# MARKET DESIGN AND ELECTRICITY RESTRUCTURING

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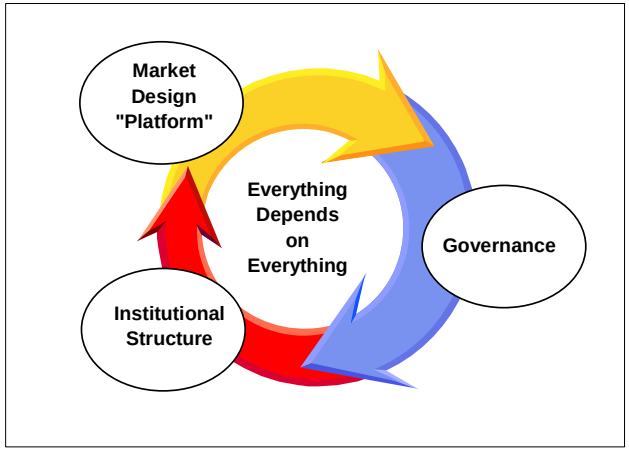
# ENERGY POLICY — Electricity Restructuring

**The Energy Policy Act of 1992 (EPAct 1992) launched a national effort to restructure electricity institutions to allow greater reliance on markets. The Federal Energy Regulatory Commission (FERC) took the lead in Order 888 (1996) by opening access to the electric transmission grid.**




**The Open Access Rule of Order 888 followed from a lengthy debate about the many details of electricity markets.**

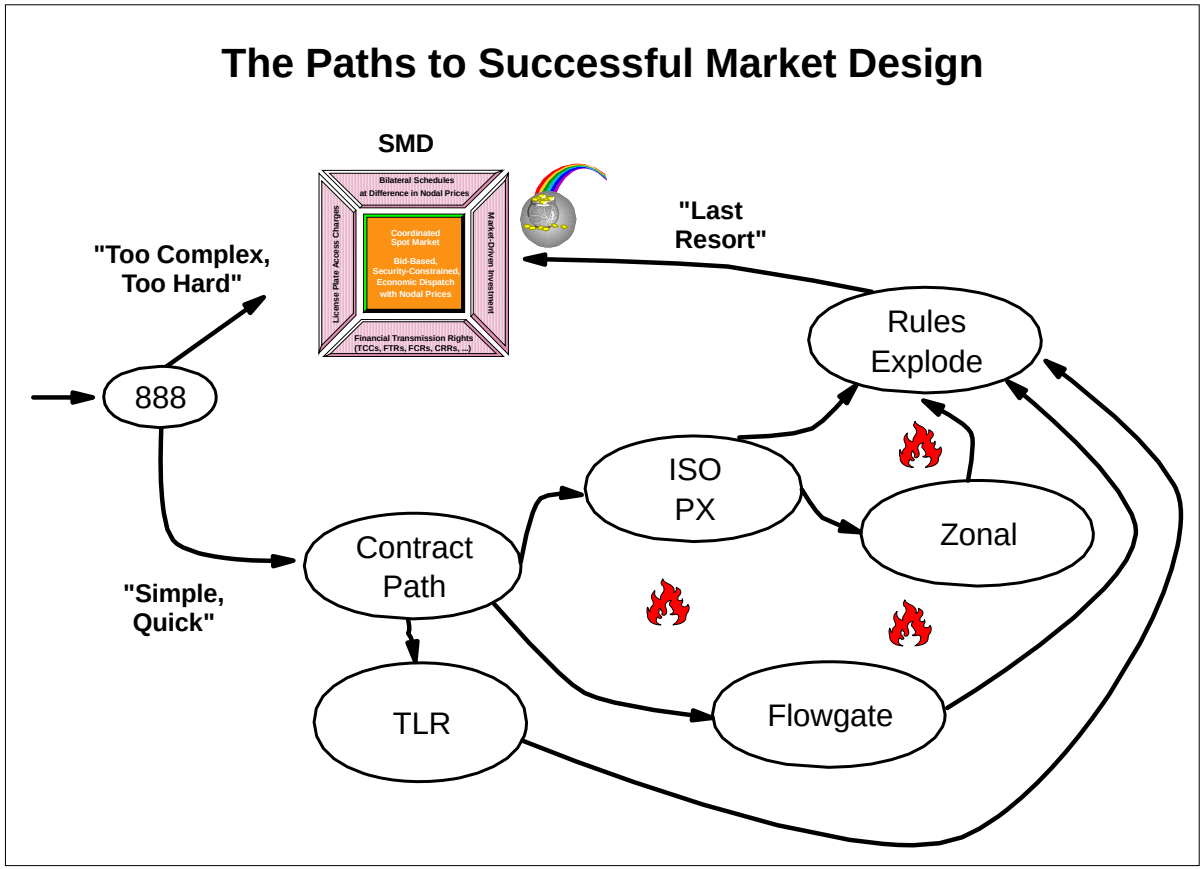
> "Today the Commission issues three final, interrelated rules designed to remove impediments to competition in the wholesale bulk power marketplace … . The legal and policy cornerstone of these rules is to remedy undue discrimination in access to the monopoly owned transmission wires that control whether and to whom electricity can be transported in interstate commerce." (FERC, Order 888, April 24, 1996, p. 1.)

## ENERGY POLICY Electricity Restructuring

**Achieving greater reliance on markets has not been easy. The California electricity crisis, and then the S******d M****t D****n rulemaking fiasco, derailed the politics and practice of electricity restructuring. FERC lost its coherence and direction while the Energy Policy Act of 2005 (EPAct 2005) was under consideration. Isolated and seemingly independent decisions interact to undermine fundamental purposes of electricity restructuring and Order 888.**

- **Maintaining the pretense that FERC can avert its eyes from market design issues.**
- **Revisiting Order 888 implementing open access and non-discrimination.**
- **Maintaining market rules suppressing scarcity signals.**
- **Designing transmission investment rules socializing costs.**
- **Standardizing rules for calculating circular definitions of available transfer capability (ATC, aka available transmission capacity).**
- **Defining reliability standards while certifying the Electric Reliability Organization (ERO).**
- **Reforming generation resource adequacy programs through expanded regulatory mandates.**
- **Reviewing the merits of security constrained economic dispatch under the EPAct 2005.**

**The experience of the decade after the EPAct 1992 appears lost in the discussions after EPAct 2005. Are we on the road to repeating the history we wish to ignore? Or is it worse?**



## ELECTRICITY MARKET — Electricity Restructuring

**EPAct 2005 imposes many new responsibilities and deadlines, but does little to address the critical issues. FERC set goals for its oversight of wholesale electric and gas markets.**

**FERC Strategic Plan FY 2005–FY 2008**

- **Goal 1: Promote Development of a Robust Energy Infrastructure.**
  - Objective 1.1: Expedite Development of Energy Infrastructure Projects.
  - Objective 1.2: Encourage Investment in Energy Infrastructure.
  - Objective 1.3: Address Landowner and Environmental Concerns Fairly.
  - Objective 1.4: Protect the Reliability, Security and Safety of the Energy Infrastructure.

- **Goal 2: Prevent Exercise of Market Power by Reliance on Effective Competition.**
  - Objective 2.1: Promote Effective Competition in Electric and Gas Markets.
  - Objective 2.2: Establish Clear Market Rules to Govern Electric Markets.

- **Goal 3: Prevent Exercise of Market Power by Reliance on Effective Regulation.**
  - Objective 3.1: Vigilant and Effective Oversight of Market Operations.
  - Objective 3.2: Firm but Fair Enforcement of Commission Rules.

**The goals are laudable and seem compatible. However, there is tension between mandates and markets in the efforts to develop infrastructure and promote effective competition.**

**Electricity restructuring presents twin challenges with a broad theme.**

- **Create an effective electricity market design with associated transmission access rules.**
  - An electricity market must be designed.
  - The market cannot solve the problem of market design.
  - Incentives should drive decisions and innovation.

- **Provide compatible market interventions to compensate for market imperfections.**
  - Market imperfections exist under the best designs.
  - Network interactions make the obvious answers wrong or even dangerous.
  - Poor market design makes interventions more necessary, more common, and more difficult.

