

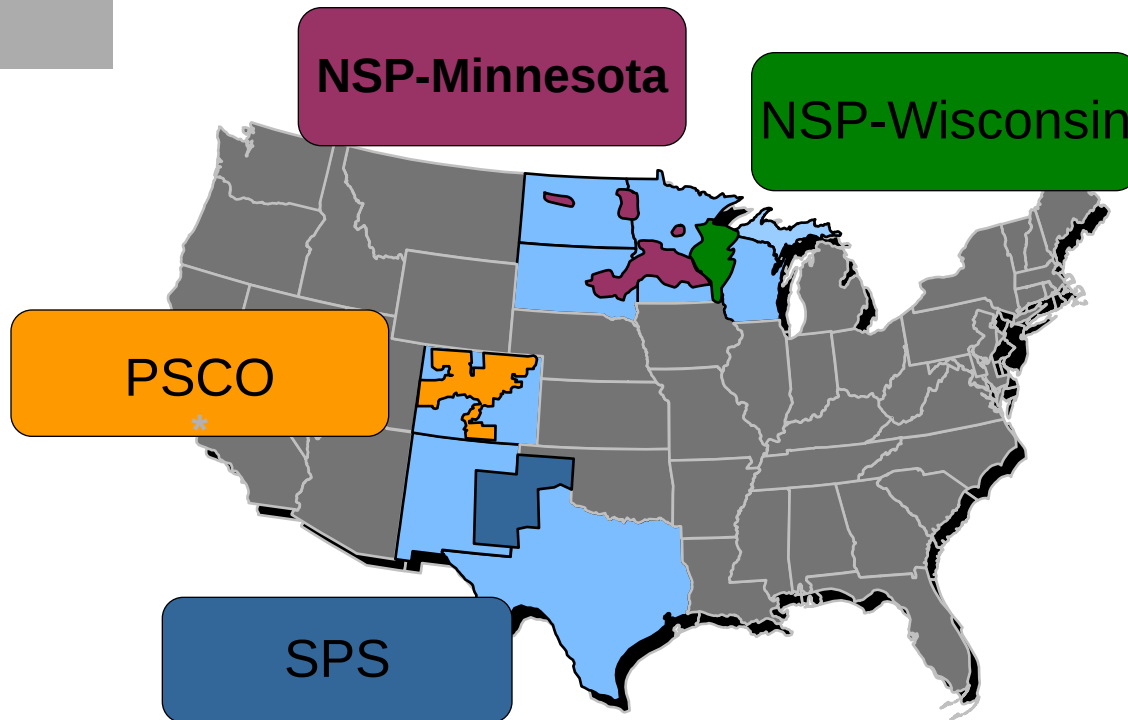
Clean Energy Transmission Summit



Stephen Beuning
Director Market Operations
1/9/13

Who We Are...

Xcel Energy is dedicated to being an environmental leader



➤ 26,000+ MWs of generation

➤ Operating in 8 States

➤ No. 1 wind power provider
No. 5 solar power provider

Customers

3.4 million electric

1.9 million gas

Xcel Energy Experience

- ▶ Number 1 wind provider in the US
 - ▶ ~5,000 MW of wind generation (Dec 2012)
 - ▶ ~250 MW of solar PV
- ▶ We operate utility balancing areas in market and non-market areas
- ▶ We see the need for better tools in the West
 - ▶ To reduce the cost of renewable integration
 - ▶ To improve the management of the electric grid

The Operating Issue with Renewable Energy

- ▶ **Wind and Solar output is variable**
- ▶ **The output is uncertain**
- ▶ **How best to deal with variability and uncertainty?**

Two General Considerations

- ▶ Better forecasting to reduce uncertainty
 - ▶ This means sufficient backup generators are available to ensure reliability while keeping costs low
- ▶ Better tools to keep electrical balance to manage variability and the resulting power flows on the grid

Dealing with Uncertainty:

Xcel Energy and Wind Forecasting

- ▶ Partner with the experts:
 - ▶ National Center for Atmospheric Research (NCAR)
 - ▶ National Renewable Energy Laboratory (NREL)
- ▶ Improve forecasts
 - ▶ High resolution weather models
 - ▶ Multiple intra-hour updates
- ▶ Tangible results
 - ▶ PSCo average forecast error reduced to 13.4% in 2011 from 18% in 2009
 - ▶ Savings: estimated \$906,000/year for each 1% reduction in error

Dealing with Variability:

