LE CENTRE FRANÇAIS SUR LES ÉTATS-UNIS
(CFE)

ENERGY AND ENVIRONMENTAL POLICY IN THE UNITED STATES

Synergies and Challenges in the Electric Industry

Susan F. Tierney and Paul J. Hibbard

ifri
institut
français
des relations
internationales

L'**Ifri** est, en France, le principal centre indépendant de recherche, d'information et de débat sur les grandes questions internationales. Créé en 1979 par Thierry de Montbrial, l'Ifri est une association reconnue d'utilité publique (loi de 1901). Il n'est soumis à aucune tutelle administrative, définit librement ses activités et publie régulièrement ses travaux.

Ifri *(French Institute for International Relations) is a research center and a forum for debate on the major international, political and economic issues. Headed by Thierry de Montbrial since its founding in 1979, Ifri is a non-profit organization.*

Le **Centre français sur les Etats-Unis** (CFE), créé au sein de l'Ifri en septembre 1999, a pour tâche d'étudier les développements politiques, économiques et sociaux des Etats-Unis, qui influencent l'image des Etats-Unis en France, autant que les relations européennes et transatlantiques. Il organise régulièrement des réunions rassemblant des décideurs des secteurs public et privé, et publie articles et *Policy Papers* sur des sujets pertinents pour l'étude des Etats-Unis et pour la relation franco-américaine.

The **French Center on the United States** (CFE), created in September 1999 within the French Institute for International Relations (Ifri), jointly with the Center on the United States and France (CUSF) at the Brookings Institution, has as its goal the amelioration of mutual understanding of the public policies of France and the United States. This is to allow their respective leaders to better understand the functioning of the system in the other country, through research on concrete subjects concerning *their current relationship.*

Ifri – 27, rue de la Procession – 75740 Paris Cedex 15 – France
Tel.: 33 (0)1 40 61 60 33 – Fax: 33 (0)1 40 61 60 60
www.cfe-ifri.org – info@cfe-ifri.org

Contents

Introduction

The energy and environmental policies of the United States are, like those of any nation, greatly shaped by a particular economic, institutional and political context. Understanding that context is useful for providing insights into the substance of US energy and environmental policy, the challenges and opportunities associated with it, and future potential for change. This article examines this policy context, focusing on the interaction of energy and environmental policies related to the electric industry.

Starting with a background discussion of the basics of the US electric industry, we describe the characteristics of the federal/state jurisdictional and institutional framework in which American electric industry policy is shaped. The division of responsibility between federal and state jurisdictions affects the way in which the electric industry is governed in the United States, though there are important differences in the types of institutions and policy approaches adopted for economic regulation of the industry on the one hand, and environmental regulation of the industry on the other. We highlight these differences in this article. Finally, to illustrate the types of synergies and challenges imposed on the electric industry as a result of these environmental and economic policy structures, we discuss two important issues – nuclear power and climate change policy – to show the current imprint of the federal/state policy framework on specific policies affecting the US electric industry. One issue (nuclear power) is dominated by federal policy, while the other (climate change) is being increasingly shaped by state-level policy action.

There are a number of themes that we observe from US policy-making towards the electric industry, all of which fit under the over-arching observation that such policy evolves through complex legal and political machinations of state and federal interests. In this context, US electricity policy – discussed in this paper – is a

patchwork quilt with common threads, fashioned over time by (1) economic and environmental concerns, (2) the interaction of state and federal jurisdictions, and (3) significant state and regional variations in indigenous resources and thus fuel mix.

First and foremost, electricity is a commodity that has been "imbued with the public interest" from its origins in the United States – and consequently throughout the 20th century has been a target of close federal and state regulation from price and environmental (not to mention social) perspectives. Economic regulation of electricity is part general policy and part case law, since, in the United States, regulatory agencies make their decisions based on a review of the legal record of evidence provided by electric companies and their allies, and consumer advocates and their allies. While constitutional "due process" considerations play a significant role in policy-making, politics is never far away because of the large amounts of money at stake and the public interest nature of the electric enterprise. By law in most jurisdictions, utility regulators must make their decisions by considering the financial interests of the utility (and its shareholders), the economic interests of consumers, and case law precedent.

In the absence of any coherent central planning function for the industry, the combination of these factors – close regulation, federal/state jurisdictional differences, physical (fuel) differences by region, specialized decision-making institutions which atomize policy towards activities that lead to multiple impacts and multiple objectives (such as tariff and rate impacts, and environmental impacts) –an industry with the following features has emerged:

- Tensions between federal and state government, part one: Some things can fall through the cracks between state and federal regulation, other things get pushed and pulled in different directions, and federal/state regulation can work at cross-purposes, introducing inefficiencies, lack of policy coordination and alignment, and so forth. One example is with respect to the nuclear industry, where investments were originally promoted by federal policy and then stymied in large part over the past 15 years by state utility regulatory

actions that prohibited recovery of a significant share of the costly investments utilities had made. These interactions ultimately set the stage for requiring nuclear energy investments to have to compete economically with other generation technologies and fuels.

- Tensions between federal and state government, part two: The federal government can step in where state action is insufficient or impractical. Prime examples: (1) improving the efficiency of wholesale market structures (e.g., the policies of the Federal Energy Regulatory Commission (FERC) to promote Regional Transmission Organizations and Standard Market Design for wholesale power markets), by aligning the geographic scope of regulatory policy more with the geographic scope of economic markets for electricity; (2) addressing regional environmental problems where there is little or no incentive within culpable states for action, especially where the benefits of action accrue to other states (e.g., power plant emissions that contribute to acid rain and ground-level ozone).
- Tensions between federal and state government, part three: State governments can take action where federal action is inadequate or slow to materialize, which is useful both for applying pressure for federal action, and for nurturing program design. For example, several states are beginning put in place policies to address sources of greenhouse gas emissions. These interact with climate change policies in ways that begin to realize real emissions reductions, provide for the design of programs that could serve as models for future federal programs, and apply real political and legal pressure for federal action.

In recent years, the United States has begun to unravel the tight regulatory structure of its electric industry, with mixed results at best. While electricity is a commodity, it is proving to be different from other commodities in terms of the expectations of the public (and of politicians) concerning prices, price volatility, guarantees of universal service, and so forth. There are still many uncertainties about whether the structure of the industry will reach a steady state, and, if so, what combination of regulation and competition will prevail over time and across space in the United States.

Overview of the Electric Industry

The architecture of regulation which covers the US electric industry has its origins in the historical economic organization of the industry. As described below, during the time the US power industry took shape over the past century, it became apparent that electricity supply and delivery was a natural monopoly, and state governments gave to a single electric company (sometimes private companies, sometimes local government departments or local "cooperative" organizations) the exclusive right to provide electricity service to retail consumers in a particular geographical area in the state. In this special "service franchise" area, the designated electric utility company would have no competitors, but it would also be obliged to provide electricity service to any household or business located in that franchise that wanted electricity service. To guard against the electric company charging excessive prices that reflected its monopoly position, state governments also legislated that the rates of the electric utility would be regulated by a "public service commission" responsible for making sure that rates were based on the reasonable cost of providing service. While each state adopted its own utility policies, this was the predominant institutional model across most states.

This basic model, with state regulation over private monopolies, is the foundation for the overall organizational structure of the US electric industry, even today. Over time, electric companies grew horizontally by increasing the geographic footprint of their monopoly service area, and vertically by taking responsibility for all of the factors of production, from building and operating power plants to generate electricity, to constructing and operating high-voltage lines to transport the power to urban areas, to wiring neighborhoods to deliver electricity to homes, stores and industries. This "vertically integrated" corporate structure was the norm, with electric companies providing "bundled" electricity service to customers according to a regulated price reflecting all of the costs of generation and transmission of the power.

