

# **ELECTRICITY MARKET REFORM: Market Design and the Green Agenda**

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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.**
- **Devilish Details.**
  - **Market Power Mitigation.**
  - **Coordination for Competition.**
- **Jurisdictional Disputes.**
  - **US State vs. Federal Regulators.**
  - **European Subsidiarity Principle.**

The short term financial crisis and long term energy policy provide a context with a rapidly changing view of the role of government.

- **Financial Crisis Presents Conflicting Diagnoses**

“Deregulation, or the failure of regulators to keep up with fast-moving markets, can become unbelievably costly, as we have seen.”<sup>1</sup>

- **Going Green Implies a Major Transformation of the Electricity Sector**

Climate change policy and the expanded focus on renewables and the smart grid present a fast moving array of subsidies, regulations and mandates.

- **Electricity Restructuring is not Electricity Deregulation**

Electricity markets with Regional Transmission Organizations (RTOs) and Independent System Operators (ISOs), the North American Electric Reliability Corporation (NERC), State Public Utility Commissions (PUCs), Public Power Authorities, and the Federal Energy Regulatory Commission (FERC) are highly regulated entities. But “failure of regulators to keep up with fast-moving markets, can become unbelievably costly, as we have seen.”

The challenge of “keeping up” emphasizes the dynamic nature of the problems and the importance of understanding the fundamentals of first principles.

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<sup>1</sup> Francis Fukuyama, “The Fall of America, Inc.,” Newsweek, October 13, 2008, p. 32.

**The Federal Energy Regulatory Commission summarized frustration with electricity restructuring efforts and providing non-discriminatory open access to transmission needed to support competitive markets.**

At its core, the debate identifies persistent disagreement about what open access means, and what models are available to achieve the purported benefits.

“Now, the goal of the NOI in this proceeding is very clear. It is spelled out in the title: Preventing Undue Discrimination and Preference in Transmission Service. We are not talking about market design. We are not talking about restructuring. We are talking about preventing undue discrimination and preference.”

(Statement of Joseph Kelliher, Chairman, Federal Energy Regulatory Commission, Regarding Notice of Inquiry on Preventing Undue Discrimination and Preference in Transmission Service, Docket No. RM05-25-000, September 16, 2005)

“The first time the Commission found Order No. 888 allowed undue discrimination and preference in transmission service occurred in 1999. The solution advanced by the Commission was restructuring: encouraging voluntary RTO formation, in Order No. 2000. ... The second time the Commission found Order No. 888 allowed undue discrimination and preference took place in 2002. The solution advanced by the Commission at the time was also restructuring, this time mandating RTO participation and a standard market design. ... The solution we advance today is not restructuring, but more effective regulation, reform of the open access rules themselves, for the first time in nearly a decade.”

(Statement of Joseph Kelliher, Chairman, Federal Energy Regulatory Commission, Regarding Open Access Transmission Tariff (OATT) Reform (RM05-25-00), May 16, 2006.)

**The Federal Energy Regulatory Commission has responsibility for regulating wholesale electricity markets. The stated framework emphasizes support for competition in wholesale markets as a clear and continuing national policy:**

“While competitive markets face challenges, we should acknowledge that competition in wholesale power markets is national policy. The Energy Policy Act of 2005 embraced wholesale competition as national policy for this country. It represented the third major federal law enacted in the last 25 years to embrace wholesale competition. To my mind, the question before the Commission is not whether competition is the correct national policy. That question has been asked and answered three times by Congress.

If we accept the Commission has a duty to guard the consumer, and that competition is national policy, our duty is clear. It is to make existing wholesale markets more competitive. That is the heart of this review: to not only identify the challenges facing competitive wholesale markets but also identify and assess solutions.”<sup>2</sup>

**A task for regulation is to support this policy framework while developing hybrid markets and dealing with both the limits of markets and the failures of market designs.**

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<sup>2</sup> Joseph T. Kelliher, “Statement of Chairman Joseph T. Kelliher,” Federal Energy Regulatory Commission, Conference on Competition on Wholesale Power Markets AD07-7-000. February 27, 2007.

