Designing Competitive Energy Markets

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Overview

- Evolution of US electric power industry
- Federal regulation
- Designing competitive markets
- Example: Mid-Atlantic region
- Impediments to competition
- Conclusions

Power Industry Evolution

- Technology
  - 1920s isolated systems, economies of scale
  - 1960s economies of scale run out, aerospace technology brings the gas turbine
- Policy
  - 1920s owners request regulation in exchange for protection from competition - franchise monopoly
  - 1970s consumers notice prices too high and demand competition (industrial sector)

Energy Legislation

- 1935: Federal power act and public utility holding company act (FPA and PUHCA)
- 1978: Public utility regulatory policy act (PURPA)
- 1992: Energy policy act (EPACT)
- 1996: FERC Orders 888 and 889
  - FERC jurisdiction for wholesale transactions comes from Federal authority for interstate commerce
Energy Legislation

◆ Legislation—promulgated by Congress, tends to lag behind actual events and popular sentiment (intent not always clear)
◆ Agency policies—FERC, EPA, FTC...—tend to lag behind Congressional actions
◆ What does policy accomplish?—Policy makers set the specific agenda for the general changes pushed by other groups.

Deregulation?

◆ Removing regulatory oversight from a highly concentrated, vertically integrated industry will not result in a competitive market.
◆ In this situation, competitive markets must be intentionally designed and created.
◆ The regulatory role changes, but will not disappear until ...

Regulation

◆ What FERC does
  ◆ Approve transmission and wholesale energy rates
  ◆ Price regulation
  ◆ Rates must be “just and reasonable,” FPA §205 (Federal Power Act, section 205)
  ◆ Approve transfers of ownership or control of regulated facilities
  ◆ Filing must be “consistent with the public interest,” FPA §203
  ◆ Reactive rather than proactive, but provide guidance

Back to Basics

◆ Characteristics of a competitive market

- Price (P)
- Supply (S)
- Demand (D)
- Marginal Revenue (MR)
- Marginal Cost (MC)
- Average Total Cost (ATC)

- Equilibrium at point E
- Where P = MR
- Where S = D
- Where MC = ATC
**Introducing Competition**

- Economic issues
  - Design a market place
  - Mitigate market power - a tremendous problem
- Technological constraints
  - Update existing system operation software to accommodate more players who are competing
  - Create new software for internet-based marketplace
- State and Federal jurisdiction battles

**Market Design**

- Identify market participants
- Identify products
- Design the marketplace (idealized goal)
  - Where will trades occur?
  - How will price be determined?
  - How will participants interact?
- Design the transition period
- Address impediments to competition

**The Previous “Marketplace”**

- The participants
  - Electric utilities
  - Native, captured load
- The product
  - Bundled electric energy (kWh), including transmission service
- The marketplace
  - None

**Power Industry Structure: Which Segments are Competitive?**

- Generation
  - Can be competitive
  - Public goods, joint products (ancillary services)
- Transmission network
  - Natural monopoly (common carrier)
  - Public goods
  - The control of transmission affects the operation of the energy market
    - Can not direct or control power flows
- Distribution (state jurisdiction)
Power Industry Players: Who Wants Competition?

**Interested in competition**
- Large industrial customers
- Energy marketers
- Independent generation owners
- Federal regulators

**Only moderately interested**
- Vertically integrated utilities (IOUs)
- Municipal and public power utilities
- Retail customers - benefits small and dispersed
- Environmental advocates
- State regulators

Market Design: Products

**What are the “unbundled” products?**
- Transmission
- Energy
- Capacity
- Ancillary services: frequency and voltage support, energy reserves (joint products with energy)

**How should the products be marketed?**
- Should there be a single energy, capacity and services market, or
- Should there be many separate markets?

Market Design: Marketplace

**Where and how will buyers and sellers meet?**
- How provide incentives for participation? Force participation?

**Create a centralized or decentralized market?**
- Require participants to interact through a central facility (internet-based trading floor)?
- Require participants to find their own bilateral trading partners?
- Allow both methods to be used?

Market Design: Information

**Understanding system design**
- The market rules are new to everyone
- People lack information on how to behave and what to expect from others

**Access to data**
- Buyers need price transparency
- Regulators need data to assess extent of competition
- Everyone needs technical data, which may now be proprietary
Market Design: Price

How is price determined?

