

ELECTRICITY RESTRUCTURING: MARKETS AND TRANSMISSION INVESTMENT

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Electricity Transmission in Deregulated Markets
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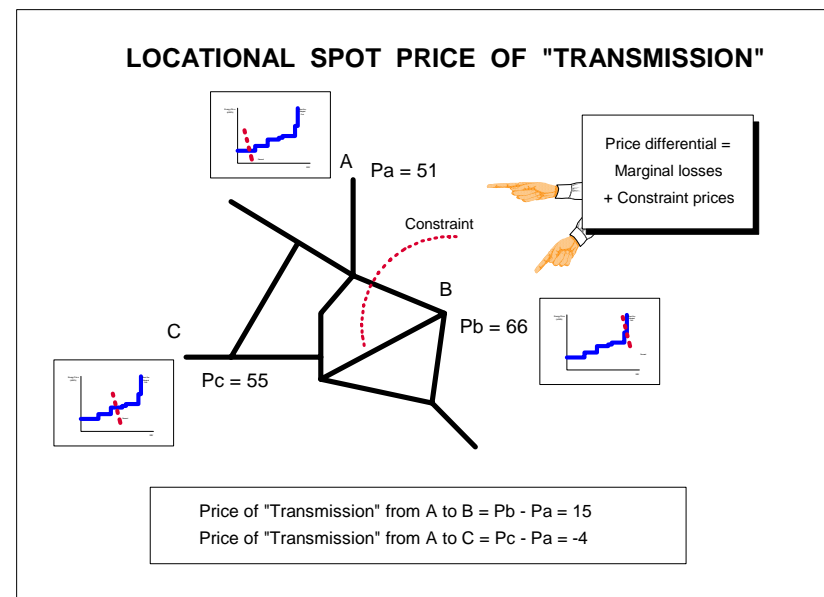
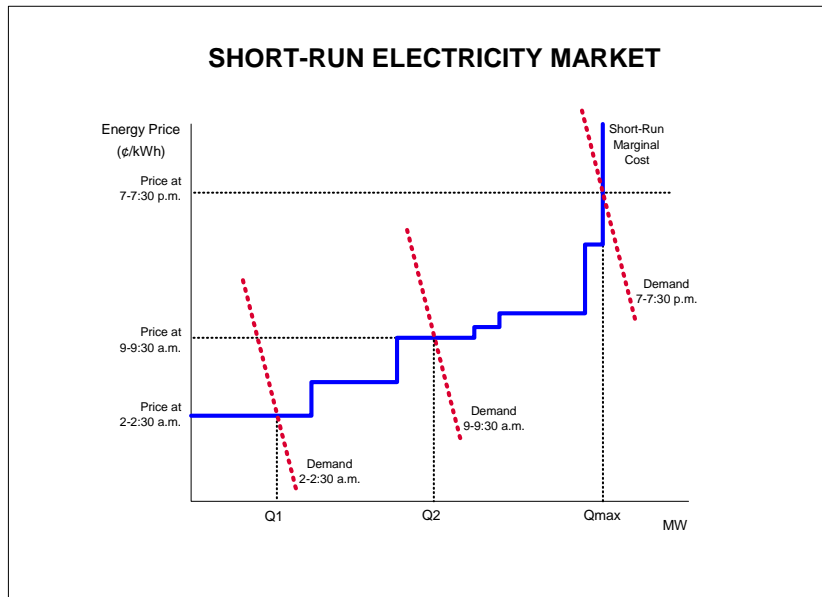
Pittsburgh, Pennsylvania
December 15, 2004

ELECTRICITY MARKET

Electricity Restructuring

There is a tension between the role of market decisions and the special requirements of electricity systems. This is about restructuring, not deregulation.

“Market mechanisms should be used where possible, but in circumstances where conflicts between reliability and commercial objectives cannot be reconciled, they must be resolved in favor of high reliability.” (Blackout Task Force Report, April 2004, p. 139.)



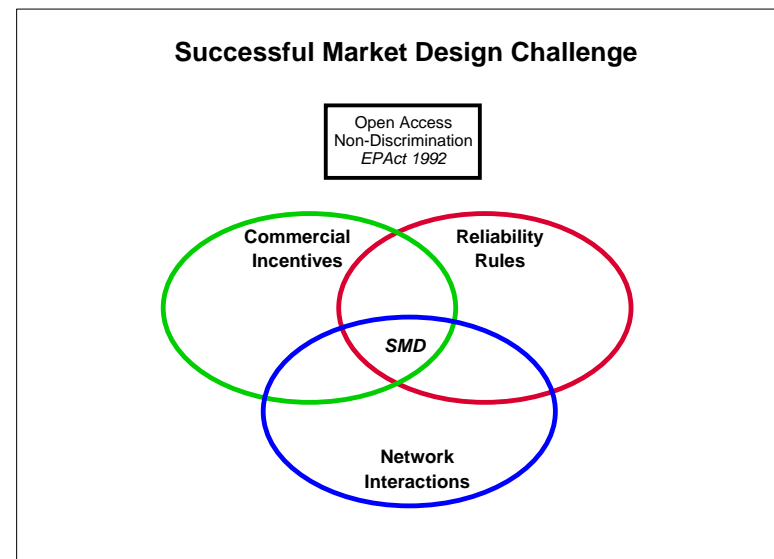
A decentralized market with supply and demand equilibrium over the network sets an ideal. But this “completely bilateral” market is not possible in the case of electricity.

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

“The need for additional attention to reliability is not necessarily at odds with increasing competition and the improved economic efficiency it brings to bulk power markets. Reliability and economic efficiency can be compatible, but this outcome requires more than reliance on the laws of physics and the principles of economics. It requires sustained, focused efforts by regulators, policy makers, and industry leaders to strengthen and maintain the institutions and rules needed to protect both of these important goals. Regulators must ensure that competition does not erode incentives to comply with reliability requirements, and that reliability requirements do not serve as a smokescreen for noncompetitive practices.”(Blackout Task Force Report, April 2004, p. 140.)