Xcel Energy and Electrical Balancing

- ▶ Regional dispatch of generation is the single most effective integration tool
 - ▶ 66% of US electric load is already in a central market with regional dispatch
 - ▶ Midwest ISO can spread the integration burden over 128,000 MWs of generation
 - ▶ Southwest Power Pool does the same with roughly 50,000 MWs
 - ▶ PSCo manages this task with as little as 5,000 MWs of thermal generation

Tools for Electrical Balance

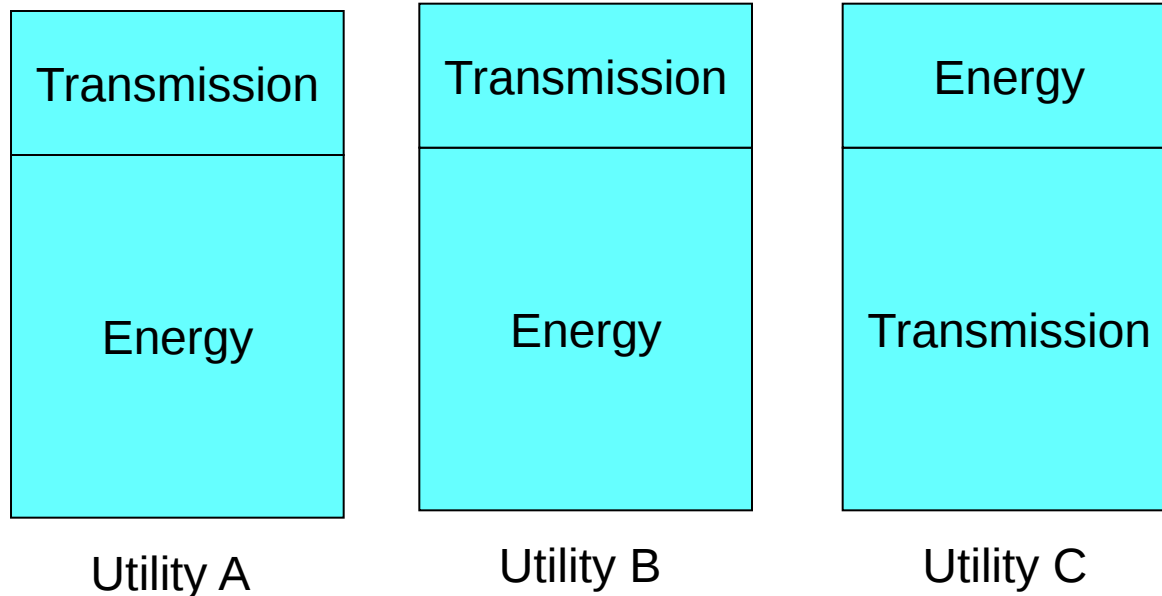
- ▶ **Regional energy markets:**
 - ▶ **Use generators from a large area**
 - ▶ **Simultaneous net evaluation of least-cost supply to meet all loads and exports**
 - ▶ **Subject to the physical limitations of the grid**
- ▶ **Contrast this to non-market areas where transmission rights are held as an option for suppliers to ship**
 - ▶ **Non-market areas tend to underutilize the wires and have more limited supply optimization**

Why not add markets?

- ▶ **Two apparent obstacles:**
 - ▶ **Wholesale competition:**
 - ▶ **Shippers holding valuable path rights may not want to relinquish those rights to competition**
 - ▶ **Grid cost differences:**
 - ▶ **Transmission providers with higher-cost transmission systems want additional transmission revenue**
 - ▶ **They may be able to derive more value from incremental transmission revenues than from variable production cost optimization**

Heuristic discussion:

