

MARKET DESIGN FAILURES AND ELECTRICITY RESTRUCTURING

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Ultimate success is an open question for the international experiment in using electricity markets for public purposes.

From Down Under

“Plans for desperately needed new power generation are up in the air again. ... [The New Zealand Labour Government's move] has the potential to up-end the electricity industry and turn back the clock to central planning. Electricity transmission is already centrally planned by state-owned Transpower.

“The question is, should you centrally plan the alternatives,’ Mr Hemmingway [Electricity Commission chairman] says. ‘Do you give companies a leg-up in the form of a subsidy to undertake the alternatives? And, how would a package of centrally implemented alternatives distort the market?’

“How far we go down this slippery slope back toward central planning is a central question here. It's the key to our deliberations. We are aware of the slippery slope danger but we are also aware that if there are alternatives out there that are less expensive than the transmission line we ought not let them go to waste.” (The Press, Christchurch, New Zealand, April 30, 2005.)

From Washington DC

“After holding its draft transmission pricing policy statement for more than two years, the federal Energy Regulatory Commission now says it will issue a final statement in two months.... The policy statement should address which customers pay for transmission expansion, [Commissioner Suede] Kelly said. The more expansively costs are spread, the more transmission will be built, she added, indicating that the approach called ‘participant funding’ should be reserved for projects with isolated benefits. ‘I don’t really want to use the word ‘socialization,’ because I think there is an argument to be made that all those people [on the grid] benefit.’” (Power Markets Week, May 2, 2005, p. 9.)

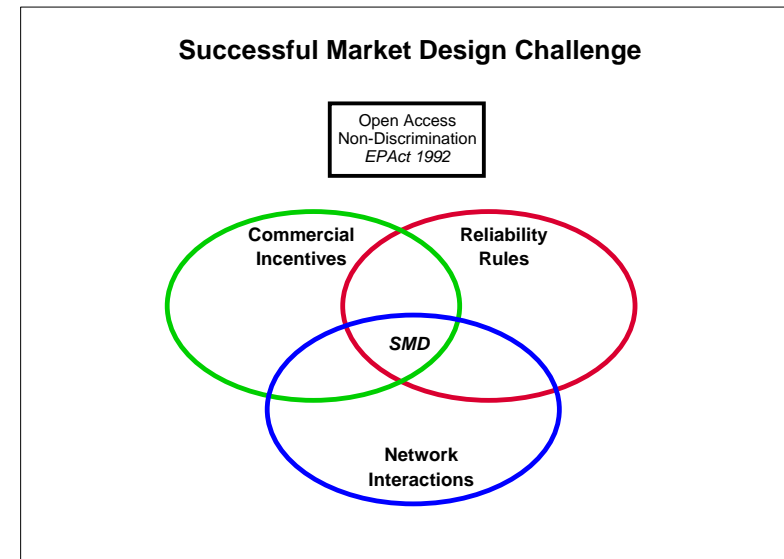
ELECTRICITY MARKET

Electricity Restructuring

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 emphasis 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, electricity restructuring itself would fail the cost-benefit test.



