Full Network Model Expansion

Draft Final Proposal Addendum:

Pre-implementation Analysis

January 23, 2014

I. Executive summary

This paper describes the pre-implementation analysis that will be conducted for the Full Network Model (FNM) Expansion initiative. Specifically, the analysis will be a powerflow-based modeling assessment that will use the methodologies described in the draft final proposal as applied to actual days' market data prior to implementation to show the difference between the current and expanded FNM modeling. The end results will compare the modeled versus actual unscheduled flow for a set of representative days for the following four interties: (1) California-Oregon Intertie; (2) Palo Verde; (3) Eldorado-Mead; and (4) Victorville-Lugo. The end results will also compare results for representative internal constraints. The results will be provided in a briefing to the ISO Board of Governors at the September 2014 meeting.

II. Modeling assessment

There are two main activities of the modeling assessment. The first is the validation of base schedule inputs and the second is the core rerunning of historical market runs. The metric used to measure whether the FNM expansion enhancement is functioning as intended will be a comparison between modeled and actual unscheduled flows. The validation of base schedule inputs will serve as an important tool to calibrate the ISO's modeling to improve this metric. These two activities will be somewhat iterative and will rely on the calibration tools described in Section III.

a. Activity 1: Preliminary base schedules validation

This activity will validate the input data used for calculating base schedules. The ISO is currently working with the WECC Reliability Coordinator and our vendors to collect the data. The sources for each component of the base schedules are described in the draft final proposal and the calibration analysis will focus on the demand forecast, net scheduled interchange, and the generation and load distribution factors.[1] Specifically, the hourly demand forecasts from the WECC Reliability Coordinator will be compared against actual hourly demand by BAA. The net scheduled interchange by BAA pair will be retrieved via the WECC Interchange Tool. The ISO will receive the data by BAA pairs. During the validation, the ISO and its vendors will compare data available in the morning (approximately 9 am) with historical tag data. The historical tag data will form the foundation of a forecast and the morning data will be adjusted to the forecasted level of interchange. The ISO will track the accuracy of the morning projections against the historical tag data. In analyzing the historical tag data, the ISO will look at both historical data based on the day-ahead tag submission deadline (at 3 p.m.) and all tags submitted by the real-time deadline (20 minutes before flow). Lastly, the generation and load distribution factors for each modeled BAA will be adapted from the State Estimator solutions and will be saved and maintained in a library, similar to the existing process for the load distribution factors for the ISO LAPs.

[1] See Sections 6.1 and 6.2.

Timing: Data collection for this activity has already started and is targeted for preliminary completion by July 2014. The preliminary validation does not need the software code. When the second activity of the modeling assessment begins, the ISO will continue to validate the source data mentioned above and use the calibration tools as necessary. Therefore, this will be an iterative process in calibrating the inputs data used for calculating base schedules.

b. Activity 2: Rerunning production savecases

The modeling assessment will rerun production savecases with the expanded FNM software functionality enabled. This means that the ISO will take a save case of an actual market day and rerun the optimization for the entire day with the base schedules and the expanded FNM software functionality to calculate the resulting unscheduled flow due to base schedules. 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 ignored in the existing day-ahead market solution – recognizing of course that any significant outages of generation or transmission in real-time could impact the actual unscheduled flows and consequently the accuracy of the day-ahead estimate. The comparison will be as follows:

Data	Description of activity	Output
Day-ahead savecase	ISO will use the day-ahead savecase from each selected day as the starting point because it has no representation of unscheduled flow	No output
Day-ahead savecase with FNM expansion code and base schedules	Using the selected day-ahead savecases, rerun each through optimization with FNM expansion initiative changes	Calculated unscheduled flow on selected interties
Real-time unscheduled flow	Retrieve actual unscheduled flow on the selected interties for the same selected days	Actual unscheduled flow on selected interties

Since there are numerous changes scheduled for Spring 2014, it is most efficient to rerun savecases after these changes are implemented. Therefore, the pool of candidate savecases is limited to those after the Spring 2014 implementation. The ISO will select savecases from two timeframes:

- Test days rerun
  - Time: Spring implementation start (estimated April 1) to market simulation start (estimated July 8)
  - Purpose: From within this timeframe, select a variety of test days with normal or “stress” conditions to rerun the day-ahead savecases. These test days will provide the ISO a range of outcomes to help us benchmark and gain experience with the calibration tools and apply them to the daily reruns.
- Daily reruns

- Time: Market simulation start and ongoing
- Purpose: Rerun each day-ahead savecase starting from market simulation using the lessons learned from the test runs. The reruns will occur on a daily basis with a short lag time. For example, on Day 3, rerun the day-ahead market *created* on Day 1 (for operating Day 2) and compare it to the real-time results from Day 2. The ISO will rerun as many days as possible leading up to Fall 2014 implementation. In preparation for a briefing to the ISO Board in September, the results of this exercise will reflect analysis from the beginning of the market simulation to approximately mid-August. The ISO will continue to rerun daily savecases in a similar manner even after go-live to further refine its calibration methodology.

The analysis will be conducted with a focus on the following four interties: (1) California-Oregon Intertie; (2) Palo Verde; (3) Eldorado-Mead; and (4) Victorville-Lugo. We believe these interties provide a good sample of major unscheduled flow concerns. The analysis will also analyze modeled versus actual unscheduled flow on representative internal constraints.

Timing: Data collection for this activity starts at Spring 2014 implementation. During this period, the ISO will also decide on the test days to rerun. When the software code is stable on the ISO system around the July 8 market simulation, the rerunning of the selected savecases (both test days and daily reruns) will begin. During these reruns, the ISO will iterate between the validation of base schedule inputs and rerunning savecases using the calibration tools described below. In order to provide a Board briefing in time for the September 18-19, 2014 meeting, the results the ISO will provide includes the test days reruns and the daily reruns from the start of the analysis till approximately mid- to late-August. Calibration of inputs will continue up to and after go-live of the full network model functionality.

III. Calibration tools

The draft final proposal provided a non-exhaustive list of calibration tools and techniques the ISO can use in this modeling assessment and after implementation. Specifically, the draft final proposal notes that the demand forecasts will be compared to a historical analysis of actual demand, and the ISO can further fine tune the demand forecasts if needed by scaling the forecast up or down. Similarly, either the net scheduled interchange or the base schedules may be adjusted to neutralize their impact. In the case of net scheduled interchange, the adjustment would be in response to observed or perceived irregularities caused by the inclusion of base schedules. The problem may be isolated to a single net scheduled interchange or it may be more wide-spread. Adjusting the net scheduled interchange (but keeping the demand forecasts and setting the generation to the sum of interchange and demand) may be enough to adjust the unscheduled loop flow to resolve identified issues. The ISO will work with its vendors to develop a mechanism to adjust the net scheduled interchange, which will affect pairs of BAAs while not adjusting the schedules for the Energy Imbalance Market Entities. In summary, the adjustments can be made to modify or neutralize the impact of net scheduled interchange and may be applied to specific pairs of BAAs or more wide-spread. Under a more extreme scenario, the entirety of the base schedules (demand, generation, and net scheduled interchange) can be

adjusted to modify or neutralize its impact. This would be done under extreme circumstances as it would affect the power flow solution of the Energy Imbalance Market entities. Note that these broad adjustment techniques are in addition to the validation and potential adjustment of the demand forecasts. The ISO can decide to adjust several or all of the BAAs as the situation requires. Should the base schedules be significantly modified or its impact neutralized, the ISO will develop a mechanism to compensate for the lack of base schedules (such as compensating for voltage and losses).