

Liberalization and Regulation of Telecoms, Electricity, and Gas in the United States

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I. Introduction

The United States has a long tradition of commission style regulation of privately owned utilities. This fact has both advantages and disadvantages. On the plus side producers, political bodies, regulatory agencies, courts, consumers, and other players are fully adapted to the idea and practice of independent regulation. Furthermore there is a ready pool of talented professionals to analyze issues and develop solutions as new issues emerge. But these advantages can also be disadvantages during times of change. Complex, well developed systems are often slow to recognize new realities and are costly to change because regulatory policies create interest groups that benefit from the status quo. In some instances new technologies and policies cannot be introduced incrementally, but rather strand investment and challenge investor's willingness to provide funds.

In this chapter we examine the development and evolution of utility regulation in the United States, focusing on energy and telecommunications. We begin with the development of these industries, taking as given the traditions, institutions, and legal frameworks created through the regulation of transportation and other industries, even though these laid critical foundations for utility regulation. We begin by describing the economic and political context for regulation. We then examine regulation for each sector. We conclude with a brief review of emerging issues.

II. The U.S. Context

In general the economy of the United States is marked by private enterprise and competitive markets. There are swings in political views when the favorable view of liberal markets is less warmly embraced than at other times, but the relative success of the market system, the U.S. Constitution's protection of private property, and an American culture that has for most of its history viewed favorably individual responsibility and liberty have worked together to maintain the economy's market orientation.¹

One notable exception to this history of liberal markets has been the regulation and provision of public utility services. Although the term public utility is not well defined, the industries treated as such have tended to be monopolistic and are affected with the public interest, meaning that their performance significantly impacts the social and economic functioning of the country and they are subject to legal obligations above and beyond those of other enterprises. (Phillips, 1993, pp. 1-2, 83-121; Glaeser 1927, pp. 170-171)

Utility enterprises are treated differently than other businesses in the economy in at least two respects. First, the utilities are generally regulated monopolies. The regulations typically include restrictions on the extent to which a utility can discriminate in its service to similarly situated customers, limits on the providers' prices, and an obligation to serve customers who are

¹ Clearly there are many who might disagree with this view of the United States or argue that the country is moving away from its liberal roots. I will not expand upon these issues because they are beyond the scope of this paper.

willing to pay the regulated price. However, the government's authority to regulate prices is limited in that the regulated prices must allow the operator an opportunity to maintain its financial integrity, i.e., the operator is allowed to recover its reasonable costs and cover its costs of equity and debt. (Phillips, 1993, pp. 319-331, 376-382; Glaeser, 1927, pp. 174-175) This limit on the government's ability to regulate prices is designed to check opportunistic behavior by the government, which would in turn reduce investment and services. (Williamson, 1983) The second way that utilities are different is that they are sometimes government owned, although private ownership is the norm. As we explain in more detail below, power providers such as the Tennessee Valley Authority (TVA) and Bonneville Power Administration (BPA) are federally owned. In addition there are more than 2000 municipally owned electric utilities. (Brown 2005; Liggett, 2000)

It can generally be concluded that, relative to the common alternatives of government provision of utility services or unregulated monopoly, the regulatory system in the United States has worked to the benefit of customers and service providers. However, it has not been without its critics. In 1940 Horace Gray argued that the concept of a private monopoly cannot be harmonized with the idea of public interest. (Gray 1940) He believed that regulation is unable to control monopoly and that social or national goals should supersede concepts of fair profit and cost-based pricing. Sam Peltzman (1976) argued that regulation occurs because of rent seeking on the part of powerful political interests and so could have little to do with a broader and vaguely defined public interest. Harry Trebing (1976, 1984a, 1984b) counters that these and similar views are based on simplifications that exaggerate the problems with government intervention and the adequacy of markets, but he found value in the debates these views generated on the shortcomings of regulation.

Regulation in the United States is an outgrowth of an interaction between economic argument and the U.S. legal system. The federal government's legal authority to regulate comes from the interstate commerce clause in the U.S. Constitution, which provides that the federal government has the authority to regulate commerce among the states. The various state governments' legal authority to regulate comes from their police powers, which the Constitution says are not delegated to the federal government. These powers allow the states to protect the health, safety, morals, and general welfare of their citizens. Through a series of legislative actions, court actions, and the like, these police powers came to include the authority to regulate prices and services of businesses that were deemed to be public utilities. Because the interstate can be affected by state regulation and visa versa, there are constant frictions between state and federal regulators. (Phillips, 1993, pp. 83-121)

One of the earliest court cases to establish the concept of a regulated business affected with the public interest was *Munn v. Illinois*.² This case upheld legislation in the State of Illinois to regulate grain elevator prices. The U.S. Supreme Court's decision found that a state has the authority to regulate a private company in the public interest if the private company could be seen as a utility. In *Munn* the court based its argument in part on the private business's market power. Subsequently in *Brass v. Stoesser*³ the court confirmed that the state of North Dakota could regulate private businesses – again grain elevators – even though the individual businesses

² *Munn c. Illinois*, 94 U.S. 113, 131-2 (1877).

³ *Brass v. North Dakota ex rel. Stoesser*, 153 U.S. 391 (1894).

lacked market power because of the effects the businesses could have on their customers. One of the earliest cases restricting governmental authority over prices was *Smyth v. Ames*,⁴ which protected utilities' rights to due process and found that regulatory commissions had to base prices on the value of the utilities' assets. The court's asset valuation criteria proved to be problematic, but it was remedied in 1944 in *Federal Power Commission v. Hope Natural Gas*⁵ where the Supreme Court determined that it should not impose a specific ratemaking methodology on regulatory commissions, but rates had to be just and reasonable, allowing a service provider to operate successfully.

Institutional economists, who emphasized issues of market power and fairness, dominated the economic discourse that helped create and shape regulation.⁶ In his studies of the industrialization of the United States, Charles Adams argued that because railroads were capital intensive, their value to the economy would be increased if prices were controlled so as to increase the volume of usage (Trebing 1987). Martin Glaeser (1927) helped refine the public utility concept and explained the economic and legal rationale for regulation, as well as the emerging lessons from experiments in the regulation of prices. James Bonbright and Gardiner Means (1932) provided insights into problems with utility holding companies and Bonbright (1961) wrote a foundational text on utility ratemaking, emphasizing fairness and concrete regulatory issues (Berg and Tschirhart, 1995). The basic postulates of these and other institutionalists were that regulation was needed to control market power, pursue public and social interest goals, improve efficiency and individual choice, and provide due process for stakeholders and operate with transparent processes. (Trebing 1987)

Neoclassical economics, which emphasizes markets and optimizing behavior subject to technological and regulatory constraints, shaped much of the current thinking on regulation. For example, Alfred Kahn's classic texts, published in 1970-71 and republished in 1988, provided a rigorous, yet non-mathematical explanation of economic efficiency aspects of utility pricing and the impacts of market structure on regulation. Work by William Baumol (1977, 1979, 1982, 1983, 1986), Gerald Faulhaber (1975, 1979), and William Sharkey (1981, 1982a, 1982b) introduced ideas of contestable markets, added rigor to concepts of natural monopoly, explained the cost structures and pricing incentives of multiproduct firms, and developed approaches for allowing price flexibility for multiproduct utilities serving in both competitive and monopoly markets. Their work also laid foundations for cross-subsidy concepts, deregulation, and access pricing applied in telecommunications, and avoided cost concepts applied in energy. Neoclassical economics also introduced other innovations important in utility regulation, including peak-load pricing (Boiteux, 1949; Steiner, 1957; Hirschleifer, 1958; and Williamson, 1966), risk assessment in the cost of capital (Sharpe, 1964), option pricing (Black and Scholes, 1973), the use of auctions to allocate scarce resources (Coase, 1959; Vickery, 1961), and Ramsey pricing (Ramsey, 1927). Although first formalized in recent times by the Austrian economist Stephen Littlechild (1983) for the regulation of British Telecom, the advancement of price cap regulation to overcome information asymmetries was also accomplished by application of neoclassical economics (Sappington, 2002).