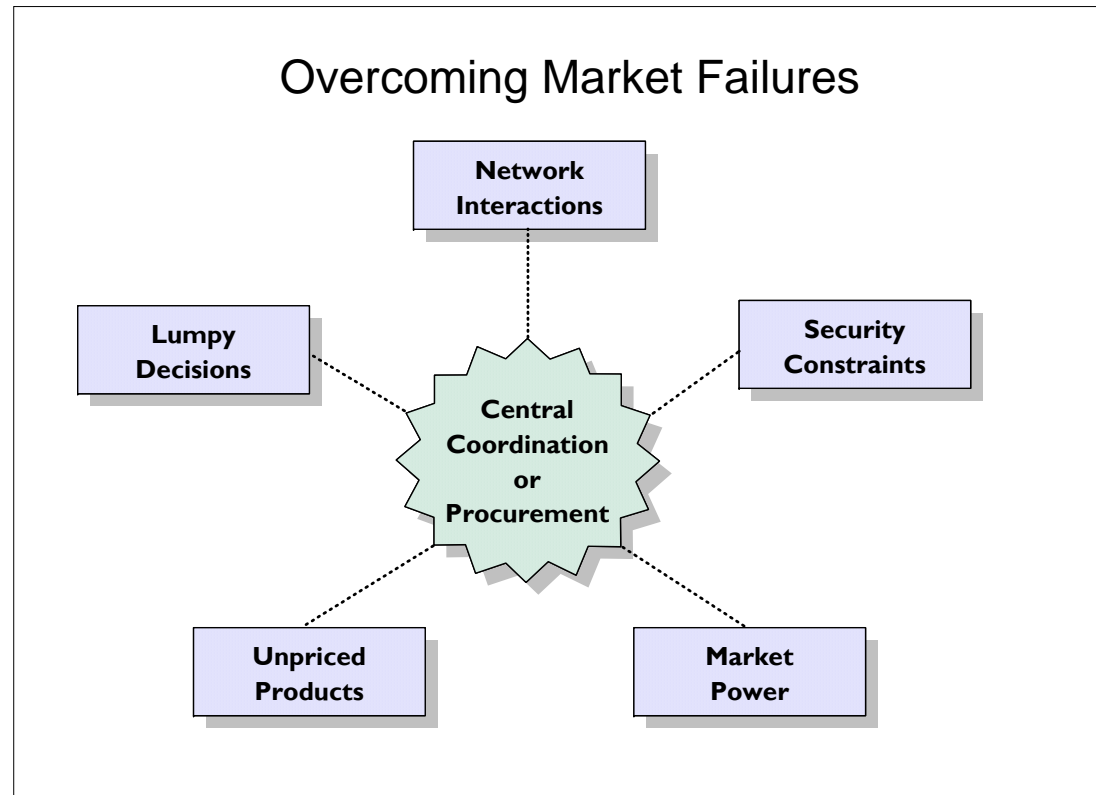
The Successful Market Design challenge dictates the need for some central institutions to support markets through the seeming oxymoron of “coordination for competition.”

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.