From almost the beginning, the US electric industry has been composed of both public and private utility companies.[1] The rates, investments, and terms and conditions of electric service offered by private companies have long been highly regulated by state governments, with those same regulators typically having little say over the rates of municipally owned electric utilities or cooperatives. Although there are variations across the United States, the rates of publicly owned utilities are set by a locally elected electric board without much oversight by state utility regulators. Currently, most electric consumers are served by large investor-owned utility companies, though these companies make up a small fraction of the total percentage of electric utilities that exist in the United States (see Table 1, below).

While virtually all the states adopted this model of industrial organization for the electric industry, there were clear differences among the states. Some of the differences related to physical factors affecting the industry, such as the types of fuels available to the local utility company, or the density of population in an area. Utilities in the Midwest – an area of abundant coal supplies – tended to build coal-fired power plants. Large utilities serving populations in rapidly growing urban centers tended to construct large baseload plants, including nuclear reactors. By contrast, utilities in parts of the country with abundant hydroelectric resources – such as the Pacific Northwest, the Tennessee Valley and upstate New York – rely on hydroelectric generating plants, and many do so as historical beneficiaries of massive, federally sponsored, "rural electrification" efforts. Rural electric cooperatives and publicly owned electric companies are predominantly although not

[1] In the United States, electric utilities that are owned by private shareholders are called "investor-owned utilities" or "publicly traded" corporations, in recognition of the fact that the stock of these profit-making companies is traded publicly and is subject to regulation as a publicly traded firm by the United States Securities and Exchange Commission (SEC). This is in contrast to private corporations whose stock is not publicly traded, and to governmental corporations or agencies, such as non-profit-making public authorities (e.g., the Tennessee Valley Authority), municipally owned electric companies (which are typically a sub-unit of a local government, such as the Los Angeles Department of Water and Power), federally owned power marketing administrations (such as the Bonneville Power Administration), or public cooperatives (whose shareholders are its consumers). This array of organizational types and forms is a hallmark of the electric industry in the United States.

exclusively located in traditional agricultural states in the Midwest and South.[2]

Table 1
Role of Different Types of Electric Companies in the United States

Type of electric company	Number of entities (1998)	Ownership of generating capacity, %, (1999)	Retail consumers, %, (1998)
Investor owned utility ("IOU")	239 (4.5%)	57.3*	74**
Federally owned electric utility	9 (0.2%)	8.6	2
Other publicly owned electric utility	2009 (37.9%)	10.9	15
Rural electric cooperative	912 (17.2%)	4.2	9
Power marketers	194 (3.7%)	[0]	[N/A]**
Non-utility electric companies	1932 (36.5%)	18.9%*	[N/A]

Source: EIA, Changing Structure of the Electric Industry, Update 2000, 10/2000, Table 2, and Figure 14 (for # of non-utilities).

* Note that since these data were reported, a significant share of IOU-owned generating capacity has been sold to non-utility electric companies. EIA, Electric Power Annual 2000, 8/2001, Volume 1, Figure 2.

** Note that these figures were prior to the advent of retail competition, so the figures for IOUs will be lower today with a larger share now provided by competitive energy suppliers;[3] EIA, Changing Structure of the Electric Industry, Update 2000, 10/2000, Volume 1, Figure 22.

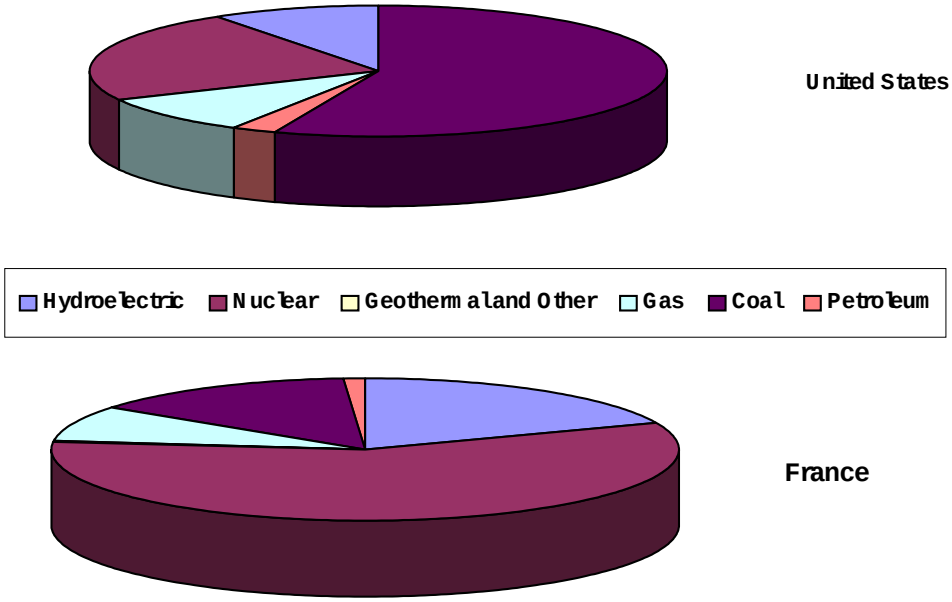
These differences in power plant technologies and fuels have made a distinct imprint on the fuels used to produce power as well as the environmental impacts of power generation and use in different parts of the country. These circumstances have intersected with regional differences in political attitudes and orientations. For example, coal is the dominant primary fuel source for electricity generation in the United States, comprising more than 50% of net generation. Fuel mix for the country as a whole is presented in Figure 1.[4]

[2] See: United States Energy Information Administration, *Changing Structure of the Electric Industry 2000: An Update*, October 2000, Chapter 3.

[3] For example, in 2001, retail sales of competitive energy suppliers totaled approximately 137 TWh – 8 % of total electric industry sales to ultimate customers in states that have deregulated the industry, and 4 percent of total sales to customers within the United States as a whole. U.S. Department of Energy, Energy Information Administration, *Electric Sales and Revenue 2001* (available at <www.eia.doe.gov/cneaf/electricity/epa/sales_state.xls>).

[4] In this and subsequent charts, we not only present figures for the United States, but also include representations for France, so that the reader may understand the relative magnitude of energy and environmental indices in the United States, compared with France.

Figure 1
Fuel Mix of Electricity Generating Capacity: United States and France

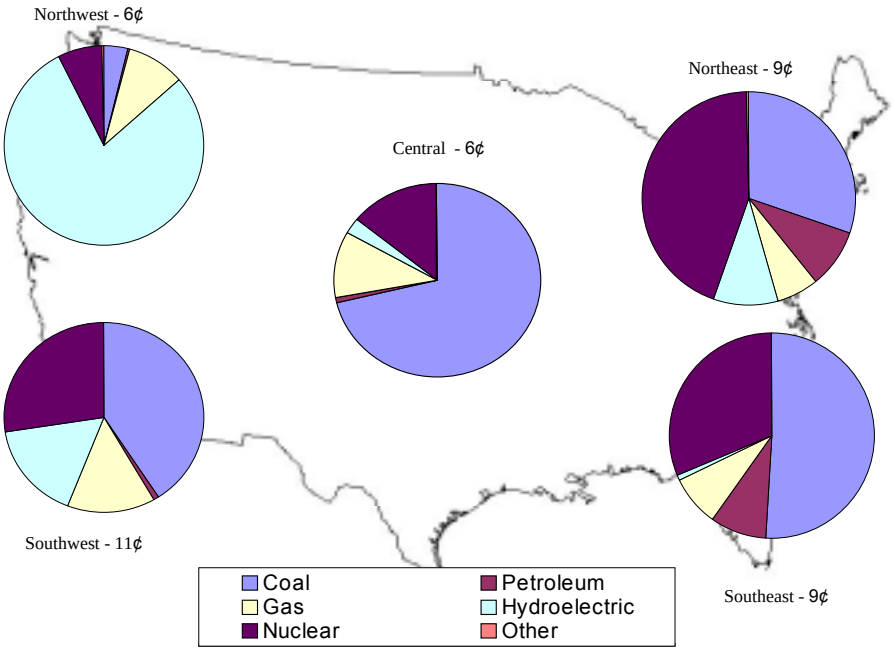


Source: EIA, Country Energy Balance, 2000.

