Lessons Learned from Past Electricity Market Design Models and Road Map for the Next Generation Design Models

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Panel: Next-Generation Electricity Market Models and Regulatory Developments
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Outline

- Evaluation of Organized Power Markets
- Unanticipated Developments
- Lessons learned from Organized Power Markets
- RTO/ISO Incentives
- EPACT 2005 Transmission Developments
- Road Map for Future Market Evolution
- Revisiting the Goals of Restructuring
Various Organized Markets for Power

- **Pools** – Britain (until 2001), Chile, Alberta, Argentina, Columbia, Singapore
  - **Central Optimization**
    - New Zealand = unregulated legal cartel
- **Bifurcated** – NY, PJM 60% bilateral **Self-Scheduled**
  - 40% **Dispatched voluntarily**
  - Bilaterals include vertically integrated utilities who self-schedule
- **Exchanges** – NordPool, Australia, Spain, Poland, (Texas, Ontario)
  - Market Clearing, Self-Scheduling
- **Bilateral 100%** – Britain (since 2001)
These designs “can work” but the bifurcated structure will likely become part of a standard design

- large bilateral segment + optimized voluntary segment
- voluntary unit commitment & continuing dispatch control

POOL designs may be obsolete
- Britain abandoned it

Separate EXCHANGES may not be viable
- PX in California and Poland had insufficient volume

Market clearing by the ISO works: NordPool, Australia, Spain

BILATERAL markets appear sufficient, and may becoming dominant
- Works in Britain & works in gas markets
- Renewed interest in pay-as-bid pricing mechanisms
Many Markets for Transmission

- **Transco's (ITCs):** Britain, NordPool, Poland, NZ, Chile
  **U.S.:** Midwest, Southwest (proposed)

- **System Operators:** Australia, Canada [power pools]
  **U.S.:** California, Texas, New England, NY, PJM, ...

- **Single Pricing** – Britain, Spain, Sweden
  **Operator (TSO) pays cost of eliminating congestion**

- **Zonal Pricing** – NordPool, Australia, California, Texas
  **TSO charges marginal cost of interzonal congestion**
  - Explicit market for adjustments to alleviate congestion
  - Southwest proposes selling firm rights to flowgates

- **Nodal Pricing** – NY, PJM, NZ, NE, to be implemented in California in 2007 and in Texas in 2009

  **TSO charges marginal cost at every substation**
Evaluating Transmission Markets

- **SINGLE PRICING** – Some argue that ample $Tx = \text{Public Good}$
  - Better reliability, more competitive and liquid energy markets
  - TSO can procure adjustment services via long-term contracts as in Britain, Sweden, ... *if congestion is infrequent*

- **ZONAL PRICING** – Proponents argued for commercial simplicity, but with increased congestion anything but simple
  - It is under attack – California is abandoning it
  - The “DEC Game” in California (and now Texas) appears fatal

- **LOCATIONAL/NODAL PRICING** – Preferred method of clearing transmission in the US
  - Financial transmission rights and hedges are needed
Unanticipated Developments

- Retail competition is a minor factor
  - Demand-side programs are small
  - Rates are regulated & capped
  - Utility’s default service obligation remains very important

- Wholesale competition is imperfect – “gaming” still a problem
  - Market power is significant; Prices are volatile

- Risk management is a major problem – “vertical” buffer lost
  - Development of financial markets hindered – prudency reviews killed financial hedging
  - Forcing utilities to trade in PX – killed long-term contracts
  - Long-term bilateral contracts play the key role
Unanticipated Developments

- ISO’s role is vastly larger and very critical
  - Unit commitment and continuing dispatch control
  - Congestion management
  - Involved in planning transmission investments
  - Provision of reserves and reliability-must-run resources
  - Its real-time balancing market drives all other markets
Lessons About Power Market Organization

- **Power Markets are very complicated**
  - Forward & real-time markets, bilateral contracts & market clearing
  - Markets for energy & transmission & reserves & ...

