Property Rights and the Federal Power Act

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Views expressed are not necessarily those of the Commission
Externalities and competition

- An externality: whenever consumer well-being or a firm’s production possibilities are directly affected by the actions of another market participant (MWG). This definition is broad.

- Acceptable in competition:
  - business stealing and
  - ‘creative destruction’
  - involuntary takings via eminent domain

- Unacceptable in competition:
  - excessive market power
  - Some dirty air and water (not FERC’s problem)
  - uncompensated loop flow???
All markets are regulated the policy question is how?

- History: story of forced exchanges
- Economics: story of voluntary exchanges
- Property rights: contracts and common law
  - eminent domain
- Institutional rules: SEC, CFTC, DOJ, FTC, FERC,...
- Antitrust (monopoly): collusion; ex post
  - Does Nash behavior violate antitrust law? No or maybe

**property rights and 'unregulated' markets**

- no just and reasonable requirement
- strong property rights
- the obligation to offer power would required a contractual commitment: a call option.
electric markets

- Energy network markets begin with
  - eminent domain for right of way and
  - environmental externalities

- Entry is not easy
- Networks have large sunk costs; Investments are lumpy
- Electric network has unusual externalities
  - Kirchhoff’s law and blackouts
  - reliability rules work against scale economies

- The electric culture
  - Because there is no effective demand response,
  - unpredictable events happen fast and response must be fast
  - we value the continuous supply of electricity,
  - measures are necessary to prevent market power
property rights and Federal Power Act

- **core mission** in both transmission and wholesales
  - prevent undue discrimination
  - establish just and reasonable rates
  - The law is Not optional

- Rate design
  - cannot be confiscatory (the opportunity to recover costs of efficient investments) and
  - must prevent monopoly rents

- Result: Weaker property rights
- No franchised monopoly!
- no explicit obligation to serve or offer!
- The analysis of market power has led to a loosening of regulation where market forces can play a greater role in disciplining the market.
- obligation to offer is a condition of the MBR authorization.
Unlearning Neoclassical Economics

- General equilibrium assumptions
  - Price takers
  - Continuous differentiability
  - Convexity
- Nash equilibrium
  - Omniscience
  - Mixed strategy for non-convexity
- Real world
  - Uncertain, discontinuous, non-convex, collusion
“All exchanges regulate in great detail the activities of those who trade in these markets. These exchanges are often used by economists as examples of a perfect competition, but it suggests that for anything approaching perfect competition to exist, an intricate system of rules and regulations would be normally needed. Economists observing the regulations of the exchange often assume that they represent an attempt to exercise monopoly power and to aim to restrain competition. An alternative explanation for these regulations: that they exist in order to reduce transaction costs. Those operating in these markets have to depend, therefore, on the legal system of the State.”
ISO markets

- Compensatory rates thru the market design.
  - must price all products
  - mitigate market power and
  - have good scarcity pricing.
- flaws and lumpiness require that ‘out-of-market’ actions
- should be priced into the market
- Last resort: RMR contracts may be necessary in certain situations
Dynamic Mitigation

- test for anticompetitive bidding
- scarcity prices for shortage conditions.
- allows highly sculpted supply offers.
- mitigates excessive bids
- better explanation just and reasonable prices.
- a rationale for not intervening in forward markets.
- Ex-post mitigation is often a very expensive and ineffective
scarcity prices: use market power or demand curve

- conceptually different.
- The first sends mixed signals about the exercise of market power.
- during scarcity conditions, market power potential is great
- market power issues are
  - causing reluctance for some to join RTOs and
  - make the promise of benefits for joining more uncertain.
- Like Lucy and the football, the argument that it will not happen again is viewed with some degree of skepticism.
- Guard rails are necessary.
- absent actual demand response, the demand curve for reserves (a public good)
  - protects the bidder and
  - allows the resulting price to be justified as just and reasonable.
IRATIONAL EXPECTATIONS

LONG-TERM CONTRACTS SHOULD HAVE BEEN PART OF THE PORTFOLIO

IN EXCESS CAPACITY MARKETS PRICE SIGNALS SHOULD DETER ENTRY

LUMPY INVESTMENTS, MITIGATION AND LOAD POCKETS

EFFICIENT WITHHOLDING

- Demand growth: 50 MW
- Lumpy generation choices: 30 MW
- Marginal cost bidding is confiscatory

WHAT IS EFFICIENT MITIGATION?
where are the HARD constraints?
Reality has hills, but few walls

- System in N-? before blackout
- X% for operating reserves
  - X-ε is unreliable!!!???
  - X+ε is no more reliable!!!???
- Nominal transmission constraints
  - Thermal limits
  - Wear and tear: let the owner decide
  - Bid: X% of nominal for y hours
- Bid: a capacitor for a day or week
Network Investments

- Public good or private good?
- Congestion creates a private good
- Quasi public/private good
- Dispatchable transmission
The gas pipeline 'merchant' model

- Open season (prior to construction) for a no undue discrimination determination
- Ex-post corrections are costly
- PCN: eminent domain
- Negotiated rates (contracts)
- Backstop rate: firm SFV rate
- Performance incentive: fixed nominal rates (RPI-RPI) with optional rate case
- Firm service creates virtual pipeline
The electric transmission 'merchant' model

