

**ELECTRICITY STANDARD MARKET DESIGN:
THE BAD, THE GOOD--KNOWING THE DIFFERENCE
AND KNOWING HOW FAR TO GO**

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MASSACHUSETTS ELECTRIC RESTRUCTURING ROUNDTABLE
Standard Market Design and Retail Issues Associated with LMP

Boston, Massachusetts
September 13, 2002

The public policy debate over reshaping the electricity industry confronts major challenges in balancing public interests and reliance on markets.

- **Enron memos.** 'Ricocheting' off the 'Death Star'. The smoking gun or collateral damage?

"...a University of California economist and energy expert said the focus on Enron and its apparent dancing around and over the ISO's rules could divert attention from larger problems. ... My concern is ... that FERC is going to use this to say the problem is with the ISO's rules and that's what caused the crisis and it's your own fault,...The larger problem ... was with the owners of California's power plants who he said created artificial shortages to drive up prices."¹

"The Enron memos reveal one an important fact about the behavior of electricity suppliers that was strongly disputed by many observers of competitive electricity markets but is a maintained assumption for economists studying these markets. That is, sellers intend to make as much money as possible and will use all available strategies to achieve this goal."²

- **Imperfect Regulation vs. Imperfect Markets.**
 - Shoreham Nuclear Plant $\approx \frac{\$6 \text{ Billion}}{0 \text{ MWH}}$.
 - Good markets are made, they don't just happen.

¹ Severin Borenstein quoted in "Federal Regulators Orders California Electricity Sellers to Save Documents," Knight Ridder/Tribune Business News, May 8, 2002.

² Frank A. Wolak, Statement before the Senate Committee on Commerce, Science and Transportation, Washington D.C., May 15, 2002. p. 3.

The failures of electricity restructuring have ranged from the embarrassing to the negligent. Public officials and market participants are at a crossroads. But the road to take depends on the diagnosis of the failures and the identification of the needed corrections.

- **Go Back.** Can markets work well in the case of electricity? If not, then the old model of monopoly and regulation may be the best choice. But has too much happened since EPAct of 1992? It would be both difficult and expensive to go back, and the delay would create even more crises.
- **Stand Still.** Can we simply stay where we are and fix a few leaks, letting the regulators go home early? The rules are in turmoil and market institutions are fragile. The ostrich strategy is an invitation to continued surprises, and this should be no surprise.
- **Go Forward.** Can we go forward, put good markets in place, and treat the costs of the mistakes as the sunk costs of an expensive education? This requires leadership by the regulators, in Washington and in the states. We know what we must do:
 - Regional Transmission Organizations.
 - Standard Market Design.
 - Significant Demand Participation.
 - Market Power Mitigation.

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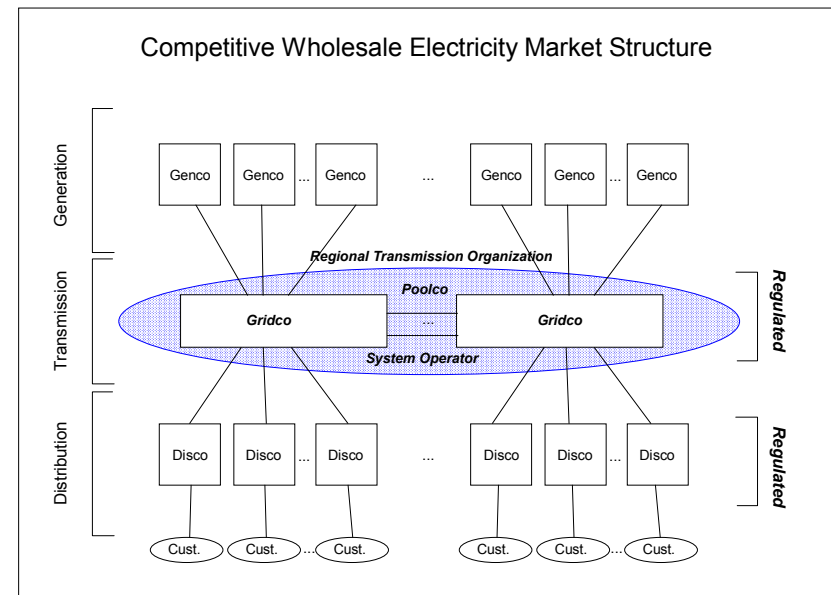
Electricity Restructuring

The evolution of electricity restructuring contains a thread of issues related to counterintuitive market design requirements requiring coordination for competition.