But reviewing overall US fuel mix overlooks significant regional variations that have implications for electricity and environmental policy. Coal is especially heavily used in the Midwest, Rockies, and the South. These areas with high coal-fired power production have tended to tie the interests and attitudes of a coal-based labor force to a low-cost source of power and to a certain degree of tolerance for the environmental emissions from such coal-fired power stations. By contrast, citizens and groups in industrialized and urbanized parts of the country (like California, Texas and the Northeast) with historically high overall pollution levels, a traditionally liberal citizenry, and traditions of environmental activism, have pressed for power production facilities with a lower environmental impact. These same areas now rely on a significant amount of non-coal power production and subject the industry to relatively high scrutiny from an environmental regulation point of view. Regulatory commissions in these different states supervise and regulate the rates for electric sales to retail consumers, and the actions of the power companies to produce and

deliver power to those consumers. Figure 2, below, presents regional variations in fuel mix across the United States.

Figure 2
Electricity Price per kWh and Fuel Mix by Major Region in the United States



Sources: EIA, Form 906 and EIA, Form 826.

Figure 2 also demonstrates the impacts of fuel mix on electricity prices. Not surprisingly, given the variations in fuel mix, electricity prices across the country vary widely. For example, with a high percentage of electricity from large hydro resources, electricity rates in the Pacific Northwest (at approximately five and a half cents per kilowatt-hour) are approximately half those found in California and the rest of the Southwest. While average electricity prices across the country have increased substantially in the past few decades, in real terms, electricity prices are essentially the same as they were 40 years ago.[5]

Finally, the dependence in the United States on coal generation has significant implications for the environmental impacts overall, and of the electricity sector in particular. Figure 3 present emissions of CO_2 from electricity generation on both a total and per-capita basis. In Figure 4, we show the total emissions of CO_2, NO_x and SO_2 for the electric generating sector and the economy as a whole.

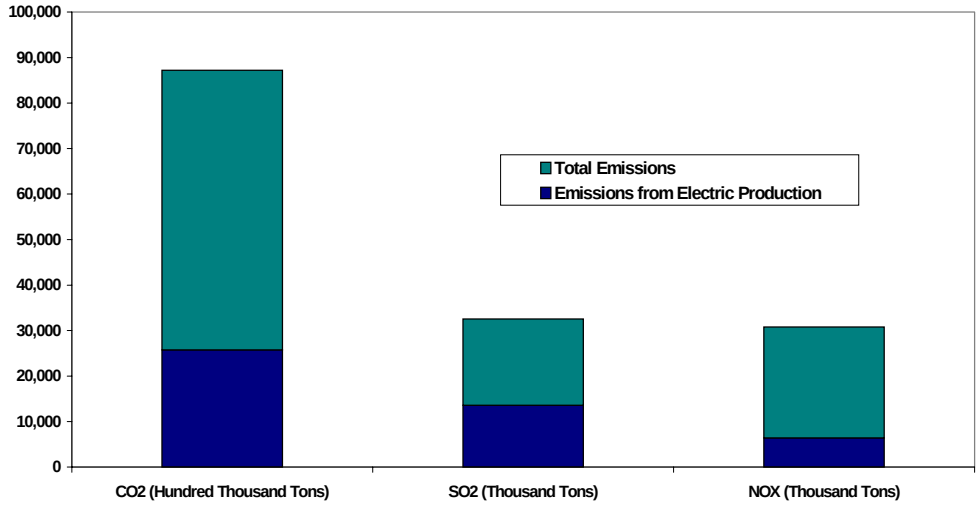
Figure 3
CO_2 Emissions From the Electricity Sector in the United States (1998)

[5] EIA, *Annual Energy Review*, 2000, Figure 8.15.

Sources: EPA, Average Annual Emissions, 2001, and CIA, World Factbook, United States and France.

While the different states have varying levels of "states rights" traditions, with some, like Texas, carefully guarding against industry changes that would shift influence away from the local level, there is a strong common voice across most of the states for keeping state control over policy developments in the industry. This is in sharp contrast to the growing pressure of economic and technological forces in the industry, which have tended to press towards enabling the efficient performance of power markets that span state boundaries. For example, over time, some electric utilities in different states have merged and consolidated, sometimes with inter-company agreements for ownership and construction of large power plants, coordinated resource planning, and/or inter-company contractual arrangements for the purchase and sale of power on a short- or long-term basis. These actions tend to require a shift in some, but far from all, regulatory authority over these entities towards the federal government.

Figure 4
US Emissions of CO_2 NO_x and SO_2 (2001)



Sources: EPA/EGRID, and EPA, Average Annual Emissions, 2001.

US Federal/State Framework over the Electric Industry

The tendency for electric utility companies to take actions with implications across state boundaries is important from the perspective of regulatory policy. In the United States, as described further below, jurisdiction over economic activity in "interstate commerce" is held by the federal government, rather than the states. Thus, under the US constitutional framework, interstate commerce is federally preempted, with national policy superseding state policy determination. Therefore, sales or transmission of power between companies in two different states is subject to federal law and regulation. Over time, the courts in the United States have held that the highly interconnected nature of the electric grid makes it virtually impossible to restrict inter-company sales, or even identify them within single state boundaries; therefore, sales of electricity for "resale" – that is, wholesale power sales that are not "retail" sales of electricity to end-use consumers – are subject to federal economic regulation, not state rate regulation.

Just as the economic markets in which power is bought and sold cross state boundaries, so too does the pollution that is emitted from these plants. And plants are subject to environmental protection policies of both state and federal government. The federal/state framework in the United States assigns significant authority to the states to establish policies that are appropriate to protecting the public health and welfare of the citizens residing in those states. These "police powers" of the states provide the historical and legal roots for a large number of laws regulating sources of air and water pollution, such as electric power plants. And the states have long exercised "siting" and other authority to determine whether and under what environmental terms and conditions a new facility, such as a power generation facility, is allowed to be located, constructed and operated at a specific site in the state.

But, in addition, in the past half century in particular, the US Congress has enacted laws that prevent pollution of the air and waterways that span the borders of any individual state. In some areas of pollution control, these laws require all states to

adopt a minimum level of environmental protection for polluting facilities in their state, but allow individual states to adopt more stringent levels of protection. In some areas, such as regulation of certain emissions of radiation from nuclear power plants and the siting of such facilities, the federal government has preempted the states from exercising regulatory authority.

This dual system of federal/state policy is both a source of strength as well as a source of tension – and is a feature common to many areas of policy in the United States, including economic and environmental regulation of the electric industry. It is an overlay upon the general economic structure of the electric industry, in which, for the most part, private companies are the entities responsible for making investments and providing "public essential services" (such as electricity) to consumers. These actions of private companies are subject to a combination of direct and indirect incentives and disincentives created by government policy.

