The Evolution of Government Policy and the Structure of the U.S. Electric Power Industry

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Few U.S. industries have been as directly affected by public policy as has electric power. From its beginning, the industry that provides us with electric energy has been at the center of shifting public debates over its structure and the form of its ownership. New policies drastically affecting the industry have been adopted in response to serious problems. Those policies, however, either failed to address other problems that became more severe or created new unintended problems. New policies were then adopted to again restructure the industry, and the cycle repeated.

The Beginnings of State Utility Commissions

The financial and political problems faced by the industry's pioneering firms exposed them to far greater risk than those of the modern industry. Electric utilities, along with the other new urban utilities at the end of the 19th century (e.g., gas and transit) needed to use the public rights of way for their distribution systems. This required a franchise: a definite-term contract between the municipality and the utility. The first utilities had to construct their entire system before receiving any revenues. Once built, the utility had already paid most of the total cost of providing service for years; if revenue fell far below expectations, it was better to continue using (but not necessarily maintain) that capital than to abandon it. Even if it were the victim of extortion, a utility had little choice but to stay in business. Utilities, including electric utilities, provided fertile ground for corruption, which was rampant; in one well-known scheme, a group of Chicago alderman would give themselves a franchise for territory already served by one or more utilities and threaten to compete unless paid off.[1] Corrupt behavior by utilities was also common. Starting an electric utility was risky and not very profitable, and raising the huge amounts of required financing was difficult and inhibited the industry's growth.[2]

Some municipalities avoided the problems faced by private utilities by operating a government-owned utility. Many saw government ownership as a way to escape the endemic corruption arising from the franchise system, but private utilities saw government ownership as a threat. In response to the controversy, an 1899 federal investigation of the industry surveyed both private and government-owned utilities and published detailed data on both.[3] Competition was

[1] Forrest McDonald, *Insull* (Chicago: University of Chicago Press, 1962), 82-89.
[2] William J. Hausman and John L. Neufeld, "The Structure and Profitability of the U.S. Electric Utility Industry at the Turn of the Century," *Business History* 32 (1990).
[3] U.S. Commissioner of Labor, *Fourteenth Annual Report of the Commissioner of Labor, 1899: Water, Gas, and Electric-Light Plants under Private and Municipal Ownership* (Washington: USGPO, 1900).

so tied to corrupt behavior that many, including adherents of the new Progressive movement, felt that competition could not be allowed. The only choice was between government ownership and protected private monopolies with rates regulated by a state commission.[4]

Price regulation by a few states had earlier been tried with railroads, and an 1877 Supreme Court decision upheld its legitimacy.[5] This power to regulate rates was limited by an 1898 decision ruling that companies subject to such regulation had a constitutional right to receive a "fair" return on the fair value of their property. [6] Protecting the return on capital helped eliminate the basis of past corruption, but this protection was easier to articulate than actualize.

In the first decade of the 20th century, a number of states passed laws creating regulatory institutions designed to meet the Court's requirements. Electric utilities came under such a system in New York in 1905 and in Wisconsin in 1907. By 1914 30 states had created commissions with the power to regulate electric utility prices and prevent competition. Regulation did ease utilities' access to capital, but disappointments with the new state utility commission system left many feeling government ownership might be preferable. [7]

The Rise of Public Utility Holding Companies

The new system of commission regulation had unintended negative consequences, one of which was that it made the industry resistant to structural changes. During the first two decades of that century, electricity was seldom transmitted over long distances. Most utilities served a fairly small local urban area, provided both generation and distribution, were locally owned, and were not interconnected with other utilities.[8] Considerable consolidation of small utilities could and did occur, but only if all saw it in their interest. By contrast, competitive industries often change their character by means other than consolidation. By the early 1920s improvements in transmission technology made it possible for integrated grids to cover larger geographic areas than the service area of a single company. These grids offered important economic advantages, but the regulatory system impeded their creation. Participating in an integrated grid not under its full control created risks for a utility whose administered rates and protected monopoly status weakened any need to accept change. Further consolidation could have led to larger integrated systems, but consolidation remained difficult.

The failure of the industry to develop into larger systems was recognized and led to two failed policy proposals in the 1920s. Sponsored by the U.S. Geological Survey, the "Superpower" proposal issued in 1921 provided a detailed engineering plan to convert the region

[4] National Civic Federation, *Municipal and Private Operation of Public Utilities: Report to the National Civic Federation Commission on Public Ownership and Operation*, vol. Part I–Vol. I: General Conclusions and Reports (1907).

[5] *Munn v. Illinois*, 94 U.S. 113 (1877).

[6] *Smyth v. Ames*, 169 U.S. 466 (1898).

[7] William J. Hausman and John L. Neufeld, "The Market for Capital and the Origins of State Regulation of Electric Utilities in the United States," *Journal of Economic History* 62, no. 4 (2002).