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

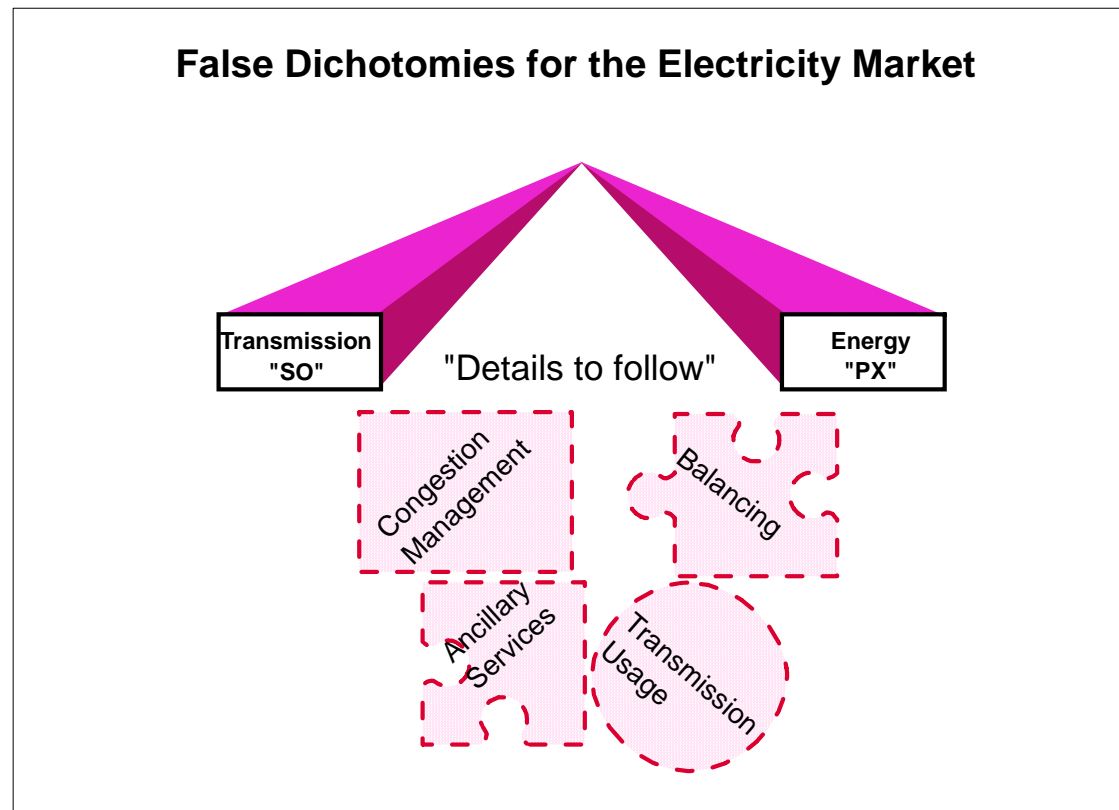


A Dangerous Definition of Market Failure. "The market fails to do what the central planner wants."

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Separation Fallacy

The market for transmission and the market for energy are inherently intertwined. Separation into a transmission operator and a power exchange is based on a fallacy. The details reveal that the pieces cannot be constructed separately and still fit together.¹

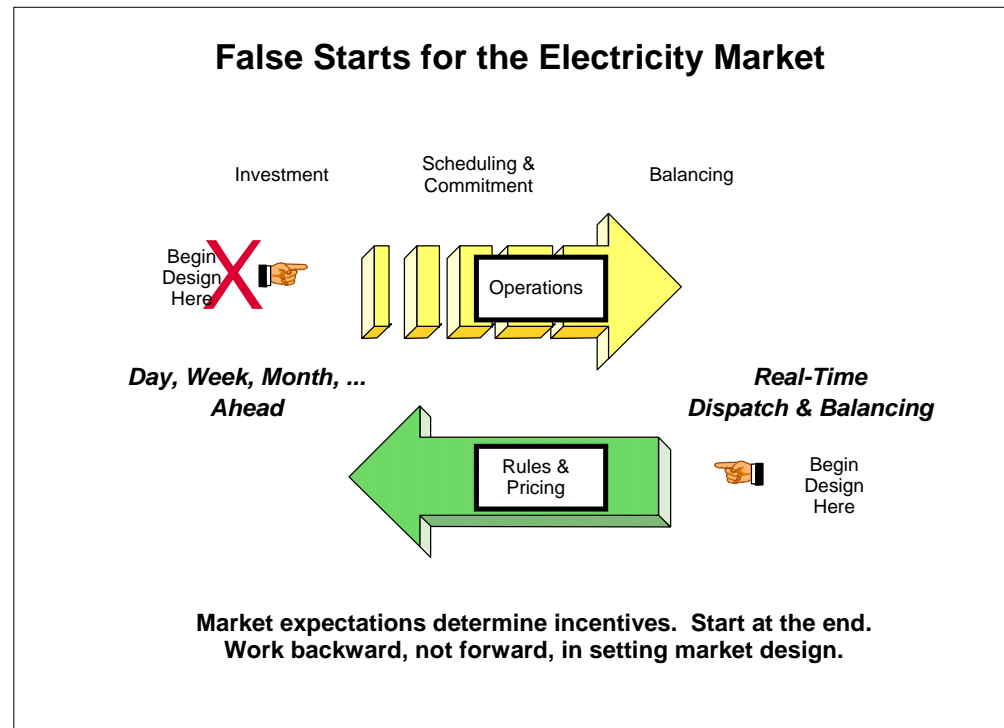


¹ W. Hogan, "A Wholesale Pool Spot Market Must Be Administered by the Independent System Operator: Avoiding the Separation Fallacy," The Electricity Journal, December 1995, pp. 26-37.

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Focus on Balancing Markets First

Good design begins with the real-time market, and works backward. A common failure mode starts with the forward market, without specifying the rules and prices that would apply in real time.