**There is a close connection between the twin challenges, and the slippery slope of intervention can lead to an electricity market that may be worse than the system it was to replace.**

**If the central planners (or regulators) know what to do, then do it.**

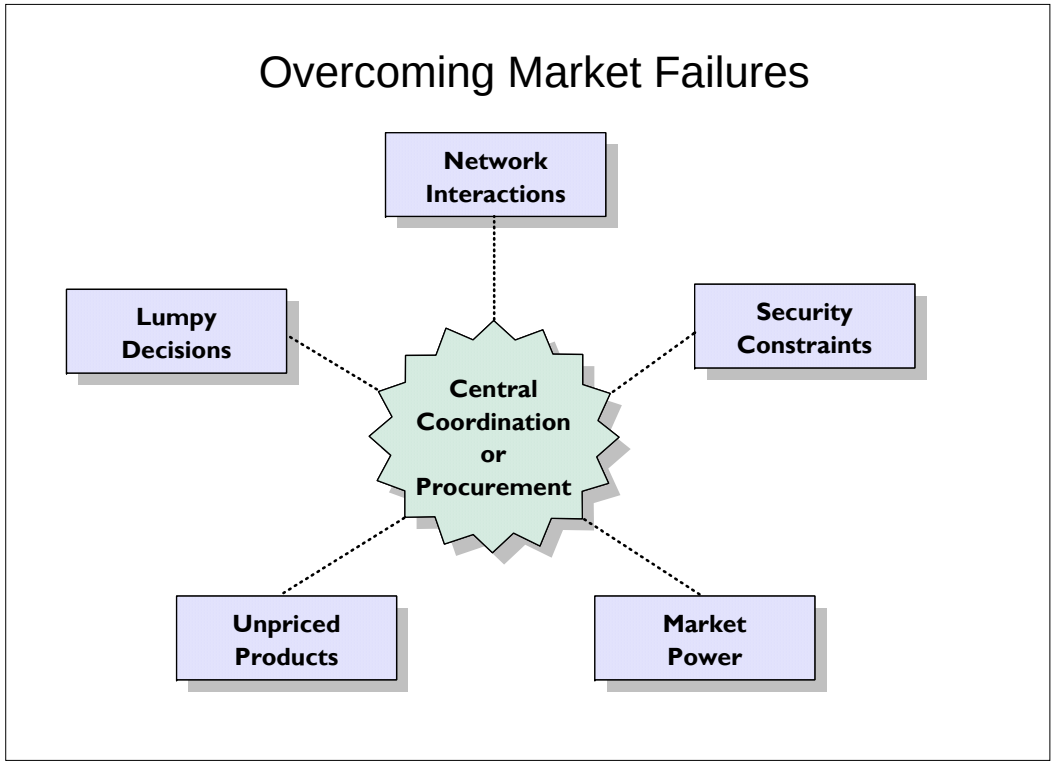
***But if true, what is the need for electricity restructuring and markets?***

**The 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 more intervention.**




**Intervene where needed, and know how to stop.** There are examples of interventions that overcome market failure without overturning the market.

## ELECTRICITY MARKET Overcoming Market Failure

**An analogy to environmental controls illustrates the tension. In the United States, not long ago there was no price on sulfur emissions. This was a market design failure. The incentives were wrong. There were two possible regulatory approaches to control sulfur emissions from coal plants, command-and-control or a market-based solution:**

- **Command-and-control. Mandate installation of scrubbers for all coal-fired power plants.**
    - o High cost.
    - o Low incentives for innovation.

- **Market-based approach. Establish cap and trade system for $SO_2$ at 50% of prior emission level.**
    - o Cost effective.
    - o Flexibility that allowed for innovation

**The "cap" feature was the intervention to overcome the market failure in sulfur emission allowance pricing. The "trade" feature allowed the emissions market to work where market participants could make most of the decisions on investments and controls. Although the problems are different, the principle of designing regulatory interventions to support markets should apply to electricity exchanges.**

**Ultimate success is an open question for the international experiment in using electricity markets for public purposes. The problems are neither new nor unique to one country.**

**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 Suedeen] 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.)

**Using electricity markets for public purposes …**

**From Boston MA**

"With deregulation, the theory went, enterprising power producers would foresee a shortage and, on their own, build or expand plants to fill the market need. … The theory hasn't worked. … There has to be a better way, and there is. ISO New England should conduct an auction in which power generators are invited to bid for the right to supply the new capacity, with the award going to the firm willing to do it for the lowest increase in rates. If this looks like a partial return to the old days of the regulated market, so be it." (The Boston Globe, Boston, MA, editorial, July 19, 2005.)

**Electricity restructuring to allow greater reliance on markets confronts two broad categories of policy terrain.**

- **Minefields**

  Entry, exit, governance, contracts, demand participation, fuel supply, environmental impacts, technology innovation, market power, competition policy, merger rules, cost allocation, customer choice, customer equity, settlements, transparency, liquidity, risk allocation, investment, etc.

The problems are not easy, but the main issues seem familiar from other contexts. Pragmatic, incremental approaches appear natural.

- **Chasms**

  Transmission access without "undue discrimination," coupled with the associated reliability rules, scheduling protocols, balancing requirements, capacity definitions, infrastructure investment, and long-term rights. Electricity is different.

The problems are not easy, and familiar or obvious solutions may be counterproductive or even dangerous. A small step or half a bridge will not cross the chasm.

**EPAct 2005 includes several provisions relevant to electricity restructuring. The "Electricity" section (Title XII) provides for an Electric Reliability Organization (ERO) with mandatory reliability standards for the entire grid. This was needed even without electricity restructuring.**

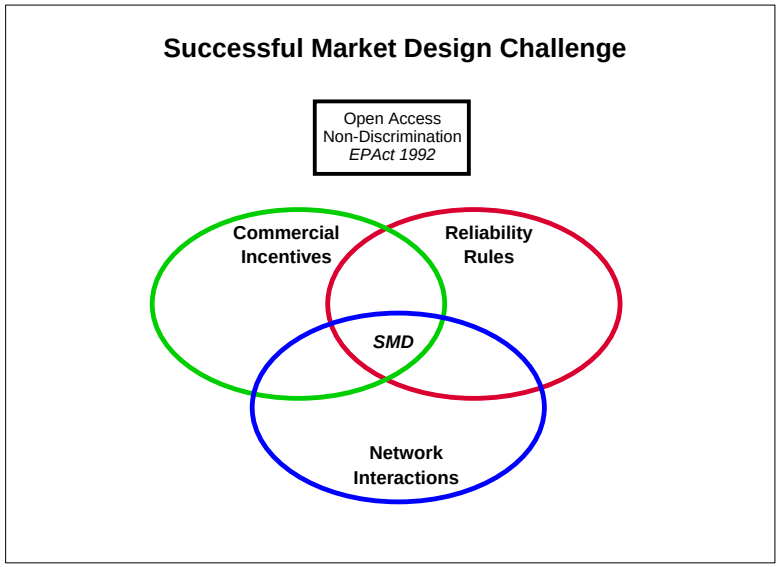
> Section 1211 (b) "JURISDICTION AND APPLICABILITY.—(1) The Commission shall have jurisdiction, within the United States, over the ERO certified by the Commission under subsection (c), any regional entities, and all users, owners and operators of the bulk-power system, including but not limited to the entities described in section 201(f), for purposes of approving reliability standards established under this section and enforcing compliance with this section. All users, owners and operators of the bulk-power system shall comply with reliability standards that take effect under this section." (EPAct 2005)

In North America all reliability standards for the interconnected grid have been voluntary. The new reliability mandate is the principal response to the Northeast Blackout of 2003. FERC has major new authority and an expansion of its jurisdiction beyond investor owned utilities. This is overdue, and could be big. But EPACT 2005 says too much, and defining reliability rules in a market context will not be easy.

> "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.)

**Seemingly independent issues have a common foundation that is both ubiquitous and unfamiliar.**

- Reliability rules
- Balancing requirements
- Scheduling protocols
- Transmission capacity definitions
- Transmission pricing
- Infrastructure investment
- Long-term transmission rights



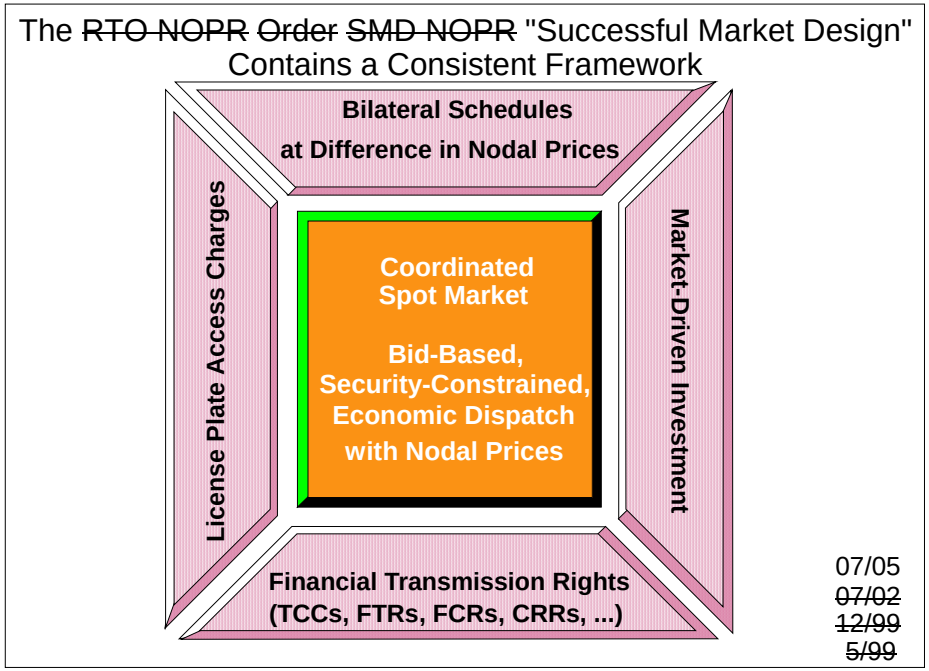

**The common foundation arises from the nature of network interactions. Different approaches arrive at a common solution. Successful Market Design (SMD) is the result, if not the objective.**

- Defining transmission capacity, or
- Creating transmission property rights, or
- Providing for "comparable," "non-discriminatory" scheduling and balancing rules, or
- Creating organized markets.