The focus should be on investment incentives and innovation, not short-run operational efficiency. With workable markets, market participants spending their own money would be better overall in balancing risks and rewards than would central planners spending other people’s money. If not, restructuring itself would fail the cost-benefit test.

What should be the default rules when markets don’t suffice?



The Successful Market Design challenge dictates the need for some central institutions to support markets through the seeming oxymoron of “coordination for competition.”

Central institutions differ in the degree of involvement and impact on the market.

- **Central Coordination.** Organized markets required to facilitate exchange between willing buyers and willing sellers in voluntary transactions. (E.g., energy purchase and sales in spot markets.)
 - Design can be compatible with largely decentralized decisions.
 - Emphasis is on consistent incentives.
 - Evaluation remains neutral on market choices.

- **Central Procurement.** Administrative determination of required products and services with imposition of mandatory payments as a condition of participation in the system. (E.g., operating reserves with charges collected through uplift payments.)
 - Emphasis is on assured outcomes.
 - Central judgment and mandatory payment replace market forces.
 - Slippery slope could undermine broad purpose of electricity restructuring.

Guidelines for design of electricity market institutions include:

- Define Products and Services Consistent with Real Operations.
- Create Property Rights.
- Establish Consistent Pricing Mechanisms.
- Design Central Institutions to Emulate Efficient Market Operations and Incentives.
- Target Structure and Scope of Central Interventions to Address Market Failures.
- Set Principled Limits for Interventions Based on the Nature of the Market Failure.
- Keep Focus on Goal of Workable, not Perfect, Markets.

**The demand for action by regulators
demands that regulators keep their eye on the ball.**

Focus on market design and market failures. Better to fix a bad design than to micromanage bad decisions.

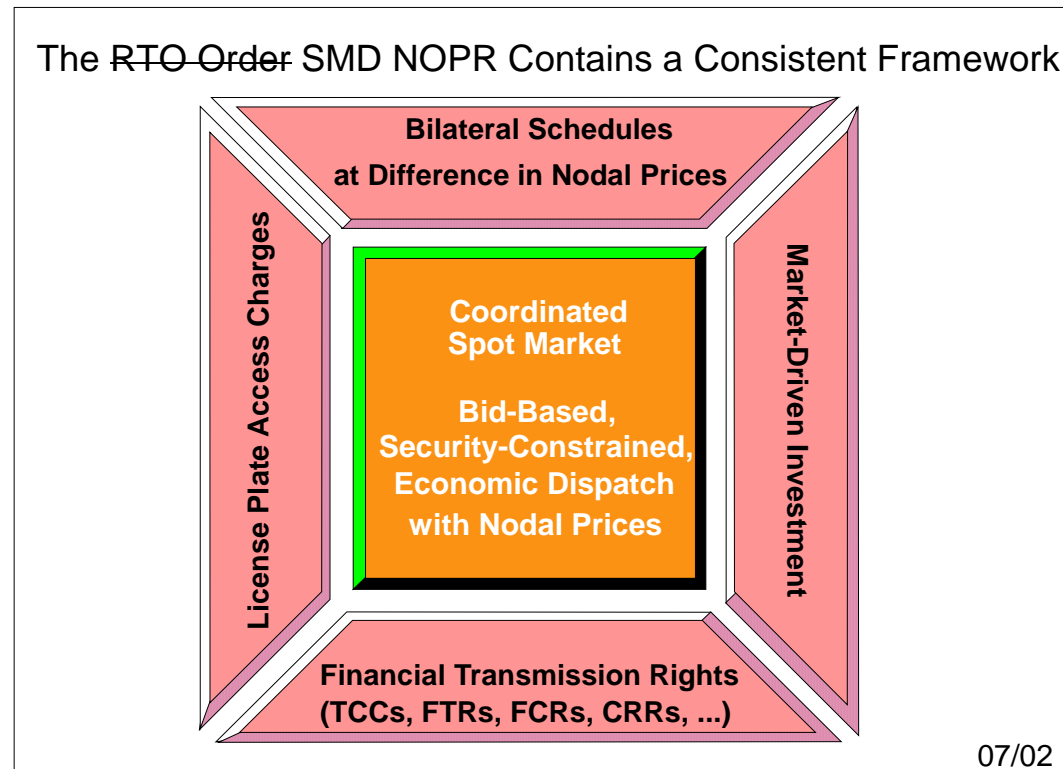
Be afraid of the reflexive market intervention that sows the seeds of intervention. Good advice might be: “Don’t just do something, stand there.” Better advice would be: “Look, and look hard, before you leap.”

Intervene where needed, and know how to stop!