**The focus on the electricity sector's role in addressing climate change through improved efficiency, development of renewable energy, and use of low carbon fuels creates expanded demands for and of electricity restructuring.**

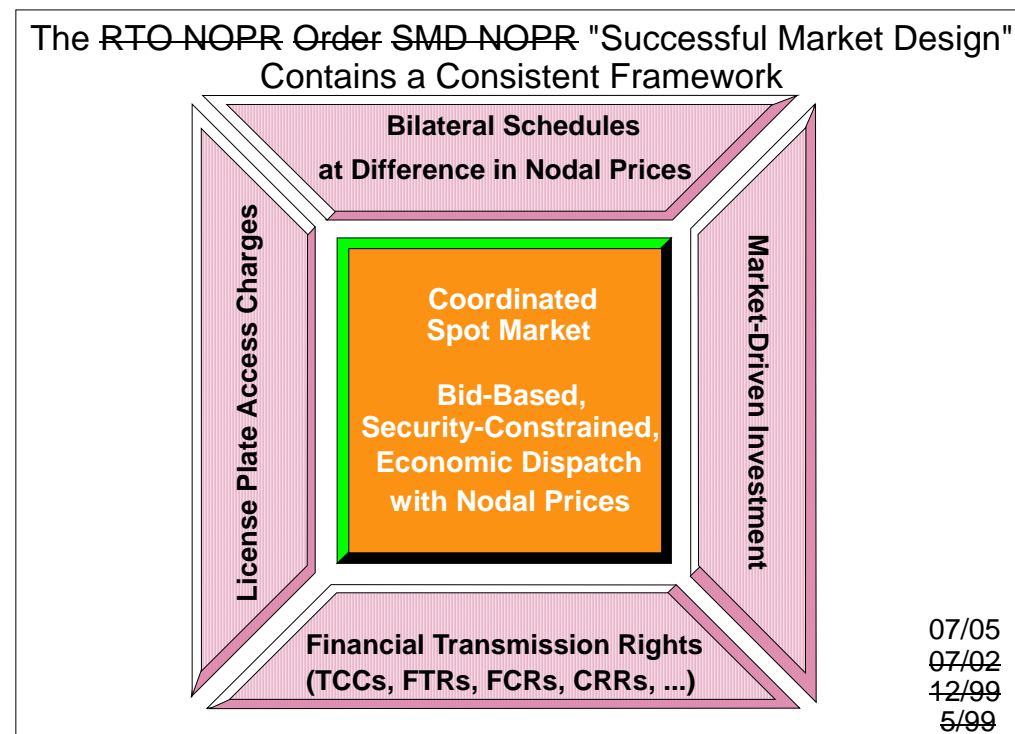
The transformation envisioned is massive, long term, and affects every aspect of electricity production and use.

- Uncertain conditions require a broad range of activities to integrate new technology and practices.
- Innovation requires promoting technologies and practices not yet identified or imagined.
- Smart grids can facilitate smart decisions, but only if the electricity structure provides the right information and incentives.
  - Open access to expand entry and innovation.
  - Smart pricing to support the smart grid technologies and information.
  - Internalizing externalities, while exploiting the wisdom of crowds.
    - Price on carbon emissions.
    - Good market design with efficient prices.
    - Compatible infrastructure expansion rules.

## ELECTRICITY MARKET

## A Consistent Framework

The example of successful central coordination, ~~GRT, 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, and California.

