California ISO
Shaping a Renewed Future

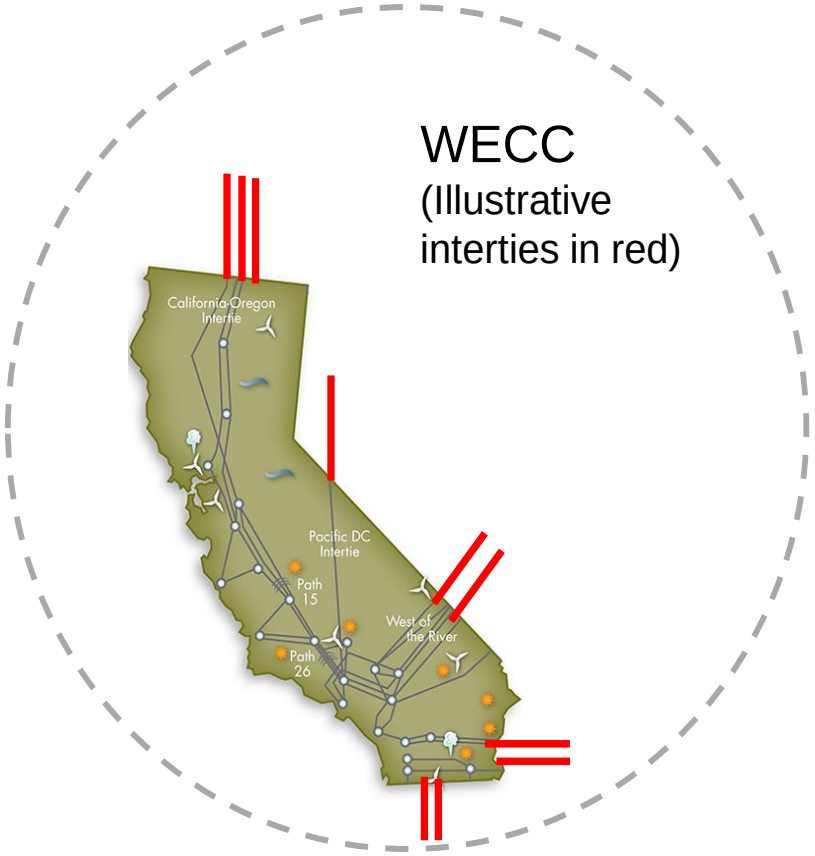
Full Network Model and Energy Imbalance Market Metrics

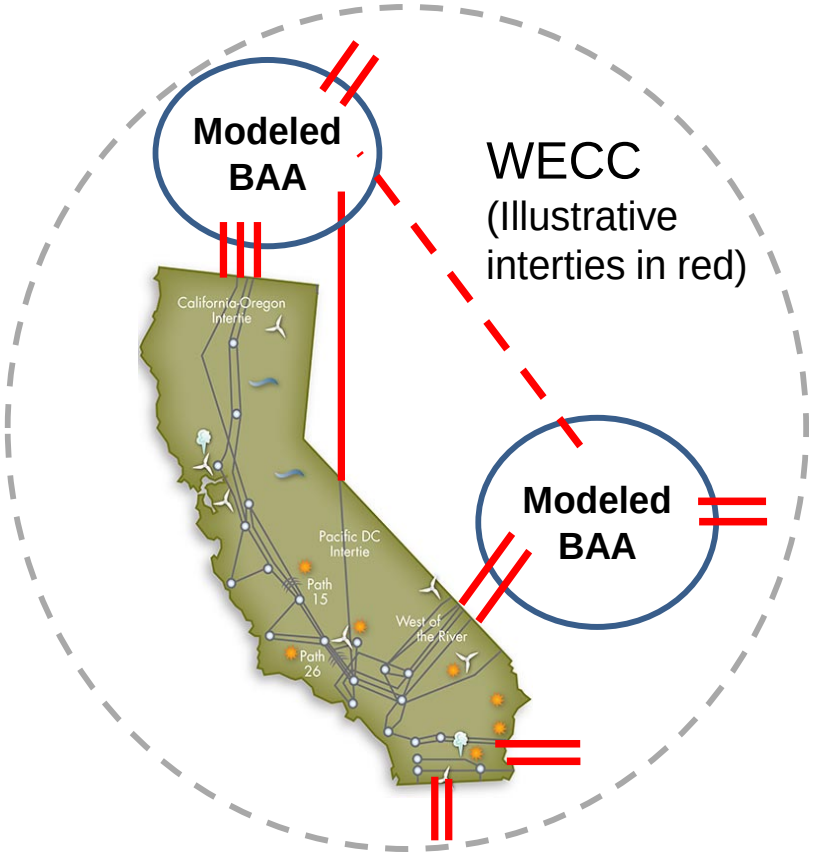
Mark Rothleder
VP Market Quality and Renewable Integration