- **PURPA, 1978.** The rise of the new generators.
- **Markets for Power, 1983.** Joskow and Schmalensee.

"The practice of ignoring the critical functions played by the transmission system in many discussions of deregulation almost certainly leads to incorrect conclusions about the optimal structure of an electric power system."³

- **Schweppe et al., 1988.** Spot Pricing of Electricity, Kluwer. Using prices to direct the dispatch.
- **Hogan, 1992.** "Contract Networks for Electric Power Transmission," JRE. Spot market pricing and transmission rights.
- **EPAAct, 1992.** The 'camel's nose' of wholesale competition.



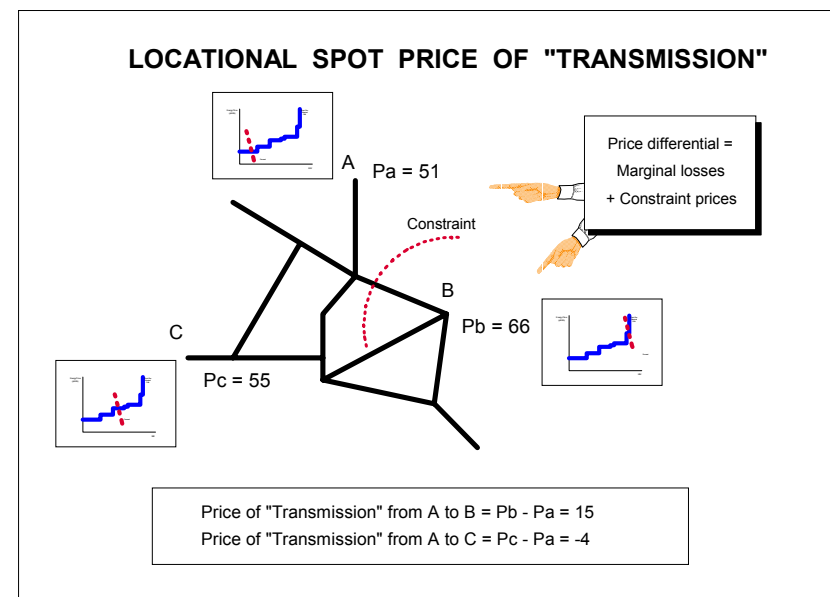
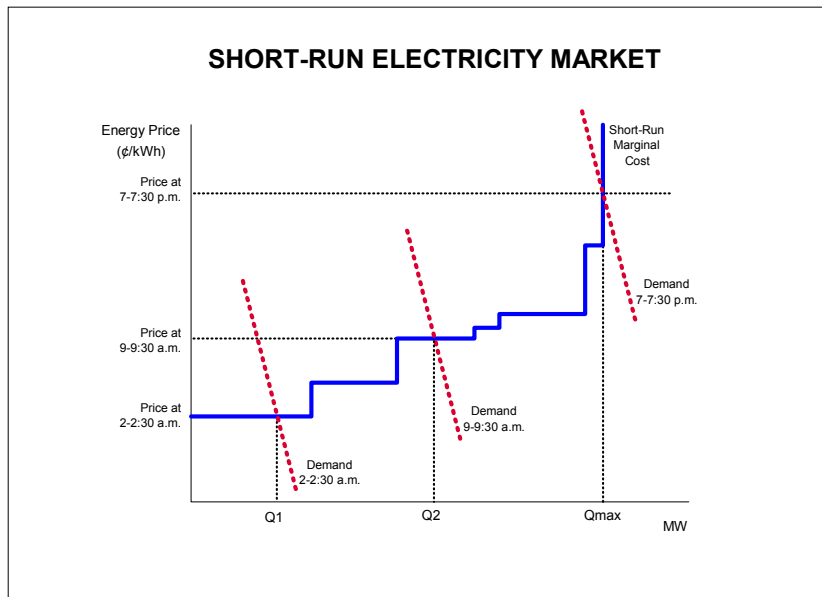
³ Paul L. Joskow and Richard Schmalensee, Markets for Power: An Analysis of Electric Utility Deregulation, MIT Press, 1983, p. 63.

ELECTRICITY MARKET

Electricity Restructuring

The evolution of electricity restructuring thread ...

- **California Blue Book, 1994.** "An Efficient Bilateral Market Needs a Pool."⁴



- **California MOU, 1995.** Separation of Power Exchange (PX) and System Operator (CAISO)⁵

⁴ William W. Hogan, "An Efficient Bilateral Market Needs a Pool," testimony before California Public Utilities Commission, August 4, 1994.