[8] Small utilities, including many that were municipally owned, only distributed power purchased from adjacent utilities.

between Boston and Washington to a single integrated system. It predicted huge benefits including a 40% reduction in total costs.[9] Despite the active involvement of Herbert Hoover (engineer and Secretary of Commerce), it proved impossible to convince the existing utilities that the benefits to each justified their loss in control. In 1925 Pennsylvania's governor, Gifford Pinchot, initiated a state-wide "Giant Power" study that proposed radical reorganization of that state's power industry. Generation, transmission, and distribution were to be separated with many generation companies and common-carrier transmission.[10] Stringent opposition from existing utilities contributed to its rejection.

Another problem unrelated to regulation arose in the 1920s. Large increases in the use of electricity contributed to increases in productivity, but required much new construction. The need for finance was greater than ever, but financial markets were inadequate. The utility holding company provided a way of addressing both the financing problem and the need for larger systems. A holding company issued its own financial securities and used the funds to purchase common stock in operating companies. A large holding company's securities had the advantage of a national brand more easily marketed to wary investors than the securities of a local operating company. Through the purchase of stock, one holding company gained control over multiple operating companies and could coordinate their operations. Holding companies provided their subsidiary operating companies with technological and business expertise and with the benefits of central purchasing, but the provision of these services subverted state regulation. Operating utilities paid their parent companies for these services, and were entitled under regulation to be reimbursed by their customers. The holding companies providing those services were not regulated; their true costs were not available to regulators; and there were no alternative providers. Holding companies commonly charged their subsidiaries bloated prices using the regulatory system to capture large profits.

The large profits from high-volume finance created a bubble mentality among both holding companies and their investors. Holding company stocks became the highest flyers on Wall Street's Great Bull Market, the dot.coms of their day.[11] A buying frenzy of operating companies resulted in virtually every privately-owned utility being controlled by a holding company. However, these operating companies were often not adjacent, and their operations could not be integrated. In 1929 the top three holding companies controlled over 45% of all private utility generation in the U.S.[12] Financial relationships became extremely complex. Holding companies owned holding companies, and two holding companies sometimes held each other's stock. Many

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[9] W. S. et al Murray, *A Superpower System for the Region between Boston and Washington* (Washington: USGPO, 1921).

[10] Morris Llewellyn Cooke and Judson C. Dickerman, *Report of the Giant Power Survey Board to the General Assembly of the Commonwealth of Pennsylvania* (Harrisburg, PA: Telegraph Printing Co., 1925).

[11] Eugene N. White, "The Stock Market Boom and Crash of 1929 Revisited," *The Journal of Economic Perspectives* 4, no. 2 (1990).

[12] U.S. Federal Trade Commission, "Summary Report on Economic, Financial, and Corporate Phases of Holding and Operating Companies of Electric and Gas Utilities," (Washington: Government Printing Office, 1935), 38.

layers of ownership often lay between a top holding company and the bottom operating companies. Excessive leveraging generated huge profits during periods of robust growth but resulted in fragile financial structures unable to withstand any reduction in that growth.

The Fall of Public Utility Holding Companies and Rise of Federal Involvement

The complex ownership structure of holding company systems made it very difficult to determine who actually controlled the nations' utilities. Some saw the industry as evolving toward a national monopoly, similar to what had already happened in the telephone industry. Others feared electric and gas utilities were already secretly controlled by a malevolent "power trust" immune to state regulation. These concerns led to three different federal investigations of holding companies. In 1928 the Federal Trade Commission (FTC) undertook the most detailed investigation ever of any American industry and continuously issued findings until the middle of the next decade.

The predictable collapse of some holding companies in the face of the 1929 stock market crash and the Great Depression resulted in the largest business failures the nation had seen. Losses associated with those failures were sometimes widespread; at least one holding company had marketed its securities to its customers with the assurance that as long as their light switch worked, their money was safe. The fury this collapse unleashed was further aggravated by the continuing reports of the FTC. One of the FTC reports unearthed a huge propaganda campaign to create opinion favorable to private ownership and opposed to public ownership that reached into the nation's schools. These reports spawned several popular books about holding company evils.[13]

The Great Depression and New Deal brought much greater federal involvement in the electric utility industry. In 1930 the Federal Power Commission (FPC) was reorganized into an independent regulatory agency responsible, among other things, for the regulation of wholesale electricity sales. Federal involvement in utility regulation created a persisting fear among state commissioners that their authority would be usurped, a fear that continues to affect federal regulatory policy.[14]

Direct federal ownership and operation of electric utilities also increased. Advocates argued that with the industry remaining primarily in private hands, government operation would serve as a form of regulation. Government-run utilities would be a "yardstick" against which the operations of private utilities could be measured, and the threat of government takeover would serve as a "birch rod in the cupboard" against any private utility offering poor service. The Tennessee Valley Authority, created in 1933 to, among other things, exploit the hydroelectric

[13] U.S. Federal Trade Commission, "Summary Report: Efforts by Associations and Agencies of Electric and Gas Utilities to Influence Public Opinion," (Washington: Government Printing Office, 1934). Among the popular books were Ernest Gruening, *The Public Pays: A Study of Power Propaganda* (New York: Vanguard Press, 1931), Ramsay, *Pyramids of Power: The Story of Roosevelt, Insull and the Utility Wars*.