ELECTRICITY MARKET

Focus on Balancing Markets First

Good design of the real-time market simplifies everything else. The basic principles stand at the center of successful market design (“SMD”), including the core elements of the FERC standard market design and subsequent wholesale market platform.

- Efficient real-time operations conform to economic dispatch, and the prices or opportunity costs at the margin equal the much discussed locational marginal prices (LMP). This fact dictates the core elements of SMD. Any other outcome will create problematic incentives requiring intrusive mandates and rules to maintain reliability and achieve efficiency.
- Available Transmission Capacity (ATC) calculations required for the contract path model are not well defined. The problem is conceptual and not just a requirement for better information. Hence, ATC estimates are arbitrary and controversial. By contrast, the point-to-point financial transmission rights found in SMD provide an alternative, well-defined and workable set of rights to support forward markets.
- Security limits dictated by reliability standards are implemented as contingency constraints which inherently require coordinated and simultaneous evaluation. Evaluation of the (many) constraints requires calculation and not just observation.
- Bid-based dispatch or balancing systems can incorporate the elements needed for efficient operations to support coordination and competition.

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.
- Maintain the 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.

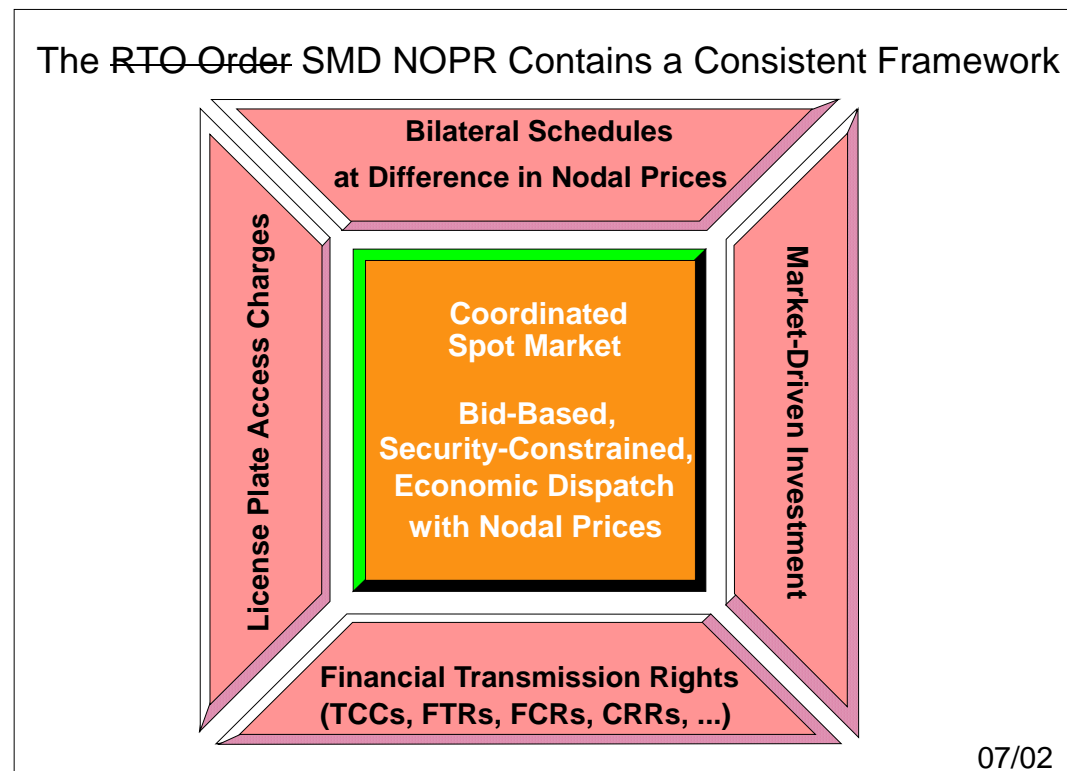
Be afraid of the reflexive market intervention that sows the seeds of intervention. Good advice might be: “Don’t just do something, stand there.” Better advice would be: “Look, and look hard, before you leap.”