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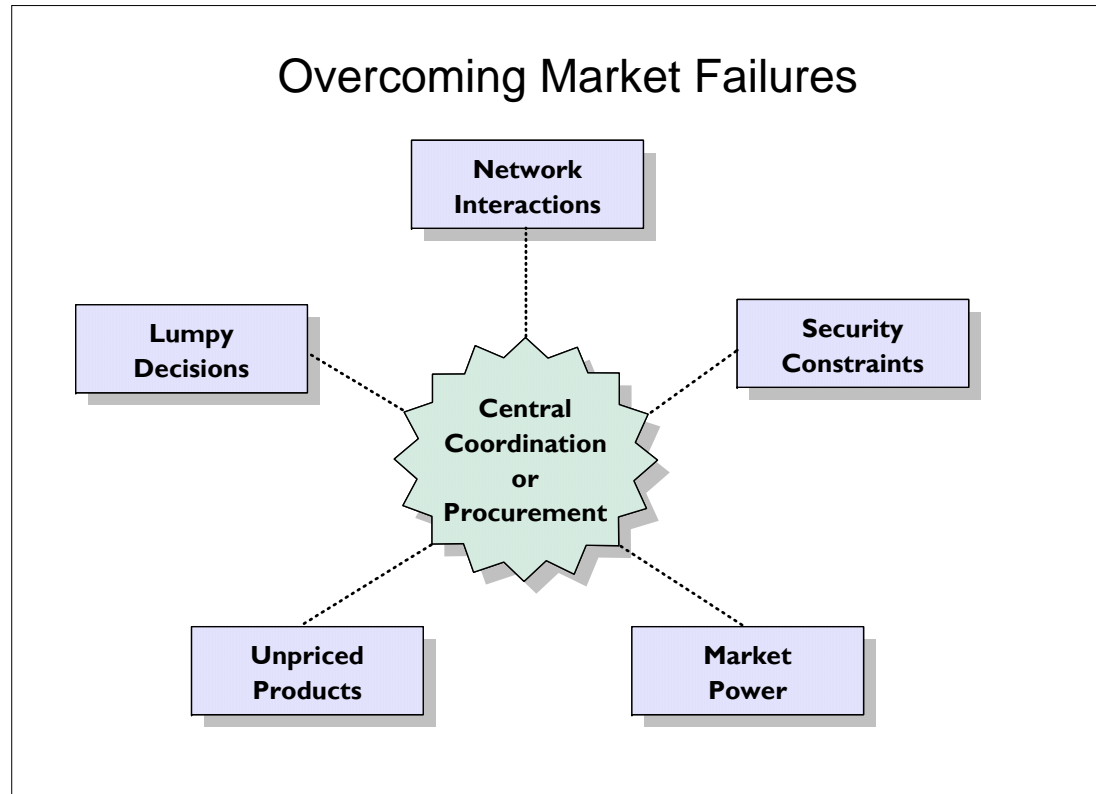
A Market Framework

The example of successful central coordination, ~~GRT, Regional Transmission Organization (RTO) Millennium Order (Order 2000)~~ Standard Market Design (SMD) Notice of Proposed Rulemaking (NOPR), provides a workable market framework that is working in places like New York, PJM in the Mid-Atlantic Region, and New England.



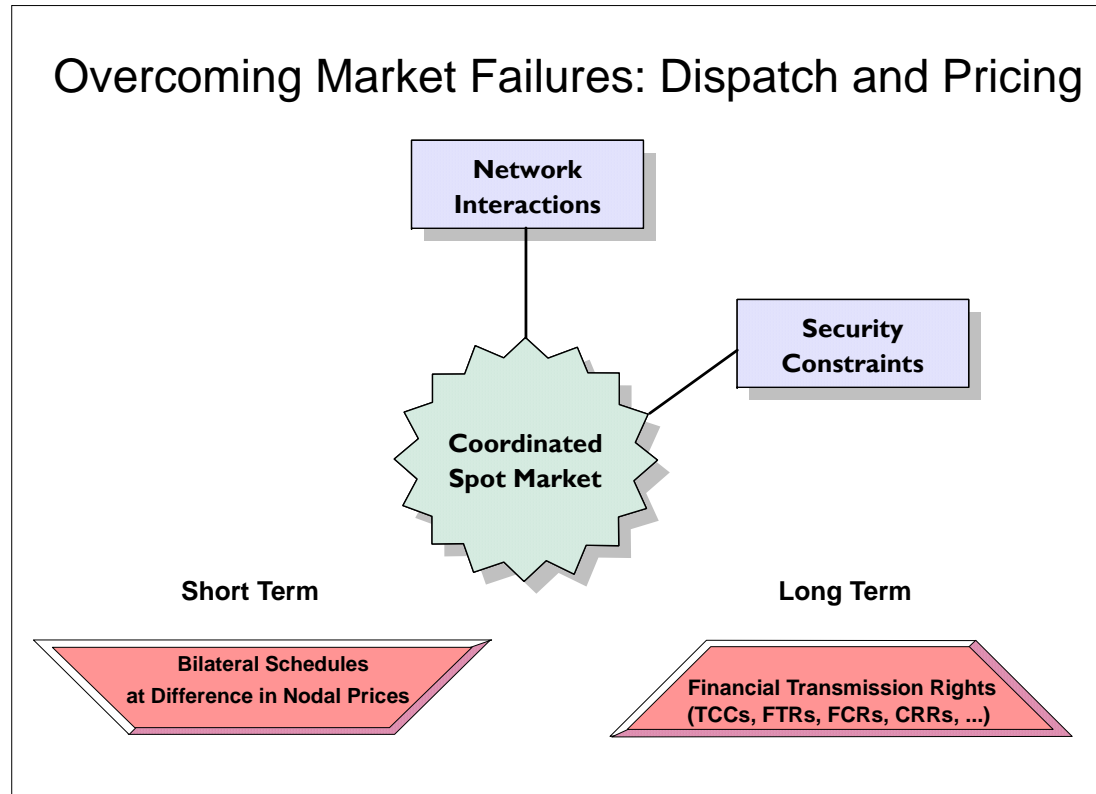
Poolco...OPCO...ISO...IMO...Transco...RTO... ITP...WMP...: "A rose by any other name ..."

The need for central institutions arises from the existence of prominent forms of market failure.