[14] Complete federal usurpation of state commission authority over railroad rates did occur as a result of Supreme Court decisions in 1922.

potential of the Tennessee River and its tributaries, became a giant utility seeking to make cheap electricity available throughout the Tennessee Valley. Where it offered service, TVA's low rates forced private utilities out of business. TVA brought electricity to rural areas that private utilities had been unwilling to serve and demonstrated that low rates would substantially increase use of electricity. In the West, the Bureau of Reclamation constructed giant hydro facilities, and its mission changed from subsidizing irrigation with electricity sales to providing electricity cheaply. The fall in rates and increased interest in rural electrification by private utilities was offered as evidence of the effectiveness of the yardstick and birch rod.

In 1935, anger over holding companies resulted in the Public Utility Holding Company Act (PUHCA). Its "death sentence" provision forced the breakup of all interstate holding company systems and effectively prevented the creation of new holding companies. Companies whose operating companies were wholly within one state were exempt, and holding companies that had created fully integrated systems were allowed to continue as registered holding companies subject to stringent regulation from the new Securities and Exchange Commission (SEC). Some of the nation's largest systems, including those of American Electric Power and the Southern Company, were maintained, but the mechanism that created them was gone. In its original form, PUHCA offered a possible alternative mechanism for creating large systems by substantially increasing the regulatory powers of the FPC to create regional grids and to compel utilities to transmit (wheel) power from other utilities.[15] This extension of FPC authority was stripped from the act after intense opposition from state commissions arguing that electric energy was a local commodity (!) not interstate in character.[16] Despite their shortcomings, holding companies had overcome the state regulatory system's impediment to interconnection and extended integrated utility systems across wider geographic areas. Most of the high-voltage transmission lines in 1935 connected utilities controlled by the same holding company, and the systems built decades ago by holding companies remain among the nation's largest.[17]

The Industry's Golden Age and Perfect Storm

World War II brought untypical political peace to the electric power industry. For almost three decades it enjoyed a "golden age" with continuing technological progress, continuing rate decreases, and little public attention. This ended in the 1970s when the convergence of multiple factors returned the industry to the center of political controversy. Environmental concerns had led to new Federal policies including encouraging reduction in the use of coal. "Energy crisis" elbowed into public consciousness with the 1973 Arab oil embargo soon after many utilities had shifted from coal- to oil-fired generation. Projections of future electricity demand growth led to

[15] These provisions were in the second Title II of the bill. *Public Utility Holding Company Act (Senate Hearings Part 1)*, 1935. The text of Title is on pages 39-44.

[16] Ibid., 730. See also testimony of various state regulatory commissioners and officers of the National Association of Railroad and Utilities Commissions ("Railroad and Utilities" was later changed to "Regulatory Utility").

[17] Testimony of FPC Solicitor General, Ibid., 243.

planning major construction projects. Nuclear technology was embraced, and power plants of previously unseen scale were designed, accompanied by new Federal regulations. Construction led to massive cost overruns and lengthy delays amid growing public concern over nuclear power safety. Rapid inflation led to huge increases in nominal interest rates coinciding with the need to raise substantial funds. Lower than expected demand growth led to construction cancellations after enormous costs had already been incurred.[18] Electricity rates began rising faster than the rate of inflation but often not fast enough to cover rising costs. By protecting utilities from experiencing the full consequences (negative or positive) of construction decisions, regulation was accused of encouraging utilities to devote insufficient attention and resources to those decisions. When regulators moved to deny utilities' recovery of some of those costs, regulated utilities became hesitant to undertake any new construction. Another apparent weakness of the system of state regulation was exposed: planning for system growth.

The 1977 National Energy Plan—Marginal Cost and PURPA

Numerous provisions of President Carter's 1977 National Energy Plan affected the electric power industry. Under the proposal, utilities that had, in response to environmental policies, switched their fuel use from coal to oil and natural gas were to bear large conversion cost to switch back. Utilities were to offer customers services to help them reduce their use of electricity. Nuclear plant licensing was to be streamlined. The structure of retail rates was to be radically reformed.