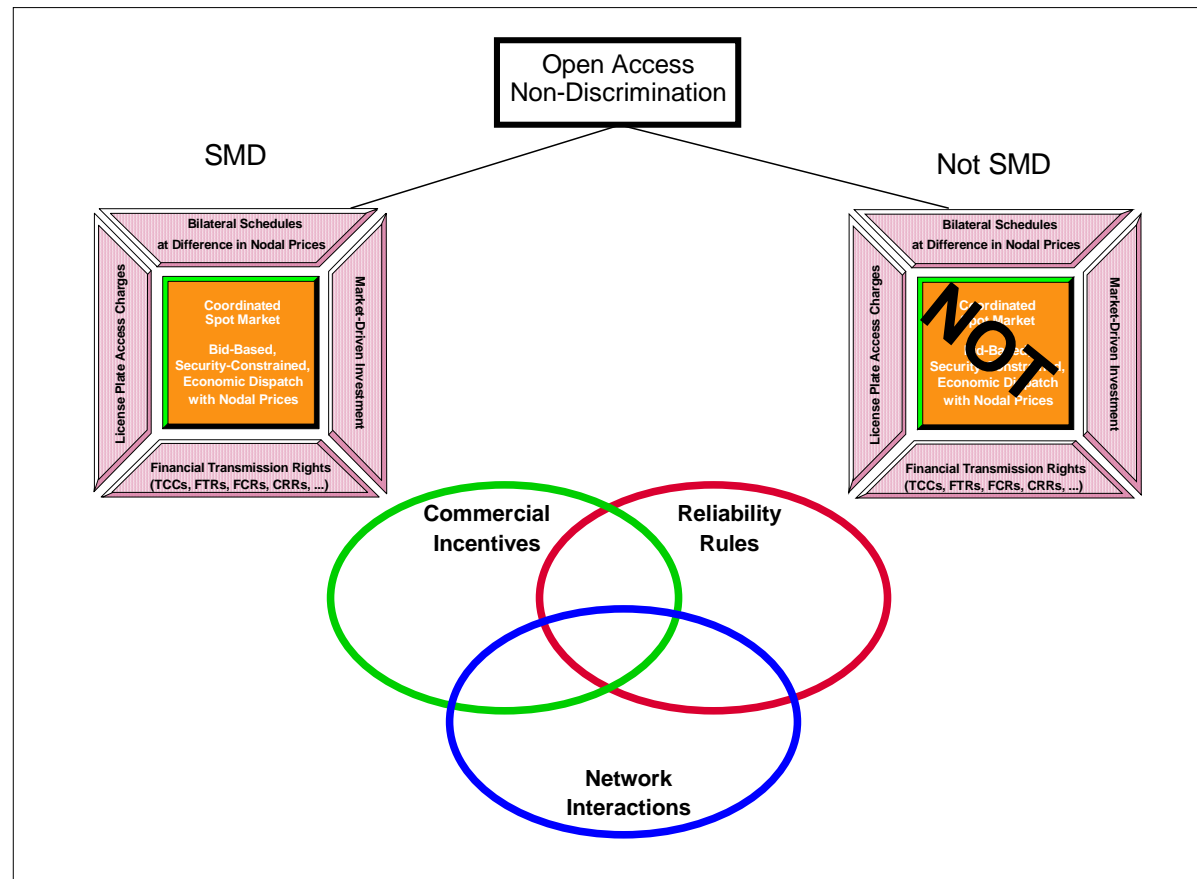


Poolco...OPCO...ISO...IMO...Transco...RTO... ITP...WMP...: "A rose by any other name ..."

