Workshop on Regional Integration of Electricity Markets
The Grove Hotel, Boise, Idaho
October 6-7, 2016

Presented by Frank Wolak, Mark Thurber, and Trevor Davis, Stanford University, in collaboration with the Western Interstate Energy Board

Take-away Messages:

• **Uniform Price vs. Pay-as-bid Markets:** Cannot expect cost savings from a pay-as-bid market. Generators change behavior to bid expected market price. Bidders fill in the price-quantity box. The information requirements associated with bidding expected market price are high and favor large generating companies.

• **Transmission Constraints:** Transmission constraints lead to regional market price differentials. Power flows from low price to high price regions. Reducing congestion to zero is suboptimal. The benefit of eliminating low frequency low magnitude price differentials unlikely to exceed the cost of constructing a new transmission line.
• **Forward Contracts:** Forward contracting for energy creates two revenue/cost streams for generation unit owners and retailers. Here are the stages of the process: (1) Generators and retailers sign fixed-price forward contracts for energy; (2) generators sell energy in the short-term market to serve retailers’ realized demand; and (3) generators and retailers settle forward contracts through difference payments equal to the difference between the forward contract price and the short-term market price times the forward contract quantity. Existence of these fixed price forward contract obligations change the incentives generators have to raise short-term market prices.

With forward contracting a generator has no incentive to set an offer price above their marginal cost of production on any generation capacity that is necessary to cover their forward contract quantity. For example, if a supplier has a forward contract quantity of 1,000 MWh, then it is profit-maximizing for this supplier to offer at least 1,000 MW of its capacity into the short-term market at marginal cost. This strategy ensures that the supplier has the least cost hedge against the short-term price for the 1,000 MWh that it sold in the forward contract.

If all suppliers have fixed-price forward contract obligations for their expected output under the assumption of price-taking behavior in the short-term market, then all suppliers will find it unilaterally profit-maximizing to set the market price that does not reflect the exercise of unilateral market power. This logic demonstrates that load serving entities should negotiate fixed-price forward contracts with multiple low-cost generators equal to their load as a way to ensure that short-term market prices do not reflect the exercise unilateral market power, even under high-demand conditions.

• **Market Integration:** Increased competition in an integrated market mitigates against the exercise of unilateral market power and reduces the overall variable power supply cost. The cost savings from market integration are likely to be unevenly distributed. An isolated market...
faces increased risk of price spikes associated with transmission line outages, thermal
generation outages, and low hydroelectric stream flow conditions.

- **Demand Response:** The use of demand response mitigates against the unilateral exercise of
  market power during tight supply and demand conditions. In workshop simulations retailers
  implemented demand-side rebates to offset the price effect of generators exercising market
  power. The results of this simulation are available [HERE](#). Demand response by retailers offset
  economic withholding by generators and lowered the market clearing price from $200 per MWh
  to $150 per MWh in this simulation.

Thank you for your participation in this regional electricity market workshop. I learned a lot about the
dynamic interactions that can occur in electricity markets, not only the instructors, but also from the
simulation participants.

Maury Galbraith
Western Interstate Energy Board
303-573-8910 x1