ELECTRICITY MARKET DESIGN: 
Energy Trading and Market Manipulation

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ELECTRICITY MARKET

The case of electricity restructuring presents examples of fundamental problems that challenge regulation of markets.

- **Marriage of Engineering and Economics.**
  - Loop Flow.
  - Reliability Requirements.
  - Incentives and Equilibrium.
  - Physical and Financial Transactions.

- **Devilish Details.**
  - Market Power Mitigation.
  - Coordination for Competition.
  - Transmission Expansion.

- **Jurisdictional Disputes.**
  - European Subsidiarity Principle.
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). Zonal aggregation creates conflicts with system operations. Successful market design integrates the market with system operations.
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A Consistent Framework

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.

“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, Tackling Investment Challenges in Power Generation in IEA Countries: Energy Market Experience, Paris, 2007, p. 16.)

Coordinated Spot Market
Bid-Based, Security-Constrained, Economic Dispatch with Nodal Prices

Start up Costs +

Generators & Customers

A Structure for Forward Market Scheduling, Spot Market Dispatch & Settlements

Scheduling Transactions

Settlements

Financial Transmission Rights (TCCs, FTRs, FCRs, CRRs, ...)

License Plate Access Charges

Bilateral Schedules at Difference in Nodal Prices

Market-Driven Investment

07/05

07/02

12/99

5/99

07/02

12/99

5/99

Excess Congestion $
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Market design in RTOs/ISOs is well advanced but still incomplete and under constant stress.¹

- **Regional Markets Not Fully Deployed**

- **Reforms of Reforms**
  Market Power mitigation through offer caps. California MRTU (April 1, 2009) and ERCOT Texas Nodal (December 1, 2010) reforms.

- **Market Defect: Scarcity Pricing, Extended LMP**
  Smarter pricing to support operations, infrastructure investment and resource adequacy.

- **Market Failure: Transmission Investment**
  - Regulatory mandates for lumpy transmission mixed with market-based investments.
  - Design principles for cost allocation to support a mixed market (i.e., beneficiary pays).

- **Market Challenge: Address Requirements for Climate Change Policy**

Market manipulation covers a wide range of topics. The focus here is on virtual and physical energy trading in organized markets. Set aside for now related but different problems of market manipulation, such as:

- Fraud and misrepresentation.
- Price index manipulation in bilateral markets.
- Collusion among market participants.
- Capacity auctions in organized markets.
- Demand response mandates.

These all present problem areas of manipulation, but they are distinct from energy trading activities in organized real-time and day-ahead markets. Recent enforcement actions such as for the Constellation Energy Commodities Group settlement\(^2\), for the Deutsche Bank Energy Trading show cause order\(^3\), or for the Gila River Power settlement\(^4\) have focused on real and virtual energy trading activities that are a centerpiece of electricity market design. (Note: I have been involved to some degree in the Constellation and Deutsche Bank matters as an expert.)


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Competitive Market

With attention to organized wholesale electricity markets, under what conditions can energy trading result in price manipulation inconsistent with workably competitive markets?

Two attributes of perfectly competitive electricity markets:

- Taking prices as fixed, transactions are profit maximizing.
- Prices clear the market, satisfying the no-arbitrage condition.

There is no perfect definition of “workably competitive.” Real transactions in real markets have some impact on prices. Changes in prices have some impact on the profitability of transactions and related financial contracts. Electrical network interactions and constraints have wide ranging effects. A workable definition of “workably competitive” requires judgments about the acceptable degree of approximation of the attributes of competitive markets.

“A market in which each supplier decides how much to supply at market prices that it cannot profitably affect for long is said to be workably competitive.”

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ELECTRICITY MARKET

Market Manipulation

A prior top ten list of issues and challenges in market power mitigation included:

...  

3. **“Scarcity pricing is good, withholding is bad.”** High prices may be politically unpopular, but absent withholding of generation there is no exercise of monopoly power. Regulators who support markets must face the periodic need for high prices during shortage conditions, at least in the real-time balancing market that sets the incentives for everything else through anticipation and arbitrage.

4. **Electricity markets make control of real time generation, transmission or load essential in exercising market power.** Derivative markets and long term contracts can change the incentives to exercise market power, but at least in organized markets withholding in real time is required to exercise market power. Otherwise, simple financial arbitrage would preclude any sustained exercise of market power.

...  