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, New England, and the Midwest.



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

How well is the Federal Energy Regulatory Commission (FERC) doing in theory in addressing the boundary between markets and mandates? A primary challenge arises in the case of transmission expansion.

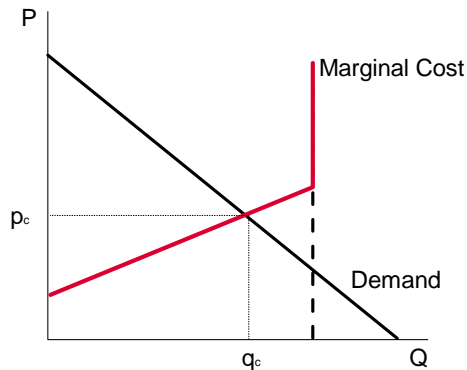
“...staff’s discussions suggest that, despite the fact that long-term hedging instruments are awarded in many RTOs in exchange for investments in transmission infrastructure, developers of merchant transmission may not consider long-term financial rights a reliable and sufficient source of revenue to obtain financing for new projects. FTR values are too difficult to forecast over a long period because of the challenges in accounting for changes to the generation resources and transmission system over time. In addition, new lines destroy a portion of the basis differentials that the FTRs reflect and are not therefore captured by FTR holders unless a contract party that benefits from the decline in basis pays in advance for them through a long-term contract.” (Federal Energy Regulatory Commission, “Long-Term Transmission Rights Assessment,” FERC Staff Discussion Paper, May 11, 2005, p. 16.)

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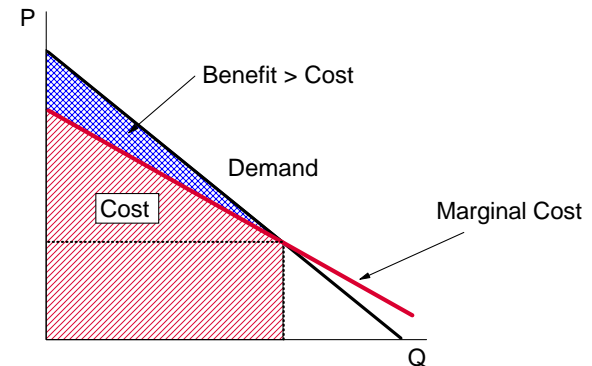
Transmission Investment

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.