Under state regulation, rate structures divide a utility's pre-determined revenue among its customers, an issue of little interest to the utility and a zero-sum game among its customers. Lack of attention to this issue preserved anachronistic features such as the non-time-differentiated demand charge, whose reason for being had long since disappeared.[19] Redesigned rates that better reflected marginal costs would have improved the use of resources within the industry and among users, but was abandoned in the face of state regulators' continuing worry over federal encroachment and large industrial users apparent fear that marginal-cost based rates would reduce the price advantage they received over other electricity users. [20]

Five laws enacted the plan's remnants that survived Congress's deliberations. A little-noticed provision in one law, the Public Utility Regulatory Policies Act (PURPA), most affected future

[18] Duke Power cancelled one plant on which sunk expenditures amounted to over 30% of the company's precancellation net worth. Douglas Hearth, Ronald W. Melicher, and Darryl E. J. Gurley, "Nuclear Power Plant Cancellations: Sunk Costs and Utility Stock Returns," *Quarterly Journal of Business and Economics* 29, no. 1 (1990).

[19] An example was the "demand charge" rate structure that dominated rate structures for industrial and many commercial users. John L. Neufeld, "Price Discrimination and the Adoption of the Electricity Demand Charge," *The Journal of Economic History* 47 (1987).

[20] U.S. Senate. Committee on Energy and Natural Resources, *Public Utility Rate Proposals of President Carter's Energy Program (Part E of S. 1469), Hearings Part 1*, July 27, 28, Sept. 7 1977. See testimony of NARUC officials beginning on page 755 and ELCON (an association of large industrial electricity users) beginning on page 484.

policy. This provision required utilities to purchase electricity from small-scale qualifying facilities (QFs) using cogeneration or renewable fuels to produce electricity. The price paid for this energy was to be determined by state regulators, not on the basis of its cost of production, but on the basis of the utility's "avoided cost," what the utility would have paid to have otherwise generated or purchased the displaced power. Some state commissions set these prices high. QFs became very profitable, and became responsible for a significant proportion of generation, particularly where regulated utilities were hesitating to undertake new construction.[21] For the first time, independent power producers were guaranteed access to the public grid, and regulated utilities were purchasing significant amounts of electricity from these producers. Unlike Great Britain, the U.S. had little experience with generation and transmission performed by different entities. PURPA made it acceptable to consider a redefined industry where competing independent power producers supplied a common transmission system from which retail distributors took power.

Separating Generation from Transmission—Restructuring the Industry

The separation of generation and transmission received impetus from the new class of independent power producers: exempt wholesale generators (EWGs) created by the Energy Policy Act of 1992. EWGs received negotiated prices, but the law enabled them to compel a utility to "wheel" their output to a wholesale customer even though that customer could otherwise have been served from the utility's own generation. The high regulated utility prices included the construction cost overruns and cancellations as well as the prices required to be paid to QFs. Falling natural gas prices enabled EWGs to rapidly construct gas-fired power plants at relatively low cost and undercut the regulated prices. Wholesale customers, e.g., municipalities, obtaining power directly from EWGs experienced large savings and became vocal advocates for further increasing access to transmission and power from independent generators. Industrial users, who were not wholesale customers, began to advocate "retail wheeling" enabling them to also enjoy the savings from dealing directly with independent generators.

By 1990, price regulation similar to that used in the electric power industry had been eliminated from a number of industries, including natural gas, the airline industry, and the trucking industry. The introduction of competition ultimately changed both the airline and trucking industries, but major restructuring of those industries was unnecessary prior to deregulation. The telephone industry had undergone restructuring under the direction of federal courts, but this had proven quite complicated, and the courts continued to remain involved in that process of restructuring. Technological developments had led to new products and new demands on the nation's telecommunication system. The existing telephone industry structure was resisting those changes; structural change had become unavoidable. In electricity, the increased

[21] By 1991 the percentage of electricity coming from outside the industry was 25% in California, 27% Louisiana, and 20% in Texas.Richard J. Gilbert and Edward P. Kahn, "Competition and Institutional Change in U.S. Electric Power Regulation," in *International Comparisons of Electricity Regulation*, ed. Richard J. Gilbert and Edward P. Kahn (Cambridge University Press, 1996), 204.

use of small-scale generating technology may have made competition more feasible in that activity, but it did not make restructuring of the industry inevitable.

Independent power production had been introduced to the industry with little attention to the industry's institutional structure. If competing independent generators were to flourish, operation of the transmission system had to change. The technology of electric power prevents the impact of a supplier's performance from being confined to its customers, all electricity users are simultaneously affected by all electricity providers. The transmission authority must maintain a constant balance between total generation and total usage for the entire system. To maintain safety and reliability, and to provide service at the lowest system cost, the transmission authority must have immediate control (dispatch) over the output of every generator based upon information it has on that generator's technology, the cost of varying its output, and the characteristics of the transmission system, but without regard to the business relationships between generators and users. With the possible exception of a few "tight" power pools (such as PJM), electrical users in the U.S. had been traditionally supplied by a transmission authority that also owned, and thus had full information about, all generators on that system. Britain, however, had experience with the separation of generation from transmission and provided a model for an institutional structure that accommodated that separation.

