Managing Unilateral Market Power in Electricity

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Outline of Talk

- Why electricity markets need regulatory oversight beyond that provided by competition law
  - Markets are extremely susceptible to exercise of market power
    - Local and system-wide market power
    - Large wealth transfers in short period of time
    - Restructuring not deregulation, particularly in US
- Responsibilities of Market Monitor
  - Smart “Sunshine” regulation
  - Ensuring compliance with market rules
  - Protecting against behavior harmful to system reliability and market efficiency
- Guidelines for enforcing market rules
- Suggested process for determining behavior detrimental to system reliability and market efficiency
- Coordinating anti-trust and regulatory oversight
Spot Electricity Markets

• Characteristics of product make it very difficult to have a workably competitive spot market
  – Supply must equal demand at every instant in time and location in the network
  – Very costly to store electricity, particularly in fossil-fuel based systems
  – Delivery of product must take place through potentially congested transmission network
  – How product is historically priced to final consumers makes wholesale demand perfectly inelastic
  – Production subject to severe capacity constraints
  – Historically, average cost of production favors construction of large facilities
  – Concentration of generation ownership in small geographic areas

Local Market Power Problem

• Transmission network was built for former vertically integrated utility regime
  – Built to take advantage of fact that both transmission and local generation can each be used to meet an annual local energy need
    • Captures economies of scope between transmission and generation
  – Vertically-integrated utility considered local generation and transmission on equal basis to find least-cost system-wide solution to serve load
  – Transmission capacity across control areas of vertically-integrated monopolists built for engineering reliability
    • Sufficient transmission capacity so imports could be used to manage large temporary outages within control area
    • Few examples where transmission capacity was built to facilitate significant across-control-area electricity trade--California/Oregon
Origins of Local Market Power

• Wholesale market has independent system operator (ISO) to allocate transmission network capacity
  – Transmission network poorly suited to wholesale market regime
  – Owner of local generation financially independent of ISO
    • In both short-term and long-term, ISO cannot take advantage of economies to scope between transmission and generation that current transmission network was designed to utilize
    • Local generators have strong incentive to cause transmission constraints under ISO regime
      – Raise local prices for energy (either by withholding capacity or bidding high prices) to cause congestion under ISO regime
      – This strategy not profitable under vertically integrated regime because supplier’s effective wholesale price is fixed by regulator
  – Generation assets of former vertically integrated monopolists sold off in bundles of units located in small geographic areas
    • This exacerbates extent of local market power problems

Origins of Local Market Power

• Because of the way state regulators price retail electricity hourly wholesale demand is virtually inelastic with respect to wholesale electricity prices
  – Little deployment of interval metering technology necessary to support active end-user participation in wholesale market

• Transmission network configuration, geographic distribution of wholesale electricity demand, concentration in local generation ownership, and production decisions of other generation units combine to create system conditions when a single firm may be only market participant able to meet a given local energy need
  – Firm is monopolist facing completely inelastic demand
  – No limit to price it can bid to supply this local energy

• Local market power mitigation necessary
Local Market Power Problem

- Congestion management or locational-pricing scheme does not solve locational market power problem
  - No limit to what firm can charge for amount of energy over which it is a local monopolist regardless of locational pricing scheme
- ISO must have the ability to mitigate firms with local market power
  - All Eastern US ISO’s have ability to mitigate bids of any market participant the ISO perceives as having local market power
    - Different methods for determining whether a supplier has local market power
  - PJM Local Market Power Mitigation (LMPM) mechanism is most stringent of those currently in place in US
    - Major reason for “superior performance” of PJM market
  - Not until after June 2001 did California have an ex ante LMPM mechanism
    - Previously paid non-RMR suppliers with local market power as-bid
- Optimal local market power mitigation (LMPM) mechanism unknown, but LMPM is essential component of successful market design
  - Particularly in US given limited amount of transmission capacity investment over past 25 years

Small Flaws Can Lead to Large Problems

- California experience--Lack of significant forward contracting between retailers and suppliers not a problem with plenty of water in Pacific Northwest
- Less water faces all fossil-fuel suppliers with less elastic residual demand curves
  - Increases extent of unilateral market power exercised
      - Huge increase in unilateral market power possessed by five merchant suppliers in summer 2000 relative to summers of 1999 and 1998
  - Enormous wealth transfers in very short period of time possible
      - $5 billion market inefficiencies in 6 months
    - Very difficult to undo these transfers once they occur
      - Emphasizes need for prospective regulatory process
      - Prevent wealth transfers before they occur
      - No need for coordinated actions for large wealth transfers to occur
Some Market Participants May to Slow to Learn

- During initial stages of market, firms may make mistakes
  - Lack of forward contracting by three large California retailers
    - Very risky to consumers and retailers
- Monitoring of forward contracting levels may be needed during transition
- Phase in of symmetric treatment of load and generation
  - Default wholesale price all demand pays is spot price
  - No different from other markets
    - Must purchase forward contract to obtain fixed price
- Market monitor can educate small market participants about how to participate in new market regime
- Provide information on market performance to all market participants