Board of Governor Meeting
General Session
September 18-19, 2014

Full Network Model

The full network model expansion increases the ISO's modeling capabilities.





Accurately accounting for unscheduled flow in the day-ahead market improves reliability and market efficiency.

Contract path scheduling

Actual flow

Full Network Model Background

- ISO Board approved Full Network Model proposal in February 2014
  - Management committed to presenting a pre-implementation analysis so Board can assess the accuracy of the ISO's unscheduled flow modeling
- FERC approved ISO's Full Network Model proposal in July 2014, conditioned on:
  - Continued implementation is contingent on the market results passing an ongoing accuracy metric
  - ISO submission of an informational report on its pre-implementation analysis

An accuracy metric compares the ability to forecast actual unscheduled flow a day-ahead under two scenarios

- **Scenario 1:** ISO models external unscheduled flow impacts in the day-ahead

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

Accuracy metric: illustrative example

- Example for one hour under one intertie. In practice, metric sums all ties for all hours.

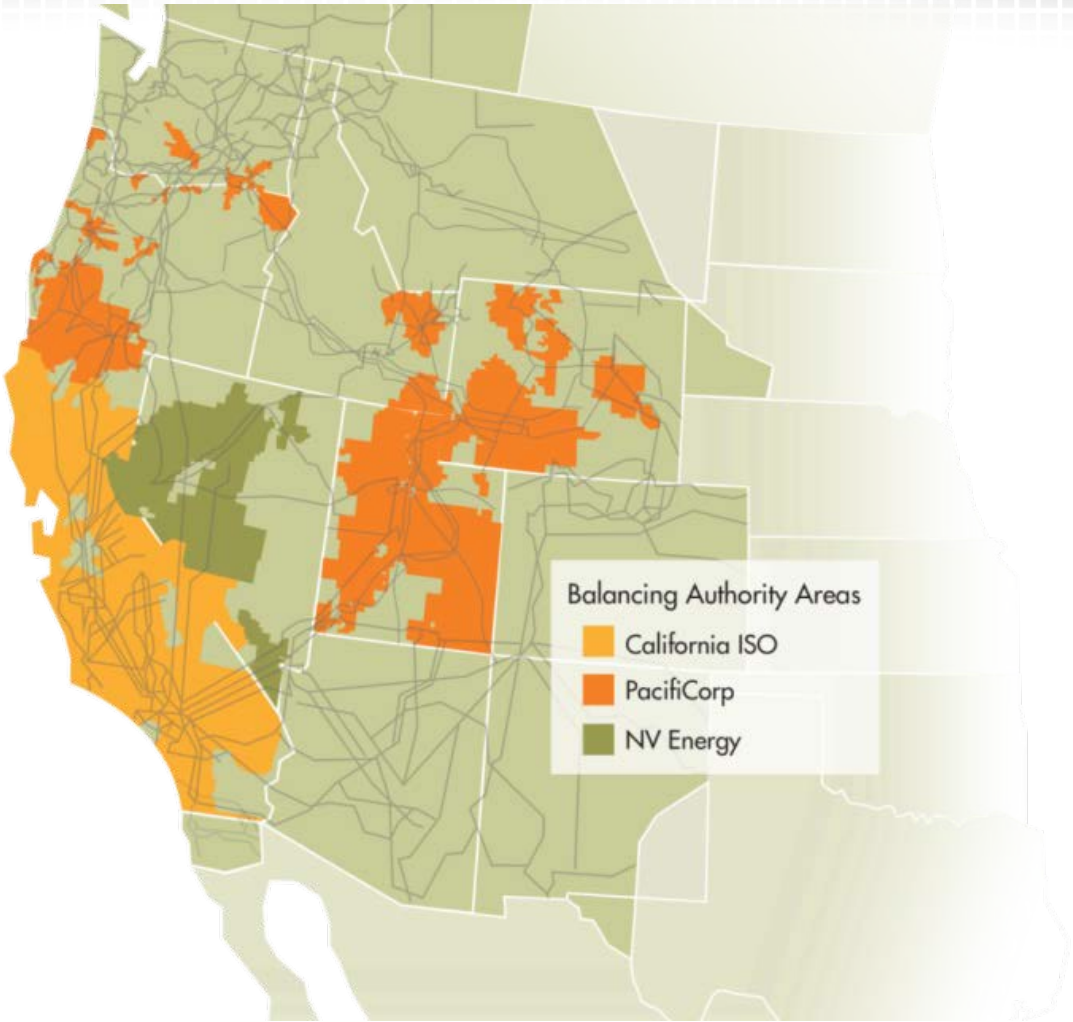
Scenario	Day-Ahead Forecast of Unscheduled Flow	Actual Unscheduled Flow	Difference
1) ISO models external unscheduled flow impacts in the day-ahead	Intertie 1 Hour 1 = 200 MW	Intertie 1 Hour 1 = 300 MW	|200 - 300| = 100 MW
2) ISO does not model external unscheduled flow impacts in the day-ahead	Intertie 1 Hour 1 = 0 MW	Intertie 1 Hour 1 = 300 MW	|0 -300| = 300 MW
Accuracy metric passes because 100 MW < 300 MW			