**The market cannot solve the problem of market design. One way or another, this task falls to regulators. And for wholesale electricity markets, the buck stops at the Federal Energy Regulatory Commission (FERC).**

The principles of transmission open access and non-discrimination underpinning Order 888 have major implications for market design. After many false starts, analysis and experience have converged on the necessary elements of market design. This is well understood.

"Successful Market Design" provides a workable framework that is working in places like New York, PJM in the Mid-Atlantic Region, New England, and the Midwest.



## ELECTRICITY MARKET Creating Organized Markets

**EPAct 2005 dropped an earlier provision banning the S******d M****t D****n rule. But this prohibition still conditions and constrains the discussion.**

~~*"The Commission's proposed rule making entitled ''Remedying Undue Discrimination through Open Access Transmission Service and Standard Electricity Market Design'' (Docket No. RM01–12–000) (''SMD NOPR'') is remanded to the Commission for reconsideration. No final rule mandating a standard electricity market design making, including any rule or order of general applicability within the scope of the proposed rulemaking, may … take effect before 20 December 31, 2006."*~~ (Language Removed from Energy Bill)

"Given the continuing development of voluntary RTOs and ISOs and the Commission's expressed intent to look into revisions to the Order No. 888 pro forma tariff in a separate proceeding, we have concluded that the SMD NOPR has been overtaken by events. Accordingly, we will exercise our discretion to terminate this proceeding." ( Federal Energy Regulatory Commission, Remedying Undue Discrimination through Open Access Transmission Service and Standard Electricity Market Design, Docket No. RM01-12-000, Order Terminating Proceeding, April 19, 2005, p. 3.)

"The Commission is issuing this Notice of Inquiry to seek comments on whether reforms are needed to the Order No. 888 pro forma open access transmission tariff (OATT) and to the OATTs of public utilities to prevent undue discrimination and preference in the provision of transmission services." (Federal Energy Regulatory Commission, Preventing Undue Discrimination and Preference in Transmission Service, Docket No. RM05-25-000, September 16, 2005, p. 1)

"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)

What could this mean?

## ELECTRICITY MARKET — Economic Dispatch

**As required by EPAct 2005, FERC launched regional boards to study electricity security constrained economic dispatch.**

> "(b) DEFINITION.—The term ''economic dispatch'' when used in this section means the operation of generation facilities to produce energy at the lowest cost to reliably serve consumers, recognizing any operational limits of generation and transmission facilities." (EPAct 2005, Sec. 1234.)

> ''SEC. 223. JOINT BOARDS ON ECONOMIC DISPATCH. ''(a) IN GENERAL.—The Commission shall convene joint boards on a regional basis pursuant to section 209 of this Act to study the issue of security constrained economic dispatch for the various market regions. The Commission shall designate the appropriate regions to be covered by each such joint board for purposes of this section." (EPAct 2005, Sec. 1298.)

> "Within one year, FERC shall convene regional joint boards under sec. 209 of the FPA to study security constrained [economic] dispatch in various market regions and submit to Congress a report on the recommendations of the joint boards. A member of the Commission will chair each board and participate. (sec. 1298)" (FERC Web Page on EPAct 2005 initiatives, http://www.ferc.gov/legal/maj-ord-reg/fed-sta/ene-pol-act.asp.)

Was this a Freudian slip?

## TRANSMISSION CAPACITY Definition

**Electricity restructuring requires open access to the transmission essential facility. A fully decentralized competitive market would benefit from tradable property rights in the transmission grid. However, the industry has never been able to define workable transmission property rights:**

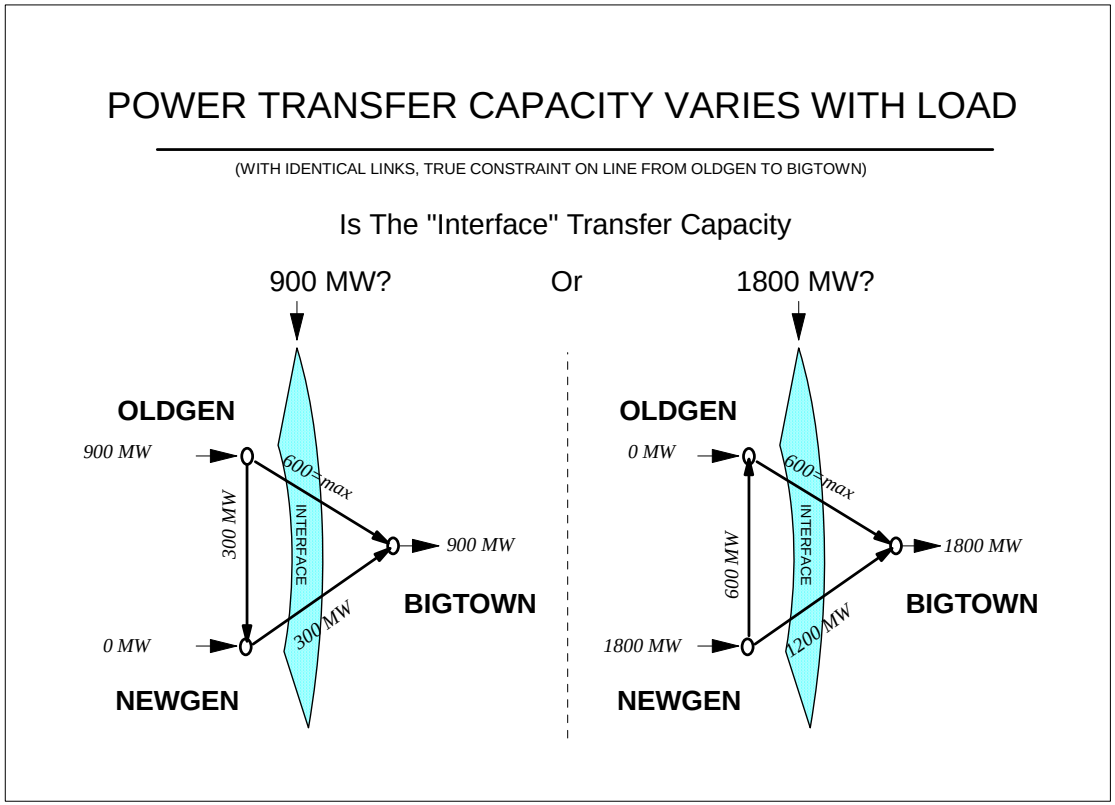
> "A primary purpose of the RIN is for users to learn what Available Transmission Capacity (ATC) may be available for their use. Because of effects of ongoing and changing transactions, changes in system conditions, loop flows, unforeseen outages, etc., ATC is not capable of precise determination or definition. "
>
> Comments of the Members of the PJM Interconnection, Request for Comments Regarding Real-Time Information Networks, Docket No. RM95-9-000, FERC, July 5, 1995, p. 8.