Transmission as a Facilitator of Competition

- Transmission upgrades increase number of independent suppliers that can compete to supply electricity at given location in network
  - Reduces extent to which all of these suppliers bid in excess of minimum cost marginal cost of supplying electricity
  - Suppliers have little incentive to undertake upgrades
    - Strong incentive to oppose upgrades to preserve local market power
- Engineering Reliability was criterion for determining upgrades in vertically integrated regime
  - Enough transmission capacity so that
    - Demand at all locations in network can be met with pre-specified probability
    - Assuming that virtually all generation units in network are owned and operated by same entity
Transmission as a Facilitator of Competition

- Economic Reliability should be criteria in wholesale market regime because configuration of transmission network impacts extent of market power suppliers can exercise.
- Sufficient transmission capacity so that all locations in the network face significant competition from enough independent suppliers to cause them to bid close to their marginal cost curve the vast majority of hours of the year.
  - All suppliers face sufficiently elastic residual demand curves a large fraction of hours of the year.
- Generation divestiture decisions can increase the economic reliability of a given transmission network.
  - Conversely, to the extent that significant generation divestiture cannot be implemented, more transmission investment may be needed to achieve economic reliability.
- Transmission network facilitates commerce in same way that interstate highway system facilitates commerce US economy.
  - US Highway system built at a cost of 330 billion 1996 dollars.
  - Net benefits from system vastly in excess of this magnitude.

Assessing Need for Transmission Upgrades

- Time lag to build transmission facilities substantially longer than lag to build generation facilities provide further justification for economic reliability approach.
- Building transmission in response to generation entry will be a continual process of catching up with consumers always bearing the cost of catching up.
- Building transmission network recognizing that supplier
  - Will enter where it is profit-maximizing to do so.
  - They will bid to maximize profits once they enter.
- Current cost of transmission network is small part of delivered price of electricity.
  - Roughly 0.4 cents/KWh delivered is average cost of transmission network for California ISO control area.
  - Average retail price of electricity close to 13 cents/KWh.
Assessing Need for Transmission Upgrades

- Undertaking upgrades that double transmission charge would come much closer to economically reliable transmission network for California
  - More competitive wholesale market would very likely lead to average wholesale energy price reductions greater than increase in transmission charge, so that delivered price of electricity would fall and retail prices would fall
- Conclusion--Larger role (than in previous regime) for market monitoring process in determining configuration of transmission network to maximize benefits of wholesale competition
  - Extremely difficult challenge associated with realizing full benefits of wholesale competition
  - Because of initial excess capacity in transmission network in most international markets this issue has not yet arisen

Goal of Monitoring Process

- Prevent substantial economic harm to consumers and producers
  - Consumers are not substantially harmed by periodic price spikes
    - Consumers harmed by persistently high wholesale prices
- Profit-maximizing firms exercise all available unilateral market power all hours of the day
  - Cannot prevent exercise of market power
    - If this was possible it would imply the existence of a perfect regulatory process
    - Existence of a perfect regulatory process implies there is no need to run a market
- Market manipulation depends on your perspective
  - Regulator is poorly suited to make such a determination
  - Substantial due process required to make a finding of “intent”
Smart Sunshine Regulation

- Public release of all data submitted to and produced by system and market operator necessary to operate market and system
  - Bids, schedules, production, and consumption
  - Forward financial contracting positions of market participants should remain confidential
- Public data release allows other entities besides market monitor to perform their own analyses
- Mechanism for government and market operator to commit to a transparent market design process
  - Any prospective entrant has same advantage as existing firm
- California crisis was allowed to persist and transform into a crisis, in part, because of FERC’s data confidentiality policies
  - All market data was kept confidential
  - Greatly reduces “sunshine regulation” value of market monitor

Smart Sunshine Regulation

- Short-time lag between market operation and data release
  - In Australia release is following day
- Definition of an outage in a wholesale market regime
  - Sick day problem
- Outage = failure to bid capacity into market at price below price cap
  - 100 MW unit, 50 MW bid at less than price cap
    - Implies 50 MW outage
    - Collect this data and publish on annual basis
Smart Sunshine Regulation

- Consistent quantitative measures of market performance
  - Measures must be comparable across markets and over time for the same market
  - Selection of measures could be coordinated with other US electricity markets
    - International market performance benchmarking possible
- Market monitor must be able measure vital signs of the health of the market to determine
  - When intervention in market is justified
  - Is market is better left to correct itself?
- Major issue in this regard is: What are acceptable levels of market power?

