ELECTRICITY RESTRUCTURING IN THE UNITED STATES

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Background Notes

- BS Natural Science, MS Public Policy
- 3 years Energy Consulting, Synergic Resources (SRC), DSM pioneer
- Ph.D. in Economics
  - Neoclassical training, but no real world skills, dissertation on Oil
  - 6 years Litigation Economics: self-taught financial theory, IO, antitrust law and economics, and business
- Law school, more “book learning”
- Management Consulting
  - Electricity deregulation in PJM, foreign legion
- Lawyer/Consultant
  - Represented ISO-NE at FERC
  - Potomac Economics, market monitor
  - Represented clients in ERCOT, pushing DSM again
Background Notes

- Generalist Approach
  - Can’t be taught in academia, too focused, profession programs teach you to be facile
  - Requires mastering multiple skills and extensive experience; learning by doing (and listening)
  - Young are smarter (at least in math), old people hopefully develop wisdom and perspective

- Tried it with my dissertation (first book on Oil)
  - Ambitious muddle, bite off more than I could chew
  - If at first you don’t succeed . . .
Book crosses genres

- **Politics**, or why things are the way they are
- **Law**, or the “rules of the game”, EPAct 1972, 1990, 2005, CAAs
- **Regulation**, how law is applied
  - Electricity regulation, FERC, NERC and PUCs
  - Environmental Regulation, EPA, Clean Air Regulations
- **Policy**, what we’d like to accomplish
  - “Economic engineering” – abstract modeling
  - Real world economics, thinking about actual markets and actors
  - Feasibility, the gap between “what is and what never should be”
- **Science & Engineering** (have to know the basics)
  - Some electrical engineering, can’t avoid it
  - Thermodynamics, chemistry, materials science
- **Business**, or how things are done (attempted)
“People of the same trade seldom meet together, even for merriment and diversion, but the conversation ends in a conspiracy against the public, or in some contrivance to raise prices.”
Background Notes

- **Influences**
  - Fernand Braudel, *Civilization and Capitalism, 15th - 18th Century*, 3 volumes, a true “tour de force”
  - Edward Leamer, “Let’s Take the Con out of Econometrics,” AER 1983
  - Paul David and the “Path Dependence” literature, economics, law (Posner), politics
In the Beginning

- Before Eve bite into the apple of deregulation
  - Investor Owned Utilities (IOUs), dinosaurs ruled the earth
  - Federal government had TVA, BPA, Western Power
  - Municipals and Cooperatives scurried through the undergrowth (with their tax exemptions)

- Federal Regulation
  - Gap filler after Attleboro
  - PUCHA to end perceived holding company abuses
Were the traditional utilities predatory dinosaurs or slow moving herbivores?
Energy Crisis

- 1970 – the year of reckoning
  - Nominal electricity prices start to rise
  - Natural gas shortages begin
  - Environmental Policy Act (EPAAct) 1970 amendments

- 1973 – Oil Embargo, price jump
  - Energy prices jump with oil prices
  - Monetary policy fuels inflationary pressures
Back in the bad old days . . .
Energy Crisis - Aftermath

- Nuclear Power Cost meltdown (before TMI)
- Plant cancellations and delays
  - Funded state efficiency plans and programs
  - Established standards for appliances (never finalized)
  - California standards lead to Appliance Conservation Act of 1987 (manufacturers wanted uniform standards)
- Demand Side Management and Integrated Resource Planning emerge at the state level in the 1980s
  - Electricity demand growth falls from pre-crisis levels
Energy Policy Act of 1978

- Power Plant & Industrial Fuel Use Act
- Natural Gas Policy Act (NGPA)
- Public Utilities Regulatory Policy Act of 1978 (PURPA)
  - Encouraged states to promote energy conservation and load management techniques
  - Created Qualifying Facilities (QFs)
    - Renewables 80 MW or less
    - Cogeneration
    - Prices to be based on avoided costs
    - Purchased Power Agreements (PPAs) with utilities
Unintended Consequences

- QF contracts in high priced states
  - Fixed price PPAs quickly subscribed
  - Developers could leverage PPAs into high debt/equity ratios
  - Barn door closed after horse fled, competitive bidding reduced QF rates
- By 1992, QF cogeneration sales 3.6% of sales
- PURPA created lobby of independent generators and developers, AES, Calpine
Natural Gas Glut