# ELECTRICITY MARKET

# Electricity Restructuring

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

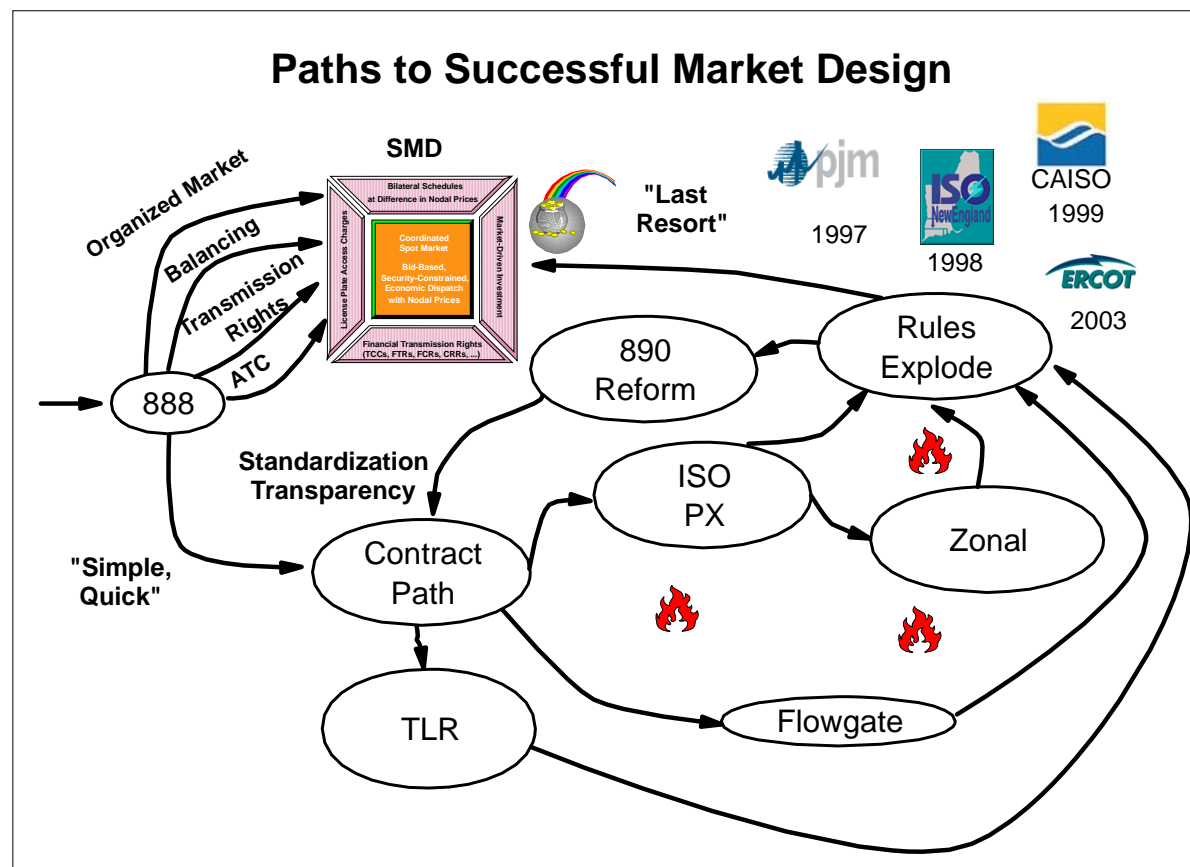




# ELECTRICITY MARKET

## 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.



Market design in RTOs/ISOs is well advanced but still incomplete.<sup>3</sup>

- **Regional Markets Not Fully Deployed**

- **Reforms of Reforms**

California MRTU (April 1, 2009) and forthcoming ERCOT Texas Nodal reforms.

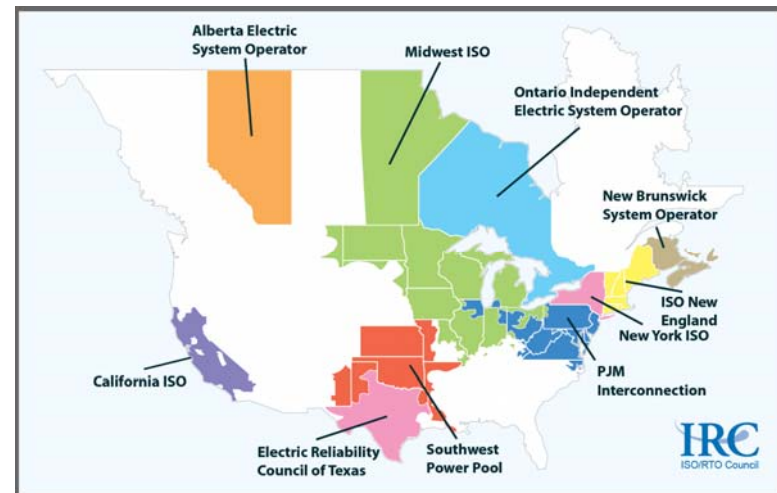
- **Market Defect: Scarcity Pricing**

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**



<sup>3</sup> William W. Hogan, "Electricity Market Structure and Infrastructure," Conference on Acting in Time on Energy Policy, Harvard University, September 18-19, 2008. (available at [www.whogan.com](http://www.whogan.com) ).

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

The International Energy Agency (IEA) examined the international experience and produced guidance for electricity restructuring.

- “Governments must ensure a stable and competitive investment framework that sufficiently rewards adequate investments in a timely manner. ...
- Governments urgently need to reduce investment risks by giving firmer and more long-term direction on climate change abatement policies. ...
- Governments should pursue the benefits of competitive markets to allow for more efficient and more transparent management of investment risks. ...
- Governments need to ensure that independent regulators and system operators establish transparent market rules that are clear, coherent and fair. ...
- Governments must refrain from price caps and other distorting market interventions. ...
- Governments must implement clearer and more efficient procedures for approval of new electricity infrastructure. ...<sup>14</sup>

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<sup>4</sup> International Energy Agency, Tackling Investment Challenges in Power Generation in IEA Countries: Energy Market Experience, Paris, 2007, pp. 15-25.

**The International Energy Agency identified the centerpiece of successful market design.**

“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.”<sup>5</sup>

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<sup>5</sup> International Energy Agency, Tackling Investment Challenges in Power Generation in IEA Countries: Energy Market Experience, Paris, 2007, p. 16.

**Application of the broad goals identified by the IEA would be compatible with recommendations by Paul Joskow for a new Federal Power Act.**

“What provisions might a Federal Power Act of 2009 contain?