- **Prices are highly volatile, financial hedges are necessary**
  - Vertical disintegration exposes a utility to wholesale prices

- **Gaming remains a problem – many rules can be gamed**
  - Careful design is absolutely necessary – no loopholes!

- **Market Power is a major problem, both in general and:**
  - Reliability-must-run units pose difficulties
  - Scarcity makes every supplier a monopolist (pivotal suppliers)
Lessons About Power Market Organization

- **Integration of energy, transmission, & reserve markets**
  - CA’s separation of PX from ISO & unbundled pricing of energy and transmission was well-intentioned [Joskow & Schmalensee, 1983]
    - But power markets are too complicated and fragile to deal with this further complication
    - Integration can lead to short term efficiencies

- **Scope** – Larger regional systems are needed (RTOs)
  - Energy markets and transmission management are regional
    - Conflicts between federal and state jurisdictions need resolution
Lessons About Power Market Organization

- **Divestiture requirements should be limited**
  - Most systems should retain some vertical integration: PJM, Texas
  - Regulatory requirement for contract cover

- **Hedging must accompany vertical disintegration**
  - Vesting supply contracts can be part of asset sales
  - Physical: long-term contracts, options on capacity, etc.
  - Financial: FTRs, contracts for differences, futures, options, etc.

- **Default service obligation must be restructured**
  - Pass through of wholesale costs – as is true for gas!
  - Development of price-responsive demand
Lessons About Power Market Organization

- **Governance – ISOs, RTOs are imperfect**
  - In practice can be bureaucratic, with weak incentives and difficulties managing stakeholder conflicts and regulatory relations

- **Outside the U.S., the Transco model may perform better (like gas in U.S.)**
  - Transcos are the proposed form in Southwest
  - Britain’s performance-based regulation of NGC may be the best model to follow
Alternative Transmission Models

- **RTO/ISO (US)**
  - Non-profit entity operates the grid and market
  - Assets owned by utilities, ITCs
  - Allocates existing transmission
  - Limited ability to expand
  - No incentives, no capital on line
  - Monitors markets
  - Answers to regulators, stakeholders, independent boards
Alternative Transmission Models

- **Transco (UK & Spain)**
  - Profit-making corporation without generation/distribution owns and operates grid
  - Plans and finances all expansion
  - Expected to accommodate customers, reduce congestion
  - Regulatory incentives to operate more efficiently
  - Answers to customers, shareholders, regulators
RTO Performance Metrics

- Magnitude of uplifts
- Efficient utilization of the grid
- Frequency of price revisions
- Frequency of tariff changes
- Compliance with NERC standards
- Accuracy of settlements
- Client focus
Road Map for the Future

- Failed market design elements:
  - Zonal pricing (PJM, New England, UK, California)
  - Sequential markets for energy and ancillary services
  - One settlement system
  - As-bid pricing
  - Failure to effectively address market power
Road Map for the Future

- **Key features of well-designed, time-tested markets:**
  - Development of Centralized Spot market/dispatch processes that reflect more, not less, of reality is necessary
  - Allow market clearing prices, including scarcity rents
  - Resulting market prices should internalize more, not less, the network externalities
  - Locational Marginal Pricing (LMP) is an integral part of successful markets in transmission constrained markets
  - Effective market power mitigation
  - Transmission network access service
  - Foster demand bidding (resolve two main problems: 1) Lack of metering and RT billing, and 2) Lack of RT central control of power flow to specific customers)
Road Map for the Future

- Key features of well-designed, time-tested markets:
  - Need Full Network Model to price all system and network constraints
  - Need Unit Commitment to ensure Reliability and commit resources to meet next day’s peak demand
  - Congestion Revenue Rights (CRRs)
  - Allow self-scheduling and encourage LSEs to enter into long-term commitments and hedging agreements
  - Resource Adequacy and capacity markets
  - Transmission Investment and Transmission Pricing Reform
Resource Adequacy