**The problems are not unique to the U. S. The same issue appears in any meshed network, as in Europe and the regulations from ETSO:**

> "Does the draft Regulation set the right objective when it requires TSOs to compute and publish transfer capacities? ETSO says both yes and no …in many cases the (Net transfer capacity or NTCs) may be a somewhat ambiguous information…The core of the difficulty raised by transfer capacities lies in the fact that they do not obey usual arithmetic: 'it makes no sense to add or subtract the NTC values…' Put it in other ways, in order to compute the maximal use of the network, one needs to make assumptions on the use of the network! This definition is restated and elaborated in ETSO (2001a) (p. 6)."
>
> J. Boucher and Y. Smeers, "Towards a Common European Electricity Market--Paths in the Right Direction…Still Far From an Effective Design," Belgium. September, 2001, pp. 30-31. (see HEPG web page, Harvard University)

**Electric transmission network interactions can be large and important.**

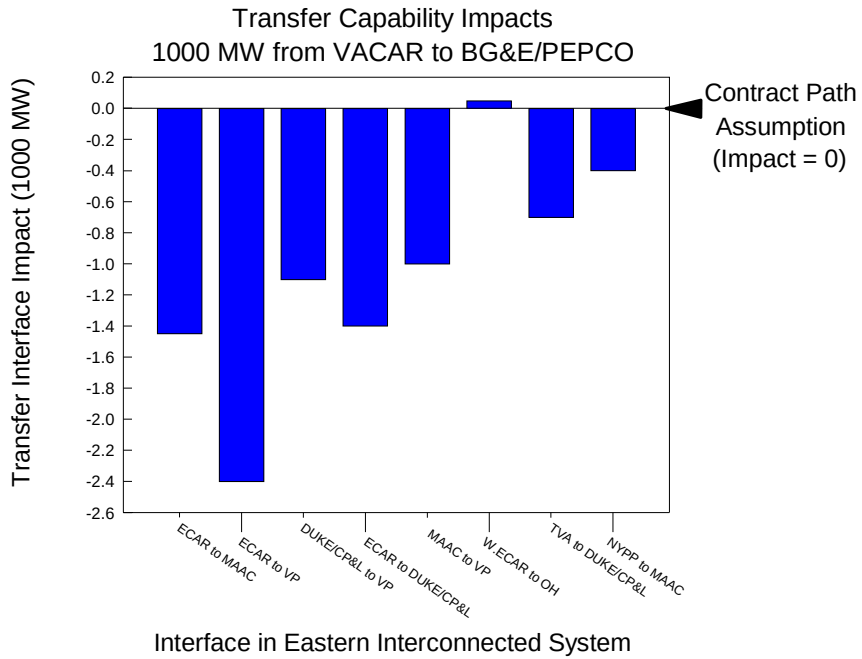
- Conventional definitions of network "Interface" transfer capacity depend on the assumed load conditions.
- Transfer capacity cannot be defined or guaranteed over any reasonable horizon.



# NETWORK INTERACTIONS — Loop Flow

**There is a fatal flaw in the old "contract path" model of power moving between locations along a designated path. The network effects are strong. Power flows across one "interface" can have a dramatic effect on the capacity of other, distant interfaces.**

## Transmission Impacts Vary Across the Eastern System




Source: VEM, Winter Operating Study, December 1993.

## ELECTRICITY MARKET Order 888 and the Contract Path

**Under Order 888 the FERC made a crucial choice regarding a central complication of the electricity system.**

> "A contract path is simply a path that can be designated to form a single continuous electrical path between the parties to an agreement. Because of the laws of physics, it is unlikely that the actual power flow will follow that contract path. … Flow-based pricing or contracting would be designed to account for the actual power flows on a transmission system. It would take into account the "unscheduled flows" that occur under a contract path regime." (FERC, Order 888, April 24, 1996, footnotes 184-185, p. 93.)

> "We will not, at this time, require that flow-based pricing and contracting be used in the electric industry. In reaching this conclusion, we recognize that there may be difficulties in using a traditional contract path approach in a non-discriminatory open access transmission environment, as described by Hogan and others. At the same time, however, contract path pricing and contracting is the longstanding approach used in the electric industry and it is the approach familiar to all participants in the industry. To require now a dramatic overhaul of the traditional approach such as a shift to some form of flow-based pricing and contracting could severely slow, if not derail for some time, the move to open access and more competitive wholesale bulk power markets. In addition, we believe it is premature for the Commission to impose generically a new pricing regime without the benefit of any experience with such pricing. We welcome new and innovative proposals, but we will not impose them in this Rule." (FERC, Order 888, April 24, 1996, p. 96.)

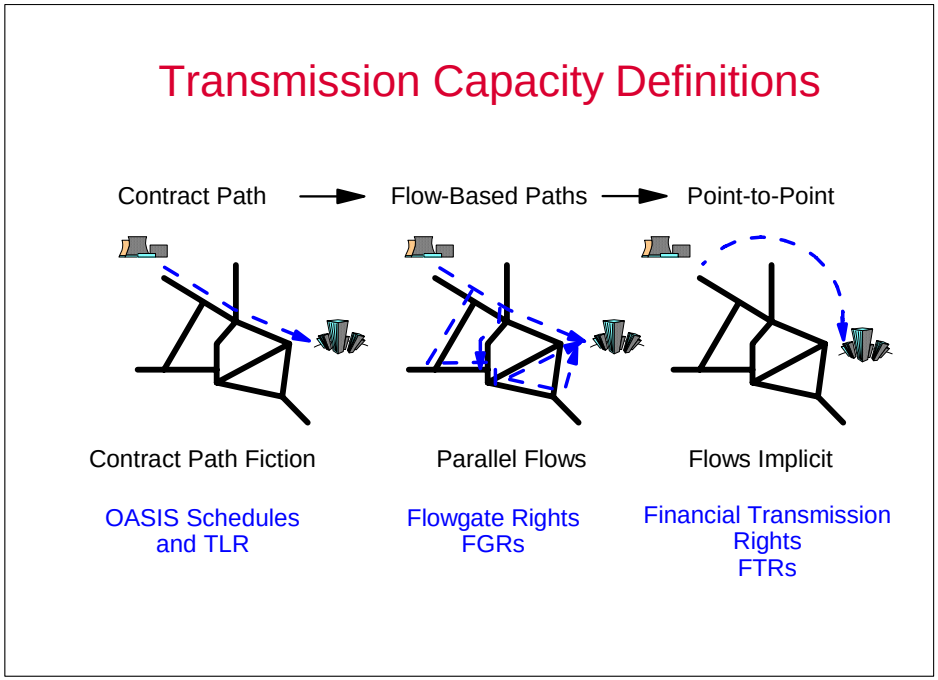
**Hence, although the fictional contract path approach would not work in theory, maintaining the fiction would be less disruptive in moving quickly to open access and an expanded competitive market!**

**Order 888 would not work in theory, but might it work in practice? The CRT provided striking evidence that FERC knew there was a serious problem.**

**Capacity Reservation Tariff (CRT), 1996.** A new model, on the same day as Order 888 (April 24, 1996).

> "The proposed capacity reservation open access transmission tariff, if adopted, would replace the open access transmission tariff required by the Commission ..."[1]

The new model outlined in the CRT moved away from the contract path to embrace point-to-point rights. The CRT was roundly rejected by industry, and received little support. But it was to reappear, again and again.




**NERC Transmission Loading Relief (TLR), 1997.** The reliability watchdogs saw the impending problem and soon created the unscheduling system to complement the contract path scheduling required under Order 888.

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

## TRANSMISSION CAPACITY Definition

**The 2005 FERC inquiry into Available Transfer Capability (ATC) characterizes the problem primarily as one of standardization.**

> "Transmission providers have incentives to understate ATC on those paths valuable to power sellers that are competitors to a transmission provider's own (or its affiliate's) power sales. The lack of clear and consistent methodologies for calculating ATC can allow transmission providers the discretion to control the transmission system to favor their own power sales or those of their affiliates. ATC can vary considerably depending on the criteria they use to calculate it and the order in which the calculations are made. Although the Commission has required transmission providers to post the formula for calculating ATC, the transmission provider has sole responsibility for, and a great deal of discretion in, its calculation. More rigorous and consistent standards and procedures for ATC calculations would help ensure that transmission providers' exercise of discretion in their calculation of ATC does not result in undue discrimination with respect to interstate transmission."