Policy-making towards the electric industry results from a combination of legislative, executive and judicial branch decisions. In Congress and the state legislatures, there are specialized committees that consider and shape bills affecting the industry. There is a historical tendency for a major piece of energy or environmental policy legislation affecting the electric industry to be enacted about once a decade.[6] Among other things, those statutes authorize executive branch agencies to take actions vis-à-vis the industry. In turn, independent regulatory agencies (such as FERC and the Environmental Protection Agency (EPA)), headed by agency heads (FERC Commissioners, an EPA Administrator) appointed by the President and confirmed by the Senate, implement the policies established in congressional law. For example, both FERC and EPA establish general regulations (or "rules") affecting all companies covered by the policy; then, as each company takes actions pursuant to those rules, the regulatory agency reviews the specific application filed by an individual company. In those case- and company-specific decisions, the regulatory agency adjudicates

[6] For example, the most recent sweeping energy legislation that passed Congress was the Energy Policy Act of 1992, with many complicated elements affecting the electric industry; before that, key national legislation included the Public Utilities Regulatory Act of 1978, the Energy Reorganization Act of 1974, the Atomic Energy Act of 1954, the Public Utilities Holding Company Act of 1934, and the Federal Power Act as amended. On the environmental policy side, the most recent major legislation affecting the electric industry was the Clean Air Act Amendments of 1990.

the interests of the applicant, taking into consideration a legal record of evidence offered by the applicant company as well as any "intervenors" or other parties that have formally been given the right to present evidence and commentary. Strong formal administrative process rules, along with law and case precedent, govern the manner in which the regulatory agency considers the record and issues a formal opinion on the case. These opinions are subject to appeal by the parties and formal legal review by the courts. Each year, for example, FERC issues thousands of opinions and orders.

State regulatory agencies operate in the same fashion, with agency decision-makers (commissioners of a state public utility commission, or commissioners of the department of environmental protection in a state) appointed by the governor (or, in some cases, even elected directly by voters). They administer laws enacted by their state legislature and in some cases administer policies delegated to the states from the federal government.[7] State regulatory agencies, like federal ones, operate according to strict constitutional "due process" requirements that give interested private parties and other levels of government the opportunity to weigh in on matters that affect them, and to appeal the actions of the agency in court.

In addition to affording citizens and companies significant formal procedural due process safeguards, this governance model has other significant features. It creates a tendency towards atomized, often market-driven decisions, of private actors, rather than centrally planned decisions. While there are always notable exceptions to such a general observation – such as the historical efforts of federal government and industry to develop commercial applications of nuclear power in the second half of the 20th century, and to electrify certain parts of previously rural America prior to that – a hallmark of the political economy in the American electric industry is that there is typically no nation-wide “grand plan” for the industry. There are many private

[7] For example, state public utility commissions have been delegated the authority to implement the requirements of the federal Public Utilities Regulatory Policy Act (PURPA), which requires electric utilities to purchase power produced from certain "qualifying facilities" at or below the utility's "avoided cost." In another example, EPA delegates to states the responsibility to administer certain portions of the Clean Air Act's requirements related to the design of permitting and emission control programs for

companies, publicly owned electric authorities, state utility regulators, state environmental regulators, investors and lenders, and so forth. Sometimes common forces (e.g., high interest rates, high international oil prices, broadly shared political expectations about the sanctity of low electricity prices) affect the actions of these parties but just as often, they are pushed and pulled by the inherent tensions that arise from different political, economic, cultural and institutional interests within the nation. Sometimes, problems do not get solved because they fall through the policy cracks (e.g., enforceable bulk power system reliability) or suffer from inconsistent, mis-aligned or even competing policies emanating from federal and state governments But sometimes the industry benefits from competing sources of ideas, ingenuity, experimentation, and authority.

This “atomization” is one of the structural features of the American system and affects virtually everything in the US electric industry: from the ways that different committees in Congress take up matters relating to economic and environmental issues affecting the industry, to the ways that different states and federal agencies regulate the affairs of electric companies, to the different public and private traditions in which the industry has organized and evolved over time in various parts of the country.

---

the control of criteria pollutants.

Federal and State Jurisdictions:
Economic Regulation of the Electric Industry

Historically, state and federal regulation of the electric industry in the United States was driven by its growth over the early 20th century into an industry (1) that was increasingly seen as a fundamental public necessity for the maintenance and advancement of US social and economic well-being, and (2) that was recognized as a natural monopoly that exhibited strong economies of scale and decreasing unit costs. In the first three decades of the last century, electricity grew from an industry serving 8% of the population -- primarily in cities -- to an industry serving nearly 70% of the population in urban and rural locations.[8] It was also in this period that the fundamental framework for economic regulation of electric utilities was established through state and federal law,[9] a framework that has only recently begun to change in some parts of the country.[10]

The electric industry found its first commercial applications limited to the largest cities, where individual power plants could economically move power to a subset of local industries and residents -- and it grew from there. At the beginning of the 20th century, privately owned electric utilities operated only within state-designated and exclusive franchise territories, in exchange for taking on the obligation to serve all

[8] EIA Update at 112.

[9] In this article's discussion of economic regulation of electric companies, we focus on the policies implemented by federal and state utility regulatory commissions – the agencies that establish the rates, terms and conditions under which electric companies provide service to consumers. (We also review environmental and siting policies in later sections of the article.) There are other agencies and bodies of regulation and law that affect the economics of electric companies – such as federal and state tax law (with federal law administered by the Internal Revenue Service), securities law (with federal law administered by the Securities and Exchange Commission), and antitrust law (with federal law administered by the Department of Justice and the Federal Trade Commission). Our focus on rate-regulation policies and agencies in this article, as opposed to the other agencies and their economic policies, is not intended to diminish their importance to the industry, but it does reflect the fact that in the United States, electric industry policy and regulation is typically viewed as the body of policy relating to rate regulation.

[10] Beginning functionally with the passage of the Energy Policy Act in 1992, state and federal governments have begun to open up certain pieces of the electric system to competition, with decidedly mixed results. In this paper, we primarily focus on the industry structure in place throughout the 20th century, although we do address recent structural trends in the industry.

customers within those service territories. By 1910, nearly half of the states in the United States had established public utility commissions ("PUCs") with authorities to grant franchise territories, and to regulate the provision of, and rates charged for, electric service within those territories.[11] Consequently, economic regulation of the prices charged by electric companies began at the state level, and state PUCs continue to serve this function at the state level today.

Over the next two decades expansion of electric company service territories and industry consolidation led to the growth of electric companies whose reach crossed state lines. As noted above, the federal government has jurisdiction over interstate commerce, and in 1927 the US Supreme Court ruled that the sale in one state of electricity that could have been generated in a different state represented interstate commerce subject to federal, not state jurisdiction. At the same time, state economic regulation of intrastate electric companies was rendered virtually impossible by the formation of large interstate “holding companies” that typically owned and controlled many individual electric companies from several states. These holding company structures were widely viewed as engaging in fraudulent and deceitful practices to the detriment of electricity consumers.[12] In response, in 1935 the US Congress passed comprehensive legislation governing regulation of the electric industry, including the Federal Power Act and the Public Utility Holding Company Act ("PUHCA"), establishing the basic framework for federal regulation of multi-state holding companies, and completed a framework for state-federal economic regulation of electric utilities that largely remains in place today.[13] The economic regulation of utilities at the federal level pursuant to PUHCA is carried out today by FERC, the federal equivalent of state PUCs.

Under this long-standing framework, utilities are required to reliably serve all residential and business customers in a service territory. In exchange for this

[11] United States Energy Information Administration, *Changing Structure of the Electric Industry 2000*: *An Update*, October 2000, 3at 5.

[12] United States Energy Information Administration, *Changing Structure of the Electric Industry 2000: An Update*, October 2000, at 29.

[13] These Acts established the framework for public utility regulation in the United States. Other major pieces of legislation affecting the electric industry, discussed later in this paper, include PURPA (1978)

obligation to serve, utilities are granted exclusive franchise rights for that territory and are allowed to recover revenues adequate to cover capital, operational and customer service expenses, including a reasonable rate of return on the invested capital of the utility. This reciprocal arrangement, often referred to as the "regulatory compact," represents the conceptual structure for electricity price regulation at the state and federal level.

The critical differences between state and federal government economic regulation of the electric industry derive from the distinction between what constitutes interstate commerce, and what constitutes intrastate commerce. In practice, this distinction separates (1) the industry participants subject to federal vs. state regulation, and (2) the physical and functional components of the electric system (i.e., generation, transmission, distribution, and customer service) subject to federal vs. state regulation. The major differences are portrayed in Figure 5.

Figure 5

Federal and State Regulation of the US Electric Industry

Source : Figure conceived by the authors.

