Promoting Competition And Efficiency Under the Standard Market Design

Richard O’Neill
Chief Economic Advisor
Office of Markets, Tariffs and Rates
Federal Energy Regulation Commission
richard.oneill@ferc.gov

Energy Trading: Promoting Efficiency Or Profiting From Manipulation

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Paradigm Change

Transitioning from cost-of-service/rate-of-return to market/incentive based regulation
PARADIGM CHANGES
WHAT IS GOOD SCIENCE?
DOES IT CHANGE? YES

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<tr>
<th>Theory</th>
<th>Old Consensus/Paradigm</th>
<th>New Consensus/Paradigm</th>
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<td>Floatation</td>
<td>Aristotle and the Church</td>
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<td>Geology</td>
<td>Flat with Biblical floods</td>
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<tr>
<td>Universe</td>
<td>Geocentricism (Church)</td>
<td>Heliocentricism</td>
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<tr>
<td></td>
<td>6,000 years old</td>
<td>15,000,000,000 years old</td>
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<td>4004BC Bishop Usher</td>
<td>Hubble telescope</td>
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<td></td>
<td>&quot;Light&quot; Matter</td>
<td>Dark Matter (90%)</td>
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<tr>
<td>Smallest Matter</td>
<td>Atom (raisin pudding)</td>
<td>Electron</td>
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<tr>
<td>Neutrinos</td>
<td>No Mass</td>
<td>Quark</td>
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<tr>
<td>Evolution</td>
<td>The Bible (96 concession)</td>
<td>evolution</td>
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<tr>
<td>light</td>
<td>corpuscle</td>
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<tr>
<td>Light speed</td>
<td>max speed</td>
<td>photons move at 1.7 C</td>
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<tr>
<td>Spectrum</td>
<td>visible</td>
<td>gamma to radio rays</td>
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<tr>
<td>Electricity</td>
<td>luminiferous ether</td>
<td>Gone</td>
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<tr>
<td>Combustion</td>
<td>Phlogiston</td>
<td>oxygen</td>
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<tr>
<td>Climate Change</td>
<td>Cooling</td>
<td>Warming (Is it the sun?)</td>
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Electric Restructuring requires
Institutional change on all levels

- **Culture**: religion, customs, and traditions
  - change interval: decade to century or more
  - Market theology: even trading develops ethical practices
  - Honor among thieves

- **Formal rules**: laws (FPA '35; EPAct '92)
  - change interval: decade +
  - *Hope* standard: What is legal under the FPA?

- **Play of the game**: regulations (888, 2000, SMD)
  - change interval: one to ten years
  - Market-based rates: hub and spoke

- **Resource allocation**: markets
  - change interval: real time
  - ISOs, Enron OnLine, bucket shops
Most retail purchases are spot
- Food, clothing, auto, housing, energy, health
- Spot: food, clothing, cars
- Forward contracts: housing, health
- Forward compacts: natural gas, electricity

Problems with Competition in Power Markets
1. Conditions for market power abuse
2. Entry and/or exit barriers
3. Demand response: 'low' demand elasticity
4. High market concentration
5. Market segmentation: congestion
6. Profitable withholding or discrimination
Physics can be inconvenient

ATC: how do you calculate it?

contract path and TLRs to simplify trading?

DC power does not flow across states

lossless transmission

vertical demand 'curve'

price signal for an infeasible market? (CAPX)

market power: assume a larger market (CAISO)

In reality based markets eventually the fictions/scaffolding must be jettisoned

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Warning Label for Short-term Markets

Failure to forward contract or submit demand schedules is risky and may be hazardous to your financial health.