6. **Monopsony is a problem as well as monopoly.** Compensating expensive generators for running when cheaper alternatives are available produces prices that are too low and should be as much a focus of policy concern as withholding to increase prices. Support of markets requires that system operators run the system to reflect the bid-based costs, not to minimize price.”

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Offer caps and seller market power. Generators have an obligation to offer production at no more than a predetermined offer cap. Actual production compensated at the market-clearing price.

- Distinguishes between monopoly rents and scarcity rents.
- Generator has an obligation to offer at least the designated amount. Offers for additional quantities are unregulated.
- Provides the right incentives for supply and demand, for entry and operations.
- If high prices caused by withholding, the offer cap will lower market clearing price. If high prices caused by scarcity, offer cap could produce high prices.
- The information burden is greater than for price caps but less than for cost-of-service regulation.
- Offer caps are generator specific and compatible with a workably competitive market.
Successful wholesale electricity market design depends on strong interactions between physical energy trading, virtual trading and financial contracts.

- **Financial contracts interact with energy trading.**
  - Financial transmission rights substitute for unavailable physical rights.
  - Contracts for differences integrate with organized spot markets.

- **Forward markets interact with real-time trading.**
  - Financial transmission rights settle day-ahead.
  - Schedules and virtual transactions integrate day-ahead and real-time markets.

- **Market hedges are imperfect.**
  - Imbalances for financial transmission contracts.
  - Portfolios for forward contracts integrated with virtual trading.

- **Barriers to entry differ in physical and financial markets.**
  - Real-time physical markets have high short-run but lower long-run barriers.
  - Day-ahead financial markets with virtual trading have low barriers to entry.

- **Prices clear the market under economic dispatch with bids and offers.**
ELECTRICITY MARKET

Electricity markets are unlike other commodity markets. Real-time physical and forward financial markets interact. But the lack of storability and the market-clearing process imply that market power cannot be sustained in forward financial markets without manipulating real-time markets.

“Because of non-storability, manipulators of power markets must be producers of power, so speculative corners are not possible. Moreover, a manipulator must have market power in generation.”

<table>
<thead>
<tr>
<th>Market Activities and Price Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Real-Time Physical Transactions</strong></td>
</tr>
<tr>
<td><strong>Issue:</strong> Monopoly and Monopsony, Energy Withholding.</td>
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<tr>
<td><strong>Policy:</strong> Mitigation with Offer Caps, Must-Run Requirements.</td>
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<td><strong>Real-Time Prices</strong></td>
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<tr>
<td>Workably competitive.</td>
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<td><strong>Forward Prices</strong></td>
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<tr>
<td>Forward contracts leverage incentives, but real-time mitigation and easy entry in forward markets leave workably competitive conditions.</td>
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<tr>
<td><strong>Forward Financial Transactions</strong></td>
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<tr>
<td><strong>Issue:</strong> Unit Commitment?</td>
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<td><strong>Policy:</strong> Reliability Unit Commitment.</td>
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<td><strong>Negligible competitive effects?</strong></td>
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<td><strong>Forward Prices</strong></td>
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<tr>
<td>Day-ahead price should approximate expected real-time price, with transaction costs and small possible risk premium.</td>
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<tr>
<td>Forward transactions do not create physical real-time energy withholding; cannot sustain manipulation of forward prices.</td>
</tr>
<tr>
<td>Workably competitive.</td>
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ELECTRICITY MARKET

Interactions among physical energy trading, market-clearing prices, and financial contracts are intended and necessary for successful electricity market design.

The mere fact that a physical transaction can affect prices to some degree, and thereby influence the prices of related financial contracts, cannot be a per se definition of price manipulation.

Nearly every physical transaction can have some impact on prices. This is basic supply and demand economics. Manipulation must involve more than a price impact on related contracts.

If holding a financial contract that benefits from the price impact of a physical transaction were to be deemed all that is required to establish price manipulation, then the entire foundation of successful electricity market design would be destroyed with one stroke.

A FERC solution for distinguishing economic transactions from price manipulation is, has been, and should be an application of a stand-alone profitability test.

“…HQ Energy did not use a combination of market power and trading activity to act against its economic interest in one market in order to benefit its position in another market by artificially moving the market price. There is no evidence that HQ Energy acted against its economic interest in any market. Rather, the facts of this case show that HQ Energy made price-taker bids and used [Transmission Congestion Contracts] to hedge congestion risk in a manner explicitly contemplated by the Commission.”