- NGPA gradual decontrol of NG prices
  - Expectation was increasing prices, based on high oil prices (barrel = 6MMBtu or 6 Mcf, $30 oil = $5/Mcf gas, $10 oil = $1.70 Mcf gas)
  - High priced gas was developed, rolled into average gas sales price, gas prices rose
  - Decontrol stimulated production, oil prices began to decline, and gas prices dropped in the early 1980s
  - By 1985, gas was essentially decontrolled and a growing spot market continued downward pressure on prices
  - Oil prices crashed in 1986, residual oil pushed gas prices down
  - FERC “spread the take-or-pay pain” between producers and pipelines
  - Congress enacts the Natural Gas Wellhead Decontrol Act in 1989

- Repeal of the Fuel Use Act in 1987 allowed Utilities to use NG
Combined Cycle (CC) Technology

- “Overnight revolution” decades in the making
  - Combustion turbines adopted from jet engines
  - 1949, CT exhaust used to heat intake water
  - Heat recovery CCs installed in 1959
  - GE Frame 7F Turbine (147 MW) CC plant installed in 1990, 45% net efficiency (coal plant ~38%)
  - QF provided market for CTs/CCs, 44,000 MW by 1992
Economics indirectly influences policy
- Influenced deregulation under Ford and Carter
- Promised consumer benefits from increased efficiency
- Early success in airlines, trucking, natural gas seemed to confirm economists’ judgment

Economists turned to electricity in early 1980s
- Joskow and Schmalensee, Markets for Power, 1983
- Schwegge, Caramanis, Tabors & Bohn, *Spot Pricing of Electricity*, 1988
Or Maybe the Consultants?

- Putnam, Hayes & Barlett (PHB, merged with Hagler Bailly in 1999, swallowed by PA Consulting in 2000)
  - William Hogan, Scott Harvey, Susan Pope, all moved to Law & Economics Group (LECG) in 1999.
  - LECG imploded in 2011
- Tabors, Caramanis & Associates (Bohn was an advisor)
- NERA
- Brattle Group
- General consensus around nodal pricing and locational marginal pricing, following the academic literature.

- Political pressure for deregulation
  - Industry wanting to bypass their utilities
  - Independent power producers (IPPs)
  - Consumer groups
- IOUs fighting a rear guard action
- Empowered FERC to order transmission access to independent power producers
Power Pools to Power Markets

- IOUs were generally self-contained, few external transmission ties or transactions
- North American Electric Reliability Corp (NERC)
  - Formed after Northeast blackout of 1965
  - 10 regional reliability councils
  - Reliability planning encouraged interconnections
- FPC had encouraged power pools
Tight Power Pools

- Contractual
  - Michigan Electrical Coordination System
  - New England Power Pool (NEPOOL)
  - New York Power Pool (NYPP)
  - Pennsylvania-NJ-Maryland (PJM)

- Holding Company
  - Allegheny Power System
  - American Electric Power System (AEP)
  - Middle South Utilities (Entergy)
  - Southern Company
  - Texas Utilities Company (TXU)
Order 888

- Began incrementally with transmission rate making decisions requiring nondiscrimination
- Notice of Proposed Rulemaking in Spring 1995
- Order No. 888 in 1996
  - Order 888 required filing of nondiscriminatory transmission tariffs
  - Required functional unbundling of wholesale transmission services
  - Required provision of ancillary services to customers
  - Required open access for power pools run by Independent System Operators (ISO)
  - Holding companies had to establish a single transmission tariff

- Order 889, issued simultaneously, established electronic bulletin boards (OASIS) posting prices and transmission availability

- New York v FERC (2002) – Supreme Court affirms FERC authority
Creative Destruction

- The Great Merger Wave
  - Divestitures, 50,000 MWs sold off between 1997-2000
  - Mergers, 41 with value > $1 billion between 1997-2002
Rising From the Wreckage

- IPPs
  - Calpine, LS Power, International Power, Dynegy, AES
  - Utility Genesis/Independent Power
    - Exelon, NRG, GEnOn, First Energy, Luminant, PSEG, PPL, Dominion, NextEra, Duke Energy, Edison
  - Power Marketing, Enron et al
Retail Competition

- High cost states
  - Primarily due to QF contracts, Nuclear costs, Northeast, Atlantic and Midwest states, along with California
  - Deals usually included stranded costs, rate caps and retail markets, securitization used to reduce costs
  - Some sort of provider of last resort
  - Buyer’s regret, once caps ended, prices often escalated, depended on wholesale price
  - If you pay stranded costs, little gain to be found in the short run
- Texas – its own little world
  - Most competitive market, but most REPs bought out, NRG, Direct Energy (Centrica), TXU Energy dominate
  - Despite rhetoric, incumbents did well on consumer inertia
Creation of Wholesale Markets