A Workable Market Has A Workable Solution



Possible Transmission Market Failure

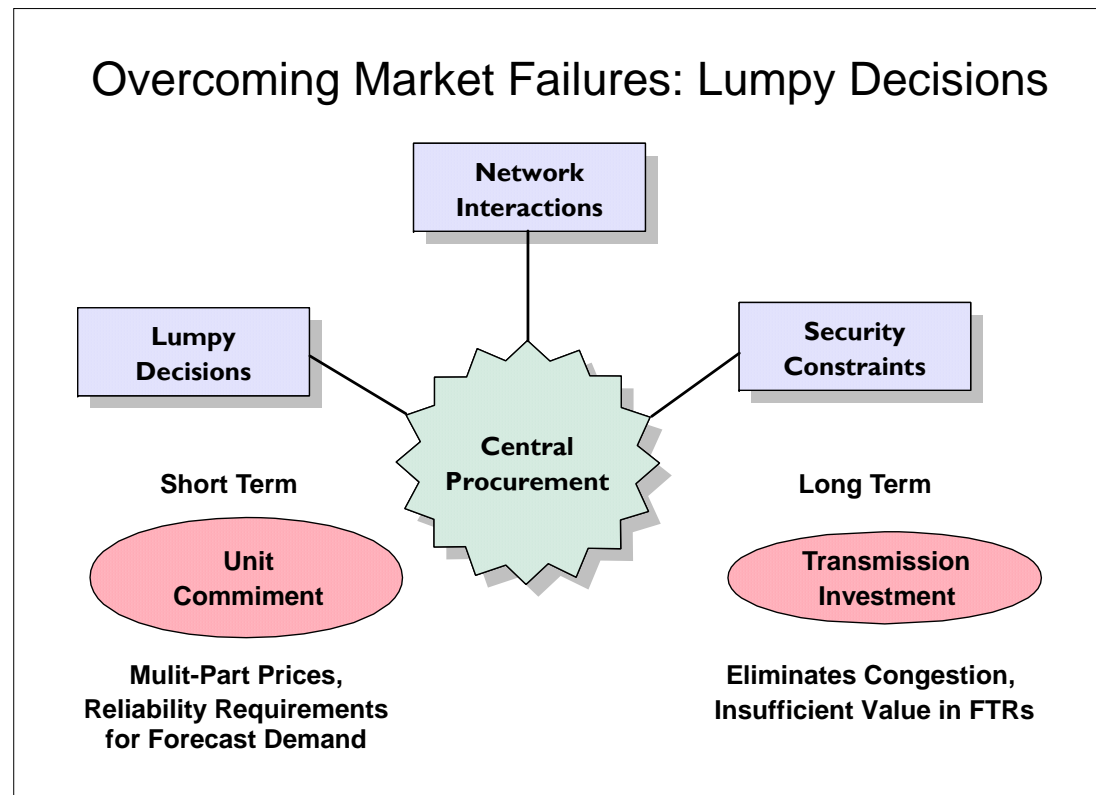


Economies of Scale with No Sustainable Market Price

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

Focus on the market failures

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?

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

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.' And the market is failing to do what the central planner wants.

- **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” is 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>, March 24, 2005)

Initial Cost / Benefit Analysis

MONITORED FACILITY		* Unhedgeable			
		Congestion \$	First Limit	Cost to Relieve First Limit	Cost / Benefit
LINE	500 KV BED-BLA (see comment)	\$1,607,237	Wavetrap	\$75,000	< 0.25
LINE	500 KV FTM-PRU (see comment)	\$307,337	Disconnect Switch	\$45,000	< 0.25
LINE	69 KV EDG-NSA	\$136,359	Disconnect Switch	\$20,000	< 0.25
PJMW500		\$3,284,457	Voltage	\$5 - \$25 Million	0.25 - 4
LINE	230 KV NWA-WHI	\$2,739,456	Conductor	\$1,000,000	0.25 - 4
EAST		\$2,551,467	Voltage	\$5 - \$25 Million	0.25 - 4
LINE	230 KV BER-HOB	\$764,194	Cable	\$2 Million	0.25 - 4
LINE	345 KV SAM-WYL	\$758,960	Conductor	\$2,500,000	0.25 - 4
LINE	230 KV NPH-WAN	\$238,765	Conductor	\$525,000	0.25 - 4
LINE	230 KV BER-LEO	\$1,236,114	Cable	\$5 Million	> 4
WEST		\$1,012,701	Voltage	\$5 - \$25 Million	> 4
LINE	500 KV HAR-KAM	\$378,989	Transformer	\$10 Million	> 4
LINE	230 KV PLY-WHI4	\$165,655	Conductor	\$1,300,000	> 4
LINE	230 KV PLY-WHI3	\$111,826	Conductor	\$1,300,000	> 4
WYLIERID	500 KV TRAN 7	\$559,862	Transformer	\$8 Million	0.25 - 4
KEENEY	500 KV AT50	\$298,694	Transformer	\$10 Million	
LINE	138 KV BAY-MAR	\$374,287	Conductor	\$2,800,000	> 4
LINE	230 KV ROS-WHI	\$159,227	Conductor	\$675,000	> 4
LINE	230 KV RIC-WAN	\$300,888	Conductor	\$575,000	0.25 - 4
REDLION	500 KV AT50	\$859,810	Transformer	\$5 - \$15 Million	> 4
LINE	230 KV BRU-YOR	\$405,216	Conductor	\$3.15 Million	> 4
LINE	230 KV DEL-MIC	\$110,022	Conductor	\$3,300,000	> 4
LINE	500 KV CLO-LEX	\$947,744	Transformer	\$12 million	> 4

* 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/2003-04-05-monthly-congestion-summary.xls>).