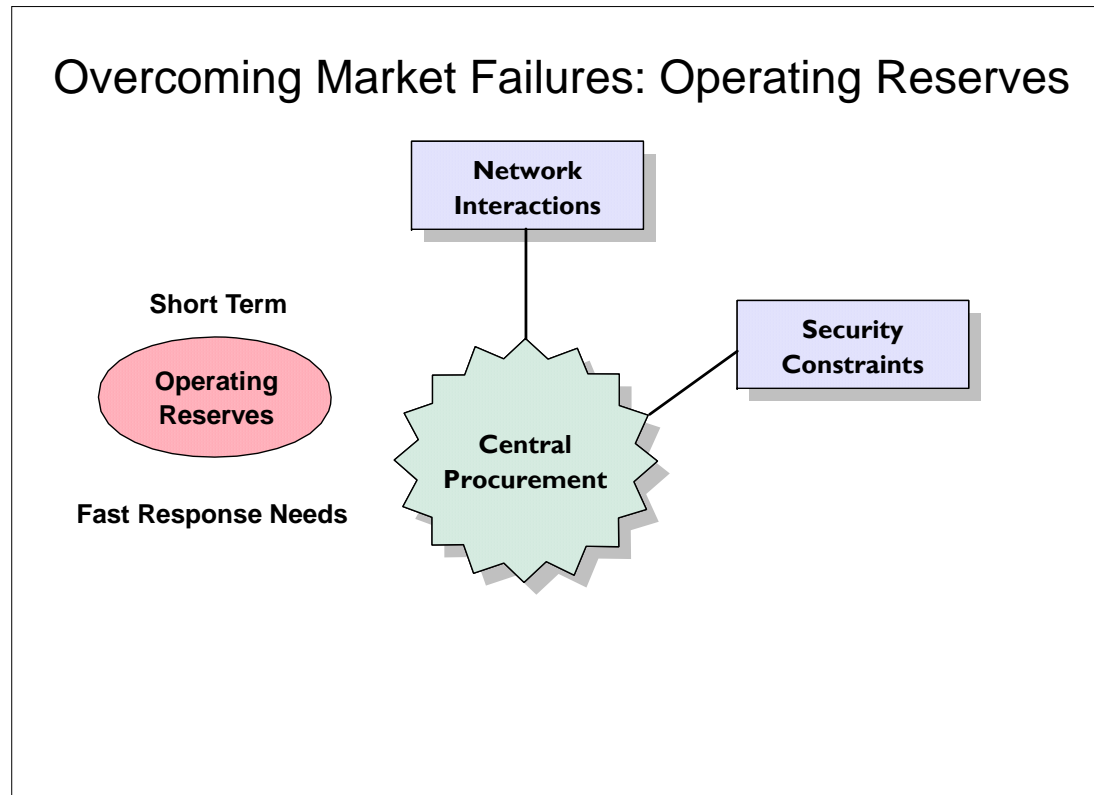
A Dangerous Definition of Market Failure. "The market fails to do what the central planner wants."

The coordinated spot market provides an example of a limited central role with a targeted purpose.



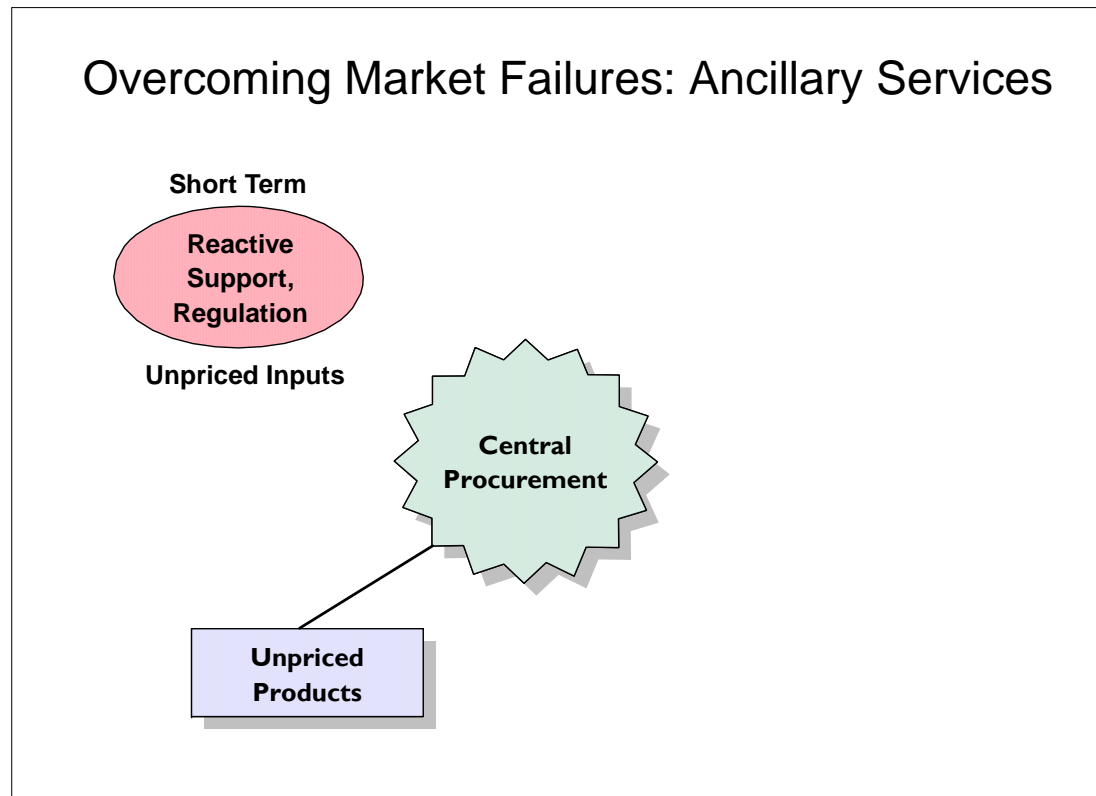
- Short-term coordination of all transactions.
- Long-term coordination of FTRs for transmission, but not CFDs for energy.