⁴ *Smyth v. Ames*, 169 U.S. 466 (1898).

⁵ *Federal Power Commission v. Hope Natural Gas Co.*, 320 U.S. 591 (1944).

⁶ For more complete descriptions of the contributions of institutional and neoclassical economics to utility regulation, see Miller and Samuels (2002), Berg and Tschirhart (1995), and Faulhaber and Baumol (1988).

As we describe in the next section, these legal and economic concepts both laid the foundation for utility regulation in the United States and led to its constant evolution from a system designed to provide stability, control market power, and promote fairness, to one that now focuses largely on efficiency and economic incentives.

III. Regulatory Models and Approaches in the United States

All state and federal regulatory bodies in the United States are permanent agencies, established either by constitution or statute, but mostly by statute.⁷ State laws and constitutions create the state agencies and federal agencies exist under federal statutes. In general the state public utility commissions (PUCs) are defined by their respective state laws as independent and not part of any other agency of the government. As a result they are free to make their own final decisions, subject only to court appellate processes, although situations arise where a state legislature will change a PUC decision by revising the state statute. In just a few states, such as Massachusetts and Iowa, and in the case of the Federal Energy Regulatory Commission (FERC), the agencies are within a government department for administrative matters, but not for their regulatory decisions. (Phillips, 1993, pp. 83-121; Brown, 2005)

Regulatory agencies in the United States combine legislative, executive, and judicial powers of government. Governmental powers in the United States are divided into three categories that form the three branches of government. Basically the legislative branch writes laws (i.e., creates basic policy), the executive branch enforces and carries out the laws, and the judicial branch interprets the laws and resolves legal disputes. Regulatory agencies combine these three powers when they, for example, set rates and standards (legislative), enforce statutes and their own administrative rules (executive), and interpret statutes (judicial). Thus the agencies are inherently independent agencies, although accountable to the legislatures, executive authorities, and courts. (Phillips, 1993, pp. 83-121; Brown 2005)

Federal regulatory agencies are essentially sector specific: The FERC regulates energy (electricity and natural gas) and the Federal Communications Commission (FCC) regulates telecommunications. State PUCs are generally multi sector. In the following sections we focus on the development and evolution of regulation by sector, beginning with telecommunications and then proceeding with energy. We do not elaborate on transportation or water regulation.

Fixed Line Telecommunications

Telecommunications in the United States began with competition between Alexander Graham Bell and Western Union over patent rights to the telephone device and the establishment of telephone exchanges.⁸ Bell negotiated an agreement with Western Union that gave Bell, whose company became AT&T, the telephone patents. Bell enjoyed a monopoly on telephone service until the key patents began expiring in the late 1800s, at which time numerous competitors – called independent telephone companies – arose to challenge Bell, which had left

⁷ Statutes typically spell out the duties, responsibilities, financing, and authority of the agencies. (Brown 2005)

⁸ We omit the development of the telegraph. Western Union was the primary telegraph provider in the United States.

so much unmet demand during its first monopoly era that soon after the patents expired the independents served more lines than did Bell. Early telephone technologies could not carry calls between cities, so telephone service was limited to service within a city, which became known as a local exchange. (Brock, 1981, pp. 97-99, 104-105) This technology boundary became a regulatory boundary through the telephone franchising process: prior to the development of state and federal regulation, telephone companies obtained franchises from city governments and these franchise agreements regulated prices, although in some instances prices were controlled by state legislatures. (Nix and Gabel, 1993; Gabel, 1994; Mueller, 1993; Mueller, 1997, p. 37)

The rapid rise in competition gave way to industry consolidation, raising concerns about monopolization. This concern coupled with the refusal of some rivals to interconnect their networks fed interest in regulating the growing industry. However, political bodies were ill suited for regulating sophisticated companies that were able to leverage information asymmetries, so state legislatures began creating PUCs in the early 1900s. (King, 1912) The rise of long distance technology, which made interstate calling possible and the development of wireless telecommunications prompted Congress in 1910 to extend the authority of the country's transportation regulator, the Interstate Commerce Commission, to include telecommunications. But neither the Interstate Commerce Commission nor the FCC, which was created by the Communications Act of 1934 and took over telecommunications regulation, had authority to regulate local telephone⁹ prices because these services were considered intrastate commerce. (Brock, 1981, pp. 158-161, 178-180)

In the early 20th century AT&T opposed both regulation and competition, but could not avoid one without having the other. As a result the company embraced the idea of regulated monopoly. Unfortunately for AT&T, federal legislation did not actually grant the company a monopoly. So in three decades when the company Hush-A-Phone proposed to attach devices to AT&T phones, something AT&T opposed, the courts and a reluctant FCC permitted Hush-A-Phone to do so, determining that companies and customers could attach devices to the public switched network as long as the devices were privately beneficial and not publically harmful.

Although competition began on the edge of the network, it quickly switched to the network's core. Hush-A-Phone constituted competition at the edges of the network: customers wanted to attach non-AT&T equipment to the AT&T network. Another company, Carterphone, represented a network innovation: Carterphone allowed customers with private radio networks to connect those networks to AT&T. Presumably with proper legal authority AT&T could have offered a radio service, but it did not do so. Furthermore the FCC's *Above 890 Decision*,¹⁰ which set aside a portion of the microwave radio spectrum for use by customers, enabled customers to self supply high capacity circuits, further enabling network competition.

The *Above 890 Decision* also made possible the development of an upstart company that eventually became Microwave Communications Inc. or MCI, which constructed a microwave network and allowed others to lease capacity. MCI soon began leasing its circuits in very

⁹ In the United States, line rental and local calling were traditionally combined into a single service called local service.

¹⁰ *In re Allocation of Microwave Frequencies Above 890 Mc.*, Dkt. No. 11866, 27 FCC 359 (1959), *aff'd on reh'g*, 29 FCC 825 (1960).

creative ways: leasing periods became increasingly short and access to circuits became increasingly automated until, eventually, a customer could “lease” an MCI circuit on a per minute basis by simply dialing a special code into their AT&T phone. This, of course, was simply long distance service under the guise of circuit leasing.

What MCI demonstrated is that price and service barriers to entry – even if embraced by the sector regulator – can be overcome. However, this was not the lesson that regulators thought they learned from the MCI experience. They concluded that since there was competition at the edges of the network and in the core of the network, but not in the fixed line portion, that it must be because the fixed line is a natural monopoly. This incorrect belief shaped telecommunications policy from the late 1970s to the mid 1990s.