If you outlaw forward electricity markets, it changes decisions in the entire value chain:

- Input fuel, all transmission, environmental
- Massive attempts to game each spot market
History of trading from arbitrage to anything goes to shakeout

1. Early gas: role of quarters and a pay phone
2. Trading floors, phones and faxes
3. Margins in gas trades shrink: 10% to .1%
4. Gas EBBs; WSPP EBB; 888 OASIS;
5. Online trading; Enron says its too risky
6. 'risk' management: who does the parameters
7. Enron Online: Good design except Enron is the sole counterparty

History of price reporting

1. NGI: 1987 last page weekly to profit center
2. Judgmental sampling
3. Prices without quantities
4. Thick and thin markets?
   1. Henry Hub
   2. Western forward
5. Some quantity reporting
6. How do you sort out round-trip trading and its country cousins?
7. Trade press reporting is not transparent
   1. First amendment rights
   2. Is it good enough for J&R?
energy trading: Anything goes

- Greed is good; test the law
- Lobby aggressively; contribute politically
- Leverage everything
- Round-trip trading and its country cousins
  - Lacking good rationale
  - Testing
  - Give commissions to charity
  - Could it be an attempt to manipulate prices
- Shakeout
- Market rules; penalties; enforce the law

Fat Boy, Get Shorty, Death Star, Ricochet, Round Tripping: what is j&r?

- What’s in a name?
- Law for dealing with market power: just and reasonable v. antitrust
- Market power exercise is usually inefficient
- Mitigation should focus on inefficiency and fairness
- Glorify unilateral market power as innovation
- Windows monopoly v. browser barriers
- Demonize certain collusion
- Did they report Round Tripping to the trade press?
- Is this a conspiracy to fix prices?
SMD: Market Design, Monitoring and Mitigation

market design

monitoring

mitigation

SMD approach to efficient trading

1. How should trading be regulated?
2. Cost/benefit test: is society better off
   - Withholding is generally wasteful
3. Mitigation and Information in spot markets
4. Monitoring and enforcement
5. Resource adequacy including demand bidding
6. Complaints: When the market clears at a high price we need to have information to show it was scarcity not withholding
market design

- Three market segments: G, T and D. Two out of three are passive market participants, active players wanted.
- Invitation to game. If you allow the exercise of market power without consequence, don’t be surprised if you get it.
- Incentives for efficient active transmission.
- Don’t design the market to favor large players.
  - Portfolio bidding creates incentives for high concentration.
  - Concentration creates market power problems.
- Deal with free riders: reservation bids.
- No property rights to market power or bad market design.

trading rules under the FPA and SMD

- Public interest v. j&r standards:
  - Know it when you see it.
  - When to intervene.
- Need SMD market to be compatible with off-SMD markets.
- Asymmetries in market design create bias and gaming opportunities.
- If you require balanced schedule, you get too much generation and large players that can avoid imbalance penalty.
- In England/Wales NETA creates over supply.
Resource adequacy

1. Start the process when entry is possible
2. Demand bidding counts
3. May need to install curtailment equipment
4. If you are short, you may have to pay a high price in the spot market
5. You may be curtailed

Price signals for End-use markets

1. Vertical demand curve in ISO markets
2. Consumers receive very weak price signals
   - No real time meter
   - No real time price; inhibits forward contracting
   - On a hot summer day
     - Wholesale price = $1000/MWH
     - Retail price = $100/MWH
   - Bill reading could be a 3 credit course
3. Value of electricity?: $20 to $20,000/MWH: give buyers a chance to express what value they place on electricity
4. Since 1992 successful Georgia Power's industrial programs
5. Puget Sound: 5% peak reduction from peak pricing
   - $30 for interval meter add on
   - Long-term lease of wireless system for reading
Buyer Market Participation is like the weather

- No motivation; time invariant prices; moral hazard
- If electricity was cars,
  - no fuel gage, no posted gas prices
  - Get reading once a month on fuel use and price of gasoline
  - Increased outage insurance or fill up more frequently
- Transactions costs and risks

Solution
- Portable entitlements (p and q) not price cap
- First: Generation in drag
- Day 2: Real demand side bidding 24x7

SMD retail market agents offer innovative demand response programs

Portable Entitlement Program

- POLR/SOLR makes and maintains entitlements under state regulation and resource adequacy requirements
- Portable entitlement program (fixed p and q)
  - Long-term entitlements includes CRRs and other commitments
  - Attached to the customer
  - Auto buy/sell for under/over entitlement in SMD spot market
  - Entitlement moves when the customer moves
  - Terminates when the customer leaves the SOLR