Fast response needs preclude pure market solutions for real-time reliability.



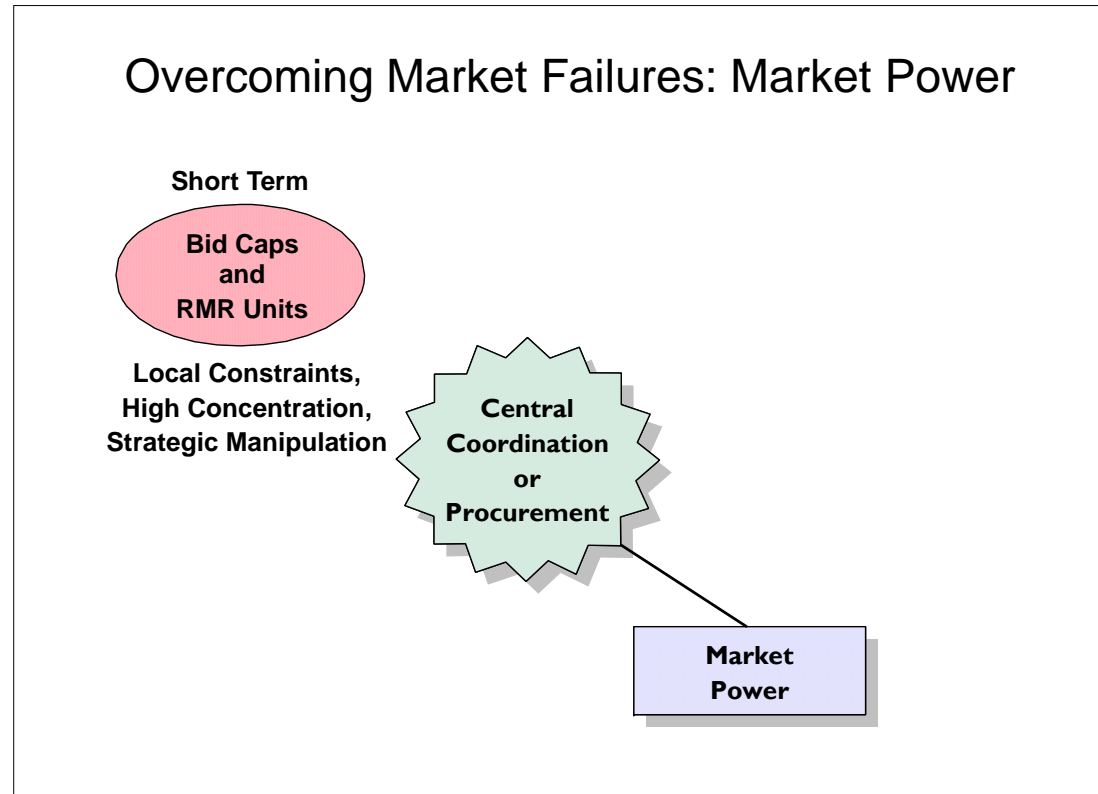
- Administrative determination of required operating reserve types, levels and locations.
- Administrative demand curves to emulate scarcity pricing, with simultaneous determination of reserve and energy prices to maintain consistent incentives.

Electricity operations require multiple products and services that have not been priced, and may be difficult to price even in principle.



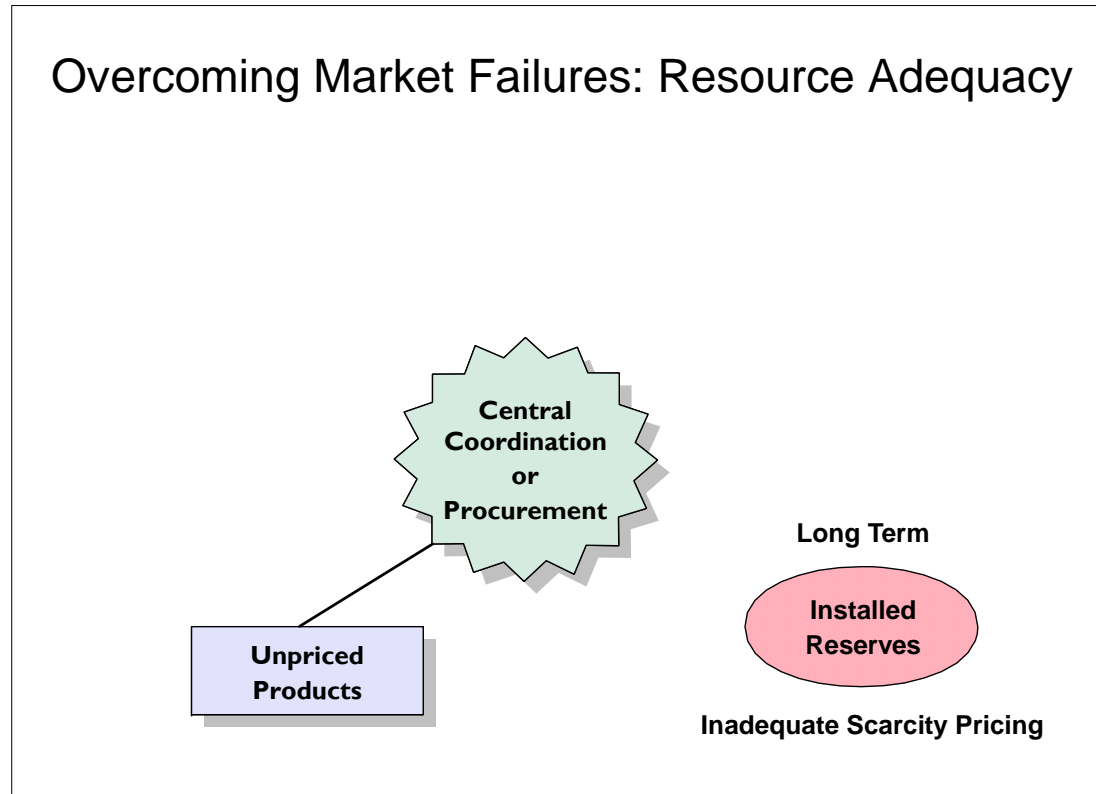
- Without market incentives, central procurement is necessary and imposes burdens.
- Mandatory payments through uplift.