- [Federalize transmission] ...
- [Mandate Regional Transmission Organizations] The key provisions of FERC Order 2000 should be put into law. This would require the creation of RTOs that manage the operation of large regional transmission networks, implement FERC’s transmission access, pricing, and planning regulations, and operate voluntary wholesale markets for electric energy, ancillary services, capacity and transmission rights. There is abundant evidence (a) that RTOs are needed to support efficient competitive markets, (b) that expanding the geographic expanse of RTOs and improving the market designs for energy, ancillary services and capacity lead to efficiency improvements, (c) and that wholesale market designs built around what is generally referred to as the “standard market design,” augmented by capacity obligations and capacity markets, promote economic efficiency.
- [Unbundle generation and distribution] ...
- [States determine retail access] ...
- [Limit generation subsidies to merchant investments] ...
- [Allocate any free CO2 allowances to electricity consumers] ...
- [State regulatory jurisdiction continue over distribution facilities] ...”<sup>6</sup>

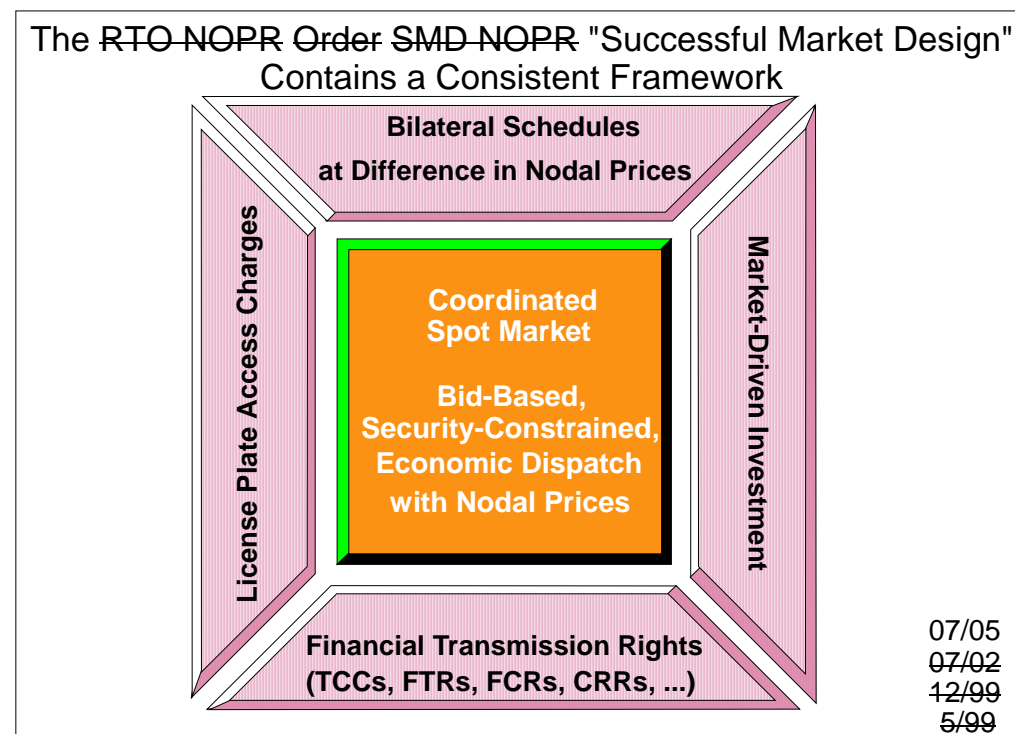
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<sup>6</sup> Paul Joskow, “Challenges For Creating A Comprehensive National Electricity Policy,” Technology Policy Institute Keynote Speech, Washington DC, September 26, 2008. (available at <http://www.hks.harvard.edu/hepg/>).

## ELECTRICITY MARKET

## A Consistent Framework

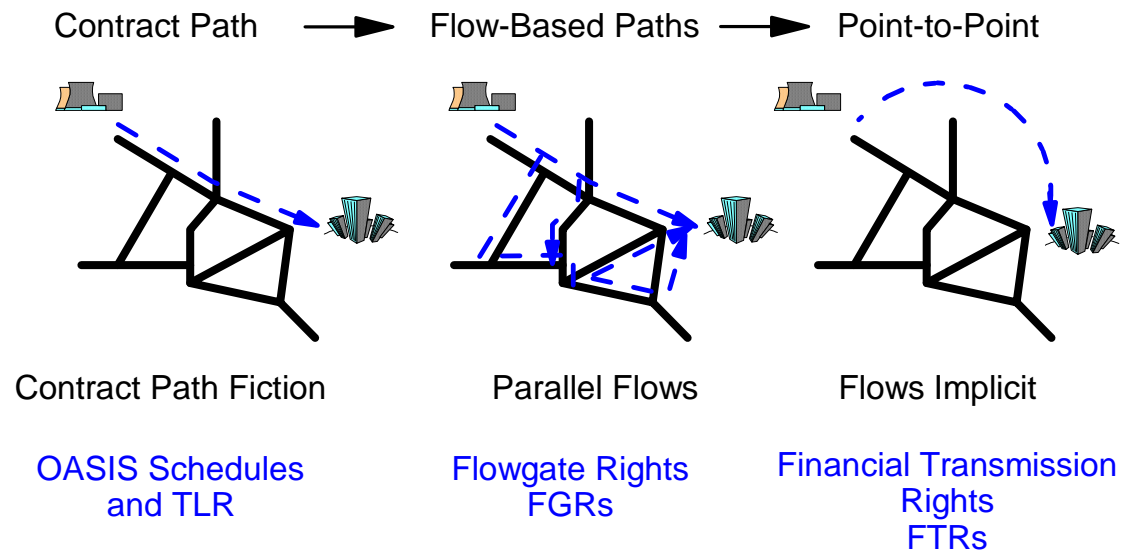
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Defining and managing transmission usage is a principal challenge in electricity markets.

