

Memorandum

To: ISO Board of Governors

From: Keith Casey, Vice President, Market and Infrastructure Development

Date: January 30, 2014

Re: **Decision on full network model expansion**

This memorandum requires Board action

EXECUTIVE SUMMARY

Management is seeking Board approval of its proposal to expand the full network model used in the ISO market. This expansion consists of:

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 the unscheduled electrical flows that will occur within the ISO balancing area based on expanded network topology caused by the load, generation, and interchanges forecast for other balancing areas in the western interconnection.
3. Modeling of unscheduled flow to produce feasible ISO market schedules and incorporating the unscheduled flow into ISO market prices. This will include incorporating physical flow limits over the certain ISO interties into the ISO markets, where currently the ISO markets only enforce limits on scheduled flow.

This proposal provides reliability and market efficiency benefits including:

- **Improved reliability:** 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.

- **Improved market efficiency:** The modeling improvements will provide more accurate market pricing by incorporating congestion caused by unscheduled loop flow and respecting the physical limits of the ISO's interties in the day-ahead market. It will also reduce infeasible schedules in the day-ahead market that result in expensive re-dispatch of resources in the real-time market. The modeling of the external network also supports the feasibility of energy imbalance market schedules.

Management proposes the following motion:

Moved, that the ISO Board of Governors approves the proposed full network model expansion, as described in the memorandum dated January 30, 2014; and

Moved, that the ISO Board of Governors authorizes Management to make all necessary and appropriate filings with the Federal Energy Regulatory Commission to implement the proposed tariff change.

DISCUSSION AND ANALYSIS

The full network model expansion provides visibility to external transmission systems and their impacts on the ISO's market processes. This will enable the ISO to more effectively dispatch and schedule resources on the ISO-controlled grid.

Background

In response to the major southwest blackout on September 8, 2011, the Federal Energy Regulatory Commission and the North American Electric Reliability Corporation cited the need for greater visibility and modeling of external networks in the day-ahead timeframe to ensure more reliable real-time operation. Meanwhile, the ISO has experienced significant uplift costs to re-dispatch resources in the real-time market to resolve unscheduled loop flows that were not modeled in the day-ahead market. Additionally, the energy imbalance market will have significant interactions with external transmission networks that will benefit from modeling unscheduled flows in the day-ahead market.

Objectives

Based on recommendations from the review of the southwest outage on September 8, 2011, the ISO identified two main areas for modeling improvements. The first is the lack of unscheduled loop flow modeling in the day-ahead market and the second is the inability to reflect outages and other security parameters of external transmission systems. Making these modeling improvements will improve reliability and produce more efficient market results.

Unscheduled loop flows occur because, outside of California, the balancing authority areas within the western interconnection rely on contract path scheduling between balancing areas. This assumes that electricity flows along a designated point-to-point path when in fact electricity flows over the path of least resistance. For example, a contract path schedule of 100 MW over intertie T1 may actually result in 80 MW of the schedule to flow over T1 and 20 MW of unscheduled loop flow over intertie T2. If the ISO does not account for the 20 MW of unscheduled loop flow on T2, it may accept ISO market schedules on T2 assuming this 20 MW of capacity is available, thereby creating infeasible schedules and potentially scheduling more energy to flow over the intertie than the physical limit.

Currently, infeasible schedules and the intertie's physical limits are managed in real-time when there is less flexibility to commit units, which may lead to re-dispatch of expensive generation or even exceptional dispatches to resolve the infeasibility. This can lead to real-time congestion offset uplift costs. These uplift costs occur when there is congestion and the market pays more than it charges to adjust generation. The difference is allocated to load. Alternatively, under Management's proposed full network model approach, the loop flow will be incorporated into the day-ahead market and the day-ahead market will produce feasible schedules with prices that more accurately reflect the conditions that will be experienced in real-time.

By expanding the full network model to include other balancing areas, the ISO will also be able to reflect outages and other reliability parameters on those external systems and analyze how that may affect the ISO market. Including these modeling improvements in the day-ahead and real-time markets will help the ISO create feasible schedules, enforce reliability, and accurately price market transactions.

Proposed methodology

In order to model unscheduled loop flows and incorporate reliability and outage information, Management proposes to include external balancing areas in the full network model to accurately enforce physical capacity limitations of the interties. Under Management's proposal, the ISO will eventually include all balancing authority areas in the western interconnection in its modeling, however, time and resource availability limits the modeling to a priority list of balancing authority areas for fall 2014 implementation. These balancing areas include the entities involved in the September 8, 2011 blackout and entities that are highly integrated with energy imbalance market entities. The energy imbalance market entities themselves will also be modeled consistent with the approach developed for the energy imbalance market. As time and resources allow, the ISO will model additional balancing areas deemed to have a significant impact on the ISO or the energy imbalance market entities.

Since unscheduled loop flows can result from almost any transaction in the interconnected grid, Management's proposal includes first modeling the demand, generation, imports, and exports of the priority balancing areas. The ISO will obtain the

data needed for this modeling from a Western Electricity Coordinating Council database developed to coordinate reliability planning. By accounting for the unscheduled flow in the day-ahead and real-time markets, the ISO will be able to establish market schedules which will be feasible in real-time.