NO SOLR PRICE CAPS
Supplier of Last Resort (SOLR)

- Not necessarily the distco or wireco
- Default for Resource Adequacy requirements
- Generation asset sales by convert to obligation to contract under state comm. rules
- If customer returns to SOLR, starts a new entitlement. Start with spot market prices
- Installs meters or automatic curtailment equip.
- Interval metering programs available upon request
- Customers with interval metering programs
  - are automatically in the SMD markets
  - Can see and respond to the prices on the internet

Entry decision

- No uncertainty:
  - discounted net revenues > investment, Invest
  - discounted net revenues < investment, Don’t
- Uncertainty:
  - E(discounted net revenues) > investment, Invest
  - E(discounted net revenues) > investment, Don’t
- Uncertainty analysis aids:
  - Historical locational prices as a forecasting aid
  - Analysis of other market participants
  - In late 90s long term contract devalued the deal
Relation between forward and spot market

- In a competitive (perfectly) market
  - Forward markets are to hedge future spot markets
  - \( E(\text{spot}) = E(\text{forward contracts}) \)

- In a not perfectly competitive market
  - Protection against opportunism including
  - Market power and asymmetric information
  - boom and bust hedging due to lead times

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Market power in forward markets

- Uncertainty
- Eminent domain,
- Environmental constraints,
- Regulation: Access rules, ...
- Behavior of other participants
- Transactions costs add costs to both spot and forward contracts
Market Power

- No market power, no uncertainty, no transactions costs, risk neutral:
  - Indifferent between forward and spot

- Market power in spot, no uncertainty, no transactions costs, risk neutral:
  - Forward contract to avoid market power

- No market power, uncertainty, no transactions costs, risk neutral:
  - Forward contract to hedge uncertainty

Forward Purchase Decision

- Forward now or spot later

- Is $E(\text{forward spot}) > \text{forward contract price}$
  - If risk neutral, buy forward contract
  - $E(\text{forward spot}) = \text{forward contract price} + \text{RP}$
    - If risk averse, buy forward contract if $\text{RP}$ is not too large
  - If current spot has market power rents,
    - If it will continue, forward price will be higher due to expected continuation of market power
    - If forward spot price is expected to have market power rents, pay a premium for forward contract
Market theology v. reality

- Because Nash got a Noble and a movie for describing a game theoretic equilibrium does not make it legal or efficient
- What if the skills of the traders were put to productive activities?
  - 'DESPITE HEAT, CREDIT CONCERNS, LACK OF LIQUIDITY ARE KEEPING PRICES IN CHECK'
    PMW Aug. 19, 02
- Compounding political issues and market power: exercising market power when there is a resulting event that can be easily politicized
  - High prices
  - Need information to counter this charge

Monitoring and mitigation

- Build tx to mitigate market power
  - Is this less expensive than spot market mitigation?
- Market power mitigation is like cooking or sports
  - Learn the basics/sound fundamentals
  - React to the specifics
- Bad basics: HHI with poor market definition
Market power: can it be discussed in polite company?

"The researches of many commentators have already thrown much darkness on the subject and it is probable that, if they continue, we shall soon know nothing at all about it."

Mark Twain

The market power price axis

What is illegal under antitrust law without collusion?

- perfect collusion: \( \frac{p-mc}{p} = 1/e \) (\( HHI = 1 \))
- Nash/Cournot (1838) equilibrium:
  \( \frac{p-amc}{p} = HHI/e \)
  - \( amc = \text{wgtd. avg marginal costs} \)
  - as \( q \) gets larger, \( e \) gets smaller
  - market shares are net positions
- market clearing price with marginal bidding
  Bertrand (1883): \( p = \max mc_i \)
Naïve to mischievous rationales for exercising and solving market power

- withholding is necessary for capital recovery
- phantom opportunity costs: coulda shoulda woulda's
- need good price signals? If taken literally you get overinvestment

- proposed cures for market power:
  - declare larger zones (CAISO)
  - forward markets (PX)?
  - forward markets are great, but they do change your competitive libido?