- **Generation**
  - It is now obvious that we need capacity & availability requirements
    - Painful recognition: restructuring delays needed investment
    - ICAP markets, options on capacity, etc.
    - Energy only markets cannot determine what level of operating reserves should be required; the policy maker needs to set the demand curves
    - Capacity markets resolve the “missing money” problem (The RA insurance premium for a 30,000 MW system may run $2 billion per year, for a 50,000 MW system may be as high as $4 billion per year)
Resource Adequacy

- Various approaches fall into 3 main categories:
  - Energy-only schemes with options or administratively set RA goals
  - Capacity markets of some sort
  - Convergent schemes which combine elements of the above
Resource Adequacy

**Transmission**
- Every non-Transco system has inadequate authority & planning
- Substitution & complementarity with generation is now very complicated
  - Mitigating market power is a major factor
- Utilities or ISOs should own RMR units
Resource Adequacy

- Reserves
  - Deficiencies (fast-start, load following) due to distorted incentives
  - Reliability criteria need revision

- Demand-Side now seen as a major resource
  - Price-responsive loads must be developed – before restructuring!
  - Some pass-through of wholesale prices is inevitable (like gas in CA)
US Transmission Grid Needs Improvement

- US investments are falling behind the rest of the world
- US investments are not keeping up with needs
- Congestion is still generally rising
  - PJM congestion costs per MWh have increased on average 64% per year over the period 1999-2004
  - NY congestion costs have increased on average 50% per year between 2001-2003
Energy Policy Act of 2005

- Transmission related provisions
  - Reliability Standards
  - Electric Reliability Organization (ERO)
    - Certified by FERC
    - Develops standards subject to FERC approval
  - DOE designation of “National Interest Electric Transmission Corridors”
  - Allows FERC backstop siting authority
Energy Policy Act of 2005

- Transmission related provisions
  - Provides for Incentive-Based Rates
    - Promotes capital investment “regardless of ownership”
    - Provides a return that attracts new investment
  - Provides long-term FTRs for native load
Long-Term FTRs for LSEs

- FERC should enable LSEs to secure FTRs on a long-term basis for long-term power supply arrangements
  - LT FTRs must be made available to those who pay for the upgrades and should be sufficient to hedge long-term power supply arrangements
  - LT FTRs should afford priority to LSEs to meet a retail service obligation
  - Initial allocation should not require participation in an auction
Revisiting the Goals of Restructuring

- The key driver of power market reform was not to achieve improved dispatching of power plants.
- The key goal was to improve investment decisions, reduce risks to consumers by assigning them to private investors and to encourage better operational performance.
To achieve the central objective of restructuring the following three problems need to be resolved:

- The quantity problem (the RA problem)
- The quality problem (trade off of costs and plant characteristics)
- The performance problem (existing plants should be operated and maintained efficiently)
Brief Presenter Biography

Dr. Alex Papalexopoulos is president and founder of ECCO International, an Energy Consulting Company that provides consulting services and expert advice on electricity market design, power systems, energy management systems and software issues within and outside the U.S. to a wide range of clients such as Regulators, Governments, Utilities, Independent System Operators and Regional Transmission Operators, Power Exchanges, Marketers, and Brokers. ECCO International is currently involved in various energy restructuring projects around the world including North America, Europe, and South America. Prior to forming ECCO International in 1998, Alex was a director of the PG&E’s Electric Industry Restructuring Group in San Francisco, California. He has made substantial contributions in the areas of network grid optimization and pricing, ancillary services, congestion management, competitive bidding, forward and real-time energy markets and implementation of EMS applications and real time control functions and forecasting. Dr. Alex Papalexopoulos received the Electrical and Mechanical Engineering Diploma from the National Technical University of Athens, Greece in 1980, and the M.S. and Ph.D. degrees in Electrical Engineering from the Georgia Institute of Technology, Atlanta, Georgia in 1982 and 1985, respectively. He has published numerous scientific papers in IEEE and other Journals. He is the 1992 recipient of PG&E's Wall of Fame Award, and the 1996 recipient of IEEE’s PES Prize Paper Award. Dr. Papalexopoulos is a Fellow of IEEE.