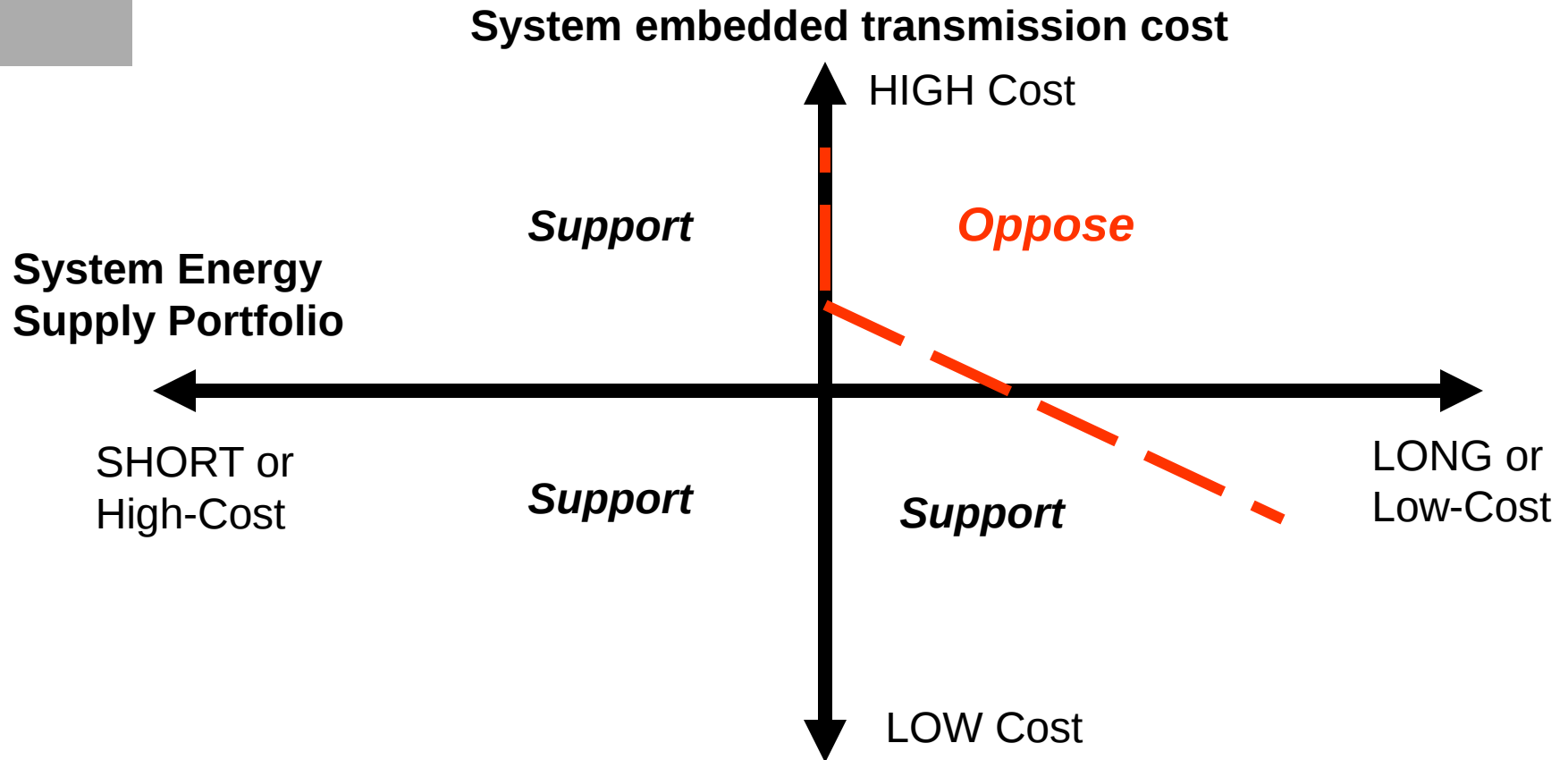
Compare Utility System Rates



- Utilities A & B are well-positioned to transition to a market. Reciprocal transmission access does not result in a cost-shift since their transmission rates are equal.
- Utility C may see more limited energy cost reductions in a market and instead will seek to recover transmission revenues from A&B.

Heuristic discussion:

Predicting Market Supporters



Conclusion

- ▶ Xcel Energy supports a number of the initiatives described in the Western Governors Association (WGA) integration report:
 - ▶ Energy Imbalance Market
 - ▶ Improve wind forecasting
 - ▶ More flexible generation capability:
 - ▶ Ramping, minimum load, cycling, operator training
 - ▶ Sub-hourly scheduling
 - ▶ Dynamic transfers
 - ▶ Geographic diversity
 - ▶ Improve reserves management

For more information...