- Allow market based prices?
- How will market prices be determined before a market exists? (The current situation.)
- Allow a central authority to set a price cap? Even if set very high, it may be viewed as a security blanket.
- Use a theoretical competitive price as a reference point?

Market Design: Public Goods

Defining public goods: Ancillary services

- Non-rival consumption
- Non-excludability, free-riders

Determining quantity

- Market forces alone will not achieve the efficient level of supply (frequency & voltage support, reserves)
- Who determines quantity required for each service and how?
- Who pays for the services?

Example: Mid-Atlantic Region

PJM is the market center and system operator for the Pennsylvania, New Jersey and Maryland electric utilities.

Players

- Local electric utilities
- Residential customers
- Industrial customers
- Regulators, state and Federal
- Electric utilities external to PJM
Example: Mid-Atlantic Region

Products
- Generation
  - Energy - kWh, what you see on your bill
  - Capacity - MW
  - Ancillary services - services provided by generators that are required for transmission service
- Transmission
  - Transmission capacity - essentially transportation
  - Ancillary services - provided by generators, yet part of transmission service

Example: Mid-Atlantic Region

New industrial structure
- New independent system operator (ISO) runs the transmission system
- Generation is competitive and deregulated

New players
- The PJM system operator, www.pjm.com
- Energy marketers and independent generation owners
- Merchant branch of regulated utilities (affiliates)

PJM Energy Market

The ISO operates a central market facility
- Day-ahead energy and capacity markets
- Hour-ahead energy markets, and
- Spot energy markets
- Ancillary services automatically included by ISO

Participants can join the ISO markets or set up bilateral transactions on their own

PJM Marketplace Design

The “Marketplace” is an internet site that simulates the market and contains:
- Price
  - Nodal (locational) energy prices for 1600 nodes
  - Transmission rates (regulated)
  - Ancillary services, a mix of regulatory oversight and market bidding
- Quantity: Transmission availability
**PJM Competitive Issues**

- **Ancillary services**
  - Players in the centralized energy spot market must supply ancillary services if technically capable
  - Preventing withholding helps mitigate market power
- **Market power (for all products)**
  - Independent monitoring unit files reports
  - Alternative dispute resolution
  - Formal complaint process
  - Regulatory oversight as a backstop

**FERC Design Method: Transition to Competition**

- **Determine time allowed for transition period**
  - Currently 5 to 6 years is common
- **Determine rules during the transition period**
  - Rights and obligations of participants
  - Entry process for new participants
- **Create non-governmental monitoring groups**
  - that all participants trust, and that report to government regulators

**Impediments to Competition**

- Participants lack experience
- Designers lack experience
- General lack of information and data
- Conflicting objectives
  - Incumbents resist change
  - Entrants demand immediate change
  - State regulators protect ratepayers (a.k.a. voters)
  - Regulatory capture: regulators know and identify with the utilities

**Incentives to Incumbents**

- In exchange for accepting mitigation, and to avoid long court battles, regulators offer incentives
- Company incentives (bribes)
  - Allow companies to recover their capital costs more quickly (stranded costs)
  - Allow market based rates for some products early
  - Bribes evolve into entitlements!
What Has Changed?

- Assume I wanted to build a generator pre-1996
- Pepco could prevent me from using the transmission system - no “open access”
- I could not sell to Pepco’s retail load
- I could not buy transmission capacity to sell elsewhere
- There was no facility for price clearing to set energy prices

Currently in PJM

- Transmission owners must let competitors in the energy market connect to their transmission system
- Transmission owners must post prices and availability of transmission service and not favor their energy marketing affiliates (moderately successful)
- PJM provides real time market-based energy prices
- More participants facilitates bilateral trading
- I still can not serve retail load

Summary

- Enabling legislation
- Respond to industry and political winds
- Offer guidance to industry
  - Define products, new market structures, and participants’ responsibilities
  - Design the implementation, transition period
  - Provide for market monitoring
  - Ensure access to data and information
  - Prevent market power abuse

Summary: Market Power

- Traditional, vertically integrated monopolies
  - Have market power by definition
  - Want to use their private property as they see fit
- Must create competition
  - Simply removing regulatory oversight is not enough
- Mitigate market power
  - Difficult to identify (prove) who has market power
  - Design methods to mitigate market power
Conclusions

- Competitive markets
  - Promote the efficient use of resources
  - Incompatible with market power, so some regulation must persist
- FERC’s role is to facilitate market development, but not to design and impose a single structure for all regions, even if it is theoretically ideal.