⁵ William W. Hogan, "A Wholesale Pool Spot Market Must Be Administered by the Independent System Operator: Avoiding the Separation Fallacy," *Electricity Journal*, December 1995, pp. 26-37.

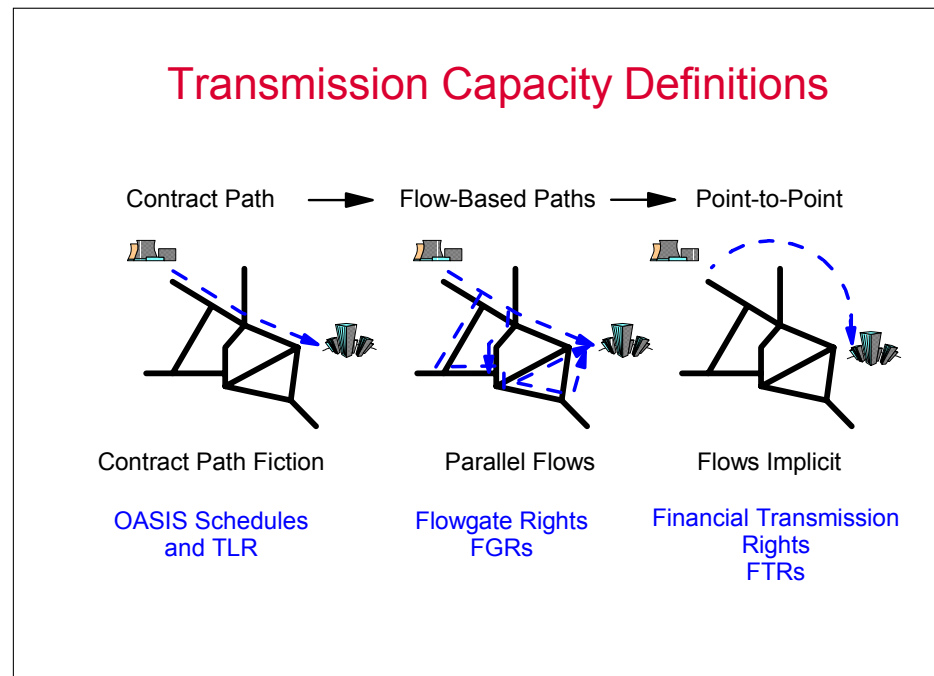
The evolution of electricity restructuring thread ...

- **Order 888, 1996.** Open Access to Transmission.

- **Capacity Reservation Tariff (CRT), 1996.** A new model.

"The proposed capacity reservation open access transmission tariff, if adopted, would replace the open access transmission tariff required by the Commission ..."⁶

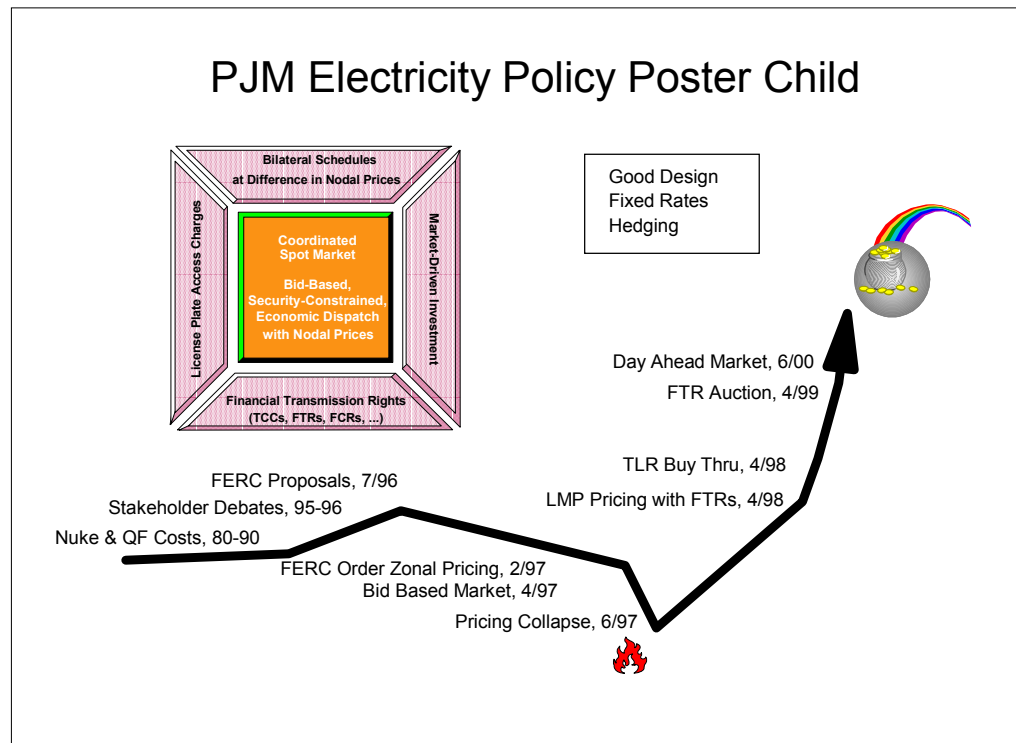
- **NERC Transmission Loading Relief (TLR), 1997.** The unscheduling system to complement Order 888.