Figure 5 portrays the following features associated with federally regulated aspects of the US electric industry:

- Interstate commerce primarily involves the movement of electricity across high-voltage transmission lines.
- These transmission lines are considered a component of interstate commerce because they are typically part of large, regional (interstate) electricity grids that connect utilities within and across states, and that connect regulated utility systems with those of federal, municipal, and cooperative electric systems.
- The transmission system also connects privately owned generating facilities

---

and the Energy Policy Act (1992).

with the electric grid, thereby providing an avenue for the sale of this "merchant" generation to electric utilities within and outside the state in which the facility is located.

- Consequently, FERC has jurisdiction over service and rates related to the construction, maintenance, and operation of the transmission facilities owned or operated by utilities or private entities in the United States.
- In setting rates for transmission, FERC reviews filings made by the owners or operators of transmission facilities, which must provide detail regarding all capital, maintenance, and operational costs associated with the construction and operation of those facilities.
- FERC also has jurisdiction over rates for all sales of electricity not made by state-regulated utilities to the ultimate consumers of electricity (residential customers, businesses). These federally regulated transactions, referred to as "wholesale" sales, would include, for example, sales of electricity among or between utilities, power marketers, power exchanges or grid operators. Generally, FERC sets the rates for such sales based on the costs of generation in areas or circumstances where no market competition exists, and approves market-based rates for sales where competitive conditions for electricity sales are in place.

Figure 5 portrays the following features associated with state-regulated aspects of the US electric industry:

- State PUCs have jurisdiction over rates charged for the generation (or purchase) and local distribution of electricity, as well as metering/billing and customer services, provided these activities and services are intended for the benefit of ultimate – or end-use – customers within the state.
- Local distribution primarily involves the movement of electricity across low-voltage distribution lines, right to the electricity meters attached to the homes and businesses of end-use customers within the state.
- In setting rates for electricity service to end-use customers, state PUCs typically review filings made by the state-regulated utilities that must provide detail regarding all capital, maintenance, and operational costs associated with the construction and operation of generation and distribution facilities, as well as expenses associated with metering, billing, and customer service activities.
- State PUCs also exercise general supervisory authority over regulated utilities. This general supervisory authority has been applied in many states with the objective of requiring utilities to plan for and operate its system in a way that is in the "public interest." Examples of public interest-related requirements include PUC-mandated installation of end-use efficiency measures, investment in renewable generation resources, and provision of discounted rates to low-income customers and prohibitions from shutting off service to the elderly.
- State PUCs tend to set utility rates in a manner that enables recovery of all prudently incurred costs (including additional costs incurred to execute public-interest related activities), as well as a reasonable rate of return on the invested capital of the utility.
- Ultimately, the state PUC will set the rate of return on invested capital in part to reflect the utility's performance with respect to cost, reliability and/or public-interest factors. That is, the rate of return may be somewhat increased or decreased (leading to more or less profit for shareholders) to reward or penalize the utility based on its ability to provide reliable service at the lowest

possible cost.

- While FERC has jurisdiction over a portion of the electricity rate-setting process, the state PUC treats such FERC-approved rates (such as power purchase contracts) as a pass-through in state proceedings so that in practice electricity customers see a single bill that includes all federal- and state-approved charges.
- FERC has delegated to the state PUCs the responsibility to administer PURPA, the statute which requires electric utilities to purchase power from Qualifying Facilities at a price less than or equal to the costs the utility would incur if it produced the power itself.

In sum, the goal of federal and state economic regulation of the electric industry in the United States in the 20th century was to provide economical and reliable service to all customers in exchange for utility recovery of costs including a reasonable return on invested capital. The breakdown of federal and state jurisdiction over the setting of utility rates is governed by whether the activity is related to the transmission or "wholesale" sale of electricity in interstate commerce (federally regulated), or is related to the generation or delivery of electricity to end-use customers (state-regulated). In practice, however, a typical end-use customer sees only one bill, including recovery of all costs related to generation, transmission, delivery, and customer service charges, since all federally approved rates for the transmission of electricity are treated as a pass-through in state regulatory proceedings and included as such in customers rates.

Finally, as noted in earlier sections, in recent years, technological, economic and policy factors have led to an increase in competition in the electric industry, and in the deregulation of the generation portion of the business in some states. That is, some states in the United States have introduced retail competition within the state, in effect allowing electricity consumers the option of purchasing the generation portion of electricity service from merchant generating companies, power marketers, or load aggregators, rather than from the regulated utility. As of this writing, 23 states and

the District of Columbia have given either all or some classes of retail electricity customers the right to choose their supplier of power, while still requiring that the local utility deliver that power to the customer's premises.[14] In most states where retail competition has been enacted or introduced by regulatory action, utilities no longer are responsible for constructing generating facilities in adequate amounts to meet the needs of retail customers although the utility still tends to be responsible for providing "back up service and supply" in the event that the retail customer cannot or does not obtain power from a non-utility supplier. In theory, in these states the generation portion of electricity rates is determined by the prices customers are able to obtain from competitive suppliers, and is passed through on utility bills. In practice, competition at the retail level has been slow to materialize, and the regulated utilities have continued to act as load aggregators for most residential and commercial customers, purchasing such power in the competitive wholesale market for the lion's share of customers in most states.[15]

Changes to enact retail competition at the state level would not have been possible without significant changes in the legal and policy framework for federal regulation of the electric industry. This is because the structure of vertical integration in the electric industry – involving generation, transmission, and distribution/retail service in a single company – presented significant financial and transactional barriers to the entrance and participation of merchants and electricity brokers in the sale of electricity at the wholesale (i.e., to other utilities, load aggregators, or system operators) or the retail (i.e., end-use customers) levels. The federal government has taken, and is still taking, steps to reduce or eliminate such barriers by laws and policies to allow equal access for all generators of electricity to the transmission systems historically owned by vertically integrated utilities.

The path to new federal policies enabling wholesale, and ultimately retail, competition

[14] In the past two years, at least six of these states have delayed or reversed steps taken to introduce retail access for electricity customers. See United States Department of Energy, *Energy Information Administration, Status of State Electric Industry Restructuring Activity*, February 2003: <www.eia.doe.gov/cneaf/electricity/chg_str/regmap.html>.

[15] Since the introduction of retail access, less than ten percent (in terms of annual energy requirements) of retail customers have chosen alternative retail suppliers in states where retail access

in the electric industry is often traced to the passage in 1978 of the Public Utility Regulatory Policies Act. This Act was passed in large part to address US dependence on foreign oil, by encouraging electricity generation by indigenous renewable resources and cogeneration facilities, through a federal requirement that utilities purchase all electrical output from such facilities (regardless of who owned them) at the utility's avoided cost. This requirement lead to the growth of independent power projects in many states, and to an increasing call for further competition in the industry. The passage in 1992 of the Energy Policy Act expanded the market participation of non-utility generators, and provided FERC with the authority needed to require through policy decisions the opening up of the nation's transmission system for all electricity generators. With this increase in wholesale competition in the industry, states were able to carry out retail competition policies.

However, the past few years have highlighted the technical and financial challenges associated with altering the traditional electric industry structure to enable wholesale and retail competition. How competition will continue to unfold in the United States remains unclear. Recent troubles in the industry create great uncertainty about whether and if so, in what form, increased retail competition will take place in most parts of the United States. These troubles have included at least the following: blackouts and severe price spikes in California in 2000-2001, along with the complete failure of the restructuring experiment of that state; actions of Enron and other energy companies found by FERC to have manipulated wholesale markets in the West; financial crises in the merchant generating businesses; the frustration of some consumers with a low level of options in the retail market place; the complete lack of interest of other customers with retail choice altogether; growing tension between state and federal regulators in different regions of the country; and the loss of trust by many stakeholders in traditional electric industry institutions.[16] Consequently, in regions (such as the Pacific Northwest and the South) where electricity prices – and

---

has been implemented. See footnote 3.