Despite the growing cracks in the AT&T monopoly, the company dominated the industry from the 1920s until the breakup in 1984, controlling approximately 90 percent of the country’s fixed lines and accounting for over 90 percent of the long distance revenue. (Economides, 2004) It was also during this time that the country achieved what became known as universal service. Conventional wisdom is that subsidies from long distance service to local service, coupled with an AT&T monopoly, led to universal service. However, as Milton Mueller (1993) demonstrated, telecommunications grew faster during the competitive eras than in the monopoly eras and universal service was largely achieved before the FCC adopted an extensive subsidy scheme.

The belief that fixed line was a natural monopoly provided the underpinnings of the breakup of AT&T in 1984. The basic concern was that AT&T had used its control of bottleneck local telephone lines to foreclose competitors and to cross subsidize its potentially competitive markets (Temin, 1990). The breakup required AT&T to divest its ownership of the Regional Bell Operating Companies (RBOCs), which owned the local fixed lines (Hughes, 1996).¹¹

Facilitating competition in long distance, making the local telephone subsidy scheme compatible with long distance competition, and addressing further encroachments by competition into the divested RBOCs’ networks occupied regulators’ time until around 1993 when it became clear that the monopoly over fixed lines could not be sustained. Fixed line was opened to competition on a state by state basis until the passage of the Telecommunications Act of 1996 (1996 Act),¹² which made local telephone competition a national policy.

The 1996 Act provides three methods of entry for local telephone service. Entrants can build their own facility-based network, lease portions of an incumbent’s network, buy an incumbent’s service and resell it, or use some combination of these three approaches. The essential trade-off in the 1996 Act is that the RBOCs and GTE were permitted to offer long distance service in exchange for effectively opening their local monopolies to competition.¹³

¹¹ Had the authorities not believed that fixed line was a natural monopoly, other viable options might have been considered, including removing barriers to competition in fixed lines, taking steps to ensure that the emerging cellular technology would be a substitute for fixed line, and creating a horizontal breakup into vertically integrated network operators.

¹² PUB. L. NO. 104-104, 110 Stat.56.

¹³ The AT&T divestiture agreement restricted the RBOCs from providing long distance service, except in limited areas (called Local Access Transport Areas, or LATAs). LATAs were typically the size of an area code region that

GTE was permitted to offer long distance immediately upon passage of the 1996 Act, but the RBOCs had to satisfy a 14 point checklist.¹⁴

Research following the 1996 Act demonstrates that its entry methods had positive, but modest impacts on the development of fixed line competition. Zolnierek, Eisner, and Burton (2001) find that the policies helped competition develop, but primarily in urbanized areas. Roycroft (2005) shows finds that lower prices for leasing network facilities from incumbents led to more entry. Jamison (2004) finds that when regulators require incumbents to receive lower profits on wholesale services sold to rivals than on retail services, incumbents limit entry. Dean Foreman (2002) and Robert Crandall (2001) find that entrants building their own networks are more successful than those that lease facilities or resell incumbent services.

Even though provisions of the 1996 Act had some success, overall the legislation is viewed as confusing, contradictory, and disappointing. Crandall (1997) finds much legacy regulation has been left in place, new layers of regulation have been created, problems of non-economic pricing are unresolved, and new opportunities for contentious regulatory games are created because the legislation was inordinately complicated. He also concludes that the 1996 Act created a class of companies that had little chance of long term survival (Crandall 2005). Nicholas Economides (1998) views the legislation as a positive development, but notes that its implementation was delayed by lengthy legal and regulatory proceedings. The Consumer Federation of America and the Consumers Union (2000) find that the 1996 Act resulted in too little competition.

Wireless Telecommunications

Wireline competition and AT&T's early interest in delaying such competition affected the development of the U.S. wireless industry. AT&T's Bell Labs developed the concept of cellular phones in 1947¹⁵ and proposed to the FCC that it allocate a large number of radio frequencies to cellular service so that the service could be widespread, meaning that AT&T would have an economic incentive to develop the new technology. However, the FCC allocated only a limited amount of frequency at that time; only enough to allow twenty-three simultaneous phone conversations in the same service area.

AT&T continued to press the FCC for additional radio spectrum for mobile services, but it was not until 1968 that the FCC reconsidered its position and formed an advisory committee to determine whether cellular technology could be successful. Following Motorola's invention of the first modern portable telephone handset in 1973, the FCC authorized three tests of cellular, granting experimental licenses to AT&T for Chicago and Baltimore, and a third experimental license to American Radio Telephone Service, Inc., for Washington, D.C.

would have existed in 1982. The RBOCs were prohibited from carrying long distance calls across LATA boundaries. GTE was prohibited from providing interLATA long distance under a different consent decree.

¹⁴ Tomlinson (2000, pp. 320-321) provides details on these preconditions.

¹⁵ A cell is an area served by a mobile carrier antenna. Radio frequency refers to the frequency with which electromagnetic wave cycles pass a given point per second. For example, the FCC's A Block license for broadband PCS included frequencies around 1850 MHz, which means 1,850,000,000 cycles per second.

It was not until 1982 that the FCC authorized commercial cellular service, beginning with the first generation (1G) mobile technology known as AMPS a year after the service had become available in Nordic countries. The FCC chose to issue two licenses in each market area. One license was given to a fixed line operator serving the area.¹⁶ The other license was to be issued to a non-fixed line operator based on a process called a beauty contest through which rivals would submit applications to the FCC, each explaining why it was the best qualified for the license. This process overwhelmed the FCC when applicants submitted volumes of documentation, some using multiple semi-trucks to carry their applications to the FCC offices, so part way through the process the FCC decided to assign its remaining non-fixed line licenses using a lottery system. The FCC retained the duopoly market structure until 1995 when it auctioned radio spectrum for use by PCS, which was the second generation (2G) cellular technology. This brought additional service providers into the market, which intensified competition and launched rapid growth in mobile services in the United States.

According to the FCC's 12th report on competition in mobile services, mobile telephony covers almost the entire country.¹⁷ The statistics show that over 99 percent of the total U.S. population lives in census blocks¹⁸ that have one or more operators. More than 95 percent of the population lives in areas with at least three mobile carriers. These statistics at least somewhat overstate the actual coverage and competition because, within a census block there may be dead zones, or areas where a customer cannot access a mobile radio signal. However, even if the coverage is overstated, there is general consensus that very few Americans cannot receive cellular service at their homes and that the vast majority have their choice of service providers.

Natural Gas

Natural gas was unimportant in the United States prior to the 1920s, but that changed with the development of new oil fields and improvements in pipeline technology. The popularity of natural gas has grown so much that in 2008 it comprised 24 percent of the energy consumption in the United States. In contrast, coal provided about 23 percent of the U.S. power in 2008 and nuclear power provided only 8 percent. Industry development has features similar to that of fixed line telecommunications development: the gas industry was considered primarily a local or state issue until technology made interstate commerce possible. Also the industry was treated as a natural monopoly until economic forces demonstrated that many functions were better regulated by markets than by government institutions.