⁶ Federal Energy Regulatory Commission, "Capacity Reservation Open Access Transmission Tariffs," Notice of Proposed Rulemaking, RM96-11-000, Washington DC, April 24, 1996, p. 1.

The evolution of electricity restructuring thread ...

- **PJM, 1997 & 1998.** Demonstration of the importance of congestion management.



- **Order 2000, 1999.** Regional Transmission Organizations, the 'Millennium Order.'

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Electricity Restructuring

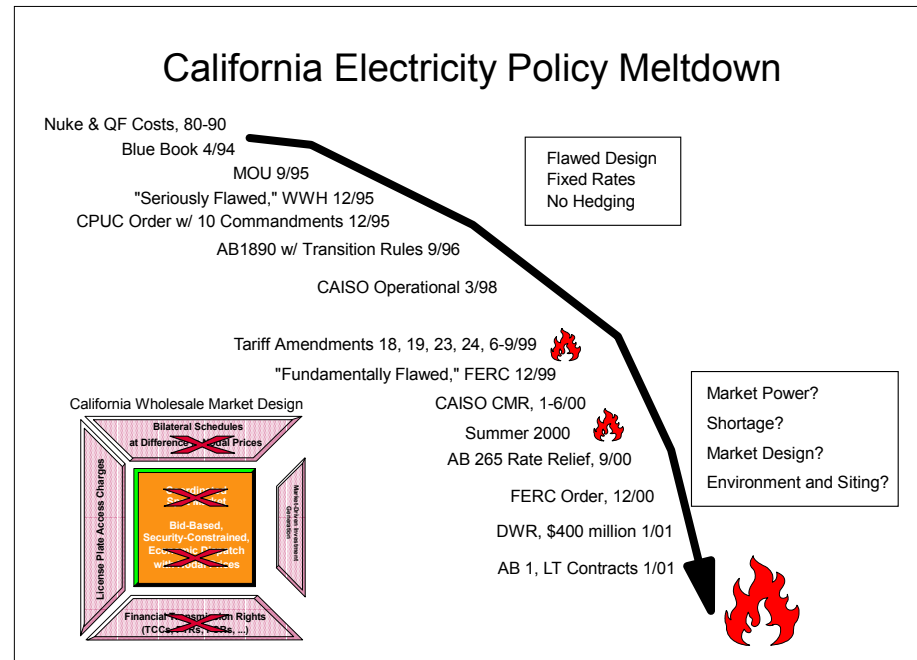
The evolution of electricity restructuring thread ...

- California CMR, 1999.** Congestion Management Reform to Comprehensive Market Redesign.

"The problem facing the [California] ISO is that the existing congestion management approach is fundamentally flawed and needs to be overhauled or replaced."⁷

- California Meltdown, 2000.** Bad policy, bad luck, and bad news.
- Bankruptcy, 2001.** PG&E and Enron, bankruptcy bookends for the "annus horribilis."

- Standard Market Design, 2002.** A good design is necessary, but not sufficient.



⁷ Federal Energy Regulatory Commission, "Order Accepting for Filing in Part and Rejecting in Part Proposed Tariff Amendment and Directing Reevaluation of Approach to Addressing Intrazonal Congestion," Docket ER00-555-000, 90 FERC 61, 000, Washington DC, January 7, 2000, p. 9. See also Federal Energy Regulatory Commission, "Order Denying Requests for Clarifications and Rehearing," 91 FERC 61, 026, Docket ER00-555-001, Washington DC, April 12, 2000, p. 4.

There is an underlying premise in many market design proposals that the functions of the independent system operator (ISO, aka ITP) can be largely separated from the operation of a wholesale spot market. This is a mistake.⁸

A False Goal

Minimize the role of the ISO: In an attempt to have a small footprint for the ISO, there is a common argument that the ISO functions should be restricted to reliability and separated from the operation of the spot market. In practice, the lack of an efficient spot market and efficient pricing drives the ISO to intervene ever more, but without the tools of the market. The ISO ends up large and intrusive, and the market works badly or not at all.