Pre-Implementation Accuracy Metric Results

- Performed analysis on 14 days
- 12 of 14 days confirms modeling of external flow impacts was more accurate than not modeling external flow impacts
- 2 of 14 days modeling of external flow was less accurate than not modeling external flow impacts due to input data issues

Conclusion

- Implementation and testing of full network model is complete
- Pre-implementation analysis supports that modeling of unscheduled flow in the day-ahead is more accurate than not modeling external flow impacts
- A data quality check process will be implemented to ensure external load, generation and interchange forecasts are reasonable
- The ISO will monitor 3 week cumulative accuracy metric:
  - Metric passes => Continue model external effects
  - Metric fails => Stop model external effects until demonstration of the metric can be achieved



TRACKING OF EIM BENEFITS

ISO will track EIM regional benefits and provide quarterly reports to stakeholders

- Compare dispatch cost to a case without EIM
- Quantify imbalance energy dispatch benefits that enable:
  - real-time economic transfers
  - new balancing resources
  - efficient and secure dispatch
- Quantify flexibility benefits that enable:
  - diversity to reducing flexibility reserves
  - sharing and compensation of flexibility reserves

Quantifying the benefits

- EIM benefit is the difference between EIM dispatch cost with EIM and without EIM dispatch
  - Cost shifted from the supply region to the demand region
  - Calculated using 15-minute market solution due to practical computational considerations
- Benefits calculated by balancing authority
- In the future, we will explore tracking other metrics including associated with:
  - Over-generation
  - Negative prices
  - Renewable production

Quantifying the benefits – areas for cost savings

- Participating resources dispatched more efficiently to meet intra-hour imbalances and transmission constraints
- Access to economic transfers between EIM regions
- Opportunity for new participating resources to displace more expensive generation
- Real-time load and supply variability will be met economically
- EIM may result in less flexible ramping needs and allow flexible ramping between regions, reducing overall flexibility procurement costs