Growth in the use of natural gas began around the time of the end of World War II. Net production increased from slightly less than seven billion cubic feet in 1950 to over 19 billion in 1979, and decreased to about 17 billion in 1990. Meanwhile pipeline transmission increased from 82,000 miles to 280,000 miles during this period. (Phillips, 1993, pp. 694-695, citing Moody's Public Utility Manual, 1982, and the American Gas Association's Gas Facts, 1990)

¹⁶ If more than one fixed line operator was in the area and wanted the license, the operators negotiated a joint business arrangement.

¹⁷ FCC, "Twelfth Report," http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-08-28A1.pdf, downloaded November 21, 2008.

¹⁸ A census block is the smallest geographic unit used by the United States Census Bureau for its decennial population census. In cities, a census block is often a city block, but in rural areas a census block may be many square miles.

Regulation developed because of beliefs in the natural monopoly nature of the industry and regulation was shaped by changes in technology. Regulation began at the city level through franchises and then extended to the state level because cities lacked jurisdiction over intercity pipelines. Prior to the improvements in pipeline technologies that made interstate pipelines possible, 87 percent of natural gas consumption was concentrated in the six principal gas producing states of Texas, Louisiana, California, Oklahoma, and Texas. (Phillips, 1993, p. 693) The new technologies made interstate pipelines possible, which triggered efforts by states to assert jurisdiction in the 1910s and 1920s. The Supreme Court ruled that the states could not regulate these pipelines because they represented interstate commerce, but it wasn't until the passage of the federal Natural Gas Act of 1938 (NGA)¹⁹ that Congress filled the regulatory void, giving the Federal Power Commission jurisdiction over interstate gas transmission. (Natural Gas Supply Association, 2008)

The natural gas supply chain includes production or extraction at the wellhead, transmission through pipelines, and distribution through local distribution companies (LDCs). The NGA focused on pipeline regulation, not wellhead regulation. That changed in 1954 when the Supreme Court ruled that that natural gas producers selling into natural gas into interstate pipelines were 'natural gas companies' under the NGA, and were subject to Federal Power Commission (FPC) regulation.²⁰ The FPC adopted rate of return regulation for these prices. Initially the FPC regulated individual producer prices, but the work load was unmanageable for the FPC because of the large number of producers. As a result the agency began a process of setting rates on a regional basis, dividing the country into five separate producing regions. This approach also proved unworkable because of the diversity of costs across producers within a region and after 10 years of effort, the FPC had set rates for only two of the five regions. Furthermore the regulated prices were significantly less than market based prices for natural gas not sold into interstate pipelines, leading to distorted producer incentives. As a result the FPC abandoned its rate of return approach and established a national price ceiling of \$0.42 per million cubic feet. However, this too was below the market price for natural gas. (Natural Gas Supply Association, 2008; Phillips 1993, pp. 698-699)

The FPC's attempts at wellhead price regulation consistently resulted in regulated prices below the market rate, resulting in natural gas shortages in the 1970s. So in 1978 Congress passed the Natural Gas Policy Act (NGPA)²¹ to create a single national natural gas market, allow a balancing of supply with demand, and permit market forces to establish wellhead prices. Rather than relying upon the FPC, the NGPA established statutory maximum prices for wellhead sales. Some of these price controls were scheduled to be phased out by 1985, but prices for wells in production before passage of the NGPA were to remain regulated. The underlying theory of this asymmetric treatment of wellhead prices was that the deregulated prices would provide an incentive for new exploration, but existing wellheads would not be allowed a windfall benefit from these potentially higher prices. (Natural Gas Supply Association, 2008) But as a result of this dichotomous treatment of old and new natural gas, some existing wellheads were taken out

¹⁹ Natural Gas Act, 52 Stat. 824 (June 21, 1938).

²⁰ Phillips Petroleum Co. v. Wisconsin (347 U.S. 672 (1954))

²¹ Natural Gas Policy Act of 1978, Public Law No 95-621, 92 Stat. 3350 (November 9, 1978)

of production so that producers could receive the higher profits allowed for gas from new wellheads.

The NGPA created a single national market by giving FERC, which had replaced the FPC in 1997, authority to approve interstate transmission of natural gas on behalf of intrastate pipelines or LDCs. (Natural Gas Supply Association, 2008)

The NGPA took significant steps towards deregulating prices at the wellhead, but left in place regulation of prices for sales from an interstate pipeline. Under the NGA and the NGPA, pipelines purchased natural gas from gas producers, transported it to its customers, and sold the bundled product at a regulated price. This system came under pressure in the early 1980s when a number of industrial customers began switching from using natural gas to other forms of energy. Because the switching was in response to the economic distortions caused by regulation, the FERC tried to allow pipelines to give special pricing arrangements to these large customers, but courts overruled FERC on the grounds that this was discriminatory. So in 1985, FERC issued Order No. 436,²² also known as the Open Access Order, which established a voluntary framework under which interstate pipelines could serve as transporters of natural gas and not gas merchants, allowing customers the opportunity to purchase gas at the wellhead and pay the pipeline for transport. To ensure that pipelines did not favor their own merchant operations, FERC established minimum and maximum transport rates. Even though almost all pipelines participated in this voluntary program, in 1992 FERC issued Order No. 636,²³ also known as the Final Restructuring Rule, making the separation of transport and sales mandatory. Under this rule, the FERC required that production and marketing arms of interstate pipeline companies be arms-length affiliates. (Natural Gas Supply Association, 2008; Phillips 1993, pp. 704-715)

Meanwhile, the Natural Gas Wellhead Decontrol Act of 1989 (NGWDA)²⁴ completed the deregulation of wellhead prices begun under the NGPA by directing the deregulation of all 'first sales' of natural gas. The NGWDA defined 'first sales' as sales to a pipeline, a LDC, an end user, or any sale preceding these sales. It excluded from first sale any sales of gas by pipelines and local distribution companies.

Today the restructuring and deregulatory approaches for natural gas are viewed as relatively successful (Costello 2009). FERC regulates transmission by pipelines and wholesale sales and transmission for interstate commerce. It also oversees siting and abandonment of interstate natural gas pipelines and storage facilities, and ensures the safe operation and reliability of proposed and operating liquefied natural gas terminals.²⁵

²² *In re Regulation of Natural Gas Pipelines After Partial Wellhead Decontrol*, Order No. 436, 33 FERC ¶ 61,007, 50 Fed. Reg. 52,217 (1985), *modified*, Order No. 436-A, 33 FERC ¶ 61,372 (1985), *modified*, Order No. 436-B, 34 FERC ¶ 61,204 (1986), *reh'g denied*, Order Nos. 436-C, 436-D, 436-E, 34 FERC ¶ 61,404 (1986), *rev'd in part and remanded sub nom*.

²³ *In re Pipeline Service Obligations and Revisions to Regulations Governing Self-Implementing Transportation Under Part 284 of the Commission's Regulations*, 59 FERC ¶ 61,030 (1992).

²⁴ Pub. Law 101-60, 103 Stat. 157.

²⁵ FERC, "What FERC Does," <http://www.ferc.gov/about/ferc-does.asp>, downloaded September 7, 2008.

Electricity

Similar to the telecommunications and gas industries, the U.S. electricity industry formed organically through the development of local electric systems. New technologies created interstate markets for electricity and the federal government responded with federal regulation.

