Power Loss: The Origins of Electric Utility Deregulation

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Outline of Talk

I. History of regulation in the utility system
   - “Bad” aspects of competition
   - Rationale for natural monopoly and regulation

II. Driving forces for restructuring
   - PURPA, 1978
   - Ideology, Gulf War, and lobbying

III. Competition in the utility business
   - New technologies may alter the business more.
   - Problems with restructuring
   - Loss of power by traditional utility managers
History of Regulation

- Utility industry in 1880s-early 1900s
  - Rapid growth, consolidation, end of competition
  - Concern for monopolistic abuses

- Economic theory of late 1800s
  - Some businesses are natural monopolies
  - Customers benefit when one company serves all instead of competitive firms involved. Can reduce wasted resources; can exploit bigness, and especially big technologies.

- State regulation of IOUs started in 1907
  - Goals: Protect customers from monopoly abuse AND ensure companies sufficient funds to operate (i.e., reasonable returns).
  - Utility managers **advocated regulation** to legitimate monopolies, provide security to investors, avoid muni takeovers.
Utility Industry Under Regulation

- Generally positive results until 1970s
  - Companies exploited bigger, more efficient technology; costs declined (as predicted).
  - Heavy promotion of electricity use (G & B).
  - Service and consumption expanded (except to rural residents before the 1930s).
  - Rates declined.
  - Utilities, stockholders, customers appeared to benefit.

Illustrations next
Edison’s Pearl Street Station
Dynamo Room, 1882
1300 MW Turbine-Generator
Promotional Ads from 1960s

Reddy Kilowatt is a registered trademark of Reddy Communications, Inc.

While the Cost of Living Has Doubled since 1940, The Unit Cost of Residential Electricity has Decreased 38%
Turbine Capacity Growth, 1907-1965

- Average capacity of power unit
- Maximum capacity of power unit
Thermal Efficiency 1882-1996

- Maximum Efficiency of Plant or Unit
- Average Efficiency of Plant or Unit
Declining Rates, 1892-1960s

Adjusted (2000) Cents per kWh vs. Year
Problems in 1970s

- Technological stasis
  - Thermal efficiency plateaus
  - Economies of scale dissipate

- Energy Crisis
  - Higher costs and rates as new technology can’t mitigate cost increases
  - Creates popular opposition to utility companies
  - Creates environment for political action
Thermal Efficiency Plateau Starts in late 1950s
Turbine Capacity Plateaus

Year

Megawatt
0 200 400 600 800 1,000 1,200 1,400 1,600

Maximum Capacity
Average Capacity
Price of Electricity Since 1962

- Nominal Prices
- 2000 Adjusted Prices
Political Response--President Carter’s National Energy Plan

- Top priority of new president in 1977
  - Sought reduced oil imports
  - Gradual deregulation of energy prices
  - Increased energy taxes
  - Incentives for energy efficiency
  - New ways to produce energy

- Five laws passed in 1978
  - Not as comprehensive as Carter wanted
  - One was Public Utility Regulatory Policies Act (PURPA)
Public Utility Regulatory Policies Act of 1978 (PURPA)

- Designed to reform rate structures of utilities
- 61 pages of text divided into 78 sections
- One obscure 3-page section dealt with incentives for new technologies
- Lobbyists paid attention to rate reform.
  - “Utilities escaped relatively easily. Although the threat of prohibition on the use of gas and oil that had been hanging like the Sword of Damocles was formally carried out--albeit with some important escape clauses--the Public Utility Regulatory Policies Act appears to contain no nasty surprises, at least.”--*Electrical World* 190 (15 December 1978), p. 3. Famous last words...
- Inadvertently unleashed forces of competition.
What did PURPA do?

- Created new class of small-scale generators called “qualifying facilities” (QFs)
  - Cogenerators especially, but also “small power producers” that generated electricity from the wind, sun, water, geothermal sources, and waste.
  - Required utilities to purchase power at often favorable “avoided cost.”
- Immediate impact: lots of cogeneration, especially in CA where other incentives existed, and especially when energy prices seemed to fall instead of rise.
New Technologies—Cogeneration

- Mature technology that still improved
  - Traditional coal and oil.
  - Modular; easy to install and start up; low cost (<$1000/kW).
  - Paper companies, oil companies, Cogentrix, AES, etc.