Better to

Recognize the minimum requirements of an ISO: There are certain functions that only the ISO can perform, and these should be done both efficiently and to support a competitive market. Done right, the result is healthy bilateral trading, liquidity, and ease of entry.

It is not good public policy to intentionally design the ISO functions to be inefficient. If we do so, we will succeed, and the ISO will not be able to provide the services that the market needs to handle the complexity of the electricity system. A well designed ISO, operating a spot market, providing price signals, and supporting transmission hedges, results in the smallest footprint possible.

⁸ W. Hogan, "A Wholesale Pool Spot Market Must Be Administered by the Independent System Operator: Avoiding the Separation Fallacy," The Electricity Journal, December 1995, pp. 26-37.

Market design problems have resulted in reforms of reforms in electricity restructuring:

- The first region in the United States to abandon a too simplified market model after it failed in practice was PJM, from its experience in 1997 when its zonal pricing system prompted actions which caused severe reliability problems. Given this experience, PJM adopted a nodal pricing system that has worked well since March 1998.⁹
- Subsequently, the original one-zone congestion pricing system adopted for the New England independent system operator (ISONE) created inefficient incentives for locating new generation. To counter these price incentives, New England proposed a number of limitations and conditions on new generation construction. Following the FERC's rejection of the resulting barriers to entry for new generation in New England, there developed a debate over the preferred model for managing and pricing transmission congestion.¹⁰ In the end, New England proposed go all the way to a nodal pricing system.¹¹

⁹ William W. Hogan, "Restructuring the Electricity Market: Institutions for Network Systems," Harvard-Japan Project on Energy and the Environment, Center for Business and Government, Harvard University, April 1999, pp. 37-44.

¹⁰ Federal Energy Regulatory Commission, New England Power Pool Ruling, Docket No. ER98-3853-000, October 29, 1998.

¹¹ ISO New England, "Congestion Management System and a Multi-Settlement System for the New England Power Pool," FERC Docket EL00-62-000, ER00-2052-000, Washington DC, March 31, 2000. The proposal includes full nodal pricing for generation and, for a transition period, zonal aggregation for loads.

(cont.):

- New Zealand has reconsidered its reforms and revisited the issues of electricity market design.¹² The Government of New Zealand set down principles for reform of the electricity market.¹³ The foremost missing ingredient in the New Zealand wholesale market design is a system of long-term transmission rights. At the end of 2001, there was common agreement that extending the model to include FTRs would provide an added tool that would provide mechanisms for hedging transmission congestion costs and incentives for long-term investment.¹⁴
- The case of England and Wales presents an exception and a challenge to the argument developed here. The New Electricity Trading Arrangements (NETA) for the market in England and Wales commenced in March 2001.¹⁵ In the NETA design the old day-ahead pool based on a coordinated spot market with a market-clearing price was replaced by a three-and-a-half-hour ahead balancing system with a complex pricing scheme that features a pay-as-bid mechanism with rules intended to penalize imbalances. Will use of inefficient pricing in the spot market result in greater costs and substantial unanticipated market behavior?

¹² Ministry of Economic Development of New Zealand, "Inquiry into the Electricity Industry," Report to the Minister of New Zealand, Wellington, New Zealand, June 2000.

¹³ Pete Hodgson, Minister of Energy, "Government Policy Statement: Further Development of New Zealand's Electricity Industry," Wellington, New Zealand, December 2000.

¹⁴ Ministry of Economic Development of New Zealand, "Inquiry into the Electricity Industry," Report to the Minister of New Zealand, Wellington, New Zealand, June 2000, p. 61.

¹⁵ For details on NETA see the UK regulator: Office of Gas and Electricity Markets, "Balancing and Settlement Code," March 1, 2001.

(cont.):

- In July 2001, Texas launched a pilot project for both retail and wholesale competition. Extension to all customers was scheduled for January 2002. The initial wholesale market design followed the same principles as those of California: a minimal ISO with restrictions to balanced trades, zonal pricing, and no formal spot market. Predictions of limited transmission congestion within and between zones were made with confidence, and invalidated with great speed. Within the first few months, the congestion cost targets for the year were exceeded, participants began to exploit the market rules, and there was an immediate need for reform of the market design. The direction of reform is to assign rather than socialize costs. Texas is moving towards the standard market design. How far and how fast was undecided at the end of 2001.
- The Midwest Independent System Operator began its deliberations with market participants dedicated to the principle that there would be no coordinated spot market or any of the other features of the standard market design. After extensive study and debate, market participants faced the reality of the need for coordination. The reality extends to an October 2001 agreement for formal coordination of market activities consolidation with the Southwest Power Pool, creating a combined entity with 120,000 MW. In November 2001, the market participants adopted a market design that includes the key elements of the standard market design: coordinated spot market for balancing and congestion management, locational marginal pricing, and financial transmission rights. Further collaboration with PJM appeared at the beginning of 2002.

