISO passed the accuracy metric because the final row in column [G] is less than the final row in column [H]. The data shown is aggregated. More granular data is available in Appendix A subject to signing the WECC Universal Non-Disclosure Agreement.

Table 3
ISO selected internal constraint accuracy metric for 12 analysis days

Date	Daily		Cumulative			Rolling average	
	Scenario 1 MWh	Scenario 2 MWh	Hours	Scenario 1 MWh	Scenario 2 MWh	Scenario 1 MW	Scenario 2 MW
[A]	[B]	[C]	[D]	[E]	[F]	[G] = [E] / [D]	[H] = [F] / [D]
8/16/2014	14,269	24,146	24	14,269	24,146	595	1,006
8/19/2014	12,492	30,080	48	26,760	54,226	558	1,130
8/20/2014	23,073	21,164	72	49,833	75,390	692	1,047
8/24/2014	20,300	24,603	96	70,133	99,993	731	1,042
8/25/2014	17,518	19,164	120	87,651	119,157	730	993
8/26/2014	8,901	22,684	144	96,552	141,842	670	985
8/27/2014	7,023	22,698	168	103,575	164,540	617	979
8/28/2014	19,899	39,089	192	123,474	203,628	643	1,061
8/29/2014	18,761	36,965	216	142,235	240,593	658	1,114
8/30/2014	1,949	31,786	240	144,184	272,380	601	1,135
8/31/2014	7,709	30,512	264	151,893	302,891	575	1,147
9/3/2014	6,128	38,132	288	158,022	341,024	549	1,184

6. Conclusion and next steps

The ISO performed consistently well on the overall accuracy metric for the days analyzed. The results show that the ISO's proposed methodology is sound and that it will help the ISO reasonably estimate in the day-ahead the external unscheduled flow that will materialize in the real-time. This is an improvement over today's practice which does not model these flows. The analysis is also an improvement over the previously described methodology because it produced results for every intertie in addition to selected internal constraints, and provides insight into the ISO's projected performance under the post-implementation accuracy metric before the obligation starts.

The ISO will hold a conference call with stakeholders on September 17, before the Board of Governor's meeting scheduled for September 18-19, 2014 to review the results. Stakeholders that are signatories to the WECC Universal Non-Disclosure Agreement may request the confidential appendix with detailed hourly and tie results by submitting a request to caisonda@caiso.com, listing their entity name as listed on the WECC Universal Non-Disclosure Agreement.

At the Board of Governor's meeting, the ISO will present the results of this analysis in a briefing to Board members. The ISO will also file this report with the Federal Energy Regulatory Commission as part of its compliance obligation.

CERTIFICATE OF SERVICE

I hereby certify that I have served the foregoing document upon all of the parties listed on the official service list for the above-referenced proceeding, in accordance with the requirements of Rule 2010 of the Commission's Rules of Practice and Procedure (18 C.F.R. § 385.2010).

Dated at Washington, DC this 22nd day of September, 2014.

/s/ Bradley R. Miliauskas
Bradley R. Miliauskas