FERC, "Information Requirements for Available Transfer Capability," Notice of Inquiry, Docket No. RM05-17-000, May 27, 2005, p. 6

**Standardization would be useful. But the lack of common rules is a symptom of a deeper problem. The deeper problem is conceptual. FERC wants total transfer capability to determine transmission use. But transmission use determines total transfer capability. The definition is circular.**

**Providing a coherent definition of ATC, independent of usage, is not simply difficult—it is a contradiction in terms.**

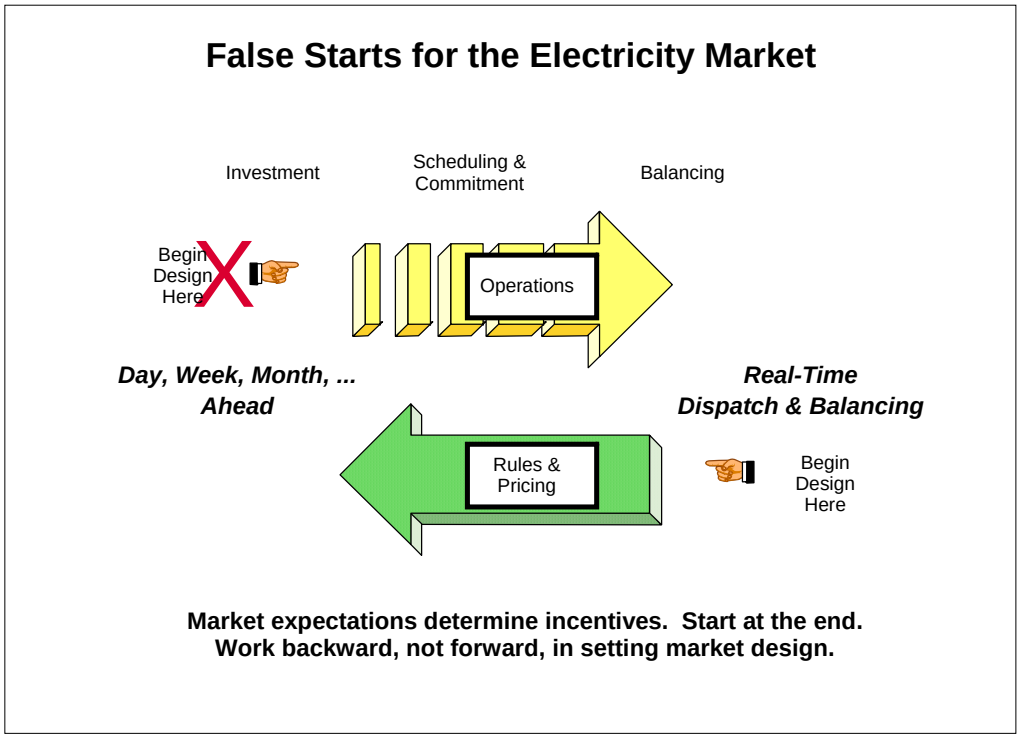
## TRANSMISSION CAPACITY Definition

**The problem of defining transmission capacity is conceptual. Transmission transfer capability cannot be defined independent of use. This conceptual conundrum is not new and it is not going away.**

> "The Transfer Capability between two areas is typically assessed or determined by modeling a generation excess in the "from" area at a specific source point(s) and a generation deficiency in the "to" area at a specific sink point(s). The increased source level at which the loading on a transmission element is at its normal rating (with no contingencies) or its emergency rating (with an outage of a generation unit or a transmission element) is be defined as the incremental Transfer Capability.
>
> Selection of the specific source and sink points will impact the calculated 'power transfer distribution factors' and various transmission facility loadings to determine the AFC/ATC values and to determine the anticipated impact of a Transmission Service Request on specific Flowgates. Therefore, the posted AFC/ATC, as well as the evaluation of a transmission service request, is greatly influenced by the selection of these points. Transmission service sold based on a set of source/sink points that do not correspond to the generation that moves for the schedule results in inaccurate ATC values."
>
> NERC, "Long-Term AFC/ATC Task Force Final Report," Revised April 14, 2005, Appendix B, P. 1

# ELECTRICITY MARKET — Focus on Balancing Markets First

**The solution to open access and non-discrimination inherently involves market design. 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.**



**System operators must perform certain functions in any electricity system.**

- **Balancing**

To maintain frequency, electricity system must maintain essentially instantaneous balance between generation and load plus thermal losses.

- **Dispatch**

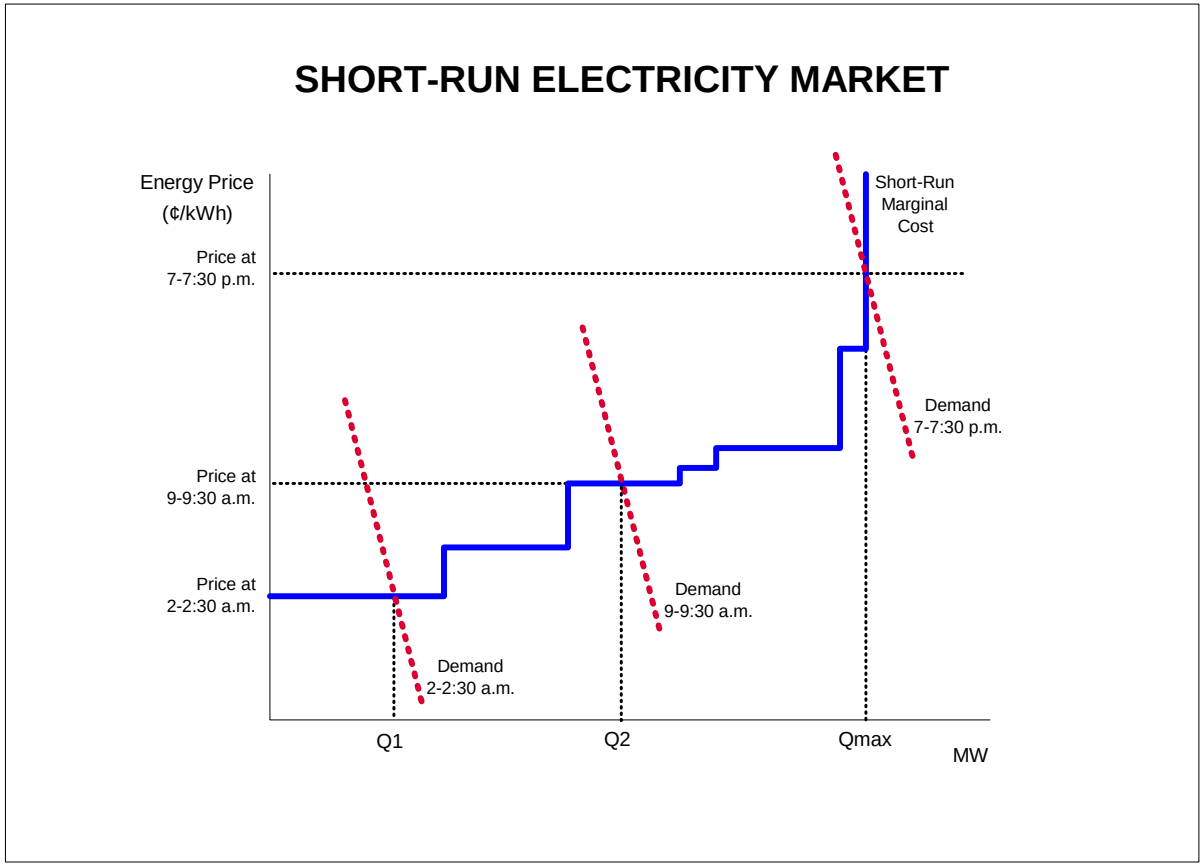
To achieve this balance, the system operator adjusts flexible generating plants and loads. Whether this is described in terms of dispatch, net dispatch, or redispatch relative to schedules, the result is the same.

- **Security constrained dispatch.**

Transmission limits and other constraints restrict the dispatch choices available to the system operator. Many of the constraints depend on possible contingencies, and the dispatch must be set so that power flows would still be feasible in the event of the contingency. This inherently requires calculation and central coordination. The constraints cannot be monitored by observing only the state of the system.