- Open season prior to construction for a no undue discrimination determination
- No PCN: no eminent domain
- Negotiated rates
- No backstop rate: firm SFV rate
- Rationale: relies on entry
- Lumpiness and the free rider
- Max reservation bid in DAM and RTM (now = 0)
- Firm service creates virtual transmission element
Transmission rights and liabilities are underdeveloped

- Without physical failure: physical = financial
- With physical failure need priority rules
- Obligations, options hybrids and granularity
- No withholding of capacity
- Dormant secondary markets
- Reliability markets: CBM should be priced
- Entry: Conn says no to Cross Sound!
- Admittance pricing on the margin
Liability standards

- Outages: unruly vegetation; trips by trees
- Customers now bear most of the risk
- No transmission liability insurance
- What should the standard be?
  - Negligence
  - Gross negligence
  - Willful misconduct
- Which describes Homer Simpson?
Active transmission providers

 Offer dispatchable transmission
  - forward markets
  - Real-time market

 Two-part tariff (similar to generation)
  - Option commitment price
  - FMP (thermal limit) and admittance price

 Sell FTRs and FGRs in forward markets
 FGRs can be traded offline
 X% of nominal for y hours
 Install a capacitor for a day or week
# Dispatchable transmission

## Node A
- Generator 1: 90 MW
  - bid = $10/MW
- Generator 2: 100 MW
  - bid = $20/MW

## Flowgate AB
- bid = $0/MW
- capacity: 96 MW
  - bid = $5/MW
- capacity: 10 MW

## Node B
- demand: 105 MW
  - bid = $10/MW
- Generator: 100 MW
  - bid = $40/MW

## Node/element

<table>
<thead>
<tr>
<th>Node/element</th>
<th>A</th>
<th>AB</th>
<th>B</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>dispatch</td>
<td>LMP</td>
<td>dispatch</td>
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<tr>
<td>Without dispatch</td>
<td>96</td>
<td>$20</td>
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</tr>
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<td>With dispatch</td>
<td>105</td>
<td>$20</td>
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</tr>
</tbody>
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What if one MW of thermal capacity on AB is offered to the market at $2000/MW?

**Line AB**
- Impedance: 1
- Capacity: 30
- Flow: 30 (B to A)
- FMP: $2700/MW

**Node B Generator**
- Capacity: 300
- Dispatch: 190
- Bid: $100/MW
- LMP: $100/MW

**Line BC**
- Impedance: 1
- Capacity: 210
- Flow: 160 (B to C)
- FMP: $0

**Node A Generator**
- Capacity: 100
- Dispatch: 100
- Bid: $50/MW
- LMP: $1900/MW

**Line AC**
- Impedance: 1
- Capacity: 200
- Flow: 130 (A to C)
- FMP: $0

**Node C**
- Demand: 300 MW
- **Node C Generator**
  - Capacity: 170
  - Dispatch: 10
  - Bid: $1000/MW
  - LMP: $1000/MW
What if one MW of capacity on AB is offered to the market at $2000/MW?

Save $2700 in generation costs
The system is reliable without AB. What if AB was dispatchable?

- **Line AB**
  - Impedance = 1
  - Capacity = 30
  - Flow = 30 (B to A)
  - FMP = $2700/MW

- **Node B Generator**
  - Capacity = 300
  - Dispatch = 190
  - Bid = $100/MW
  - LMP = $100/MW

- **Node A Generator**
  - Capacity = 100
  - Dispatch = 100
  - Bid = $50/MW
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- **Line BC**
  - Impedance = 1
  - Capacity = 210
  - Flow = 160 (B to C)
  - FMP = $0

- **Node C**
  - Demand 300 MW
  - **Node C Generator**
    - Capacity = 200
    - Dispatch = 10
    - Bid = $1000/MW
    - LMP = $1000/MW

- **Line AC**
  - Impedance = 1
  - Capacity = 200
  - Flow = 130 (A to C)
  - FMP = $0
What if AB was dispatchable? save $9000 in generation costs and load saves $170,000

Node A Generator
Capacity = 100
Dispatch = 100
Bid = $50/MW
LMP = $100/MW

Line AC
Impedance = 1
Capacity = 200
Flow = 100 (A to C)
FMP = $0

Node B Generator
Capacity = 300
Dispatch = 200
Bid = $100/MW
LMP = $100/MW

Line BC
Impedance = 1
Capacity = 210
Flow = 200 (B to C)
FMP = $0

Node C
Demand 300 MW
Node C Generator
Capacity = 200
Dispatch = 0
Bid = $1000/MW
LMP = $100/MW
Reliable market design

- Reactive power pricing
  - Get incentives right
  - Price relative to real power
- Reserve pricing
- Admittance pricing
- Dispatchable transmission
- MIP opens up the modeling possibilities
Computational considerations
“perennial gale of creative destruction” Schumpeter

- 1996: LMP in NZ
  - 300 nodes
  - transmission constraints are manual
- 1990s: linear programs improved by $10^6$
  - $10^3$ in hardware
  - $10^3$ in software
- 2000s: mixed integer programs already $10^2$
  - Hardware: parallel processors and 64 bit FP
  - Software: ?
- New modeling capabilities in MIP
- 2006: 30000 nodes
  - 10000+ transmission constraints
  - 1000 generators with n-part bids
“Almost every generally accepted view was once deemed eccentric or heretical.”

Everett Mendelson, Stephen Jay Gould, Gerald Holton and other leading scholars in a Supreme Court brief