[16] For more information on these and other issues, see United States Department of Energy, *Energy Information Administration, Status of the California Electricity Situation*, February 2003: (available at <www.eia.doe.gov/cneaf/electricity/california/california.html>).

thus interest in retail competition – have been relatively low, there is likely to remain little interest among state regulators for retail competition. There will also continue to be considerable push-back by these states on federal efforts to establish regional transmission organizations and market structures intended to facilitate competition at the wholesale level.

However, in some regions, such as the Mid-Atlantic and Northeast states, regional grid operators have with some success developed and operated central bid-based spot markets with locational prices, and most states have enacted retail choice as a way to address the relatively high electricity costs in the region, while retaining essential public interest protections. While recent troubles in the industry have surely injected a healthy degree of caution in the ongoing restructuring efforts in these states, the relatively successful regional market designs and state regulatory programs have prevented any serious efforts to eliminate retail competition and return to a traditional industry framework.

Federal and State Jurisdictions:
Environmental Regulation of the Electric Industry

As with the economic regulation of electric utilities, environmental regulation of power plants occurs at both the federal and state levels. But unlike economic regulation, in which the spheres of state and federal jurisdiction are largely separate, state and federal environmental regulators carry out pollution control programs that are legally and administratively linked, and that are often focused on reduction in emissions of the same pollutants.[17] In fact, many state programs related to the control of power plant emissions are designed and administered in accordance with federal requirements and guidelines issued by the US EPA pursuant to federal law.

In general, state Departments of Environmental Protection ("DEPs") are responsible for designing, administering, and enforcing emission control programs that cover all polluting sectors (power plants and other "stationary sources," mobile sources, area sources, etc.). In developing regulations to meet environmental goals, states choose which polluting sectors to target for emission controls, what levels to set for allowable emissions, how to administer the program, and how to enforce control requirements through penalties, fines, etc. States can choose to set standards as stringent as they deem appropriate with one critical caveat: states cannot set standards that are less stringent than mandated federal requirements. Consequently, state programs to

[17] The environmental impacts of power plant construction, operation, and decommissioning include land use and water quality impacts, disposal of toxic, radioactive, and non-hazardous solid waste, and degradation of local, regional and global air quality. In this article, we do not attempt to review the regulatory settings for all of these impacts, and instead focus primarily upon the incidence and regulation of air pollution as an example of federal and state environmental regulation of the electric industry. Our focus in this area is not intended to diminish the importance of the industry's impacts in other media (land and water); but it does reflect the fact that in the United States, the incidence and control of utility air emissions has arguably had the most significant impacts in the past few decades from the perspectives of power plant economics, public health, and environmental improvement. We also choose air emissions in light of the significant role the electricity sector must play in the coming decades in addressing the challenge of climate change.

control pollution are built on top of a foundation of federal requirements – federal requirements that are established by EPA pursuant to federal law.

The Federal Foundation

In the case of controlling emissions of air pollutants from the electric generating sector, the federal law that serves as the foundation for federal and state emission control programs is the Clean Air Act ("CAA"). The Clean Air Act was originally passed by the US Congress in 1970, and has been amended several times since then, with the last substantive changes made through amendments in 1990.[18] In relevant part, the CAA contains the following major components:

- The Setting of Air Quality Standards – EPA is required to establish and periodically update "National Ambient Air Quality Standards" ("NAAQS") for pollutants considered harmful to public health and the environment. NAAQS represent maximum allowable concentrations of pollutants in ambient (outside) air. Currently, EPA has set NAAQS for carbon monoxide, lead, ozone, sulfur dioxide, particulate matter, nitrogen dioxide and volatile organic compounds.
- Identification of Areas Exceeding the Standards – EPA identifies geographic areas within states that exceed the NAAQS for any pollutant, triggering state obligations to take steps to bring these areas into compliance with the standards.
- Requirements for State Control and Permit Programs – EPA requires states to submit State Implementation Plans ("SIPs") that must identify steps that will be taken to meet NAAQS standards for each air pollutant.[19] State SIPs are required to include a demonstration that their proposed plan and implementation mechanisms will lead to compliance, and are required to include a permit program, whereby all major pollution sources must obtain and periodically update an operating permit issued by the DEP.

[18] The CAA is sometimes known as the CAAA, reflecting the Clean Air Act Amendments.
[19] In states that are already in compliance with all air quality standards, SIPs must demonstrate that this compliance will be maintained and identify steps that will be taken by the state to prevent a significant deterioration of air quality.

- National Acid Rain Program – Finally, recognizing that acid rain is a national pollution concern, in the 1990 amendments to the CAA Congress included a comprehensive nation-wide sulfur dioxide emission reduction and emission allowance trading program to be administered entirely by EPA.

As noted above, states have the primary administrative obligation to implement the air quality provisions of the CAA, and must demonstrate to EPA that their SIPs (1) will achieve the level of emission reductions needed to achieve or maintain acceptable air quality; (2) include effective administration and enforcement mechanisms (including pollutant monitoring, emission reporting requirements, and fines and penalties); and (3) contain adequate funding mechanisms for the competent state administration of air quality programs. The US Congress included in the CAA a few provisions to provide substantial incentive for states to design and administer effective SIPs that meet the CAA's requirements, including the potential withdrawal of important federal funding for state programs (such as federal funding for interstate transportation highways) in states that do not comply, and ultimately providing for direct EPA administration of a state program for states that do not administer an effective program on their own.

Direct design of power plant emission control programs is not left entirely to the states. The federal government has recognized that certain public health and environmental hazards – such as ground-level ozone and acid rain – are the result of a complex sequence of events (including the physical and chemical transformation of power plant emissions, and the long-range transport of pollutants and their precursors) that occur over some time and distance after pollutants are emitted from the stacks of power plants. In these cases power plant and other industry operations result in interstate transfer of air pollutants with public health and environmental impacts. Congress and EPA addressed these issues in the design and administration of the CAA through direct federal requirements (such as the national acid rain program) or through administrative provisions that allow EPA to require reductions in emissions of pollutants in one state, if it finds that those emissions

contribute to the degradation of air quality in downwind states. The practical effect of these administrative provisions has been the institution of regional multi-state programs to control emissions, including the national emission trading program to control acid rain and a regional emissions trading program (covering 20 states) to reduce ground-level ozone across the eastern half of the country.

State Initiatives

As noted above, emission control programs of states are driven to a significant extent by federal laws and regulations. However, a state is free to (a) design and administer such programs in any way it sees fit, provided it can convince EPA that the design will achieve the requisite level of air quality, (b) implement programs intended primarily to address CAA requirements, but that include standards more stringent than would be necessary to meet federal requirements, and/or (c) implement entirely state-based programs free from federal oversight, that go beyond federal requirements in scale (again, provided they are more, and not less, stringent) and scope (by, for example, requiring the control of pollutants not regulated at the federal level in any way).

Not surprisingly, the extent to which a given state implements emission control programs that go beyond federally mandated requirements varies greatly across the country, and is driven by several interrelated factors, including (1) the economic importance and political strength of the polluting industries; (2) public perception of the importance of environmental protection, and the organization and political effectiveness of environmental interests within the state; (3) the exposure and sensitivity of the population and ecosystems of the state to the impacts of local and regional environmental pressure; and (4) the cost (and in the case of electric generating facilities, the impact on electric rates) of achieving additional reductions. The disparity in these factors from state to state, and the fact that public health and environmental damages in one state often begin, in part, with emissions from upwind states, lead to an interesting dynamic in the United States for the design of both state and federal emission control programs.