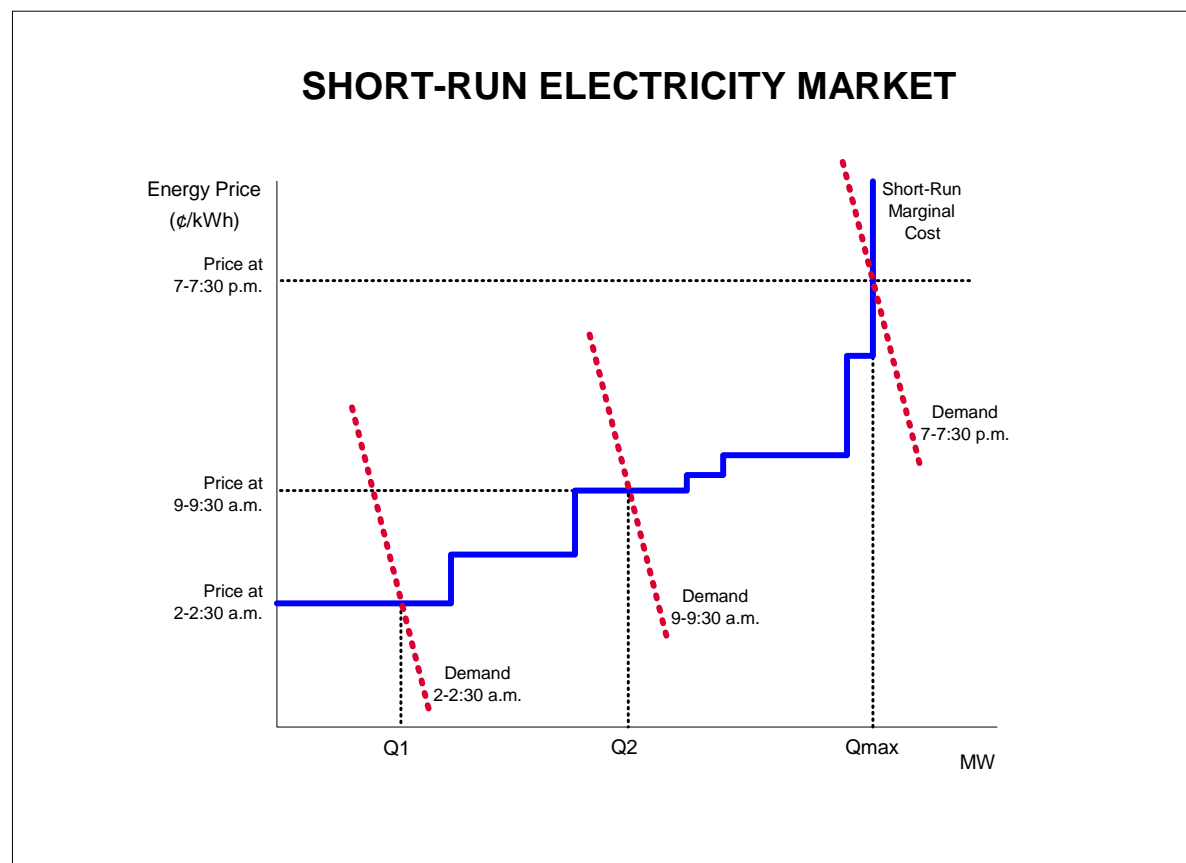
## Transmission Capacity Definitions



# ELECTRICITY MARKET

## Pool Dispatch

An efficient short-run electricity market determines a market clearing price based on conditions of supply and demand. Everyone pays or is paid the same price.



