ELECTRICITY MARKET DESIGN:
Energy Trading and Market Manipulation Redux

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ELECTRICITY MARKET Trading and Manipulation

The continuing story of how to define and prevent market manipulation raises important questions about market design, the role of trading and traders, and public policy to support competitive wholesale markets under a framework of open access and non-discrimination.

- **How did the successful market design arise and why is it important?**
- **What is the role of financial contracts and forward trading?**
- **What are the implications for defining market manipulation?**

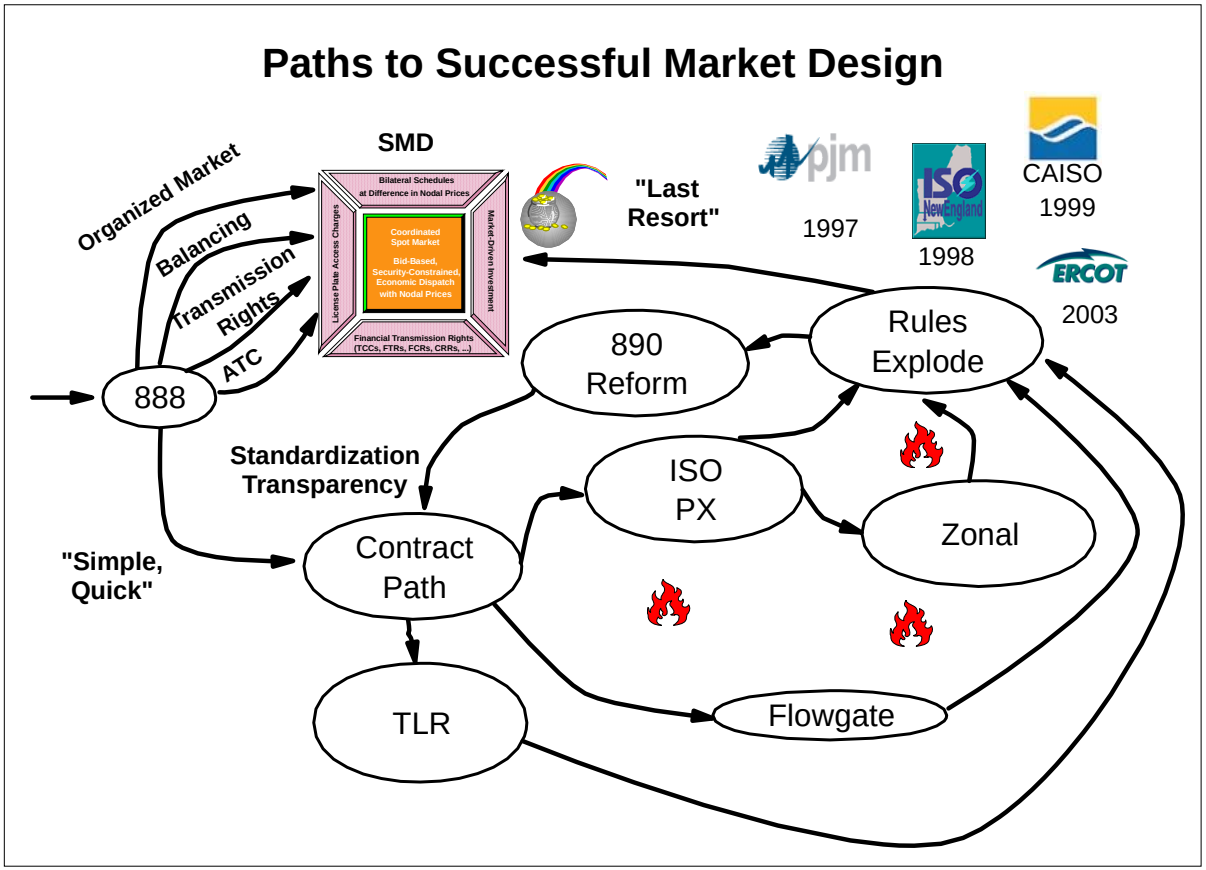
The case of electricity restructuring presents examples of fundamental problems that challenge regulation of markets.

- **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.**
  - **US State vs. Federal Regulators.**
  - **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.

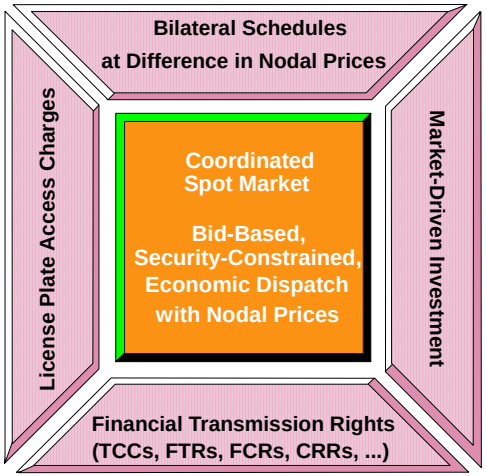


ELECTRICITY MARKET A Consistent Framework

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.)