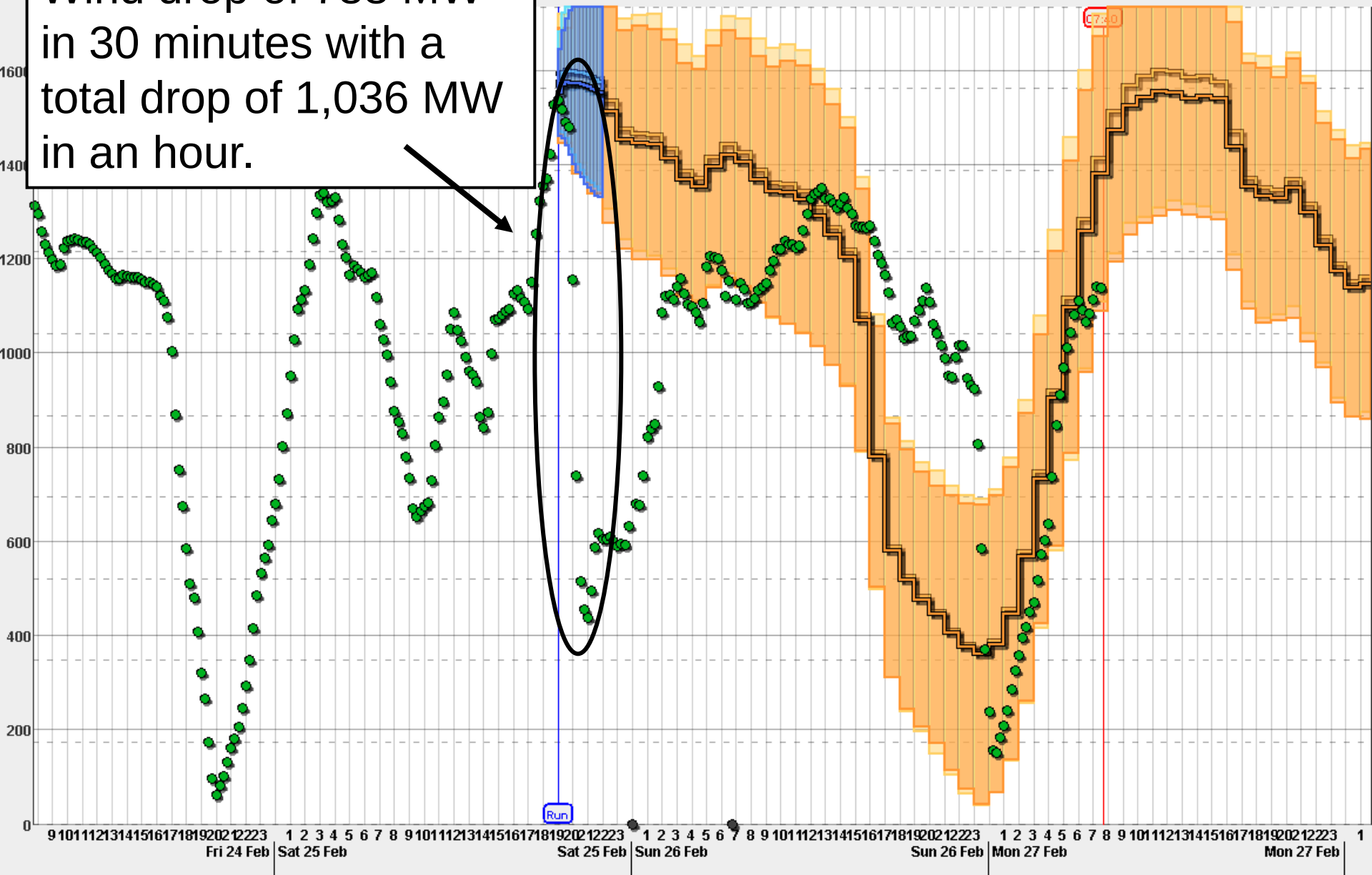
- ▶ Many relevant documents are available at the PUC-EIM web page hosted by the Western Interstate Energy Board.
- ▶ See the following link:
 - ▶ <http://www.westgov.org/PUCeim/index.htm>
- ▶ Or call Xcel Energy if you have questions you would like to discuss.
 - ▶ Steve Beuning at 303-571-2711