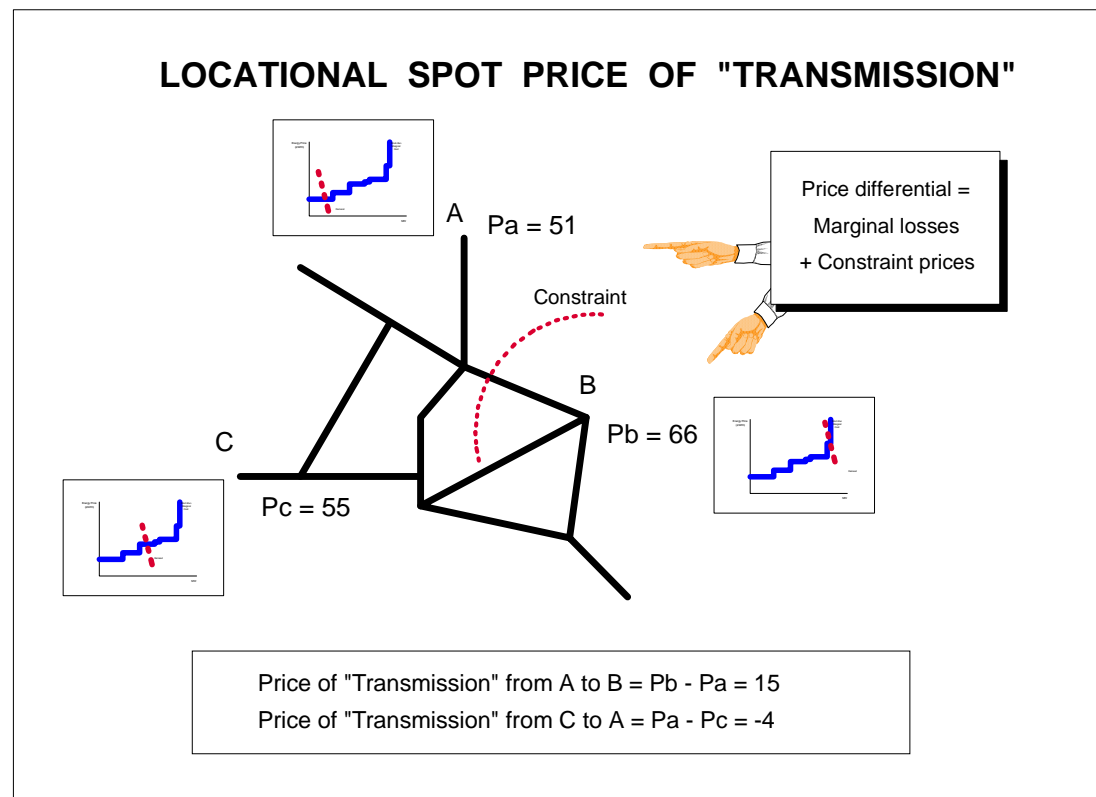


## NETWORK INTERACTIONS

## Locational Spot Prices

The natural extension of a single price electricity market is to operate a market with locational spot prices.

- It is a straightforward matter to compute "Schweppe" spot prices based on marginal costs at each location.
- Transmission spot prices arise as the difference in the locational prices.



## NETWORK INTERACTIONS

## Locational Spot Prices

RTOs operate spot markets with locational prices. For example, PJM updates prices and dispatch every five minutes for over 8,000 locations. Locational spot prices for electricity exhibit substantial dynamic variability and persistent long-term average differences.

