ELECTRICITY MARKET DESIGN

William W. Hogan
*Mossavar-Rahmani Center for Business and Government*
*John F. Kennedy School of Government*
*Harvard University*
*Cambridge, Massachusetts 02138*

Successes, Failures and Where We Go Next

150th New England Electricity Restructuring Roundtable

May 18, 2016
ELECTRICITY MARKET

Electricity Restructuring

The early discussion of the immediate problems in the electricity industry was disjointed and focused in the perceived pieces of the solution rather than the larger puzzle. The traditional model and even the meaning of the word would have to change.

Policy Challenge: Create Options and Make Choices

This Puzzle Has No Solution
ELECTRICITY MARKET  

Electricity Restructuring

Developing a consistent policy for electricity restructuring depended on having a coherent market design. This puzzle has a solution, but some old ideas must be discarded and new components put in place.
ELECTRICITY MARKET

Path Dependence

The path to successful market design can be circuitous and costly. The FERC “reforms” in Order 890 illustrate “path dependence,” where the path chosen constrains the choices ahead. Early attempts with contract path, flowgate and zonal models led to design failures in PJM (’97), New England (’98), California (’99), and Texas (’03). Regional aggregation creates conflicts with system operations. Successful market design integrates the market with system operations. (Hogan, 2002)
ELECTRICITY MARKET

Energy Market Design

The U.S. experience illustrates successful market design and remaining challenges for both theory and implementation.

- **Design Principle: Integrate Market Design and System Operations**
  Provide good short-run operating incentives.
  Support forward markets and long-run investments.

- **Design Framework: Bid-Based, Security Constrained Economic Dispatch**
  Locational Marginal Prices (LMP) with granularity to match system operations.
  Financial Transmission Rights (FTRs).

- **Design Implementation: Pricing Evolution**
  Better scarcity pricing to support resource adequacy.
  Unit commitment and lumpy decisions with coordination, bid guarantees and uplift payments.

- **Design Challenge: Infrastructure Investment**
  Hybrid models to accommodate both market-based and regulated transmission investments.
  Beneficiary-pays principle to support integration with rest of the market design.
The example of successful central coordination, CRT, Regional Transmission Organization (RTO) Millennium Order (Order 2000) Standard Market Design (SMD) Notice of Proposed Rulemaking (NOPR), “Successful Market Design” provides a workable market framework that is working in places like New York, PJM in the Mid-Atlantic Region, New England, the Midwest, California, SPP, and Texas. This efficient market design is under (constant) attack.

Poolco…OPCO…ISO…IMO…Transco…RTO…ITP…WMP…: "A rose by any other name …"

“Locational marginal pricing (LMP) is the electricity spot pricing model that serves as the benchmark for market design – the textbook ideal that should be the target for policy makers. A trading arrangement based on LMP takes all relevant generation and transmission costs appropriately into account and hence supports optimal investments.” (International Energy Agency, 2007)

This is the only model that can meet the tests of open access and non-discrimination. Anything that upsets this design will unravel the wholesale electricity market. The basic economic dispatch model accommodates the green energy agenda, as in the expanding California-Pacificorp Energy Imbalance Market (EIM).
All energy delivery takes place in the real-time market. Market participants will anticipate and make forward decisions based on expectations about real-time prices.

- **Real-Time Prices**: In a market where participants have discretion, the most important prices are those in real-time. “Despite the fact that quantities traded in the balancing markets are generally small, the prevailing balancing prices, or real-time prices, may have a strong impact on prices in the wholesale electricity markets. … No generator would want to sell on the wholesale market at a price lower than the expected real-time price, and no consumer would want to buy on the wholesale market at a price higher than the expected real-time price. As a consequence, any distortions in the real-time prices may filter through to the wholesale electricity prices.” (Cervigni & Perekhodtsev, 2013)

- **Day-Ahead Prices**: Commitment decisions made day-ahead will be affected by the design of day-ahead pricing rules, but the energy component of day-ahead prices will be dominated by expectations about real-time prices.

- **Forward Prices**: Forward prices will look ahead to the real-time and day-ahead markets. Although forward prices are developed in advance, the last prices in real-time will drive the system.

- **Getting the Prices Right**: The last should be first. The most important focus should be on the models for real-time prices. Only after everything that can be done has been done, would it make sense to focus on out-of-market payments and forward market rules.
ERCOT launched implementation of the ORDC in 2014. The summer peak is the most important period. The first year results showed high availability of reserves and low reserve prices. The experience in 2015 illustrates the fundamental properties of the ORDC, and higher reserve prices.

Source: Resmi Surendran, Analysis of Reserves and Prices, July 2, 2015-August 23: Hour Ending 17:00, ERCOT TAC Presentation, August 27, 2015.