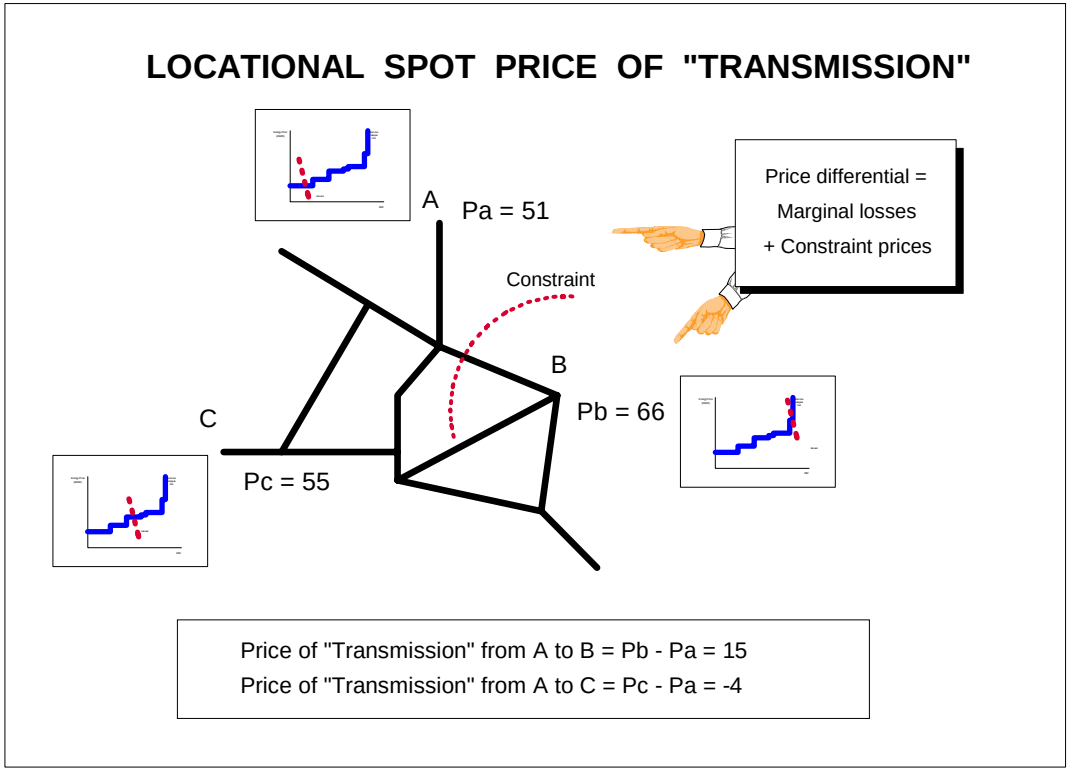
**These requirements existed before electricity restructuring, and continue in the context of electricity markets. In addition, system operators have traditionally considered cost in order to achieve a security constrained economic dispatch. This is not new.**

**Economic dispatch is equivalent to efficient market equilibrium. 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.**



**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.



**The system operator must provide a security constrained dispatch function. Three questions remain. Just say yes, and the market can decide on the split between bilateral and coordinated exchange.**

- **Should the system operator be allowed to offer an economic dispatch service for some generating plants?**

The alternative would be to define a set of administrative procedures and rules for system balancing that purposely ignore the information about the costs of running particular plants. It seems more natural for the system operator to accept bids and provide an economic dispatch for some plants.

- **Should the system operator apply marginal cost prices for power provided through the dispatch?**

Under an economic dispatch for the flexible plants and loads, it is a straightforward matter to determine the locational marginal costs of additional power. These marginal costs are also the prices that would apply in the case of a perfect competitive market at equilibrium. In addition, these locational marginal cost prices provide the consistent foundation for the design of a comparable transmission tariff.

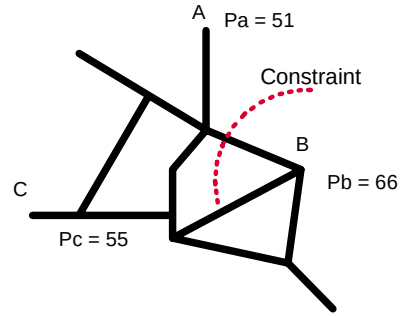
- **Should generators and customers be allowed to participate in the economic dispatch offered by the system operator?**

The natural extension of open access and the principles of choice would suggest that participation should be voluntary. Market participants can evaluate their own economic situation and make their own choice about participating in the operator's economic dispatch or finding similar services elsewhere.

# NETWORK INTERACTIONS Financial Transmission Rights

**A mechanism for hedging volatile transmission prices can be established by defining financial transmission rights (FTR) to collect the congestion rents inherent in efficient, short-run spot prices. The FTRs do not depend on actual transmission usage. This resolves the internal contradiction in providing workable definitions of ATC and associated long-term transmission rights.**

## NETWORK TRANSMISSION FINANCIAL RIGHTS




Price of "Transmission" from A to B = Pb - Pa = 15
Price of "Transmission" from A to C = Pc - Pa = -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.

## 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").**

- 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.

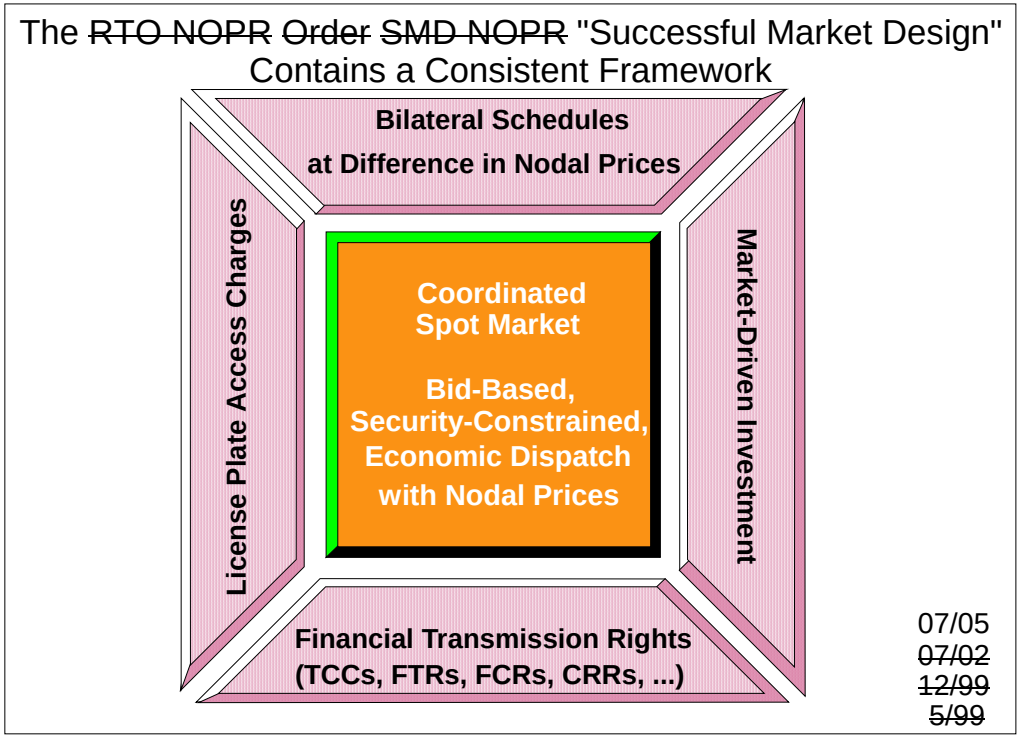
- Available Transfer Capability (ATC) calculations required for the contract path model are not well defined. The problem is conceptual and not just a requirement for better information. Hence, ATC estimates are arbitrary and controversial. By contrast, the point-to-point financial transmission rights 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.

## ELECTRICITY MARKET — A Market Framework

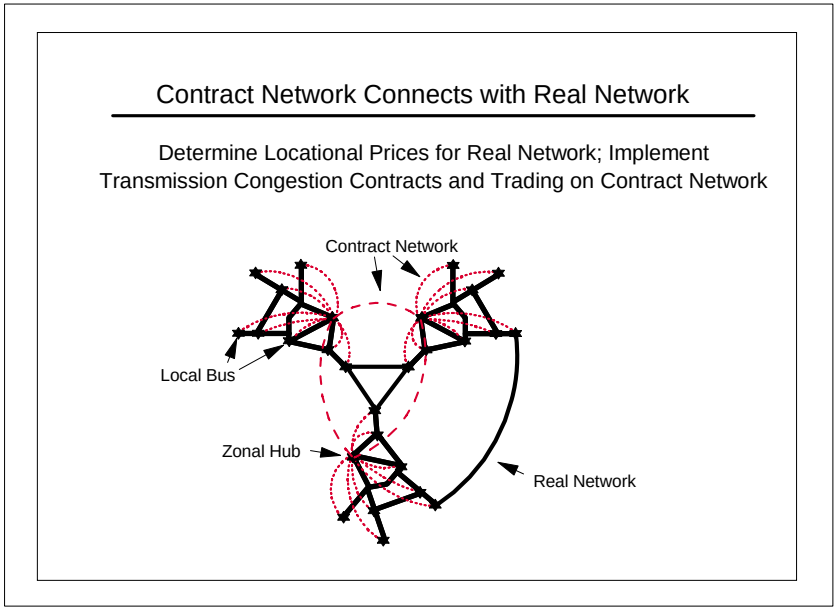
**The example of successful central coordination, ~~CRT, Regional Transmission Organization (RTO) Millennium Order (Order 2000) Standard Market Design (SMD) Notice of Proposed Rulemaking (NOPR),~~ "Successful Market Design" provides a workable market framework that is working in places like New York,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




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

**Locational pricing provides a sound foundation for a competitive electricity market. However, having different prices at every location appears complex. Can the market operate with a simpler system? Yes, the hub and spoke model works in theory and in practice.**

Locational marginal cost pricing lends itself to a natural decomposition. For example, even with loops in a network, market information could be transformed easily into a hub-and-spoke framework with locational price differences on a spoke defining the cost of moving to and from the local hub, and then between hubs.