Electricity was developed largely by private businesses, but also by municipalities. Many industrial customers produced their own electricity in the early 20th century, but soon began buying their power from vertically integrated electric utilities because of their scale economies and reliability. Soon the industry integrated horizontally through mergers and acquisitions, government programs, legal and regulatory mandates, and various policy decisions. (Brown 2005; Liggett, 2000)

The development of regulatory regimes paralleled the sector development. Initially municipalities granted franchises or licenses to local operators or created their own utilities, which came to be known as public power. Horizontal integration resulted in utilities that extended beyond the jurisdictional reach of local governments. This, plus a need to reduce corruption and professionalize regulation, led to the development of regulation by states. (Brown 2005, Glaeser 1927, Knittel 1999) Most states already had regulatory commissions for railroads or other monopoly industries and most states simply gave these commissions authority for electricity regulation, along with regulation of telecommunications, natural gas, and water and wastewater. (Brown 2005)

Prompted in part by the rise of multistate holding companies that were beyond the jurisdiction of state regulatory commissions, federal regulation of electricity appeared in the 1930s with the Federal Power Act (FPA) and the Public Utilities Holding Company Act (PUHCA),²⁶ both enacted as part of President Franklin D. Roosevelt's New Deal reforms along with the formation of the Tennessee Valley Authority (TVA) and Bonneville Power Administration (BPA). The FPA created the FPC and, in filling a gap in state regulation, namely the regulation of interstate wholesale electricity transactions, gave the FPC jurisdiction over all wholesale power exchanges and the use of the transmission grid for such transactions. The federal government formed TVA in the southeast and BPA in the northeast to take advantage opportunities for hydropower in situations where private investment was not forthcoming. Also as part of the New Deal, the National Rural Electrification Act (REA) led to the development of rural electric cooperatives in areas unserved by private operators and municipalities. These cooperatives are owned by their customers and generally receive federal subsidies in the form of low interest loans initiated by the National Rural Electrification Act (REA).

Today the electricity sector is largely privately owned by publicly traded companies, but about 25 percent of the U.S. load is served by government owned entities and rural electric cooperatives. The government owned operators include federal entities, such as the TVA and BPA, and more than 2000 public power utilities. (Brown 2005; Liggett, 2000) Research has shown that this mix of private and public ownership has resulted in some inefficiency, owing in part to the inefficiencies of regulating private companies. Rose and Joskow (1990) find that the government owned generation companies are slower to adopt new technologies than are their

²⁶ Public Utility Act of 1935, Public Law No. 333, Sec. 2(a)(7)(1935).

privately owned counterparts. Berry (1994) finds that investor owned electric companies are more technically efficient than are rural electric cooperatives, which are owned by their customers. Kwoka (2006) finds that privately owned electricity distribution companies are less technically efficient than their publically owned counterparts unless faced with either competition for large customers or benchmark competition.

The division of responsibilities between state and federal regulators often led to turf battles because all market participants are in some way regulated by both the state and federal regulators. States oversee the rates charged by electric distribution companies, but the FERC oversees their energy purchases and their access to the grid. The FERC oversees transmission companies' revenues and access policies, regulates transmission reliability, monitors and investigates energy markets, and licenses and inspects private, municipal, and state hydroelectric projects, but states oversee their siting, licensing, and the like. Independent power producers and other generating companies are regulated in the same ways as transmission companies,²⁷ but states also affect them through the states' oversight of retail markets and distribution companies. (Brown 2005) Often state PUCs lack authority over prices of public power entities and rural electric cooperatives.

The second major structural reform of the sector found its beginnings in the late 1970s. Prompted in part by rising energy costs in the late 1960s and into the 1970s, Congress passed the Public Utility Regulatory Policies Act of 1978 (PURPA), which allowed nonutility facilities to enter the wholesale market. Generation by non-utilities was further advanced by the Energy Policy Act of 1992 (EPAct), which created a new category of power producers and exempt wholesale generators (EWGs), which are wholesale producers that do not sell electricity in retail market and do not own transmission facilities.

This major structural reform, also called "dereg", short for deregulation, continued until the debacle with California's electricity system in 2000. Dereg was intended to intensify competition in generation by reforming grid access, divestiture of some generation assets, and the creation of trading institutions. (OECD, 1998) Generation was unbundled from regulated utility operations, which continued to provide transmission and distribution. In some cases generation was sold or transferred to a utility affiliate, but in others the generation was actually sold off. (OECD, 1998; Lien, 2008) Currently about 40 percent of the generating capacity is owned by non-utility generators. (Lien, 2008, citing the U.S. Department of Energy's Energy Information Administration)

California was one of the first states in the United States to adopt dereg. In the 1990s, California customers routinely paid above the national average for their electricity in a system that was dominated by three vertically integrated utilities, each of which was a monopoly in its own territory.²⁸ The California Public Utilities Commission (CPUC) recommended restructuring in the early 1990s and the legislature adopted statutes to do just that in 1996. For a time after deregulation began in 1998, the system more or less worked.

²⁷ FERC, "What FERC Does," <http://www.ferc.gov/about/ferc-does.asp>, downloaded September 7, 2008.

²⁸ William Booth, "Mutiny on the Meter?; California Races to Fix Deregulated System as Prices, Tempers Rise," Washington Post, December 3, 2000.

Under California's dereg plan, the utilities sold off about 50 percent of their power plants and the state created an independent system operator (ISO) to manage the transmission grid, and a Power Exchange, which daily purchased electricity from power plants to supply the needs of the utilities. Wholesale prices were set in the spot market, but the retail prices that utilities could charge were regulated by the CPUC and could not rise with increases in wholesale prices.²⁹

In the summer of 2000 wholesale prices for electricity rose sharply. Soon the prices California's utilities paid for electricity reached a crisis level and with retail price caps in place, the utilities were unable to recover their costs. Two utilities approached bankruptcy and suppliers threatened to stop shipments.³⁰ Insufficient supply led to rolling blackouts. Efforts at FERC and in California to address the crisis devolved into a state-federal battle, with the California governor blaming FERC for not addressing the critical issues and accusing producers and marketers of manipulating the markets. Some FERC commissioners joined in accusing the industry for artificially creating the crisis, but FERC limited its formal response to allowing California's utilities to stop buying exclusively from the spot market and instead negotiate long term contracts.³¹ The California governor and politicians, and many interest groups criticized the FERC response as being tepid. One of the California utilities sued FERC.

By early 2001 electricity demand had outstripped supply and the state continued to experience blackouts. The policy battle was between federal regulators, who did not want to cap wholesale prices to accommodate retail price caps, and state regulators and politicians, who did not want to lift retail price caps to accommodate deregulated wholesale prices. By the summer of 2001 the FERC acquiesced and imposed wholesale price caps, a move that is largely credited with ending the California crisis.