Silly arguments

- need high prices to recover fixed costs is a cost of service argument
- entitlement: need to exercise market power to recover fixed costs
- you may have paid to much
- in competitive markets the market values your assets. It's not what you paid!
- One part bids can not estimate marginal costs allow for infeasible dispatch
Market Power Mitigation Options

1. Hear No Evil, See No Evil, Speak No Evil
2. Let antitrust folks take care of it
3. Punitive Ex-post (The Antitrust Approach)
4. Watch (Chauncy Gardner), Report and?
5. Return to Cost-of-Service (Regression Therapy)
   a. Price Caps and curtailments
   b. Price caped long-term contracts: number please
6. Divestiture (the Big Stick): \( \frac{(p-amc)}{p} = \frac{HHI}{e} \) !!!!
7. Ex-ante: Must offer with bid caps
8. Hydrants must be checked one hour before all fires

Must Offer with Bid Caps (Efficient Competition)

1. Require creditworthiness
2. Demand bidding or contract cover: no vertical demand curves
3. Develop triggers for mitigation: no withholding
4. Non-punitive: Bid at marginal costs get market clearing price
   a. Requires
      i. Rough calculation of marginal costs
      ii. Day-ahead market for ex-ante correction
5. Does not require
   a. Capital costs
   b. Regulation of marketers or forward trades
can you estimate marginal costs? yes

☺ Marginal costs are going-forward incremental opportunity costs
☺ include start-up and no load costs
☺ Technology is known; test for heat rate
☺ RTO/ITP must know equipment capabilities
☺ spot fuel prices are well known but?
☺ should be able to calculate vc within 20%
☺ energy limited generation: opportunity costs

Hydro and Energy Limited Resources

★ Requires forward planning of generation
★ Complicated opportunity costs
★ Special bidding rules
  ★ Bid daily max energy
  ★ DAM will get maximum revenues
★ Monitoring
  ★ Announce rules for non-economic activities
  ★ E.g. Fish protection, irrigation, other
  ★ Observe bidding pattern over time
  ★ E.g. running off-peak and not on-peak
  ★ Compare to announced program
Scarcity rents

Market clearing price $30/MWh

Quantity in MWh

No curtailment

No scarcity rent for $30 generator

Scarcity rents

$10/MWh

$20/MWh

$30/MWh

bid $/MWh

demand

Curtailment

What should generators be paid? between $30 and $8000 per MWh

Quantity in MWh

Blackout due to vertical demand
A demand curve allows the market to clear above the highest marginal cost generator.

SMD NOPR and Cooper, CFA

- common carriage: SMD creates a national non-discriminatory access to the network
- problems with market power: SMD mitigates market power
- Wants infrastructure development: SMD sets up a resource adequacy program to develop infrastructure
- Obligation to build?
- Does not repeal PUCHA
What is needed for competition?

- good market design and information
- organizing principle: compatible incentives
- recognition and mitigation of market power
- recognition of how displacement markets work. Not air traffic controller
- understand the choices
  - free market (Coasian dream), NOT
  - markets with market rules (SMD)
  - administrative rules (TLRs and OFOs)
  - State socialism

21st Century Network Oligopoly Governance

- information allows less and targeted regulation
  - high quality and electronic
  - trading and regulation
  - include cost, price, and quality
- incentives:
  - performance-based
  - benchmarked
- institutions:
  - group self-governance
  - structured smart e-markets
- contracts (not compacts) to create property rights
- good (not forced) choices
Wholestic Market Design AGORAPHOBIA

You don’t always get it right the first time.
Now you have experience
Try SMD

NO, WE DIDN’T NUKE OURSELVES BACK INTO THE STONE AGE. WE Deregulated our electric utilities...

Are you a Copernican or a Ptolemain?

All power corrupts, but we need the electricity