TRANSMISSION INVESTMENT

Challenges

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.

"How far we go down this slippery slope back toward central planning is a central question here." (Electricity Commission Chairman, Roy Hemmingway, quoted in The Press, Christchurch, New Zealand, April 30, 2005.)

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?

The Argentine experience after 1992-2003 provides an alternative approach to defining a boundary between markets and mandates for transmission investment.

“The Argentine approach to transmission expansion uses such a competitive solicitation process but enables users rather than regulators to identify the investment projects.” (Stephen C. Littlechild and Carlos J. Skerk, “Regulation of Transmission Expansion in Argentina Part I: State Ownership, Reform and the Fourth Line,” CMI EP 61, 2004, p. 6.)

“For major transmission network expansions, then, the onus for action was put firmly on the users of the network, not on the incumbent or the regulator. This was not an ideological or ad hoc decision: it was the final and perhaps most imaginative and bold part of a consistent approach to the design of electricity privatisation in Argentina.” (Stephen C. Littlechild and Carlos J. Skerk, “Regulation of Transmission Expansion in Argentina Part I: Developments Since the Fourth Line,” CMI EP 61, 2004, p. 26.)

- **Coordinated Markets under SMD principles.**
- **Participant Investment Decisions.**
- **Participant Investment Funding.**

TRANSMISSION INVESTMENT

Argentine Approach

An outline of the Argentine experience bears directly on the debate in the United States and elsewhere. (For details, see Stephen C. Littlechild and Carlos J. Skerk, "Regulation of Transmission Expansion in Argentina Part I: State Ownership, Reform and the Fourth Line," CMI EP 61, 2004, pp. 27-28.)

- **Coordinated Spot Market.** Organized under an Independent System Operator with Locational Marginal Pricing.
- **Expansion of Transmission Capacity by Contract Between Parties.** Allowed merchant transmission with voluntary participant funding.
- **Minor Expansions of Transmission Capacity (<\$2M).** Included regulated investment with assignment of cost, either through negotiation or allocation to beneficiaries as determined by regulator, with mandatory participant funding.
- **Major Expansions of Transmission by “Public Contest” Method.** Overcame market failure without overturning markets.
 - Regulator applies the “Golden Rule” (Cost-Benefit Test).
 - 30%-30% Rule. At least 30% of beneficiaries must be proponents. No more than 30% of beneficiaries can be opponents.
 - Assignment of costs to beneficiaries with mandatory participant funding under “area of influence” methodology.
 - No award of Financial Transmission Rights!
 - Allocation of accumulated congestion rents to reduce cost of construction (“Salex” funds).

What impact did the Argentine approach have on transmission investment?

“To illustrate the change in emphasis on investment, over the period 1993 to 2003 the length of transmission lines increased by 20 per cent, main transformers by 21 per cent, compensators by 27 per cent and substations by 37 per cent, whereas series capacitors increased by 176 per cent. As a result, transmission capacity limits increased by 105 per cent, more than sufficient to meet the increase in system demand of over 50 per cent.” (Stephen C. Littlechild and Carlos J. Skerk, “Regulation of Transmission Expansion in Argentina Part II: State Ownership, Reform and the Fourth Line,” CMI EP 61, 2004, p. 56.)

Lessons

- **Transmission investment could be compatible with SMD incentives.**
- **Beneficiaries could be defined.**
- **Participant funding could support a market.**
- **Award of FTRs would be an obvious enhancement.**

TRANSMISSION INVESTMENT

Boundary Condition(s)

How would the Argentine model translate into the United States context?