Acceptable Levels of Market Power

- Regulatory decision-making process must be informed by how much market power is due to
  - Providing market participants with “wrong incentives”
    - Market design flaws
- Consistent measures of market performance needed to
  - Increase speed and accuracy of determining market design flaws
- Focus should be on exercise of market power that imposes significant harm to system reliability and market efficiency
  - Cannot eliminate exercise of all market power
  - Converse of the fact that there is no such thing as a perfect regulatory process
Insuring Compliance with Market Rules

• Comparing electricity and financial markets
  – Participants buy and sell rights to inject and withdraw electricity
  – Participants buy and sell rights to risky income streams

• Rationale for ensuring compliance with market rules in electricity and financial markets
  – Ensure that buyers and sellers comply with all contractual obligations
  – Maximize liquidity of spot market
    • Less liquid spot market reduces willingness of buyers and sellers to sign forward financial contracts that clear against spot price on “delivery” date

• Penalties and sanctions are necessary to ensure compliance with market rules

Protecting Against Harmful Behavior

• Important difference between electricity and financial markets
  – All energy must be delivered through a common transmission network
    • Reliability of network impacts profits earned by all market participants
  – Behavior of market participant can impact reliability of network
    • Suppliers not following dispatch instructions
      – May be unilateral profit-maximizing for supplier
      – Reduces grid reliability (and expected revenues) for all market participants
  – Regulator must prevent behavior that may be privately profitable, but is harmful to system reliability and market efficiency
Protecting Against Harmful Behavior

- Local market power mitigation
  - Determine system conditions when supplier possesses local market power worthy of mitigation
  - Method for determining bid of mitigated supplier
  - Method for determining payment to mitigated supplier and how this impacts payments received by other suppliers

- Formulate market efficiency enhancing market rule changes
  - Market design flaws continually discovered
  - Can impose significant harm if not quickly corrected

- Penalize behavior that is harmful to system reliability and market efficiency
  - Behavior must be persistent and cause significant harm
  - Pre-specified process for making this determination that allows market participants to eliminate harmful market outcomes

- Determine when market activities can be suspended
  - Electricity market can have short-lived periods of extreme harm
    - New England Installed Capacity Market
    - New Zealand in June to September of 2001 and 2003
    - California in June 2000 to June 2001

Guidelines for Enforcing Market Rules

- Design market rules such that determination of violation require little judgment by regulator
  - Similar to issuing speeding ticket

- Penalties must by high enough to make it unprofitable to violate rules
  - Enron problem
    - Violate rule and pay $50 fine, but earn $100 profit, ahead $50

- Pre-set penalties for given market rule violation

- Penalties imposed should not exceed total harm market rule violation causes
Process for Determining Behavior Harmful to System Reliability and Market Efficiency

- Focus process on preventing harm to consumers and producers
- Major problem is determining whether behavior of market participant *intended* to harm system reliability and market efficiency
  - Process should focus on establishing “intent to harm”
- Regulator must have ability to demand and receive information necessary to make finding of “intent to harm”
- Multi-stage process used by regulator to make finding of intent that provides ample opportunity for market participants to solve problem

Process for Determining Behavior Harmful to System Reliability and Market Efficiency

- Identify behavior that is likely to harm market efficiency and system reliability
  - Behavior must be persistent
  - Have potential to impose significant harm
- If behavior satisfies these two requirements proceed to disclose behavior and identity of market participant to public
  - First step of intent determination process
  - Provides all market participants with opportunity to address problem
- If behavior continues, regulator can request information from market participant necessary to make finding of intent
  - Establish direct causal relationship between behavior and harm
- If direct causal relationship is found then penalties should be issued
- Very unlikely this process will ever go to conclusion
  - Provide clarity in process so that harmful market outcomes will be eliminated by market participants as soon as possible
  - Need for all market participants to understand “off-equilibrium” outcomes to enforce equilibrium outcome
Oversight of risk management

- Electricity retailing = spot price risk management
  - Must ensure that retailers don’t gamble with ratepayers money,
  - Wholesale bid caps, increases incentives for retailers to take this gamble
  - May be expected profit-maximizing to satisfy fixed price retail obligation from spot wholesale market
    - Go bankrupt if spot price increases too much
  - Monitor forward contract holdings and obligations
    - 500 MWh fixed price retail obligation 1 year from now requires 400 MWh fixed price wholesale commitment 1 year from now
  - Cause of meltdowns in New Zealand and California

- Analogy to retail banking sector
  - Banks take in deposits and may be tempted speculate with deposits to earn higher returns
  - Regulators set short-term reserve requirements to prevent this

Conclusions

- Market monitor
  - Provides Smart “Sunshine” regulation
  - Ensures compliance with market rules
  - Protects against behavior harmful to system reliability and market efficiency
    - Not on finding and punishing “bad behavior”
      - Massive wealth transfer can occur without it
    - Collect data that convinces market participant to stop harmful actions
  - Should have the ability to suspend market mechanisms if there no other viable way to prevent harmful market outcomes
For More Information On

- Lessons from international market monitoring
- Electricity market design
- Market performance measurement
- Diagnosing California electricity crisis
- http://www.stanford.edu/~wolak