The British Model

Beginning in the 1920s Britain began the construction of a nationwide grid operated by a single authority, the Central Electricity Board (CEB). Generation remained in the hands of a number of private power companies and municipalities, but the CEB acquired dispatch authority.[22] Electric power, and other utilities, had been nationalized following World War II. Following other utilities, electric power was re-privatized in 1989 with the ownership of generation separated from transmission. The operating rules were established the following year and have influenced developments in the U.S. Those rules required each generator to submit each day to the transmission authority the level of generating capacity it would make available the following day and the price at which it would sell energy. These offers from all generators were to be used by the transmission authority to determine dispatch order: cheapest to most expensive. The highest price at which energy was purchased during each half-hour period would determine the System Marginal Price (SMP) for that half-hour period: the primary basis for the payments made to all generators and collected from all wholesale customers. Generators also were to receive payment for power capacity made available even if unused. A separate real-time market enabled the transmission authority to make balancing adjustments resulting from random fluctuations in usage. Long-term contracts between generator and distributor were to have no effect on the operation of the transmission system but obligated payments between generator and

[22]Generation was not completely deregulated, but some competitive behavior emerged. Leslie Hannah, *Electricity before Nationalisation: A Study of the Development of the Electricity Supply Industry in Britain to 1948*, ed. Thomas P. Hughes, *Johns Hopkins Studies in the History of Technology* (Baltimore: Johns Hopkins University Press, 1979), 100-149.

distributor based on differences between contracted and system prices.[23] The British plan also provided for phased-in retail competition allowing final users to select their power supplier.

Benefits of Restructuring

Separating generation from transmission and permitting market competition to determine prices at the generator and system generating capacity offered three benefits over the system of regulated integrated utilities.

1. Those making generation investment decisions would face the full consequences of their decisions. This should solve the problem discussed above that existed with capacity planning by regulated integrated utilities.
2. Generators would face a constant market incentive to improve efficiency. They would immediately receive the benefits of cost reductions, but competition would result in such reductions by all generators, eventually resulting in lower prices and elimination of inefficient generators. By contrast, a regulated integrated monopoly utility has less incentive to improve the efficiency of generation since whatever costs it bears will be passed on to customers without any threat of being forced out of business.
3. It would become easier to expand the area served by a single integrated transmission system. A single transmission system covering larger areas reduces the requirements for generating capacity, and may offer opportunities for more efficient dispatch. A larger transmission area may also reduce the proportion of reserve capacity required to offset unexpected generator breakdowns. Regulated integrated utilities have little incentive to merge their transmission systems with those of neighboring utilities, while extending the area controlled by an independent transmission operator may be relatively simple.

Environmental Regulation

Heightened public awareness of the connection between energy use and environmental problems led to regulations with major impact on the electric power industry. Power plants are a tempting target for environmental regulation for several reasons. They consume approximately one third of the primary energy used in the U.S. and emit a significant proportion of many pollutants. Unlike vehicles, another major pollution source, they stay in one place making them easier to monitor. Power plants are relatively similar. Traditional state regulation of privately owned utilities may make them relatively amenable to environmental regulations since the costs imposed can be passed on to customers through regulated rates, while environmental concerns of citizens may directly affect the behavior of municipally-owned power plants. This focus on power plants means further reductions in their regulated emissions likely will be more expensive than reductions from vehicles. [24]

[23] Richard Green, "Reshaping the CEGB: Electricity Privatization in the UK," *Utilities Policy* 1, no. 3 (1991).

[24] Fowlie *et al.* (2008a) argue that the marginal cost of reducing NOx emissions from power plants is twice the cost of reducing NOx emissions from cars.

The U.S. Clean Air Acts and Amendments (CAAAs) provide the basic framework for the environmental regulation of power plants and other stationary ("point source") air polluters. [25] The Environmental Protection Agency (EPA) has established "National Ambient Air Quality Standards" limiting the levels of five "criteria" pollutants, and EPA determines whether or not a particular region is in "attainment." [26] If a region is not in attainment, additional regulations may include mandating the use of specified control technologies and imposing other requirements on new pollution sources.

Market mechanisms, including cap-and-trade, were introduced in 1990 to reduce pollution at the lowest possible cost. The centerpiece, the Acid Rain Program limiting SO2 emissions from power plants, has been widely regarded as more successful in reducing emissions at substantially lower cost than the prescriptive methods previously used.[27] Other cap-and-trade programs, such as RECLAIM in Los Angeles, have been more controversial.[28] Nevertheless, programs using market mechanisms are likely to be at the center of future environmental policies.

Environmental policies to reduce emissions of greenhouse gases (GHGs), especially CO2, will most affect the electricity industry in the near future. Coal is cheap and abundant, and considerable progress has been made to reduce its negative environmental effects, but its use in power plants is a major source of GHGs. The capture and sequestration of carbon from burning coal seems feasible, but the technology faces major hurdles and is likely to be expensive. Reducing GHG emissions from electricity production will likely require substantial reductions in the use of fossil fuels, especially coal. This goal is likely best achieved by a combination of reduced overall use of electricity (conservation) and increased generation from alternative technologies.