(cont.):

- In January 2002, the CAISO achieved what could be a major breakthrough in market design.¹⁶

“Upon reexamination of the [Congestion Management Reform] proposal ... we find that some of the crucial assumptions underlying the [Locational Pricing Areas] concept break down.”(CAISO, p. 13)

The assumptions were crucial and flawed. Trying to make the market simpler than is possible turned out not to be possible.

“...in reality, the ‘simplicity’ of the zonal system only appears so because the complexity is assumed away, allowing market participants to ignore it in scheduling while the CAISO must manage it through real time adjustments and periodic modifications to the rules to mitigate novel gaming strategies as they arrive. ... it will be far simpler, and more transparent, to design forward [congestion management] procedures to be as consistent as possible with the real-time operating needs of the grid.”(CAISO, p. 14)

Amen. The CAISO paper elaborates on the implications and outlines a new direction that is a major break with its past. The same design lesson was learned earlier in the Northeast markets including PJM, New York and New England. Similar insights can be found in well-designed wholesale markets in other countries, from Chile to New Zealand.

¹⁶

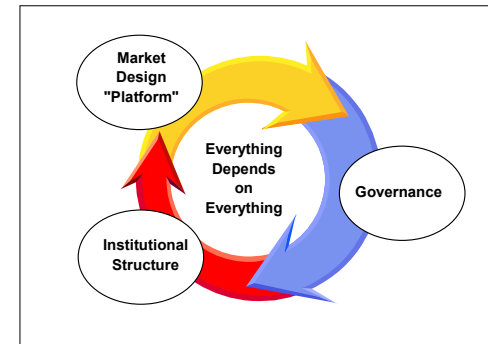
CAISO proposal, “Market Design 2002 Project: Preliminary Draft Comprehensive Design Proposal,” January 8, 2002.

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Some Lessons of Market Formation

Cycles around the loop take months to years when it is only talk. Once implemented, cycles take years or forever.

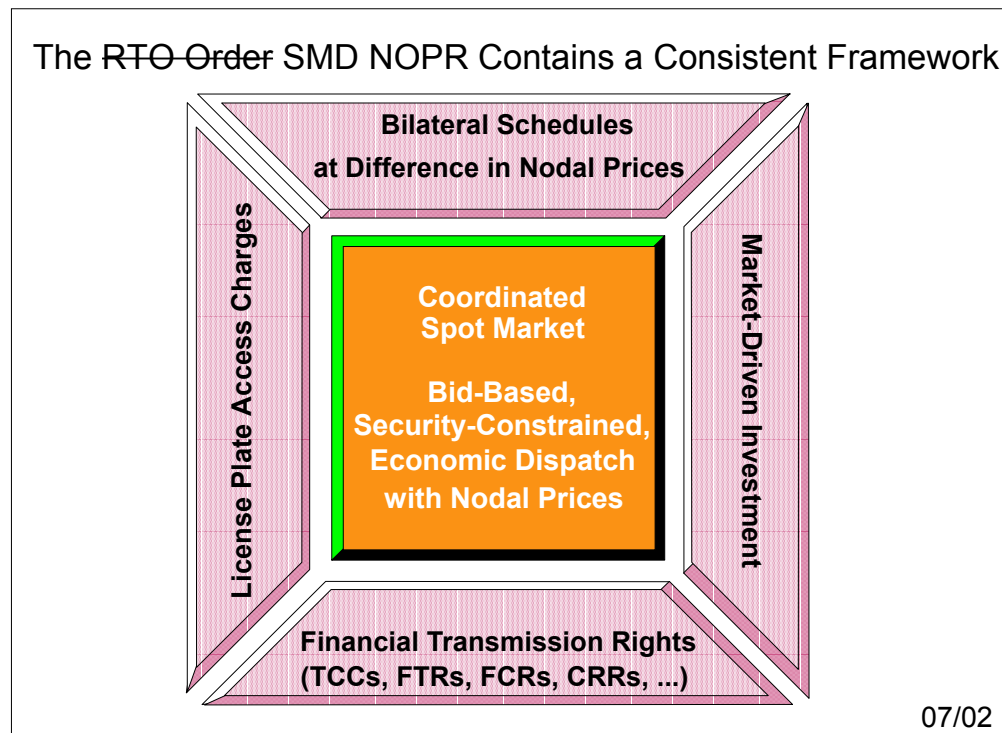
- **Don't Assume It is Easy to Muddle Through.** Errors are costly. Bad market design leads to serious disruption itself (PJM-1997, NE-1999) or helps make bad problems worse (California-2000). Bad governance structures make all problems more difficult.
- **Get the Prices Right.** When a monopoly that makes all the decisions, the details matter less. But whenever market participants are given a choice, it is critical that they see the right prices. Market participants will respond to incentives. That after all, is the foundation for restructuring. Opportunity cost pricing supports efficient behavior. Otherwise, the system operator and regulators will be forced to intervene with non-market mechanisms that negate the broader purpose.
- **Recognize that the Market Can't Solve the Problem of Market Design.** There are too many moving parts that must move together. Absent strong public oversight, the complex interactions and the competing interests provide a textbook case for sacrificing the public interest and sinking to the least common denominator.
- **Face Squarely the Mandates of Order 2000.** If FERC means what it says, the Order goes a long way in defining how a wholesale electricity market must be organized. But it is too timid and indirect. "If it looks like a duck and walks like a duck, it must be a duck." In the SMD NOPR, FERC makes clear what it means. If it follows through, there can be a workable market.