Compared to California, another dereg situation, the Pennsylvania, New Jersey, and Maryland (PJM) market has worked well. PJM was created as a power pool in 1927 by three utilities in Pennsylvania and New Jersey, but by time it became an ISO in 1997 it included eight interconnected utilities. (Bowring, 2006) Joseph Bowring attributes PJM's success to features that were missing from the California market, including flexibility for buyers to enter into bilateral contracts, to self-schedule generation, and to supply their own generation. He also credits nodal pricing – a system for determining prices in which prices are calculated for a number of locations on the transmission grid (nodes), each of which represents a location where energy is either injected or drawn. Bowring concludes that these effective systems were possible in the case of PJM because the members had a history of working together, developed a complete set of market rules prior to implementation of the market, adopted an independent governance structure, created an effective monitoring process, and formed an adaptive process for changing policies as circumstances changed.

Several studies have concluded that the restructured markets in general have had positive impacts, but issues remain. Bushnell and Wolfram (2006), Fabrizio, Rose and Wolfram (2007),

²⁹ For a full analysis of the California case, see Borenstein (2002).

³⁰ Pacific Gas & Electric filed for bankruptcy the following year.

³¹ The utilities were also no longer forced to sell their generation into the PX, and could sell directly to their customers. See FERC's chronology for "Addressing the Western Energy Crisis" at <http://www.ferc.gov/industries/electric/indus-act/wec/chron.asp>.

and Shanefelter (2006) credit the markets with improving technical efficiency, as does Lien (2008). However, studies have also found that improvements could be made. For example, Bushnell, Mansur, and Saravia (2008) find that residual vertical integration in restructured markets in higher commodity prices, even though Bowring observes that this feature improves market stability and success.

IV. Present Challenges and Opportunities

Current service providers in the United States vary in size and scope. The largest telecommunications operator, the vertically integrated AT&T, provided about 45 percent of the country's fixed lines and had \$124 billion in annual revenue in 2008, but it is second to Verizon in numbers of mobile customers with 77 million subscribers. Verizon provided 31 percent of fixed lines. New entrants into the fixed line market held a 17.6 percent market share in terms of switched lines in 2007, down from a high of 19 percent in 2005. Wireless was 49 percent of industry revenue in 2007, up from 16 percent 10 years earlier. (FCC 2008; Hoovers 2009) The gas industry is less concentrated than the telecommunications: industry revenues of \$92 billion in 2007 were spread across a large number of companies, with the three largest gas utilities -- Atmos, Southern California Gas, and Pacific Gas and Electric -- receiving only about 10 percent. (AGA 2009) The largest electric utility in the U.S. in 2008, Exelon, had revenue of nearly \$19 billion, but retail electricity revenue for the country was nearly \$344 billion in 2007. The next largest electric providers -- Southern Company and FPL Group -- had a little more than \$15 billion each in revenue in 2008. (DoE 2009; Standard and Poor's 2009)

Many of the problems that have been encountered in utility liberalization in the United States can be described as failures to fully adapt to new visions and new circumstances. In telecommunications regulators and policy makers failed to understand that traditional industry boundaries and pricing schemes would not withstand competitive market forces, that regulatory management of entry and technology would delay innovations and lower efficiency, and that entry is easier and more effective in new markets than in legacy markets with little unmet demand. In natural gas there was a failure to see that regulating prices for some customers, but not all, would lead to arbitrage and that attempting to bundle a potentially competitive commodity (gas) with a monopoly service (distribution) would lead to uneconomic bypass if customers were able to find alternatives. In electricity policy makers in California, and probably at FERC, at first failed to appreciate how completely dereg would change electricity pricing -- in part because the political process that redesigned the markets lacked expertise -- thinking that retail price caps would have no consequence but to limit consumer prices. As the system began to unravel, federal and state officials were slow to recognize the contradictions in their dereg approach. Furthermore, as Douglass Jones and Edwin Rosenberg (2008) explain, market reform initiatives often fail to foresee that the utilities themselves need to undergo cultural changes and that these changes can be costly, difficult, and prone to failure.

Adaptive challenges also form the underlying theme for the emerging challenges for U.S. utilities and their regulators. In telecommunications the major issues are broadband penetration, universal service, and radio spectrum management. For broadband and universal service, the policies of the outgoing Bush administration and the stated policies of the incoming Obama

administration both suffer from the application of legacy ideas to new technologies and new markets. The Bush administration deregulated broadband as an information service, which ignores its nature as a transmission service,³² and kept in place the traditional universal service subsidies that have been ineffective and bias markets towards legacy technologies. The new administration has so far embraced the OECD practice of simple measures of broadband and has stated that it wants to apply the legacy subsidy system to broadband, continuing the long held assumption, refuted by research, that telecommunications penetration is most effectively advanced through subsidies. A more effective approach might be to recognize that broadband has many dimensions, focus on the development of the broader ICT system of which broadband is a component, and leverage what the U.S. economy is generally good at, innovation and competition. Regarding radio spectrum management, the United States has been a leader in applying market-based management. A primary challenge is to continue that approach and avoid the temptation to substitute political judgment for economic decision making by businesses and customers regarding how spectrum should be used.³³

In energy the leading issues are investment and environmental. Regarding investment there is a need to expand generation and transmission capacity and to replace aging facilities. The incoming Obama administration has indicated that constraining carbon emissions and increasing the use of renewable energy are high priorities. Taken together the investment and environmental issues have the potential to create a perfect storm of higher costs and risk while imposing changes in technologies, system design, and political roles. That costs for utilities and prices for consumers will be higher is clear. Indeed, higher prices are likely to be an important policy instrument to limit energy consumption. The new administration's stated carbon emissions targets are ambitious and unlikely to be met without new technologies, actual decreases in energy consumption, or both. Technology challenges exist throughout the value chain, from producer to consumer. Indeed some potential technologies – such as plug-in hybrids automobiles, distributed solar and wind generation, and smart grid – imply system changes that could result in two-sided markets for power, experimentation, changing roles for utilities and consumers, and changing roles for regulators as federal regulators take increased authority over facility siting, environmental regulators either increase their say over utility issues or utility regulators increase their jurisdiction over environmental issues, and international bodies exert say over what have traditionally been domestic issues. The uncertainties with respect to policy direction, regarding whether policy makers have the political will to allow adequate cost recovery, how regulators will treat costs of technology and system experiments, and technology costs are making the financial community and the utilities reluctant to make long term investments, which limits opportunities for long term solutions.³⁴

³² As the FCC uses the terms, an information service provides or modifies content. Transmission services do not modify content.

³³ For more extensive discussion, see Hazlett (2008), Weiser and Hatfield (2008)

³⁴ For additional discussion of U.S. electricity issues, see Cannell (2009), Chupka et al. (2008), Chupka and Basheda (2007), and Steinhurst (2008).

V. Conclusion

This chapter examined the development and evolution of utility regulation in the United States, emphasizing the experiences with market reforms. We find that regulation first developed to address practical concerns with utility markets and then evolved to emphasize efficiency concerns and recognize realities of policy maker, regulator, industry, and consumer incentives. Even though the system adapted as circumstances changed, miscues were common when policy makers failed to recognize the extent of the changes they were experiencing and the full implications of their policy changes. This is both good news and bad news as the country faces new changes of broadband penetration in telecommunications and growing investment needs and environmental regulations for energy: Regulators, policy makers, and stakeholders are experienced in creating new approaches for solving problems, but are also prone not fully recognizing how bottom up, individual economic decision making will interact with top down economic controls.