- Tight power pools
  - NEPOOL (ISO-NE), NYPP (NYISO), PJM
- NERC region
  - ERCOT
- De novo
  - California
- Further down the line
  - MISO
  - SPP
Evolution of Markets

- ISO-NE, NYISO, PJM
  - All three gradually moved to multi-settlement (day ahead & real time), congestion management systems (LMP with some sort of financial transmission hedge).
  - Price caps ($1,000/MW), capacity markets

- ERCOT
  - Deregulation an “insiders’ game,” rates were low
  - Pat Wood ordered transmission built to relieve congestion, postage stamp pricing, zones
  - Retail and wholesale in same region starting in 2002
  - Didn’t go multi-settlement LMP until December 2010.
  - Energy Only Market
Order 2000 Markets

- Attempted to cajole all transmission utilities to join/form Regional Transmission Organizations (RTOs)
- Passive resistance in West and Southeast
- Midwest ISO (MISO), hodgepodge ISO formed in Midwest
  - Multi-state, mostly IOUs
  - Hard to reach consensus on market rules
- Southwestern Power Pool (SPP) formed out of NERC regional council, goes LMP in 2014
California

- Camel (horse designed by a committee)
  - Driven by politics, technical decisions on market design ended up as political compromises
- CalPX, CAISO created out of thin air
  - Used different models
  - CalPX day-ahead, CAISO ran balancing market
- Didn’t relieve north-south congestion before opening market
- What can go wrong . . . Drought, storms, El Paso gas line (accident and collusion), air pollution, etc.
Market Power

- MISO price spikes of 1998 a warning
- Market Based Rates based on IOU transactions
  - Market power analysis was rudimentary, 20% rule
  - FERC had understaffed monitoring and enforcement groups
- Utilities and IPPs failed to share required data, including data they gave to NERC
- Filed rate doctrine meant limited refund authority, 60 days after a complaint, subject to refund for 15 months
- Strategic bidding was legal under FERC rules and antitrust law (no collusion, Cournot)
California Loophole

- CAISO’s Market Monitoring and Information Protocol put offenders on notice
  - Bans “gaming practices”
  - Applied to many sorts of market manipulation, including noncompetitive bidding
  - Used as basis of California and Western markets refund proceedings
- FERC then incorporated similar language in its Market Based Rate Authorization order.
Energy Policy Act of 2005

- Repealed PUHCA
- Prohibited market manipulation or deception on contravention of Commission rules
  - References SEC Rule 10b-5
  - Penalties for violations of the FPA or NGA from $5,000 to $1 million
- Incentive based rates for transmission
- Authority still limited, can’t order building of transmission, states can still block projects
EPAct 2005 and Reliability

- Reliability standards to be established, enforced by FERC
- NERC designated as Electric Reliability Organization, no longer voluntary, and under FERC’s authority
- FERC authority extends even into ERCOT
- Motivated by 2003 Midwest/Northeast blackout
  - 50 million without power
  - Triggered by equipment malfunctions, failure to trim trees, operator error
Lessons?

- Policy formulation is extremely complex
  - “Essentially, all models are wrong, but some are useful”
    - Box & Draper, *Empirical Model-Building and Response Surfaces*
  - The devil is in the details, start with the details, then simplify, don’t simplify away the details
  - History teaches us humility, something economists need reinforced on a daily basis
- Muddling through is a rational response to complexity
  - The best is the enemy of the good (Voltaire)
  - Real options theory says flexibility has value
  - Learning by doing requires doing to learn
Coming Attractions

- **Shale We Dance on the Oil Peak**
  - Natural gas deregulation, the World Oil Market, Peak Oil, Shale Gas, LNG tankers, CAFÉ standards, Energy Security, ISIS, Iran, Saudi Arabia, Putin’s chest hairs, and anything else that fits.

- **In the Next World You’re On Your Own**
  - Climate change (aka Global Warming), Renewable energy, smart grid, electric cars, energy efficiency, sustainable growth and the limits to growth.
  - “In the long run, we’re all dead”
  - “All things being equal, I’d rather be in Philadelphia”
Chapter One: "POLICE STREET" — IT'S THE WORST STREET IN TOWN, IT'S 30 BOO!