The ~~RTO NOPR Order SMD NOPR~~ "Successful Market Design" Contains a Consistent Framework



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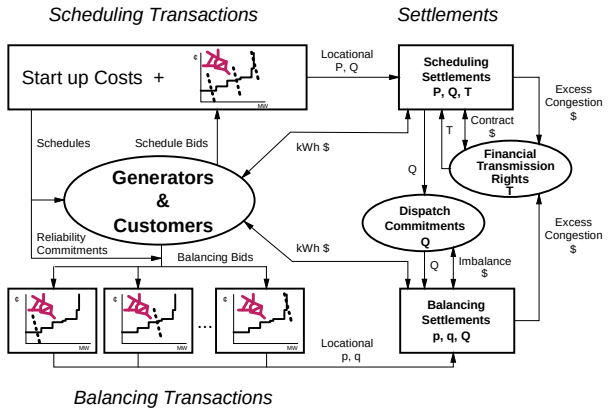
A Structure for Forward Market Scheduling, Spot Market Dispatch & Settlements



ELECTRICITY MARKET Forward Contracts

A critical challenge in market design with unbundled transactions was to provide a framework and a capability to arrange longer term contracts between generators and loads.

The vertically integrated system provided long-term arrangements by utilities owning generation on behalf of load. The unbundled competition model required replacements that would allow for contracts connecting generation and load.

- **"Contracts for Differences" at a location.**
  - Contracts do not determine or constrain economic dispatch.
  - Contract imbalances settled at locational prices.

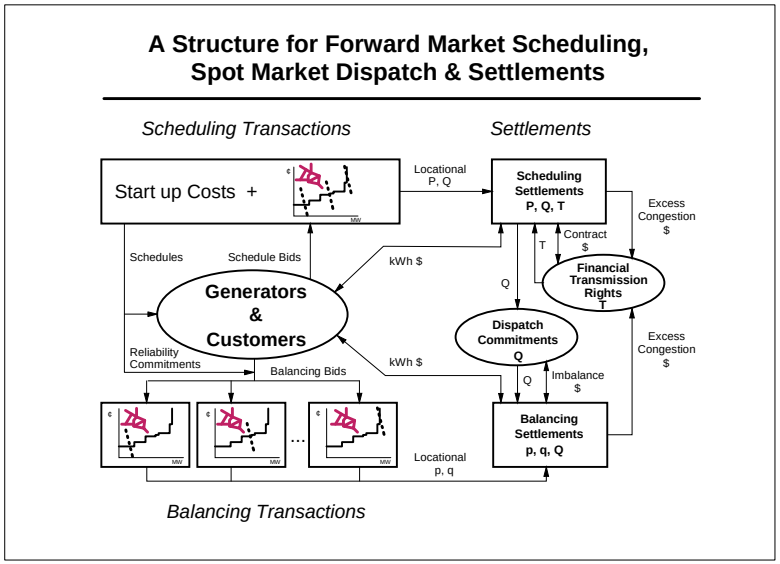
- **Financial Transmission Rights (FTRs) between locations.**
  - Unworkable physical rights and contract paths replaced by FTRs.
  - Settlements based on the difference between locational prices.

- **Contract durations set by market requirements.**
  - Forward contracts are financial instruments unknown to the operator.
  - Varying durations create a need and an opportunity for energy trading.

ELECTRICITY MARKET — Related Positions

Market design in RTOs/ISOs reflects an explicit reliance on "related positions."[1]

- **In a one settlement system, long-term FTRs settle against and hedge real-time prices.**
- **In markets with two settlements, a related transaction is required.**
  - FTRs settle against day-ahead prices.
  - Day-ahead schedules create new transmission rights.
  - Virtual contracts day-ahead settle against real-time prices.
  - An FTR plus an equivalent day-ahead virtual contract allows the long-term FTR to settle against real-time prices.
- **In a day-ahead market, the prices of the related transactions are interdependent.**
  - The bid for the schedule or virtual contract increases the value of the FTR.
  - The schedule or virtual contract is necessary to transfer the FTR hedge to real-time prices.



[1] S. M. Harvey, W. W. Hogan, S. L. Pope, "Transmission Capacity Reservations and Transmission Congestion Contracts," June 6, 1996, (Revised March 8, 1997), pp. 51-53, available http://www.hks.harvard.edu/fs/whogan/tccoptr3.pdf.

ELECTRICITY MARKET — Market Interactions

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.**

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.

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." [2]

[2] *DC Energy, LLC v. H.Q. Energy Servs. (U.S.), Inc.*, 124 FERC ¶ 61,295 at 22 (2008) [footnote in original omitted]. Transmission Congestion Contract is another term for Financial Transmission Right.