References

- American Gas Association. 2009. Available at <http://www.aga.org>.
- Baumol, William J. (1977). "On the Proper Cost Tests for Natural Monopoly in a Multiproduct Industry." *American Economic Review* 67, no. 5 (December): 809-822.
- _____ (1979). "Minimum and Maximum Pricing Principles for Residual Regulation." *Eastern Economic Journal* 5, no. 1-2 (January/April): 235-248.
- _____ (1982). "Contestable Markets: An Uprising in the Theory of Industry Structure." *American Economic Review* 72, no. 1 (March): 1-15.
- _____ (1983). "Some Subtle Pricing Issues in Railroad Regulation." *International Journal of Transportation Economics* 10, no. 1-2 (April/August): 341-355.
- _____ (1986). *Superfairness: Applications and Theory*. Cambridge, MA: MIT Press.
- Berg, Sanford V. and John Tschirhart. 1995. "Contributions of Neoclassical Economics to Public Utility Analysis." *Land Economics*, Vol. 71, No. 3, pp. 310-330.
- Berry, Dan Michael. 1994. "Private Ownership Form and Productive Efficiency: Electric Cooperatives versus Investor-Owned Utilities," *Journal of Regulatory Economics*; 6:399-420.
- Black, Fisher, and Myron Scholes. "The Pricing of Options and Corporate Liabilities," *J. Polit. Econ.*, May/June 1973, 81(3), pp. 637-54.
- Boiteux, Marcel. "La tarification des demandes en point: Application de la th6orie de la vente au couit marginal," *Revue generale de l'electricite*, Aug. 1949, 58, pp. 321-40; translated as "Peak Loading Pricing," *J. Bus.*, Apr. 1960, 33(2), pp. 157-79.
- Bonbright, James C. 1961. *Principles of Public Utility Rates*. New York: Columbia University Press.
- Bonbright, James C., Albert L. Danielson, and David R. Kamerschen. 1988. *Principles of Public Utility Rates*. 2d ed. Arlington, VA: Public Utilities Reports, Inc.
- Bonbright, James and Gardiner C. Means. 1932. *The Holding Company*. New York: McGraw Hill.
- Borenstein, Severin. 2002. "The Trouble With Electricity Markets: Understanding California's Restructuring Disaster," *Journal of Economic Perspectives*, 16(1): 191-211.
- Bowring, Joseph. 2006. "The PJM Market," in *Electricity Market Reform: An International Perspective*, Fereidoon P. Sioshansi and Wolfgang Pfaffenberger, eds. Amsterdam: Elsevier, pp. 451-476.

Brock, Gerald W. (1981). *The Telecommunications Industry: The Dynamics of Market Structure*. Cambridge, MA: Harvard University Press.

Brown, Ashley. (2005) "The Structure and Process for Regulation of the Electricity Industry in the United States," Working Paper, Harvard Electricity Policy Group, John F. Kennedy School of Government, Harvard University.

Bushnell, James and Catherine Wolfram (2005). "Ownership Change, Incentives and Plant Efficiency: The Divestiture of U.S. Electric Generation Plants," University of California Energy Institute, Center for the Study of Energy Markets, Working Paper WP-140.

Bushnell, James B., Erin T. Mansur, and Celeste Saravia. 2008. "Vertical Arrangements, Market Structure, and Competition: An Analysis of Restructured US Electricity Markets." *American Economic Review*, 98:1, 237–266.

Cannell, Julie. 2009. "The Financial Crisis and Its Impact On the Electric Utility Industry." *Edison Electric Institute* Washington, D.C. Available at http://www.eei.org/ourissues/finance/Documents/Financial_Crisis_and_Industry.pdf.

Chupka, Marc W. and Gregory Basheda. 2007. "Rising Utility Construction Costs: Sources and Impacts." Available at http://www.eei.org/ourissues/finance/Documents/Rising_Utility_Construction_Costs.pdf.

Chupka, Marc W., Robert Earle, Peter Fox-Penner, and Ryan Hledik. 2008. "Transforming America's Power Industry: The Investment Challenge 2010-2030." Available at http://www.eei.org/ourissues/finance/Documents/Transforming_Americas_Power_Industry.pdf.

Coase, Ronald H. 1959. "The Federal Communications Commission," *Journal of Law and Economics*, 2, 1-40.

Consumer Federation of America and Consumers Union. 2000. "Lessons from 1996 Telecommunications Act: Deregulation before Meaningful Competition Spells Consumer Disaster." Available at <http://www.consumersunion.org/pdf/lesson.pdf>.

Costello, Ken. 2009. "The Natural Gas Industry at a Glance." National Regulatory Research Institute. Available at http://nrri.org/matrix/gas/natural_gas_industry_at_a_glance.pdf.

Crandall, Robert. 1997. "Are We Deregulating Telephone Services? THINK AGAIN" Brookings Policy Brief Series # 13, Washington, D.C.: The Brookings Institution.

Crandall, Robert. 2001. *An Assessment of the Competitive Local Exchange Carriers Five Years After the Passage of the Telecommunications Act*, Washington, D.C.: Criterion Economics.

Crandall, Robert, "Competition and Chaos; U.S. Communications Since 1996", Washington, D.C.: The Brookings Institution, 2005.

Department of Energy, Energy Information Administration. 2009. "Electric Sales and Revenue 2007." Available at http://www.eia.doe.gov/cneaf/electricity/esr/esr_sum.html.

Economides, Nicholas. 1998. "The Telecommunications Act of 1996 and its Impact." Working Paper, Stern School of Business, New York University.

Economides, Nicholas. 2004. "Telecommunications Regulation: An Introduction." Working Paper, Stern School of Business, New York University.

Energy Information Administration. 2000. "The Changing Structure of the Electric Power Industry 2000: An Update," Energy Information Administration, U.S. Department of Energy, Washington, D.C.

Faulhaber, Gerald R. (1975). "Cross-Subsidization: Pricing in Public Enterprises." *American Economic Review* 65, no. 5 (December): 966-977.

_____ (1979). "Cross-Subsidization in Public Enterprise Pricing." *Pricing in Regulated Industries: Theory and Application, II*; papers presented at an economic seminar, ed. John T. Wenders. Denver, CO: Regulatory Matters Division, Mountain States Telephone and Telegraph Co., 76-121.

_____ and William J. Baumol (1988). "Economists as Innovators: Practical Products of Theoretical Research." *Journal of Economic Literature* 26, no. 2 (June): 577-600.

Federal Communications Commission. 2008. "Trends in Telephone Service." Available at <http://www.fcc.gov/wcb/iatd/trends.html>.

Foreman, R. D. 2002. For whom the bell alternatives toll: demographics of residential facilities-based telecommunications competition in the United States. *Telecommunications Policy* 26 (9-10), 573-587.

Fabrizio, Kira R., Nancy L. Rose, and Catherine D. Wolfram. 2007. "Do Markets Reduce Costs? Assessing the Impact of Regulatory Restructuring on US Electric Generation Efficiency." *American Economic Review*, 97(4): 1250-1277.

Glaeser, Martin G. (1927). *Outlines of Public Utility Economics*. New York: The Macmillan Company.