While the specifics of each state differ, it is possible to use some general examples to illustrate how disparate industry, physical, and socioeconomic features of states can affect the setting of emission control requirements. As noted above, the mix of fuels for electricity generation varies across regions of the United States to a great extent as a function of the level and type of resources indigenous to each region. This also has played a role in the aggressiveness of state government in seeking reductions in power plant emissions. For example, as noted above, states with a high degree of native coal resources and/or a high percentage of coal-fired electricity generation (such as those in the Midwestof the United States) have the most to lose (from the perspectives of job security, state economic output, and electricity prices) from the imposition of stringent controls on air emissions from power plants. Conversely, these states do not necessarily experience an equivalent level of impact from coal generation, since (a) many of these states do not have the high population density found in eastern states; and (b) the transport of emissions from tall stacks, and the regional/global nature of impacts that result (including acid rain, urban ozone, and climate change) are ultimately realized to a great degree outside the state's boundaries. Consequently, states with these characteristics tend to be the least aggressive from the standpoint of state environmental protection, and work at the federal level – with some degree of success – to deter the imposition of more stringent federal standards.

On the other hand, there are states that are in effect in the opposite position – that is, they have a more urban and/or less industrialized socioeconomic structure, little or no indigenous fossil fuel resources (thus relying for electric generation purposes on non-fossil generation and/or on fossil imports), and are in effect at the end of the pollution pipe from the perspective of transported environmental impacts. In recent history, states with some or all of these characteristics have been the most aggressive in setting at the state level, and pursuing at the federal level, emission control requirements.

This legal and administrative framework for the interaction of state and federal environmental programs has played an interesting and important role in the development of federal air quality programs. It means in effect that states can be both the laboratories and the impetus for federal standards. States with aggressive approaches to emission controls have developed programs that then serve as a model for federal programs. Also, by imposing requirements prior to federal action on a given pollutant or impact, states can begin to build political and public-support momentum for the passage of federal standards. This may be the most important facet of states' ability to independently address environmental problems – it has worked as the model for moving to EPA's control of SO_2 to reduce acid rain, to control emissions of NO_x to address regional ozone, and (as discussed below) is in play in the United States now with respect to measures to address global climate change affected by human activities.

Federal and State Jurisdictions – Siting Power Plants

One particular area of electric industry policy in which economic and environmental regulation converge – for moments in time, at least – is with respect to the siting of energy facilities: power plants and transmission lines. Energy facility siting is largely within the domain of the states, although there are certain facilities and technologies (nuclear power plants, hydroelectric facilities, and interstate natural gas pipelines) that are regulated for siting purposes at the federal level by FERC. Construction of such energy facilities cannot take place without a permit issued by the state (or the federal government, in the case of nuclear, hydroelectric or gas facilities).

State jurisdiction over siting is rooted in the fact that power facilities tend to have local environmental impacts, as well as the historical role of electric companies being the entity that proposed power facilities as part of their state-regulated obligation to provide reliable service to retail consumers. Increasingly, there is growing friction between an expanding competitive wholesale electricity market – which tends to lead to facilities designed to serve markets and customers in other states – and traditional siting and consent procedures for power plants or even high voltage transmission lines – which is in the purview of individual states.

Part of the tension now felt today in siting proceedings around the states springs from the essential foundations of siting policies, which arose during the days when the standard utility company was vertically integrated and had long-term obligations to provide the power needs of retail consumers. In this traditional industry model, utilities planned capacity expansions in order to assure adequate supplies of power to meet forecasted customer need. Most although not all power plant additions were proposed in-state. And during the 1970s, many states (including California,

Massachusetts, Connecticut, Ohio, and Florida) began to be concerned about whether specific proposals for large power plants were in the public interest. States introduced siting reviews to ensure not only that the proposed facility was needed but that it would be constructed at a suitable site from environmental and other points of view.[20] Formal requirements of states that power plant applicants obtain a "siting approval" were part of a utility planning model, in which state siting regulators reviewed ahead of time whether the state needed new plant capacity; state siting and environmental regulators reviewed whether the environmental impacts of the plant were acceptable; and state rate regulators determined after the fact whether the investment in the plant was prudent, used and useful and therefore recoverable from ratepayers.[21]

In this same institutional framework, state siting agency reviews can modify, accept or reject a specific proposal, but typically cannot force the construction of an alternative that might be preferred for environmental/overall siting reasons. States react to proposals from specific power plant developers (sometimes public utilities, sometimes private power developers), rather than plan for investment and bring them about in a certain way, timeframe or location, as might occur in a more centrally planned industry. Additionally, in many states, proceedings to review proposals to site power plants typically are not coordinated (or are poorly coordinated) with consent processes of the environmental agencies, or proceedings required at a public utility commission to approve any cost recovery for the investment in the power plant. This atomization of facility siting and consent requirements can lead to high costs in the regulatory process itself, opportunities for citizen groups to intervene to

[20] As described above, the siting of certain facilities (nuclear power plants, hydroelectric stations, and natural gas pipelines) is federally preempted, and therefore states are prohibited from directly exercising authority over whether and under what terms such types of energy facilities can be sited in the state. States still have a significant role in reviewing whether to approve an investment in or contract to purchase power from such a facility is in the public interest and is recoverable in rates. The case of nuclear facilities and electric utility companies' investments in them is described further below.

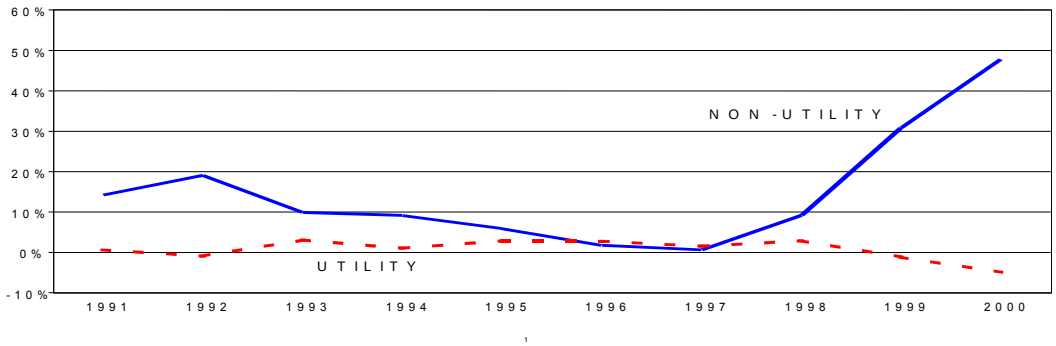
[21] Susan F. Tierney and Paul J. Hibbard, *Siting Power Plants: Recent Experience in California and Best Practices in Other States*, Hewlett Foundation Energy Series (<www.ef.org/energyseries_powerplants.cfm), February 2002, page 24. See also, Susan F. Tierney and Paul J. Hibbard, "Siting Power Plants in the New Electric Industry Structure," *The Electricity Journal*, April 2002.

object to the facility plans, and inconsistent and sometimes conflicting timing of decisions from different agencies.

In the past decade, the foundations of this utility planning model have changed. In virtually every region of the country, at least some states have begun to introduce competition into wholesale power markets, with a substantial and growing fraction of generation capacity/energy now provided by non-utility generators, or electric companies other than the local utility company (see Figure 6). These generators effectively must sell their power into competitive markets. While there are still many vertically integrated utilities in parts of the country, a significant number of new power plant additions in the past five years have been proposed by merchant generators (some of which are affiliated with regulated utilities, others of which are stand-alone generating companies) whose development plans are driven more by forward prices and other conditions in regional wholesale markets than by long-term plans of utilities to invest in capacity to meet the forecasted needs of their retail customers.[22]

Figure 6

Annual Growth Rate of Utility and Non-Utility Generation in the United States



Source : US DOE, Energy Information Administration, IEA Electric Power Monthly, November 2001 and Annual Energy Review, 2001.

[22] This situation has abruptly changed in the past year or two, as a result of the financial collapse of merchant generating companies, and the saturation of the market with new capacity in some regions. It appears that it may be increasingly difficult over the next decade for non-utility, merchant generating companies to build power plants in the absence of a long-term power purchase agreement with a utility company with regulated rates and a captive consumer base.