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A stand-alone profitability test does not require perfection, and is compatible with a workably competitive market.

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- **Conventional application with unique market-clearing price.**
  - Taking the market price as given.
  - Not “against economic interest.” Profitable, or at least not loss making.

- **Generalized application with degenerate case of multiple market-clearing prices.**
  - Taking market prices as given.
  - Not “against economic interest” for all prices in the degenerate range. In other words, meets the stand-alone test for some price in the degenerate range. A symmetric rule would apply for evaluating transactions not undertaken (i.e., withholding).

Passing the stand alone test would provide a safe harbor. Failing the stand-alone test would raise a question of possible price-manipulation “to act against its economic interest in one market in order to benefit its position in another market by artificially moving the market price.”

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The Gila River Power settlement does not speak to the distinctions articulated in the HQ Energy matter. This could have major implications for electricity market design and trading.

- Gila River Power traders knew that their wheeling transactions could benefit other transactions by affecting the price.\(^{10}\)
- The strategies were profitable: “Gila River engaged the Standalone Wheel strategy from July 22, 2009 through March 16, 2010 and made approximately $613,801 in profits from the strategy. … Gila River engaged in the Adjustment Wheel strategy during the entire Relevant Period, i.e., from July 2009 through October 2010, and made approximately $296,753 in profits from this strategy.”\(^{11}\)
- The only reference possibly consistent with the HQ Energy standards is provided without support or explanation: “Gila River’s Wheeling Through transactions done in conjunction with its Adjustment Wheel strategy were undertaken with the intent to increase the revenues for its imports sourced from the Gila River plant and were not based on market fundamentals.”\(^{12}\)

What were the “market fundamentals”? Were the separate transactions profitable on a stand-alone basis? Or were the individual transactions “against economic interest” absent any impact on prices and other transactions? Or is trading with the knowledge and intent to affect prices all that is required!?

Is the Gila River Power settlement consistent with or opposed to the HQ Energy standards?


\(^{11}\) Gila River Power, pp. 3-4.

\(^{12}\) Gila River Power, p. 6. (emphasis added)
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The principles and protocols that determine electricity market manipulation are in flux. The definition of what constitutes manipulation is unclear. Changes in enforcement practices have created concerns for market participants. In some instances enforcement actions imply restrictions that threaten the very structure of efficient electricity market design.

- What is the theoretical framework defining market manipulation?
- How do market manipulation analyses differ for real-time and day-ahead transactions?
- What defines safe harbors for transactions and conduct?
- How can confidential enforcement settlements affect policy and precedent?
- How can the system provide transparency while deterring and detecting market manipulation?
- What can be done to support efficient market design and mitigate market manipulation?
Would a proactive policy by industry participants help reduce uncertainty about enforcement and improve market operations? Create a voluntary industry subscription service to:

- Define voluntary compliance regime.
  - Establish framework identifying market manipulation practices.
  - Define code of conduct for market participants.
  - Develop model(s) of “best practice” compliance regime(s).

- Offer enforcement litigation insurance.
  - Monitor energy enforcement matters at FERC, CFTC and PUCT.
  - Provide legal support for subscribers meeting compliance standards.

- Support electricity market analysis and design.
  - Identify design problems that implicate market manipulation.
  - Establish benchmarks for empirical analysis.
  - Analyze compatible regulatory remedies.

The purposes would be to bring greater transparency to distinguish manipulation from efficient market activities, reduce uncertainty for market participants, and hedge the litigation costs of enforcement actions. The deterrence effect of fines and penalties would remain.
Electricity markets are unlike other commodity markets. Real-time physical and forward financial markets interact. But the lack of storability and the market-clearing process imply that market power cannot be sustained in forward financial markets without manipulating real-time markets.

Offer caps address the problem of generator market power mitigation for physical transactions and real-time markets.

Interactions among physical energy trading, market-clearing prices, and financial contracts are intended and necessary for successful electricity market design.

The mere fact that a physical transaction can affect prices to some degree, and thereby influence the prices of related financial contracts, cannot be a per se definition of price manipulation.

A FERC solution for distinguishing economic transactions from price manipulation has and should include an application of a stand-alone profitability test.

Passing an appropriate stand-alone profitability test should provide a safe harbor. Otherwise, the entire foundation of successful electricity market design would be destroyed with one stroke.