Gray, Horace M. 1940. "The Passing of the Public Utility Concept," *The Journal of Land & Public Utility Economics*, Vol. 16, No. 1 (Feb., 1940), pp. 8-20.

Hazlett, Thomas W. 2008a. "A Law & Economics Approach to Spectrum Property Rights: A Response to Weiser and Hatfield." *George Mason Law Review* 15(4): 975-1023.

Hazlett, Thomas W. 2008. "Property Rights and Wireless License Values." *Journal of Law and Economics* 51(3): 563-598.

Hirshleifer, Jack. "Peak Loads and Efficient Pricing: Comment," *Quart. J. Econ.*, Aug. 1958, 72(3), pp. 451-62.

Hoovers. 2009. Available at <http://premium.hoovers.com>.

- Hughes, Miles W. 1996. "Telecommunications Reform and the Death of the Local Exchange Monopoly," *Florida State University Law Review* 24(1): 179-217.
- Jones, Douglass N. and Edwin A. Rosenberg. 2008. "Utility Restructuring and its Unnatural Acts." *Fortnightly's Spark* (February 2008), pp. 1-2, 7-9.
- Kahn, Alfred E. 1988. *The Economics of Regulation: Principles and Institutions*, Vols. 1 and 2, 2d ed. Cambridge: MIT Press (New York: Wiley, 1970-71).
- King, Clyde Lyndon. (1912) "The Need for Utility Commissions," in Clyde Lyndon King, ed., *The Regulation of Municipal Utilities*, New York: D. Appleton and Company.
- Knittel, Christopher. 1999. "The Origins of State Electricity Regulation: Revisiting an Unsettled Topic," Working paper, Department of Finance and Economics, Boston University.
- Kowka, John E. 2006. "The Role of Competition in Natural Monopoly: Costs, Public Ownership, and Regulation," *Review of Industrial Organization* (2006) 29:127-147.
- Lien, Jeff. 2008. "Electricity Restructuring: What Has Worked, What Has Not, and What is Next," Working Paper, United States Department of Justice.
- Liggett, William D. 2000. "Historical Overview of the Electric Power Industry," in "The Changing Structure of the Electric Power Industry 2000: An Update," Energy Information Administration, U.S. Department of Energy, Washington, D.C., pp. 5-8.
- Littlechild, Stephen. 1983. *Regulation of British Telecommunications' Profitability*. London: HMSO.
- Miller, Edythe, and Warren J. Samuels, eds. 2002. "The Institutionalist Approach to Public Utilities Regulation." East Lansing: Michigan State University Press.
- Mueller, Milton. 1993. "Universal Service in Telephone History: A Reconstruction." *Telecommunications Policy* 17(5): 352- 369.
- Mueller, Milton. 1997. *Universal Service: Competition, Interconnection, and Monopoly in the Making of the American Telephone System*. Washington, D.C.: AEI Press.
- Natural Gas Supply Association. "The History of Regulation." <http://www.naturalgas.org/regulation/history.asp>, downloaded September 7, 2008.
- Nix, Joan and David Gabel. 1993. "AT&T's Strategic Response to Competition: Why Not Preempt Entry?" *The Journal of Economic History* 53(2): 377-387.
- OECD. 1998. "United States - Regulatory Reform in the Electricity Industry."
- Peltzman, Sam. 1976. "Toward a More General Theory of Regulation," *Journal of Law and Economics* 19(2): 211-240.

- Phillips, Charles F. Jr. 1993. "The Regulation of Public Utilities." Arlington, Virginia: Public Utilities Reports, Inc.
- Ramsey, Frank. "A Contribution to the Theory of Taxation," *Econ. J.*, Mar. 1927, 37, pp. 47-61.
- Rose, Nancy L., and Paul L. Joskow. 1990. "The Diffusion of New Technologies: Evidence from the Electric Utility Industry," *The RAND Journal of Economics*, 21(3): 354-373.
- Sappington, David E.M. 2002. "Price Regulation." In *Handbook of Telecommunications Economics, Volume 1: Structure, Regulation, and Competition*. Martin E. Cave, Sumit K. Majumdar, and Ingo Vogelsang, eds. Amsterdam: Elsevier, pp. 225-296.
- Shanefelter, Jennifer Kaiser (2006). "Restructuring, Ownership and Efficiency: The Case of Labor in Electricity Generation," University of California Energy Institute, Center for the Study of Energy Markets, Working Paper WP-161.
- Sharkey, William W. (1981). "Existence of Sustainable Prices for Natural Monopoly Outputs." *Bell Journal of Economics* 12, no. 1 (Spring): 144-154.
- _____ (1982a). "Suggestions for a Game-Theoretic Approach to Public Utility Pricing and Cost Allocation." *Bell Journal of Economics* 13, no. 1 (Spring): 57-68.
- _____ (1982b). *The Theory of Natural Monopoly*. New York: Cambridge University Press.
- Sharpe, William F. "Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk," *J. Finance*, Sept. 1964, 19, pp. 425-42.
- Standard and Poor's. 2009. "Electric Utilities Comparative Company Analysis."
- Steiner, Peter O. "Peak Loads and Efficient Pricing," *Quart. J. Econ.*, Nov. 1957, 71(4), pp. 585-610.
- Steinhurst, William. 2008. "The Electric Industry at a Glance." National Regulatory Research Institute. Available at http://nrri.org/pubs/electricity/electricity_at_a_glance.pdf.
- Trebing, Harry M. 1976. "The Chicago School versus Public Utility Regulation," *Journal of Economic Issues*, 10(1): 97-126.
- Trebing, Harry M. 1984a. "Public Utility Regulation: A Case Study in the Debate over the Effectiveness of Economic Regulation." *Journal of Economic Issues*, 18(1): 223-250.
- Trebing, Harry M. 1984b. "Public Control of Enterprise: Neoclassical Assault and Neoinstitutionalist Reform." *Journal of Economic Issues*, 18(2): 353-368.
- Trebing, Harry M. 1987. "Regulation of Industry: An Institutionalist Approach," *Journal of Economic Issues*, Vol. 21, No. 4, *Evolutionary Economics II: Institutional Theory and Policy* (Dec., 1987), pp. 1707-1737.

Temin, Peter. 1990. "Cross Subsidies in the Telephone Network After Divestiture." *Journal of Regulatory Economics*, 2: 349- 362.

Tomlinson, Richard G. 2000. "Tele-Revolution: Telephone Competition at the Speed of Light." Penobscot Press.

Vickery, William. 1961. "Conterspeculation, Auctions, and Competitive Sealed Tenders." *Journal of Finance*. 16, 8-37.

Weiser, Philip J. and Dale Hatfield, 2008. "Spectrum Policy Reform and the Next Frontier of Property Rights," *George Mason Law Review* 15(3): 549-609.

Williamson, Oliver E. "Peak Load Pricing and Optimal Capacity Under Indivisibility Constraints," *Amer. Econ. Rev.*, Sept. 1966, 56(4), pp. 810- 27.

Williamson, Oliver E. 1983. "Credible Commitments: Using Hostages to Support Exchange," *The American Economic Review* 73(4): 519-540.

Zolnierek, J., Eisner, J., Burton, E. 2001. An empirical examination of entry patterns in local telephone markets. *Journal of Regulatory Economics* 19 (2), 143-159.