- Gas turbines and combined cycle technology
  - Aided by Dept. of Defense R&D on jet engines.
  - Aided by decline in natural gas prices after deregulation in early 1980s. Cost down to about 3-4¢/kWh.
Cogeneration Facility

- AES Deepwater Facility (Pasadena, TX)
- Power output: 143 MW
- Steam output: 1,430,000 lb/hr
- Steam customer: Lyondell/Citco Refining
- Construction start: 2/84
- 100% load: 5/27/86
- Fuel: petroleum coke
- Cost $280 million

Gas Turbine, Combined-Cycle Project

- Tampa Electric IGCC Demonstration Project
- 250 Mwe (net)
- Fuel: coal
- Start date: 9/96
- Cost: $303 million
New Technologies—"Renewables"

- Wind turbines
  - NASA, NSF sponsored work on “giant” turbines
  - More successful were smaller-scale turbines
    - CA—lots of wind, lots of incentives
    - US Windpower and lots of other companies
    - By early 1990s, cost of wind power declines to 5¢/kWh
  - Solar power cost declines; geothermal gets cheaper too.
Declining Cost of Renewables

![Graph showing declining cost of various renewable energy sources over time.](image)

*Courtesy: Carl Weinberg of Weinberg Associates*
New generators compete with utilities in generation.

Utilities are still the aggregators of power, but not the only producers.

Utility managers don’t like loss of control and power.
Impact on Regulation—Questioning the Rationale for Natural Monopoly—1

- Policy makers realize that if small-scale generators produced power as cheaply (or more cheaply) than utilities, then why are utilities considered natural monopolies? And why regulation?

- “The traditional defense of regulation has been economies of scale. There are no particular economies of scale apparent on the generating side any more, and therefore that argument ... lacks persuasive force today.”--FERC Commissioner Charles Stalon, 1987
Impact on Regulation—Questioning the Rationale for Natural Monopoly—2

- PURPA technologies invalidate natural monopoly rationale (cont.): ”If electricity were a natural monopoly, this [avoided cost] would be a minimum cost that other, smaller scale suppliers could not match. However, potential suppliers have reflected a broad range of project sizes and a wide choice of technology, fuel, and financial organization. The natural monopoly condition of continuously declining costs with increasing plant size is conspicuously absent.”--FERC Chairperson Martha Hesse, 1988.

- Other concerns: raising money, most efficient use of resources
- AC expanded competition to demand-side approaches
Other Drivers of Restructuring—1

- Increased desire to deregulate industries
  - Telecomm, banking, securities, airlines, trucking, etc.
  - Goal: new services, lower cost.
  - Religious mantra of deregulation.
  - Why not electric utilities too, especially since natural monopoly rationale doesn’t exist any more?
Other Drivers of Restructuring—2

- High electricity prices in some states.
- Declining cost of natural gas and gas turbine technologies.
- Big customers lobbied for direct access to cheaper power.
Other Drivers of Restructuring—3

  - Response to Gulf War.
  - Use of free-market mechanisms.
  - Allowed states to deregulate retail sale of power.
    - Lots of generators (due to PURPA) could now sell directly to customers.

- 1996, 4 states passed laws restructuring utility system.

- By end of Sept. 2001, 23 states (plus DC) passed restructuring legislation; 1 other state restructured through regulatory proceedings.
Restructuring as of Sept. ‘01
Deregulation or Restructuring?

- Only a small part of the utility system has been deregulated (retail generation).
- Distribution remains regulated by states.
- Transmission remains regulated by federal government.
- Wholesale competition allowed after EPAct (1992), but that’s been curtailed a bit in 2001 due to “California crisis.”
- Still lots of environmental regulation.
Future Drivers of Restructuring?

- Continued technological innovation in small-scale generating equipment. Increased use of DISTRIBUTED GENERATION for reliability, cost, and security.

- Are these radical technologies—technologies that destroy the institutional and business structure of the formerly regulated utility system?
Radical Technologies—1

- Microturbines
  - Generally in 30-200 kW range.
  - Promised to be low cost (250-500 $/kW)
  - Can be used to produce electricity and steam for heating

- Pictured is Capstone 30 kW unit, from http://207.198.87.194/cases/TDMini.htm (7/13/00)
Radical Technologies—2

- Fuel Cells
  - Range from 5 kW to several MW
  - Can provide electricity and heat
  - No combustion; little pollution

- Pictured is PlugPower/GE HomeGen 7000, 7 kW residential fuel cell, to be marketed in 2001, at http://www.gemicrogen.com/homegen_installation.html (7/13/00)
Why Power Loss?