- **Coordinated Spot Market.** Organized under an Independent System Operator with Locational Marginal Pricing. The Successful Market Design with FTRs.
- **Expansion of Transmission Capacity by Contract Between Parties.** Allow merchant transmission with voluntary participant funding. This is the easy case. Allocate long-term FTRs for the transmission expansion.
- **Minor Expansions of Transmission Capacity (<\$2M).** Includes regulated investment with assignment of cost either through negotiation or assignment to beneficiaries as determined by regulator with mandatory participant funding. Leave small investments to the initiative of the existing wires companies. Auction incremental FTRs along with FTRs for existing system.
- **Major Expansions of Transmission by “Public Contest” Method.** Overcoming market failure without overturning markets.
 - Regulator applies the “Golden Rule” (Cost-Benefit Test). Use the same economic cost benefit analysis to identify expected beneficiaries.
 - 30%-30% Rule. At least 30% of beneficiaries must be proponents. No more than 30% of beneficiaries can be opponents. This provides an alternative, or a complement, to the “Market Failure Test” to help the regulators limit intervention and support the broader market.
 - Assign costs to beneficiaries with mandatory participant funding.
 - Award either Auction Revenue Rights or long term FTRs to beneficiaries along with costs.

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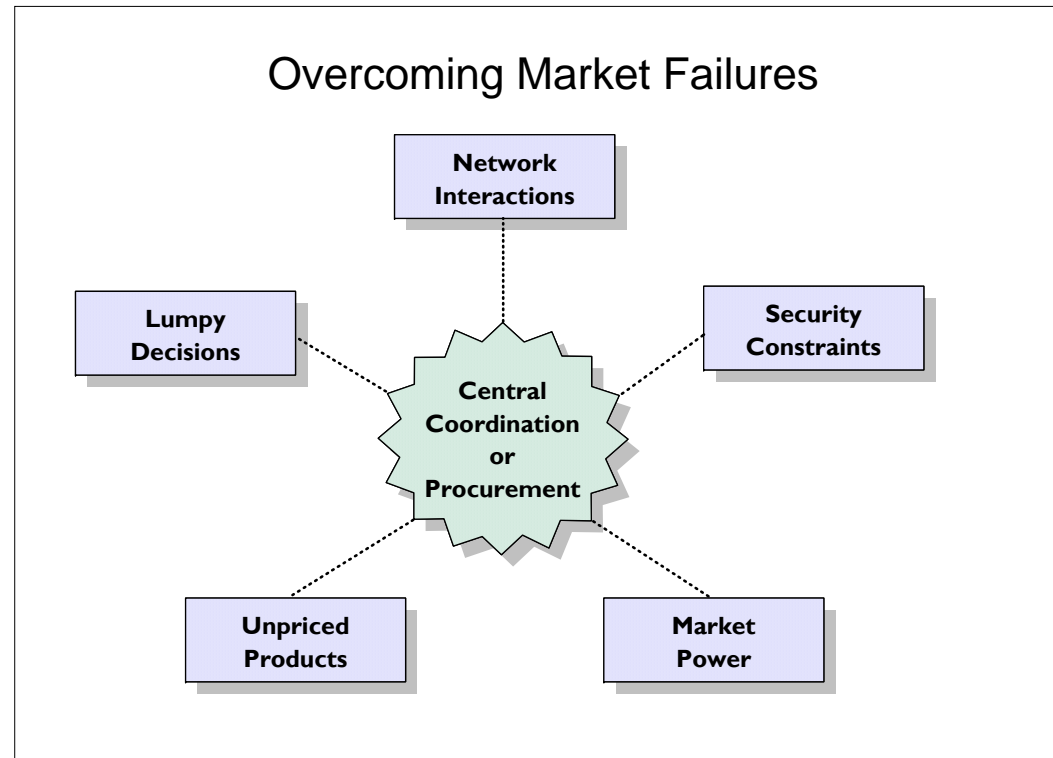
Overcoming Market Failure

The need for central institutions arises from the existence of prominent forms of market failure. The challenge is to address market failures while preserving the market as the default.

A dangerous definition of market failure. “The market fails to do what the central planner wants.”

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.



Intervene where needed, and know how to stop. The Argentine experience with transmission expansion provides empirical support for the viability of a market and suggests an approach for limited central procurement that overcomes market failure without overturning the market.

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