The ability to profit by withholding supply undermines the fundamentals of restructuring.



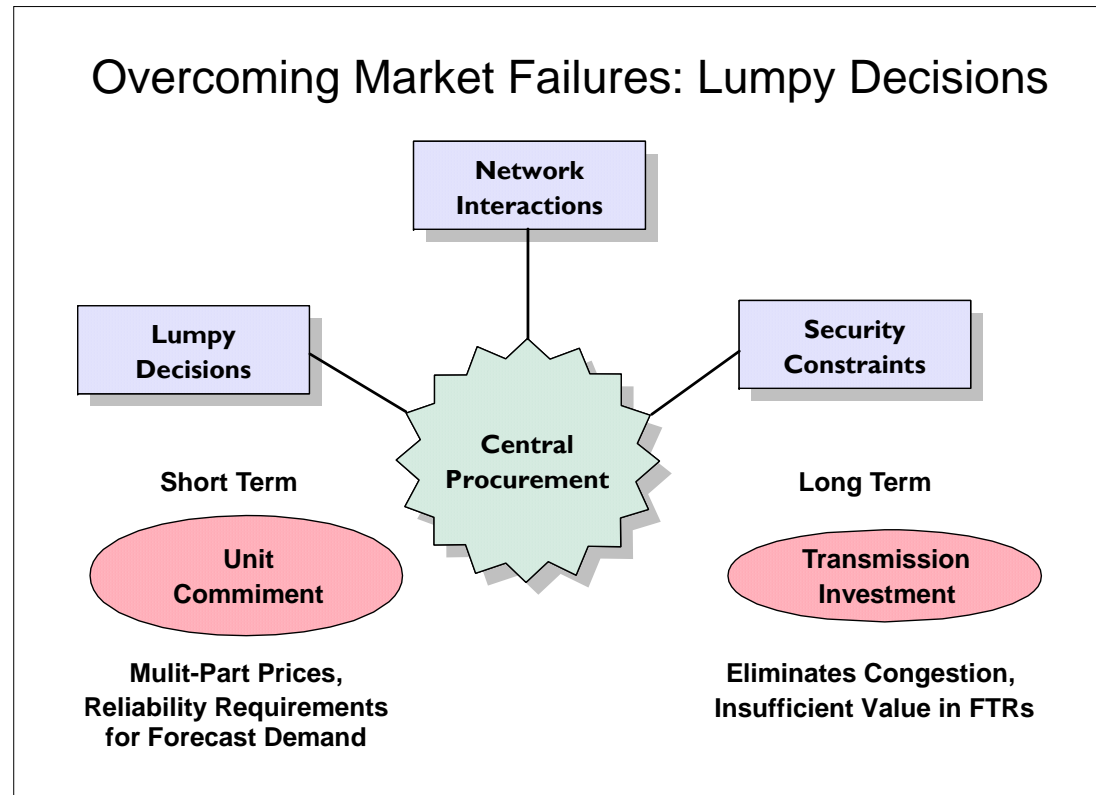
- The difficult problem is distinguishing good high prices from bad high prices.
- Focus on mitigation when structural solutions are unavailable or hard to evaluate.
- Target bid caps and “must offer” rules to focus on the short-term market failure.

Limits on scarcity pricing may underprice reliability and produce inadequate capacity.



- Low “damage control” price caps and zonal pricing rules create market failures.
- Installed capacity markets of increasing complexity arise to undo the consequences.

Lumpy decisions may affect market prices so much that no simple market equilibrium exists.

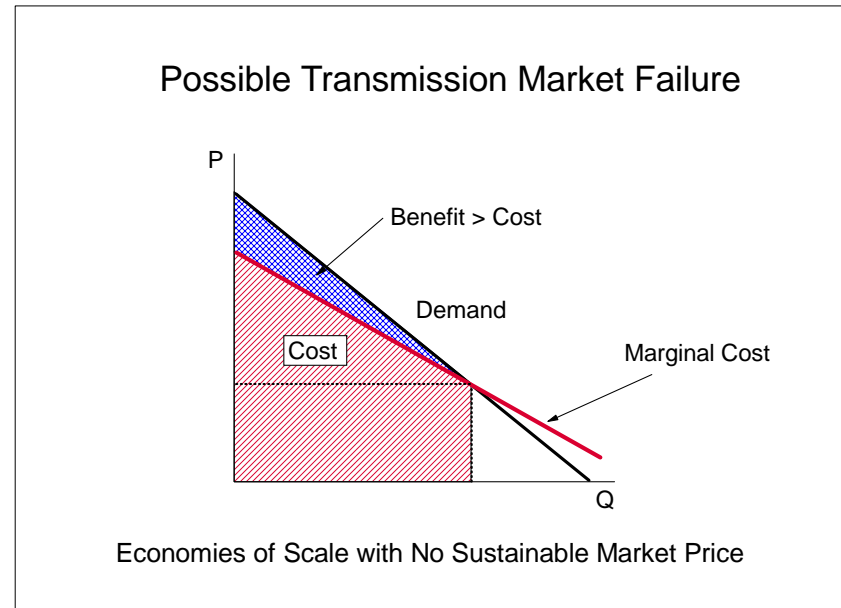
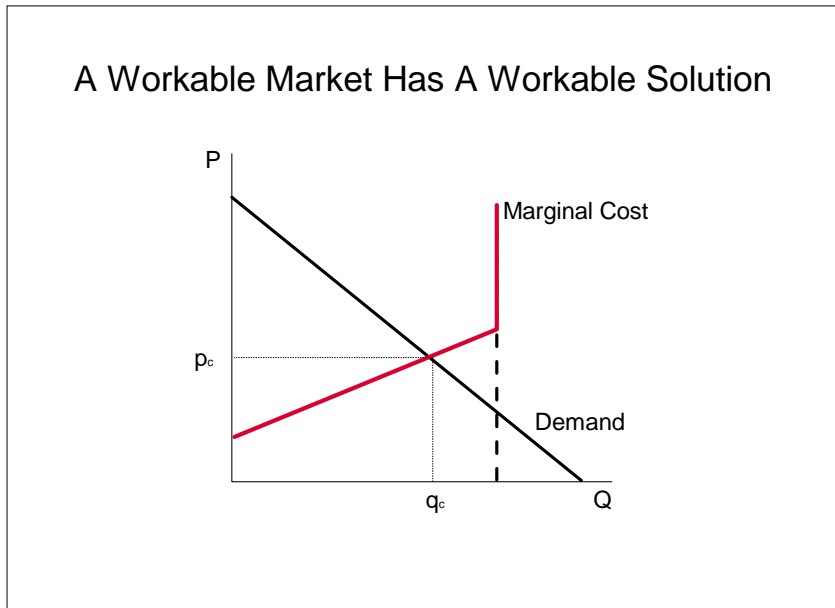