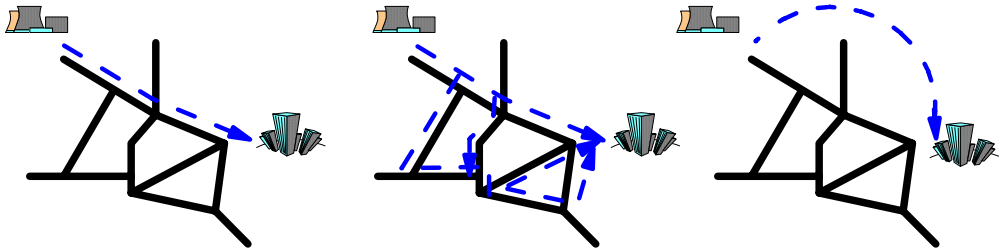

Creation or elimination of hubs would require no intervention by regulators or the ISO. New hubs could arise as the market requires, or disappear when not important. A hub is simply a special node within a zone. The ISO still would work with the locational prices, but the market would decide on the degree of simplification needed. However, everyone would still be responsible for the opportunity cost of moving power to and from the local hub. There would be locational prices and this would avoid the substantial incentive problems of averaging prices. This system works (and is working in AR, NZ, PJM, NY, NE, MISO, …) to simplify without distorting locational prices.

## ELECTRICITY MARKET — Too Many Paths, Too Many Flowgates

**The path-based and flowgate models fail not in principle but in practice. There are too many paths and too many flowgates to operate the electricity system by trading physical rights.**

### Transmission Capacity Definitions

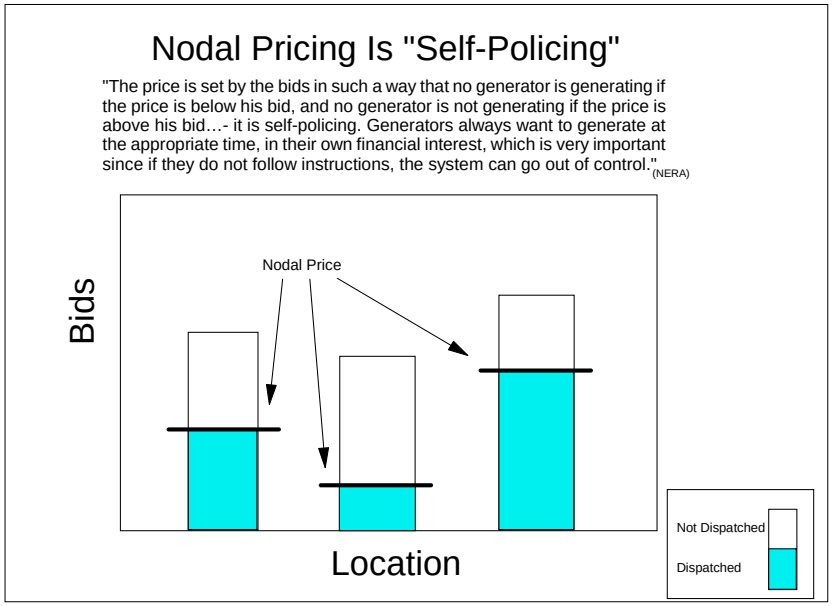
Contract Path → Flow-Based Paths → Point-to-Point

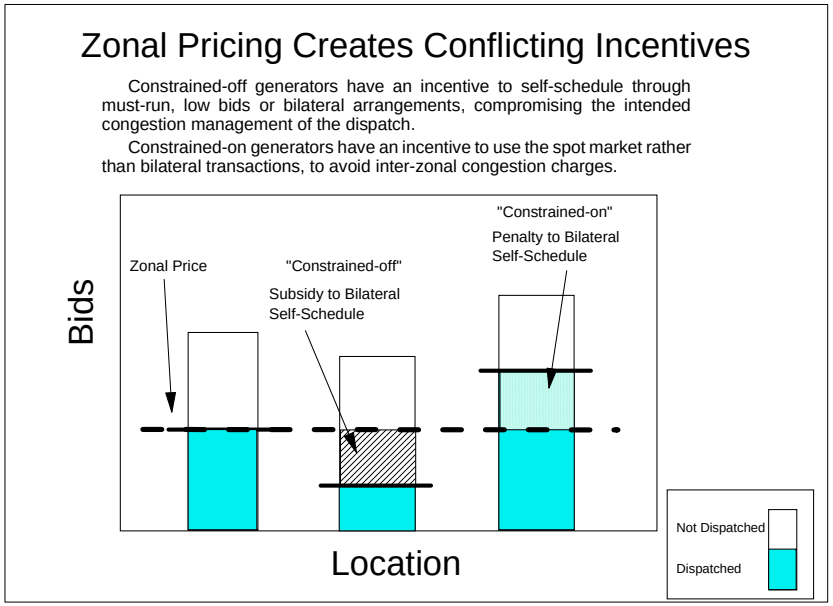


| Contract Path Fiction | Parallel Flows | Flows Implicit |
|---|---|---|
| OASIS Schedules and TLR | ~~*Physical*~~ Flowgate Rights FGs<br>*Financial* FG-FTRs | Financial Transmission Rights PTP-FTRs |

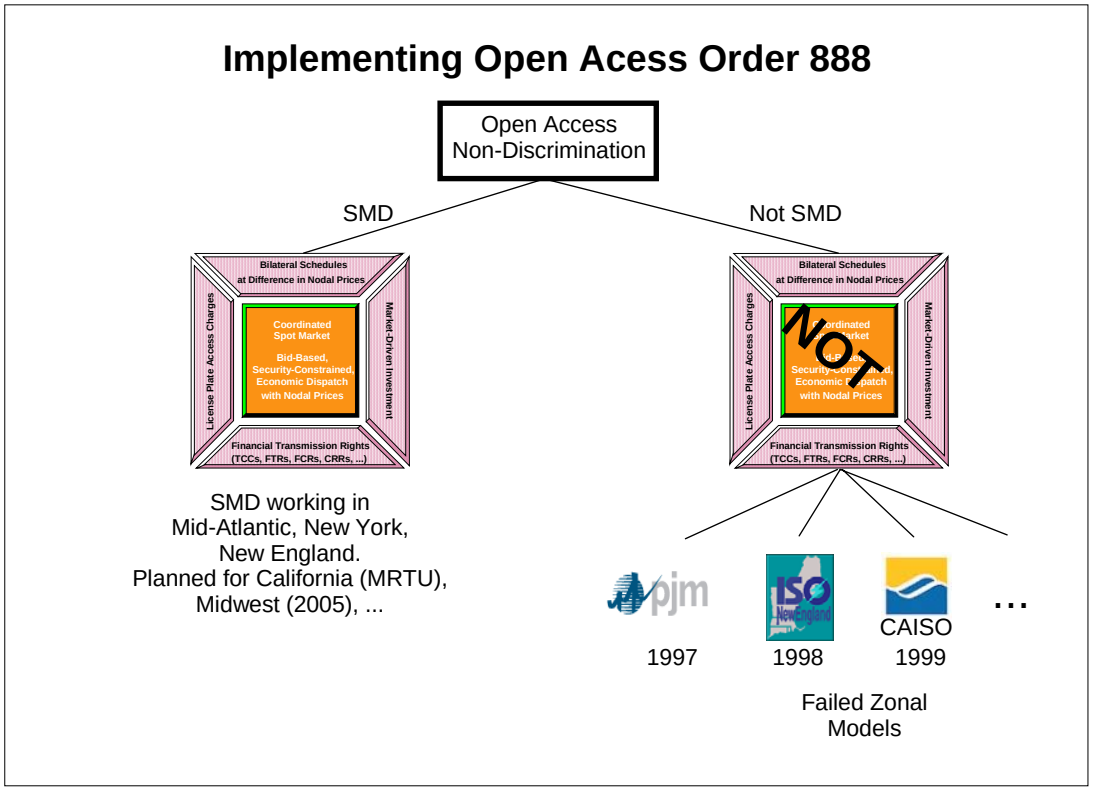
Obligations and Options

**The LMP model appears complex with many locations and many different prices. A common approach is to aggregate into a "few" zones. This creates conflicting incentives.**



**The basic simplification of zonal models allows many possible implementations. The details matter, but only in determining the details of the ultimate failure.**




**If there are many different LMPs, pretending there are a few zones is more self-deception than simplification. Many attempts to create workable, highly aggregated zonal models have failed.**

**The California experience with congestion management and a zonal model is instructive.**

**California CMR, 1999.** From "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."[2]

**In January 2002, the CAISO addressed the contradictions of the "simplified" design.**[3]

> "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)

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[2] 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.