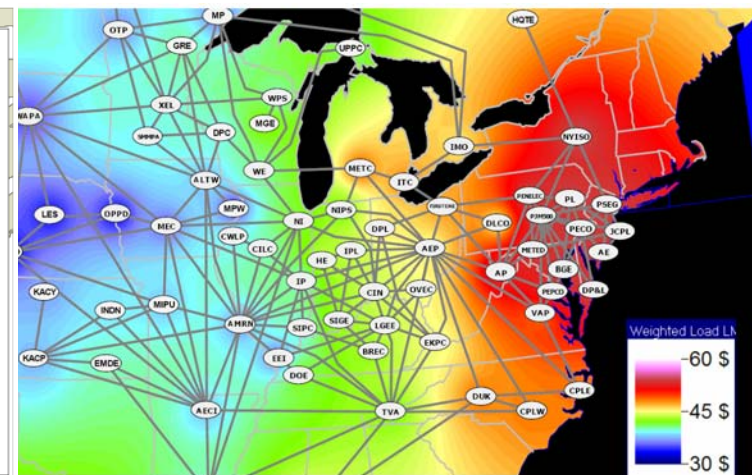
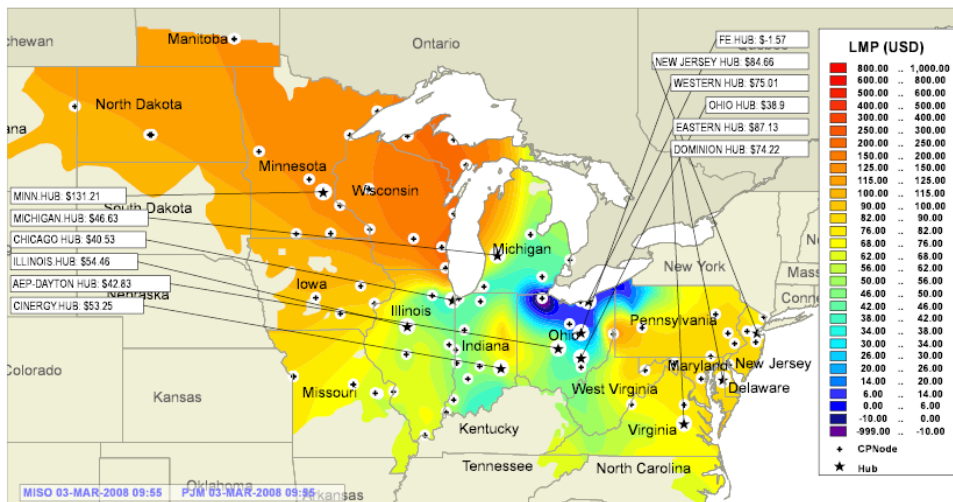


Figure 2.2-3 Contour Map of Annual Load Weighted LMP

Minnesota Hub: \$131.21/MWh. First Energy Hub: \$-1.57/MWh.

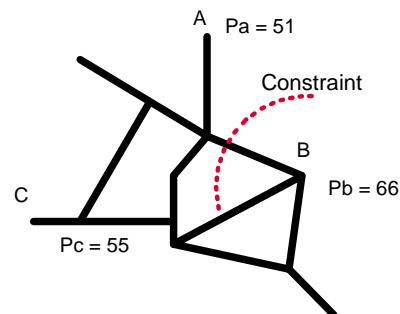
From MISO-PJM Joint and Common Market, <http://www.jointandcommon.com/> for March 3, 2008, 9:55am. Projected 2011 annual average from 2006 Midwest ISO-PJM Coordinated System Plan.

## NETWORK INTERACTIONS

## Financial Transmission Rights

A mechanism for hedging volatile transmission prices can be established by defining financial transmission rights to collect the congestion rents inherent in efficient, short-run spot prices.

### NETWORK TRANSMISSION FINANCIAL RIGHTS



Price of "Transmission" from A to B =  $P_b - P_a = 15$   
Price of "Transmission" from A to C =  $P_c - P_a = -4$

- DEFINE TRANSMISSION CONGESTION CONTRACTS BETWEEN LOCATIONS.
- FOR SIMPLICITY, TREAT LOSSES AS OPERATING COSTS.
- RECEIVE CONGESTION PAYMENTS FROM ACTUAL USERS; MAKE CONGESTION PAYMENTS TO HOLDERS OF CONGESTION CONTRACTS.
- TRANSMISSION CONGESTION CONTRACTS PROVIDE PROTECTION AGAINST CHANGING LOCATIONAL DIFFERENCES.

**Financial Transmission Rights (FTRs), including Transmission Congestion Contracts (TCCs) and Congestion Revenue Rights (CRRs), present a variety of issues.**

- **Definitions.**
  - Duration.
  - Obligations vs. Options.
  - Auction Revenue Rights.
  - Sequential Markets.
  - Expansion Rules.
- **Revenue Adequacy.**
  - Theory: Simultaneous Feasibility Ensures Full Funding with Same Grid.
  - Practice: Carve Outs, Outages and Loop Flow Forecasts can Affect Feasibility.
- **Market Performance.**
  - Arbitrage and FTR Prices.
  - Gaming and Credit Risks.
  - Market Power Interactions.
- **Investment and Trading.**
  - Grid Expansion.
  - Continuous Trading: Nodal Exchange.  
( [http://www.nodalexchange.com/about\\_nodal/overview.php](http://www.nodalexchange.com/about_nodal/overview.php) )

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