- **Short Term:** Unit Commitment for bid load based on total cost. Reliability Unit Commitment for forecast load based on commitment cost.
- **Long Term:** Investment for “economic” transmission expansion. Knowing how to stop?

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Transmission Investment

Can a market support all electricity investments? Perhaps not. Economies of scale and scope imply possible market failure. The most prominent case is transmission investment.



How can regulators define rules to support market transmission investments when markets work, and intervene when markets fail?

Focus on the market failures

How well is FERC doing in theory in addressing the boundary between markets and mandates?

A good start with the SMD: Efficient spot market design, locational opportunity cost pricing, license plate access charges, financial transmission rights for incremental investments, emphasis on market-driven investments, and participant funding for regulated investments.

The theory needs a workable definition of market failure to demarcate the boundary between regulated and market-based investments. We need a principled, hybrid system.

- **Reliability Investments.** Limited in scope to deal with benefits not priced in the market.
 - Keeping the lights on (e.g., reactive power support).
 - Not just keeping prices low.
- **Economies of Scale and Scope.** Regulated investments would address economic benefits when private incentives do not support aggregate efficiency
 - Lumpy investments that produce material changes in market prices. Ex post value of financial transmission rights less than cost of investment.
 - Capture other externalities, such as mitigating market power, in a least -cost framework.
- **Mitigating Free Riding Incentives.** Participant funding would require beneficiaries to pay.
 - Identifying beneficiaries as well as benefits.
 - Using the coercive power of regulation to make beneficiaries pay.

How well is FERC doing in practice?

Recent decisions suggest an agenda to support transmission infrastructure investment no matter what the cost. Apparently we don't need a market because we know what to do: 'you can never have enough transmission.'

- **PJM Mandates for Economic Investments.**
 - Economic investment: “PJM’s [Regional Transmission Expansion Planning Protocol] includes an economic planning component to develop cost-effective solutions to alleviate congestion on the transmission system that, in the judgment of PJM, cannot be hedged by the use of financial transmission rights or other hedging instruments available pursuant to the PJM Tariff or the Operating Agreement and that no market participant or other entity has proposed to resolve.” (<http://www.pjm.com/planning/epis.html>, December 13, 2004)
 - A short window for market investments before central planning kicks in to socialize costs.
 - “Unhedgeable Congestion:” A creative idea that does not withstand examination. Under SMD all congestion is hedgeable, at a price.
- **NEPOOL Tariff and Transmission Cost Allocations (TCA).**
 - Participant funding morphs into that which market participants volunteer to pay.
 - Identifies net benefits but not net beneficiaries. Not everyone benefits, but everyone pays.

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Transmission Investment

PJM “Market Window” spreadsheet summary. (<http://www.pjm.com/planning/downloads/market-window.xls>, December 13, 2004)