A Couple of Real-world Illustrations

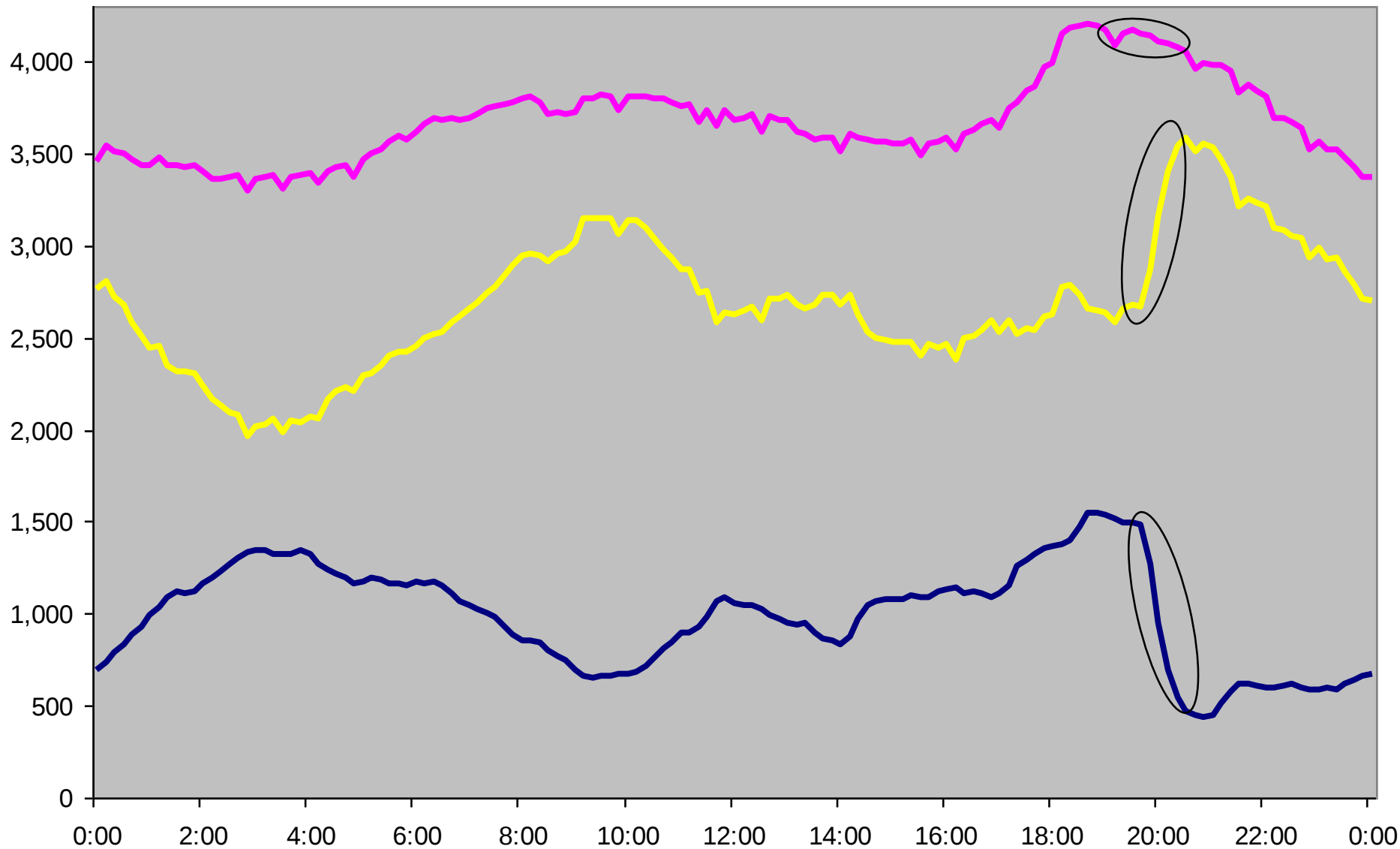
Variable Resource Impacts in Colorado

Wind drop of 788 MW
in 30 minutes with a
total drop of 1,036 MW
in an hour.



60-min wind Ramp in context of PSCo load (2/25/2012)

Load Ramp = (191)MW Wind Ramp = (1035)MW Net Load Ramp = 844MW



Proposed Energy Imbalance Market

- ▶ Comparable economic benefits as seen at MISO and SPP (though smaller due to a smaller pool)
 - ▶ MISO estimated benefit: \$1 billion+/year
 - ▶ SPP estimated benefit: \$104 million/year
- ▶ SPP market had a startup cost of approximately \$50 million and ongoing annual cost of approximately \$20 million
 - ▶ SPP has provided an updated indicative estimate of \$37 million startup and \$13 million annual to operate the EIM in the west

Open EIM Issues

- ▶ EIM Structural Issues:
 - ▶ Governance
 - ▶ Funding and cost recovery, especially transmission service charges
- ▶ Operational Issues:
 - ▶ Coordination with reserve-sharing groups
 - ▶ Seams Coordination Agreements
- ▶ General resistance to change

System Reliability

- ▶ Reliability concern is mostly limited to large, loss-of-wind-generation events

Common Misperception: “*Wind is a variable resource that can be here one minute and gone the next.*”

- ▶ False for ramps due to loss of wind speeds
 - ▶ 10's of minutes to hours for ramps to occur
 - ▶ Starting point = High winds = High reserves
- ▶ True for wind over-speed turbine tripping
 - ▶ Infrequent events, lack of geographic diversity
 - ▶ PSCo has systems in place to address this

Emissions Avoided by Wind Energy

- ▶ **Estimated CO2 emissions reductions from wind energy in each Opco in 2011:**
 - ▶ **PSCO: 3.6 Million Tons**
 - ▶ **NSP: 3.1 Million Tons**
 - ▶ **SPS: 1.2 Million Tons**