- Loss of political and economic power.
  - Resulting from PURPA
  - Resulting from negotiations during restructuring.
    - Environmentalists and others gain leverage as utilities seek “stranded cost” recovery.
- From consequences of restructuring
  - Utility managers lose more control as states (as in CA) force divestiture and take over several functions.

California Woes

Extra California Power Costs May Eat 1.5% of Household Income, Study Says

By Robert Gavin
Staff Reporter of The Wall Street Journal

Sharp increases in electricity and natural-gas prices could eat up an extra 1.5% of average household income in California during the next year and create an additional burden for consumers.

California Plans Big Rise in Retail Electricity Rates

Two Main Utilities' Shares Soar in Heavy Trading; Burden May Be Uneven

By Rebecca Smith
And John R. Emshwiller
Staff Reporters of The Wall Street Journal

California regulators revealed plans to raise electricity rates by 20% for Pacific Gas & Electric Co., a unit of PG&E, and 23% for San Diego Gas & Electric, both of which are under Chapter 11 bankruptcy protection. The increases would affect 4.3 million customers in California, making it the largest rate hike in the state's history.

Utility's Chapter 11 Filing Could Snarl Efforts To End California Crisis

By Rebecca Smith
And John R. Emshwiller
Staff Reporters of The Wall Street Journal

The decision by Pacific Gas & Electric Co. to seek bankruptcy-law protection could greatly complicate efforts to extricate California from an electricity crisis that threatens the state's finances and prosperity.

Taking Charge

Hurt by Deregulation Of Power, California Gives Itself Lead Role

State Becomes Major Buyer Of Electricity and Faces Little Oversight of Deals

Davis Says Move Is Working

By Rebecca Smith
And John R. Emshwiller
Staff Reporters of The Wall Street Journal

Sacramento, Calif.—In a video
Could Problems Spread?

Saving Gracefully
California’s Shortages Rekindle Its Efforts To Conserve Electricity

Dr. Rosenfeld Tests Solutions He Says Won’t Require State to Sacrifice Comfort

White Roofs, Digital Meters

By John Emshwiller
Staff Reporter of The Wall Street Journal
SACRAMENTO, Calif.—With unruly white hair and a mildly absent-minded manner, 76-year-old Arthur Rosenfeld looks like the retired physics professor he is. But these days he has a new career: developing stealth weapons to help keep electricity shortages from short-circuiting California this summer.

Dr. Rosenfeld’s humble probing grounds are Building G, a somewhat grimy one-story structure owned by the Sacramento Municipal Utility District, and a slightly spiffier Kaiser Permanente medical office building 16 miles away. There’s nothing remarkable about the two facilities—except that both have slashed their electricity demand for lighting and air-conditioning by as much as 30%, largely without their occupants noticing the change.

Down to the Wire
Why California Isn’t The Only Place Bracing For Electrical Shocks

In Deregulated Environment, Many States Are Vulnerable To Erratic Pricing, Supply

Warning Signs in Manhattan

By Rebecca Smith
And John R. Emshwiller
Staff Reporters of The Wall Street Journal

From Manhattan to Montana, worries are mounting that skyrocketing power prices and rolling blackouts will soon spread from their epicenter in California.

The problem is rooted in the nation’s piecemeal, poorly thought-out utility-deregulation process, which planted time bombs that could continue to explode for years to come. Deregulation in the ’90s prodded many utilities to sell off power plants and then to sign long-term contracts to buy back the output. Now, those contracts are expiring. That will mean utilities are going to be
Summary/Conclusion—1

- PURPA and innovation of small-scale technologies destroyed rationale for natural monopoly and hence rationale for regulation.
- Also, ideology of deregulation in 1970s+.
- Desire for lower rates, esp. for big businesses.
Summary/Conclusion—2

- Restructuring is a mixed bag.
- California looks bad; other states (PA, TX) look better.
- Some states holding off on restructuring in light of CA experience.
- New technologies and new policies may drive restructuring further.

The end—finally!