Despite improvements in the efficiency of electricity use, many studies show that substantial improvements are still possible. Higher electricity prices are an effective mechanism to achieve those improvements, and it is well documented that consumers do reduce the use of electricity when its price increases.[29] This has not been a politically popular approach compared to public appeals for conservation and utility-sponsored demand reduction. Increasing generation from alternative technologies poses additional problems. Electricity from nuclear power produces no GHGs but faces other problems. Renewable sources—solar, wind, and biomass—offer another alternative. The benefits of GHG reduction from biomass will be reduced if its cultivation displaces other plants or uses inputs that themselves consume fossil fuels. Wind and solar generation operate intermittently and may be far from load. Increased generation by

[25] Clean Air Acts were passed or amended in 1963, 1966, 1970, 1977, and 1990.

[26] Ozone, particulate matter, carbon monoxide, sulfur dioxide, nitrogen oxides and lead are the criteria pollutants. Carbon dioxide and other greenhouses gases are not criteria pollutants and are currently not regulated under the CAAAs.

[27] See US EPA (2009) and Stavins (1998). Carlson *et al.* (2000) argue that the cost savings were primarily due to the regulatory flexibility which allowed compliance by using low-sulfur western coal

[28] Fowlie *et al.* (2009) argue that RECLAIM reduced emissions by 25% and discuss the diversity of viewpoints in the literature on the success of the program.

[29] See for example Reiss and White (2008).

renewables will require substantial enlargement of the transmission system and construction of new generating capacity. Renewable portfolio standards (RPS) requiring a minimum percentage (typically 10% to 25%) of generation from renewable resources have been adopted by over 25 states. The effectiveness of these mandates depends on the extent to which they encourage improvements in the economics of renewable resource generation and on the extent to which their use displaces coal-fired generation rather than other technologies whose use produces less GHGs than coal. The magnitude of neither effect has been established, leaving the effectiveness of these mandated standards to reduce GHGs subject to debate.

Current Regulatory Climate

The division of regulatory responsibility between states and the federal government has resulted in a fragmented policy environment. Because their negative impacts are contained within a geographic area, regional variations in the regulations of pollutants such as NOx are justifiable. But regional regulations of GHGs, as in California, will likely have no effect on global climate change and can be justified only as a political response to a failure of the federal government.

The divided regulatory environment has also resulted in great variation in the role of markets in wholesale electricity. In the restructured states, such as Texas and California, independent and regulated power producers bid into a centralized market.[30] In other areas, including much of the Southeast, the structure of the electric utility industry is the same as it has been for decades. In other states, such as West Virginia, traditional regulation continues but transmission is operated independently. In the late 1990s, this divided regulatory environment appeared to be a transitional phase prior to nation-wide restructuring. The California electricity crisis of 2001 halted the process in some states and stopped others from considering initiating it. (See Figure 1.)

The new system led to unforeseen problems with market power. Generators operating in restructured wholesale electricity markets may unilaterally increase the market price, by bidding above marginal cost. While this may decrease that firm's sales, the higher market price can increase the firm's profits. This type of market power clearly contributed to California's electricity crisis.[31] Policy makers currently avoid major inefficiencies from market power by encouraging long-term contracts and by measures such as price caps and occasional bid mitigation. These measures however might reduce the benefits of market competition by adversely affecting investment incentives.

Retail competition has not been embraced by consumers in most states where it has been offered; Texas has had the most success. Unfortunately, retail providers have little ability to

[30] The system operator then uses these bids to dispatch the system and to compensate the generators by calculating either market clearing prices or locational marginal prices (market clearing prices adjusted for transmission constraints).

[31] See Borenstein *et al.* (2002) and Joskow and Kahn (2002).

differentiate their product; all the power comes from the same transmission system and is distributed over the same distribution system. [32] Retail providers typically do not provide the meters and cannot offer such options as time-of-day pricing where not supported by the meters. On the other hand, retail competition clearly imposes information and switching costs on consumers who frequently do not make the best choices. For these reasons, it is likely that electricity retailing will remain regulated along with local distribution in most regions.