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A Market Framework

The ~~Regional Transmission Organization (RTO) Millennium Order (Order 2000)~~ Standard Market Design (SMD) NOPR contains a workable market framework that is working in places like New York and the PJM Interconnection in the Mid-Atlantic Region.



Poolco...ISO...IMO...GO/SO...Transco...RTO... ITP...: "A rose by any other name ..."

The failure to make a rapid transition to RTOs and the market meltdown in California put pressure on the FERC. In the summer of 2001, the Commission began what appears to be a more aggressive policy to push forward with electricity restructuring through creation of RTOs.

- **Large RTO Integration:** The ISOs in the Northeast were assigned to a mediation effort to consider consolidation into one large RTO. The details were still under discussion at the end of 2001, but the differences were over the speed of consolidation of the markets, not over the goal of greater integration. Similar discussions have been underway in the Southeast.
- **Standard Market Design Rulemaking:** Creation of RTOs includes pursuit of a standard market design. The details of the final rulemaking were uncertain at the beginning of 2002, but the only viable market model shown to work is the Northeast model of the Millennium Order framework as explained in the FERC Standard Market Design NOPR of July 31, 2002. The details are many and need close scrutiny.
- **MISO and Alliance:** The consolidation of the Midwest Independent System Operator and the Southwest Power Pool was approved by FERC as the first official RTO. The subsequent rejection of the Alliance and its alternative market model left the MISO and PJM as the principal alternatives for the Alliance members, with the MISO and PJM working formally at market consolidation.
- **Independent Transmission Companies and ITPs:** The industry and the FERC were beginning to recognize the potential for independent transmission companies that work in and with an ITP (RTO), but do not take on the public interest responsibilities of the ITP (RTO).