Initial Cost / Benefit Analysis

<u>MONITORED FACILITY</u>	<u>* Unhedgeable Congestion \$</u>	<u>Limit</u>	<u>Cost to Relieve Limit</u>	<u>Cost / Benefit</u>	<u>Limit Increase</u>
LINE 230 KV ADA-BRUX	\$1,091,588	Circuit Switcher	\$200,000	< 0.25	26%
LINE 500 KV BED-BLA	\$1,607,237	Wavetrap	\$75,000	< 0.25	N/A
BED-BLA	\$83,999,705	Voltage	\$5 - \$25 Million	< 0.25	N/A
LINE 230 KV ADA-BENX	\$4,146,221	Circuit Switcher	\$200,000	< 0.25	26%
LINE 138 KV BRU-EDI	\$1,134,130	Circuit Switcher	\$200,000	< 0.25	11%
LINE 69 KV SHI-VIN	\$3,397,773	Conductor	\$500,000	< 0.25	N/A
LINE 500 KV FTM-PRU	\$307,337	Disconnect Switch	\$45,000	< 0.25	13%
PJMW500	\$3,284,457	Voltage	\$5 - \$25 Million	0.25 - 4	N/A
LINE 230 KV NWA-WHI	\$2,739,456	Conductor	\$1,000,000	0.25 - 4	N/A
EAST	\$2,264,606	Voltage	\$5 - \$25 Million	0.25 - 4	N/A
JACK ME 230 KV 4 BA-P	\$2,454,986	Transformer	\$2,500,000	0.25 - 4	N/A
YORKANA 230 KV 1A BANK	\$1,647,801	Transformer	\$2,500,000	0.25 - 4	N/A
LINE 230 KV CED-CLIK	\$709,851	Disconnect Switch	\$50,000	0.25 - 4	2%
LINE 230 KV BER-HOB	\$654,222	Cable	\$2 Million	0.25 - 4	N/A
LINE 138 KV EDI-MEAR	\$499,774	Circuit Switcher	\$200,000	0.25 - 4	21%
LINE 500 KV ELR-HOS	\$112,364	Wave Trap	\$300,000	0.25 - 4	10%
LINE 69 KV EDG-NSA	\$47,120	Disconnect Switch	\$20,000	0.25 - 4	54%
LINE 230 KV BRA-FLA	\$200,355	Wave Trap	\$200,000	0.25 - 4	15%
JACK ME 115 KV 5 BA-S	\$9,272,381	Transformer	\$2,500,000	0.25 - 4	N/A
LINE 230 KV GRE-POR	\$268,024	Line Trap	RTEP Reliability Upgrade	Expected to Mitigate Congestion	
WYLIERID500 KV TRAN 5	\$6,797,499	Transformer	RTEP Reliability Upgrade	Expected to Mitigate Congestion	
CEDAR	\$5,480,787	Voltage	RTEP Reliability Upgrade	Expected to Mitigate Congestion	N/A
BRANCHBU500 KV 500-1	\$192,863,356	Transformer	RTEP Reliability Upgrade	Expected to Mitigate Congestion	
BRANCHBU500 KV 500-2	\$3,556,256	Transformer	RTEP Reliability Upgrade	Expected to Mitigate Congestion	
NORTH PE	\$1,841,999	Voltage	RTEP Reliability Upgrade	Expected to Mitigate Congestion	N/A
LINE 230 KV ATH-SAD	\$1,337,026	Cable	\$3 million	> 4	N/A
LINE 230 KV BER-LEO	\$1,167,763	Cable	\$5 Million	> 4	N/A
...					

* The unhedgeable congestion values only include the cost to "affected load" and may not be indicative of the benefit determined for the 1 year cost-benefit assessment. The unhedgeable congestion dollars are cumulative since August of 2003. Refer to the following link for unhedgeable congestion dollars by month (<http://www.pjm.com/planning/downloads/20032004-congestion-summary-post-updated.xls>).

Drawing a line between merchant and regulated transmission investment is a pressing requirement.

- **FERC Intentions.** FERC's stated policy is to support both merchant and regulated transmission investment.
- **FERC Actions.** Motivated by pressure to stimulate transmission investment, recent FERC decisions undermine the policy goal. The mandated economic investment rules in PJM and cost socialization rules in New England defy the logic of electricity restructuring.
- **Slippery Slopes.** Regulated investment shifts the risks and provides cost recovery mechanisms not available to the merchant investor. Absent a bright line between regulated transmission investment and competing alternatives, there will be enormous and justifiable pressure on the regulator to put generation and demand investments on the same playing field of reduced risk and mandatory collection through regulated mechanisms. The intended modest domain of regulated transmission investment would expand to include integrated resource planning. The end state could be recreation of the central regulatory decision problems that motivated electricity restructuring in the first place.

Draw the line between regulated and merchant investments to focus on market failure.

- **A Possible Line Between Merchant and Regulated Investment.** Regulated investment for economic upgrades would be limited to those cases where the investment is inherently large relative to the size of the relevant market and inherently lumpy in the sense that the only reasonable implementation would be as a single project like a tunnel under a river. Everything else would be left to the market. This results in a two-part test:
 - **Economic Justification:** The (expected net present value) aggregate benefits exceed the aggregate costs. This is the usual social welfare calculation that applies to all regulated investment under traditional regulation. Nothing new.
 - **Market Failure Justification:** The investment is large and lumpy enough to materially affect market prices, making the ex post rights worth less than the cost of the investment. A new test.

Some transmission investments and most other (generation and demand side) investments would not meet the second test. This principled boundary could provide a plateau on the slippery slope.

- **A Dangerous Definition of Market Failure.** “The market fails to do what the central planner wants.” This is the de facto definition apparent in FERC’s recent actions on transmission investment. It is not hard to see where this leads. Most investments would be left to the purview of the regulators and central planners, who operate a better collection agency.

If the central planners (or regulators) know what to do, then do it.
But if true, what is the need for electricity restructuring and markets?

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 Allegheny Electric Global Market, American Electric Power, American National Power, Australian Gas Light Company, Avista Energy, Brazil Power Exchange Administrator (ASMAE), British National Grid Company, California Independent Energy Producers Association, Calpine Corporation, Central Maine Power Company, Comision Reguladora De Energia (CRE, Mexico), Commonwealth Edison Company, Conectiv, Constellation Power Source, Coral Power, Detroit Edison Company, Duquesne Light Company, Dynegy, Edison Electric Institute, Edison Mission Energy, Electricity Corporation of New Zealand, Electric Power Supply Association, El Paso Electric, GPU Inc. (and the Supporting Companies of PJM), GPU PowerNet Pty Ltd., GWF Energy, Independent Energy Producers Assn, ISO New England, Maine Public Advocate, Maine Public Utilities Commission, Midwest ISO, 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, NRG Energy, Inc., Ontario IMO, Pepco, Pinpoint Power, PJM Office of Interconnection, PP&L, Public Service Electric & Gas Company, Reliant Energy, Rhode Island Public Utilities Commission, San Diego Gas & Electric Corporation, Sempra Energy Resources, SoCalGas, SPP, Texas Utilities Co, TransEnergie, 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 the web at www.whogan.com).