Dispatch and transmission also follow a variety of models throughout the U.S. In California and Texas, independent system operators dispatch units over a grid owned by the regulated utilities. Transmission remains integrated with generation and distribution in the Southeast. At the national level, the Federal Energy Regulatory Commission (FERC, successor to FPC) continues to promote larger transmission systems under independent control but with limited success. (See Figure 2.) One recent success involved the westward expansion of PJM. The huge increase in power flows and reduction in generation costs associated with this expansion suggests that PJM's model of dispatch with locational marginal prices might achieve efficiencies if more widely adopted.[33]

Unitary control of transmission facilities with different owners complicates compensating those owners according to the contribution their property makes to the entire system. That contribution cannot be directly measured, for example by measuring the current carried. More interconnected generation strengthens competition, and stronger competition may lower prices. Transmission capacity can increase competition independently of the amount of current actually transmitted.[34] Conversely, transmission facilities can have a negative value. A new transmission line with low capacity that becomes congested can force the dispatch of more expensive generation to balance the system. Finally, the value of intermittent generation, such as from wind or solar, is increased if it is combined in a transmission system with conventional generation. Payments to transmission owners not reflecting the true value of their assets will fail to encourage maintenance and new investment where it would be most valued. Efficiently maintaining and upgrading the transmission grid may be the greatest challenge facing the electricity industry.

One disappointment with industry restructuring is that it has not led to time-varying retail prices reflecting changes in marginal costs. Independent transmission operation produces wholesale prices that vary over time, but this has had little effect on the structure of retail prices despite both agreement and evidence of the benefits of a changed structure. There have been efforts in some places to provide consumers with real-time price information, but a reluctance to impose a new pricing structure remains. If retail competition were able to give consumers the

[32] See Joskow 2002.
[33] See Mansur and White (2009).
[34] See Borenstein, *et al.* (2000).

option of accepting time-varying prices, this could significantly improve the efficiency of electricity use.[35]

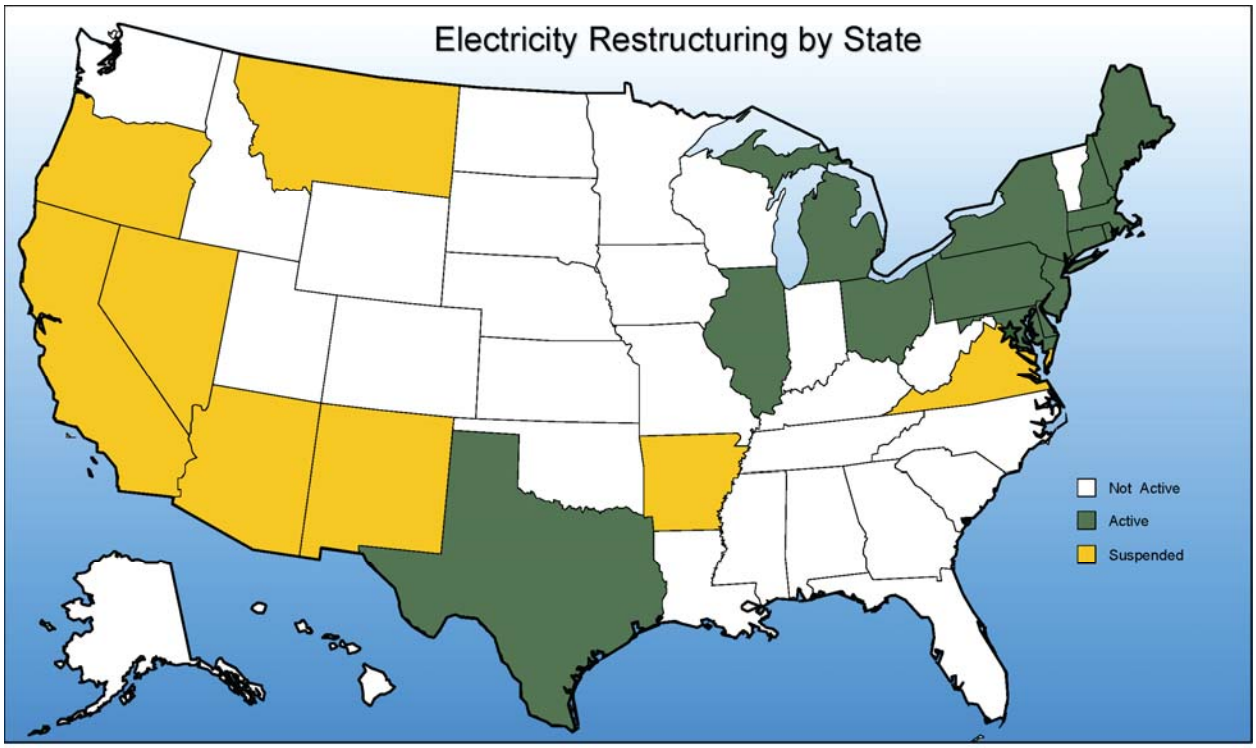
Conclusions

Mark Twain remarked that history doesn't repeat, but it does rhyme. Throughout its history the U.S. electric power industry has been shaped and reshaped by changes in public policy. The restructuring of the industry that has occurred in some states is radical, but the establishment of the state commission system, the breaking up of the holding company system, and the large scale intervention of government, especially the federal government, as industry participants were also radical changes. The current policy changes came at the end of an unusually long period of relative policy indifference, and this may cause it to seem unusual. Perhaps more than any of the historical policy initiatives, the restructuring movement has been influenced by policy activity in other countries.