Management proposes to seek FERC authorization to model and enforce physical flow limits, as appropriate, on interties in the day-ahead so that the combination of unscheduled loop flow and flow from accepted market schedules do not exceed the physical capability of the line. One exception to this change is the California Oregon Intertie, where the ISO is the path operator. For the California Oregon Intertie, Management proposes to continue to enforce only the scheduling constraint in the day-ahead market and use the Western Electricity Coordinating Council's unscheduled flow mitigation procedure in the real-time market, as it does today. The mitigation procedures on qualified paths, which include the California Oregon Intertie, allow the ISO to curtail schedules causing unscheduled loop flow. The separate treatment for the California Oregon Intertie is a continuation of how the California Oregon Intertie is operated today and respects multi-party operating agreements in effect.

In line with these changes, the ISO will also improve its modeling of high voltage direct current transmission and true-up the underlying model used for congestion revenue rights with the expanded full network model.

Nexus with energy imbalance market

Though the impetus to expand the full network model did not come from the energy imbalance market implementation, accurate modeling of energy imbalance market entities depends on accurately modeling highly interconnected external systems. This is especially the case for PacifiCorp West, which relies on Bonneville Power Administration's transmission system. The full network model expansion will provide improved power flow solutions with greater awareness of external impacts on the combined ISO and energy imbalance market footprints. Therefore, the full network model expansion is scheduled to be implemented simultaneously with the energy imbalance market in fall 2014.

POSITIONS OF THE PARTIES

Stakeholders generally support the goal of expanding the full network model but have specific concerns with Management's proposed approach for modeling external balancing areas, which are discussed below. Management developed this proposal through an extensive stakeholder process and has reflected stakeholder input in the proposed approach. For example, Management originally proposed to model imports and exports as having sources and sinks distributed at locations outside the ISO balancing area. However, Management deferred this aspect of its proposal to a future separate stakeholder initiative based on stakeholder concerns with the potential impacts of such an approach.

The Market Surveillance Committee supports Management's proposal. The MSC's Final Opinion is attached for your reference.

The following addresses stakeholder positions raised during the stakeholder process. A detailed stakeholder comment matrix is also attached for reference.

Position 1: Some stakeholders requested additional analysis validating the ISO's proposed methodology. Specifically, some stakeholders are concerned that the external load, generation, and interchange data at the time the day-ahead market is run will not reflect all the transactions that are finalized later in the day.

Response: Management commits to analyze the results of the full network model functionality and demonstrate its accuracy prior to putting it into production. Management has provided stakeholders with a detailed plan for this pre-implementation testing and calibration. Management further commits to reporting back to the Board on the results of this analysis during its September 2014 meeting.

Position 2: A few stakeholders believe that a different subset of balancing authority areas should be additionally modeled and that the implementation should be separated from the energy imbalance market.

Response: Management believes modeling the identified priority balancing areas is sufficient for accurate unscheduled flow modeling. The modeling priorities for fall 2014 include balancing authority areas to support the energy imbalance market entities to obtain accurate power flow solutions.

Position 3: A few stakeholders were under the incorrect assumption that the proposed approach for limits on schedules and modeled flows on the California Oregon Intertie is counter to today's practices and agreements.

Response: The separate treatment the California Oregon Intertie is a continuation of today's practices and is not inconsistent with current practices and agreements. Moreover, it allows the ISO to use the Western Electricity Coordinating Council's unscheduled flow mitigation procedure in the real-time.

Position 4: One stakeholder opposes enforcing limits on physical flow over interties, in addition to the current limits on scheduled transactions over interties, because it will change the prices at the interties and will limit intertie schedules in the day-ahead market in a way that may not reflect market participants' scheduling priority in adjoining balancing areas. Instead, this stakeholder would prefer the ISO negotiate the limit for the total amount of day-ahead schedules that it can accepted for an intertie each day.

Response: The physical flow limit is already enforced in the real-time over the interties and is enforced both day-ahead and real-time within the ISO. The proposal extends this practice to the interties in the day-ahead so that the day-ahead model better reflects real-time conditions. Physical flow constraints exist regardless if they are in the market

model or not. This initiative seeks to enforce the physical flow limit so that the ISO's market solutions and prices at the interties will reflect this reality. It would not be practical to address the physical flow constraints by adjusting intertie scheduling limits because many of these constraints can be addressed by dispatching internal ISO generation without restricting intertie schedules.

Position 5: Several stakeholders have requested a revision to the current cost allocation methodology for real-time congestion imbalance offset uplift based on cost causation principles.

Response: One of the root causes of real-time congestion imbalance uplift is the lack of unscheduled flow modeling in the day-ahead market. The ISO believes it is important to see the impact of this initiative on such costs and use the data collected from this effort, at a minimum, to inform any future change to the cost allocation of this uplift charge.

Position 6: A few stakeholders are concerned that including flows from external balancing authority areas will render *currently* held congestion revenue rights infeasible.

Response: The ISO expects previously released congestion revenue rights to remain feasible because the ISO conservatively released these only up to 75 percent of the system transmission capacity. If, despite this, they turn out to be infeasible there are procedures in the tariff to address the infeasibility.

CONCLUSION

Management respectfully requests Board approval of the full network model expansion as described in this memorandum. The modeling improvements will enhance reliability and market efficiency by decreasing infeasible schedules in the day-ahead market, increase awareness of outages and other changed conditions throughout the western interconnection, and decrease congestion uplift costs. The separate treatment for the California Oregon intertie allows the ISO to take advantage of west-wide unscheduled flow mitigation procedures and adheres to multi-party operating agreements. Finally, the improved modeling will allow for more accurate power flow solutions for the energy imbalance market.