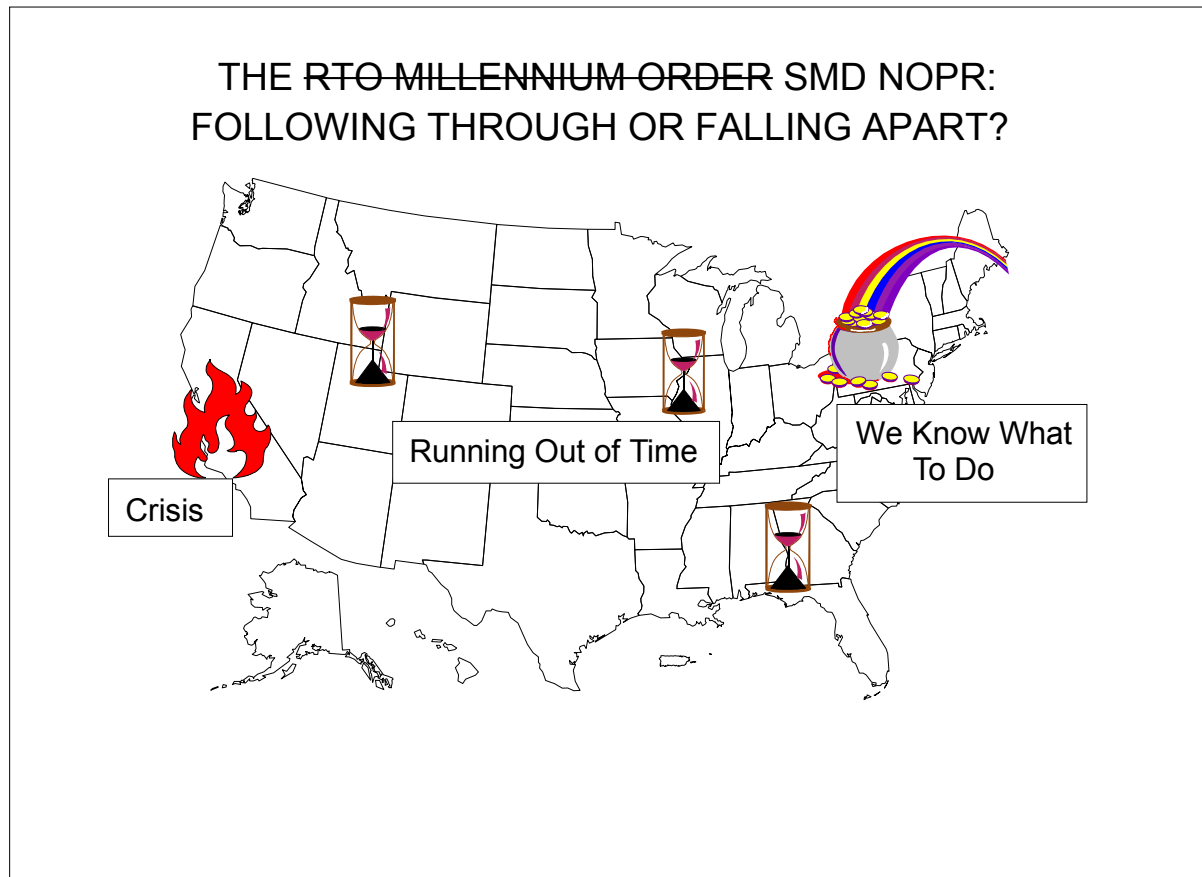
In the SMD NOPR of 2002, the FERC covers a great deal of ground beyond the basics of coordinated spot markets and financial transmission rights.

- **Spot Markets:** The greatest strength is in the clear instructions for real-time balancing markets, and integrated day-ahead markets with financial transmission rights. Here the design has many gears that have to mesh, and the FERC SMD builds on the best experience. The details matter, but we are close.
- **Market Power Mitigation:** There is no perfect answer. The FERC SMD offers a compendium of tools for market power mitigation that may be the best of a bad lot.
- **Resource Adequacy:** The prize for the newest idea goes to the attempt to design a short-term system for long-term resource adequacy. This replacement for installed capacity requirements will produce many comments with struggles to understand what is proposed and how it might work.
- **Governance:** The Achilles heel of the SMD NOPR may be in the huge political fight over governance, now underway. The rhetoric of states' rights and the reality of the detailed rules both threaten collateral damage to the progress on market design.

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Reforms of Reforms

National progress in implementing the advance of regional transmission organizations under the Millennium Order (Order 2000) still hangs in the balance. Time is running out. If the SMD effort succeeds, workable electricity markets can be obtained. If it fails, ...?



Supporting papers and additional detail can be obtained from the author. William W. Hogan is the Lucius N. Littauer Professor of Public Policy and Administration, John F. Kennedy School of Government, Harvard University and a Director of LECG, LLC. This paper draws on work for the Harvard Electricity Policy Group and 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 American National Power, Brazil Power Exchange Administrator (ASMAE), British National Grid Company, Calpine Corporation, Comision Reguladora De Energia (CRE, Mexico), Commonwealth Edison Company, Conectiv, Detroit Edison Company, Duquesne Light Company, Dynegy, Edison Electric Institute, Electricity Corporation of New Zealand, Electric Power Supply Association, GPU Inc. (and the Supporting Companies of PJM), GPU PowerNet Pty Ltd., Independent Energy Producers Association, ISO New England, Mirant Corporation, 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, Pepco, PJM Office of Interconnection, Public Service Electric & Gas Company, Reliant Energy, San Diego Gas & Electric Corporation, Sempra Energy, TransÉnergie, Transpower of New Zealand, Westbrook Power, Williams Energy Group, and Wisconsin Electric Power Company. 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 <http://www.ksg.harvard.edu/whogan>).