Public awareness has been most aroused when prices have seemed high, service has seemed bad, or the industry has otherwise been seen as abusive. A sequence of events led to the restructuring movement in the U.S., but the high and rising electricity prices of the 70s and 80s were a necessary stimulant, and restructuring came first to those states with higher rates. Was California's disastrous experience caused by implementation that compromised market operation or was it evidence that unregulated markets could not supply inexpensive and reliable electricity? The answer doesn't matter; the momentum of the restructuring movement was totally dissipated. Any new momentum will likely require a situation that becomes widely, although not necessarily correctly, perceived as exposing an intolerable problem. Another California-type crisis in a currently restructured state could result in a move to re-regulate the industry. Alternatively, high prices or serious capacity shortages in a currently unrestructured state could revive deregulation or perhaps government ownership. Whatever happens is likely to introduce new problems, and the effort to use public policy to create a more perfect electric power industry will continue.

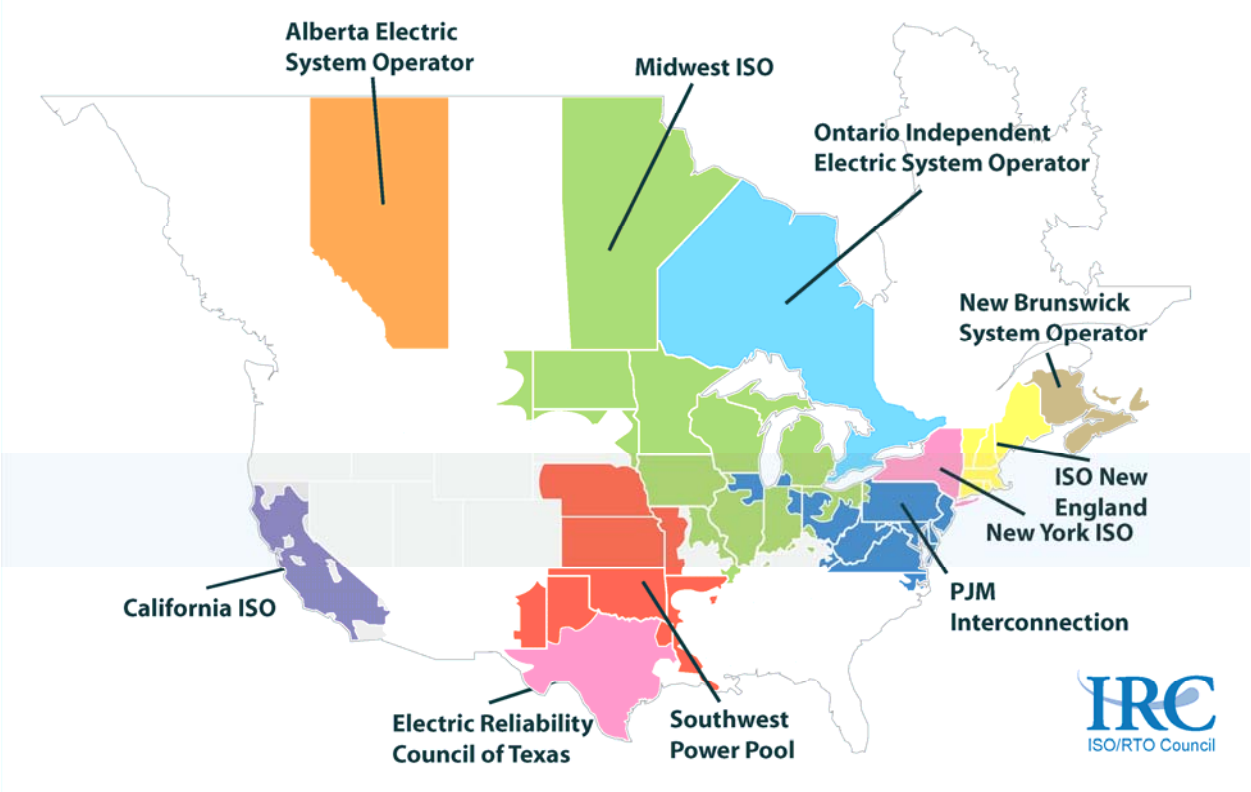
[35] See Borenstein and Holland (2005), Borenstein (2005), and Holland and Mansur (2006).

Figure 1–Status of Electricity Restructuring by State.



Source: Energy Information Administration
(http://www.eia.doe.gov/cneaf/electricity/page/restructuring/restructure_elect.html)

Figure 2–ISO RTO Operating Regions.



Source: ISO/RTO Council.

.http://www.isorto.org/site/c.jhKQIZPBImE/b.2604471/k.B14E/Map.htm.

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