[3] CAISO proposal, "Market Design 2002 Project: Preliminary Draft Comprehensive Design Proposal," January 8, 2002.

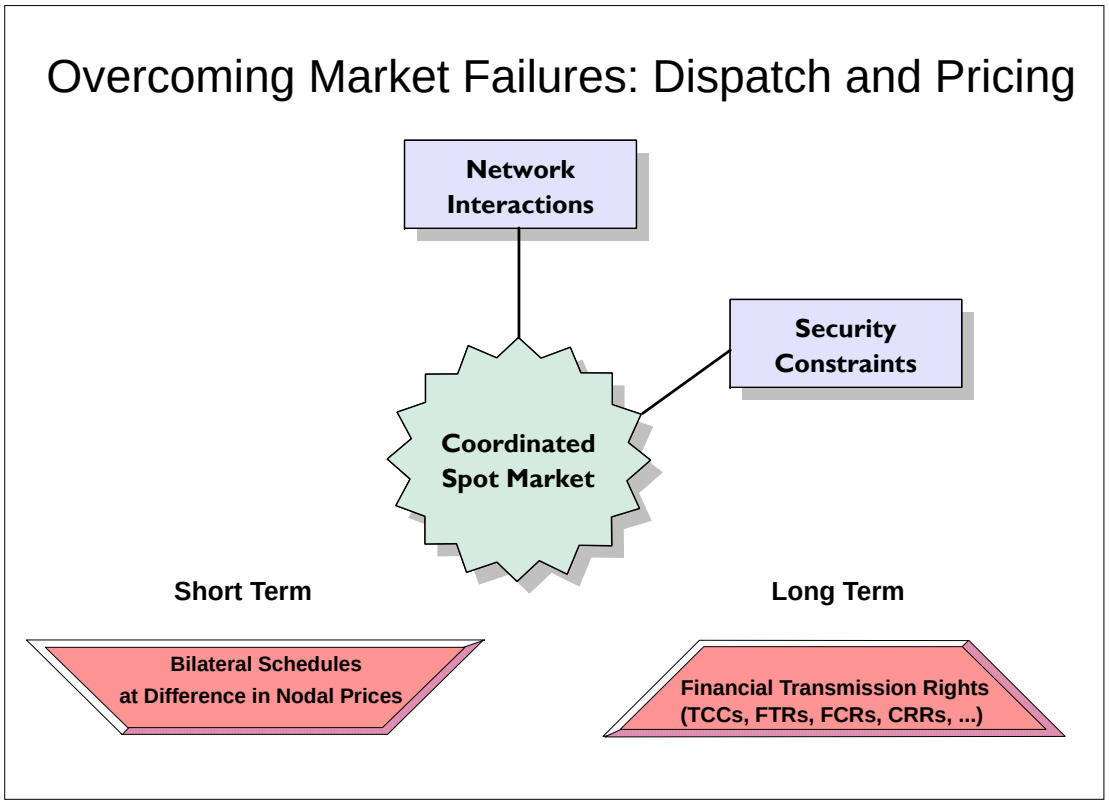
**The problems with zonal models are well known and often repeated. For example, see the experience in ERCOT:**

"The results in this area of the report confirm prior findings in the 2003 SOM Report and the Market Operations report that:

- the vast majority of congestion in ERCOT is intrazonal, which is difficult for loads to hedge and is not transparent;
- the current zonal market can result in large inconsistencies between the interzonal flows calculated by SPD and the actual flows over the CSC interfaces; and
- these inconsistencies can result in under-utilized transmission capability and difficulties in defining transmission rights whose obligations can be fully satisfied.

The most complete long-run remedy for both the interzonal and intrazonal issues identified in this report would be to implement nodal markets, an option that is currently being evaluated in ERCOT. These markets would provide transparent prices for both generators and loads that would fully reflect all transmission constraints on the ERCOT network." (Potomac Economics, Ltd., 2004 State of the Market Report for the ERCOT Wholesale Electricity Markets, July 2005, p. xxv)

**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 coordination not required for CFDs for energy.

**Frustration with electricity restructuring raises calls for reform of open access and efforts to develop 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.

Under the conceptual umbrella of revisiting the ideas of open access and Order 888, one appeal is to consider alternatives to the recent FERC policies regarding Regional Transmission Organizations (RTOs):

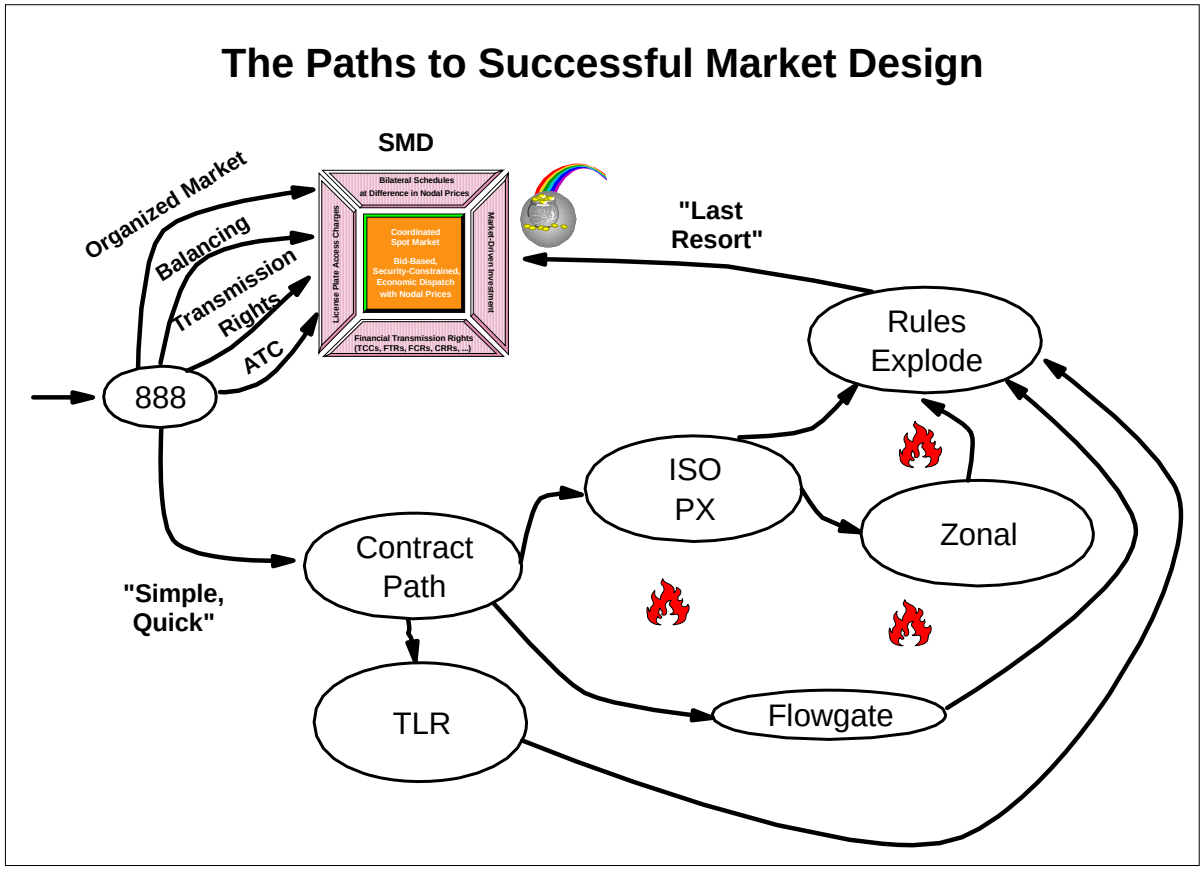
> **"… it should not be assumed that RTOs are the only, or even the preferred, mechanism available to ensure competitive wholesale power markets."**[4]

A competing formulation might be put as:

> **"… it should not be assumed that RTOs are *not* the only, or even the preferred, mechanism available to ensure competitive wholesale power markets."**

[4] American Public Power Association, Restructuring at the Crossroads: FERC Electricity Policy Reconsidered, Washington DC, December 2004, p. 14.

**Turning away from Successful Market Design is either turning away from open access, or embarking on a painful and circuitous route. With its core elements, SMD is the only design that works both in theory and in practice. Market design is not a distraction from Order 888. Faithfulness to the mandates of open access and non-discrimination leads to SMD.**



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