The Duetsche Bank FERC settlement announced a policy fundamentally at odds with the FERC HQ Energy position and the requirements of successful market design for wholesale electricity markets:

> "Enforcement concluded that Deutsche Bank's CRR traders acted with the requisite manipulative intent because, among other reasons, they engaged in the physical transactions with the intent to increase the value of Deutsche Bank's CRR position. Specifically, as stipulated by Deutsche Bank, the CRR traders sought for the exports at Silver Peak to change the price to benefit the bank's losing CRR position. Deutsche Bank's physical transactions were not profitable. ***Even if these physical transactions had been profitable, however, profitability is not determinative on the question of manipulation and does not inoculate trading from any potential manipulation claim (although profitability may be relevant in assessing the conduct).*** Rather, as we have recognized, the elements of manipulation are 'determined by all the circumstances of a case.' (footnote in original) Here, based on all the facts and circumstances, Enforcement determined that Deutsche Bank's conduct constituted manipulation."[3]

This policy strikes at the heart of the necessary solution for successful wholesale electricity markets.

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[3] Federal Energy regulatory Commission, "Deutsche Bank Energy Trading, Order Approving Stipulation and Consent Agreement," LLC Docket No. IN12-4-000, January 22, 2013, ¶20, p. 5, (emphasis added).

ELECTRICITY MARKET — Market Interactions

Electricity markets are unlike other commodity markets. Real-time physical and forward financial markets interact. But the lack of storability, the market-clearing process and easy entry imply that market power cannot be sustained in forward 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."[4]

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

[4] Craig Pirrong, "Manipulation of Power Markets," Washington University, March 24, 2000, p. 1.

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

"…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." [emphasis added]

- **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 should 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."

ELECTRICITY MARKET Market Manipulation Summary

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

- **If there is a claim of sustained manipulation of forward markets, there must be some barrier to entry for financial participants utilizing virtual contracts. The focus should be on removing the barriers and increasing liquidity, not on undoing the market design.**

- **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 is, has been, and should be 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.**

William W. Hogan is the Raymond Plank Professor of Global Energy Policy, John F. Kennedy School of Government, Harvard University. This paper draws on research for the Harvard Electricity Policy Group and for the Harvard-Japan Project on Energy and the Environment. The author is or has been a consultant on electric market reform and transmission issues for Allegheny Electric Global Market, American Electric Power, American National Power, Aquila, Atlantic Wind Connection, Australian Gas Light Company, Avista Corporation, Avista Utilities, Avista Energy, Barclays Bank PLC, Brazil Power Exchange Administrator (ASMAE), British National Grid Company, California Independent Energy Producers Association, California Independent System Operator, California Suppliers Group, Calpine Corporation, CAM Energy, Canadian Imperial Bank of Commerce, Centerpoint Energy, Central Maine Power Company, Chubu Electric Power Company, Citigroup, City Power Marketing LLC, Cobalt Capital Management LLC, Comision Reguladora De Energia (CRE, Mexico), Commonwealth Edison Company, COMPETE Coalition, Conectiv, Constellation Energy, Constellation Energy Commodities Group, Constellation Power Source, Coral Power, Credit First Suisse Boston, DC Energy, Detroit Edison Company, Deutsche Bank, Deutsche Bank Energy Trading LLC, Duquesne Light Company, Dyon LLC, Dynegy, Edison Electric Institute, Edison Mission Energy, Electricity Corporation of New Zealand, Electric Power Supply Association, El Paso Electric, Exelon, Financial Marketers Coalition, FTI Consulting, GenOn Energy, GPU Inc. (and the Supporting Companies of PJM), GPU PowerNet Pty Ltd., GDF SUEZ Energy Resources NA, Great Bay Energy LLC, GWF Energy, Independent Energy Producers Assn, ISO New England, Koch Energy Trading, Inc., LECG LLC, Luz del Sur, Maine Public Advocate, Maine Public Utilities Commission, Merrill Lynch, Midwest ISO, Mirant Corporation, MIT Grid Study, Monterey Enterprises LLC, MPS Merchant Services, Inc. (f/k/a Aquila Power Corporation), JP Morgan, Morgan Stanley Capital Group, National Independent Energy Producers, New England Power Company, New York Independent System Operator, New York Power Pool, New York Utilities Collaborative, Niagara Mohawk Corporation, NRG Energy, Inc., Ontario Attorney General, Ontario IMO, Ontario Ministries of Energy and Infrastructure, Pepco, Pinpoint Power, PJM Office of Interconnection, PJM Power Provider (P3) Group, Powerex Corp., PPL Corporation, PPL Montana LLC, PPL EnergyPlus LLC, Public Service Company of Colorado, Public Service Electric & Gas Company, Public Service New Mexico, PSEG Companies, Red Wolf Energy Trading, Reliant Energy, Rhode Island Public Utilities Commission, San Diego Gas & Electric Company, Sempra Energy, SESCO LLC, Shell Energy North America (U.S.) L.P., SPP, Texas Genco, Texas Utilities Co, Twin Cities Power LLC, Tokyo Electric Power Company, Toronto Dominion Bank, Transalta, TransAlta Energy Marketing (California), TransAlta Energy Marketing (U.S.) Inc., Transcanada, TransCanada Energy LTD., TransÉnergie, Transpower of New Zealand, Tucson Electric Power, Westbrook Power, Western Power Trading Forum, Williams Energy Group, Wisconsin Electric Power Company, and XO Energy. The views presented here are not necessarily attributable to any of those mentioned, and any remaining errors are solely the responsibility of the author. (Related papers can be found on the web at www.whogan.com).