This situation, however, has not significantly changed the expectations of public citizens who insist (in all states) that they have a voice and play a meaningful role in the siting process. Both neighbors and environmental activists expect environmental protections for large-scale power plants. These players see new plant developments as introducing a very long-lasting change to the physical landscape of their communities and they want to make sure that no plant is allowed to be built that is not needed, well-designed or as clean or as unobtrusive as it can possibly be. These facts heighten the tension between market-driven siting requirements of developers, on the one hand, and the due process requirements embedded in traditional siting processes practiced by states, and traditional democratic norms of public participation in the United States, on the other.

Some of the states have been looking to reform siting processes in the context of somewhat countervailing conditions in the electric industry. The changing nature of the industry has brought to the forefront several fundamental considerations that have always been important in state regulation of power plant siting but are more fought over than ever before. Many states recognize that wholesale generation competition, siting requirements and procedures themselves can play an undesirable and even adverse role in barring entry to markets – something that undermines competition. At the same time, states recognize that for their siting processes to be credible and ultimately worthwhile in terms of the public interest goals of siting statutes, siting processes must allow for robust public participation and review prior to construction even in the face of growing pressure from developers.[23]

[23] In California, of course, this tension hit the breaking point politically, in light of the 2000-2001 electricity price and reliability crisis, and the emergency prompted the state to tip the balance towards getting plants permitted and built as quickly as possible. Other states have implemented siting process changes under similarly difficult conditions – for example, in the context of comprehensive restructuring efforts that required the full attention of all involved not just to siting, but to issues of market structure, stranded costs, public benefits, and industry realignment as part of an entire package.

Benefits and Challenges of this Structure: Two Examples

To further explain the roles and interactions of and tensions between federal and state government on the economic and environmental policies affecting the electric industry, we describe two issues in more detail: policies towards nuclear industry, and policies towards reducing greenhouse gases from the electric industry. One of these issues – nuclear power – is dominated by federal policy; the other – climate change policy towards the electric industry – is increasingly influenced by state actions.

Case Study: Nuclear Power – Strong Federal Role

The imprint of a strong federal government role in electricity policy is perhaps best exemplified by the case of nuclear power. The very roots of the nuclear industry in the post-World War II era can be traced to the US government's support for finding non-military uses of the atom, and the federal government has continued to dominate nuclear policy. The recent history of the technology and its role in producing electricity, however, has also been significantly influenced by actions of the states.

While many activities in the US nuclear industry are carried out by the private investor-owned companies and publicly owned electric companies that own nuclear plants, federal law in the United States carves out a series of special roles for the federal government:

- regulation of the safety and of the environmental and radiological emissions of nuclear power plants is effectuated exclusively through the Nuclear Regulatory Commission's ("NRC") issuance of licenses to construct and operate a nuclear reactor;
- responsibility for storage of spent nuclear fuel and other high-level radioactive

wastes from commercial nuclear reactors is largely the responsibility of the Department of Energy ("DOE"), pursuant to certain radiation standards established by NRC;

- liability insurance for the nuclear industry is underwritten by the federal government, according to the terms of the Price Anderson Act of 1954, as amended by Congress;
- the federal government supports a significant research and development program relating to nuclear energy; and
- regulation over the recovery of the costs of nuclear power plant investments and expenses of companies subject to federal rate regulation falls to FERC.

By contrast, the states have more limited – although still very important – roles:

- regulation over the recovery of costs of nuclear plants owned by state-regulated electric distribution companies is subject to the decisions of those state public utility commissions; and
- responsibility for low-level radioactive wastes is assigned to the states.

Starting nearly 50 years ago with the Atomic Energy Act of 1954, the federal government has had exclusive authority to regulate the siting, construction, operation, and decommissioning of commercial nuclear power plants. Today NRC[24] exercises this jurisdiction as the successor agency to half of the functions of the original and now-defunct Atomic Energy Commission ("AEC"). AEC was established in the 1950s, but was eventually broken up in the 1970s due to concerns over its dual – and inherently conflicting – missions of both advocating for the development of and regulating the safety of nuclear power plants.[25]

Like FERC, NRC is an independent regulatory commission headed by commissioners appointed to specific terms of service by the President and confirmed by the Senate, with a large professional technical staff. Among the responsibilities of

[24] NRC was created as an independent agency by the Energy Reorganization Act of 1974, which abolished the Atomic Energy Commission and assigned its regulatory responsibilities to NRC.

[25] AEC's responsibilities relating to nuclear research and development were passed to the Energy Research and Development Administration, which eventually evolved into the United States

NRC are the licensing of the design, construction, operations and decommissioning of nuclear plants and other nuclear facilities (nuclear fuel cycle facilities, uranium enrichment facilities), and the siting, design, construction, operation and closure of high- and low-level radioactive waste facilities.[26] Even EPA lacks authority over radiation emissions at nuclear sites, although EPA is responsible for setting standards for radiation emissions beyond the borders of nuclear sites and for a nuclear site after it has been decommissioned.[27]

Additionally, in the United States, the federal government is responsible for permanent disposal of spent fuel from commercial nuclear reactors as well as wastes generated at federal facilities (such as the nation's facilities for nuclear research and weapons programs). For years, the electric industry, states, and DOE argued legally and politically as to whether DOE was responsible for "taking title" and possession of spent fuel from commercial reactors in advance of the development and construction of a facility for permanently handling high-level radioactive wastes. Ultimately, the US Supreme Court held that according to federal law, DOE was responsible for interim storage of spent fuel from nuclear reactors. States have the authority to develop disposal facilities for disposing of low-level radioactive wastes or to enter into a compact with another state to accept such wastes. In 2002, also after decades of investigation and political and legal disputes, Yucca Mountain was recommended by President Bush and approved by the US Congress as the site for the development of a geological repository for the disposal of spent nuclear fuel and high-level wastes from commercial and government nuclear facilities.[28]

In the 30-plus years after the first commercial reactor license was issued by NRC,[29]

Department of Energy.

[26] United States NRC, Information Digest, 2002 Edition, NUREG-1350, Volume 14, May 2002, page 6.

[27] See Testimony of Ms. Gary L. Jones, Associate Director at General Accounting Office, "Nuclear Regulation: Regulatory and Cultural Changes Challenge NRC," GAO, before the Subcommittee on Clean Air, Wetlands, Private Property, and Nuclear Safety, Committee on Environment and Public Works, United States Senate, March 9, 2000.

[28] Mark Hold and Carl E. Behrens, "Nuclear Energy Policy", *Congressional Research Service*, Library of Congress, January 30, 2003, page CRS-12. See also Nuclear Energy Institute, (available at <www.nei.org/doc>).

[29] *Id*., Table 11.

there were over 200 nuclear plants ordered by US electric companies, with 104 nuclear reactors now operating in 31 states (60% of the states). The last reactor was ordered in 1970 and came on line in 1996.[30] Over 100 reactors that were ordered were cancelled prior to or during their construction. Currently, 86,000 MW of nuclear capacity produces nearly 20% of all power produced in the United States – down from 101,000 MW peak in 1996.[31] Thus, even though several previously operating nuclear reactors have been shut down before the end of their 40 year lives,[32] the industry as a whole is providing a higher percentage of the Nation's energy from the remaining operating nuclear plants. This reflects recent trends towards reduced average outage time and modifications to boost output at existing plants.[33]

Operating licenses issued by NRC last for 40 years, and approximately one-third of all of the current licenses will expire by 2015. In 1995, federal law[34] was changed to allow operators of current nuclear reactors to apply to NRC for a 20-year license renewal – a process that is expected to take between 3-4 years, and is intended to examine safety and environmental issues such as the detrimental affects of aging on system performance and structures. It is up to the power company that holds the license for a nuclear plant to decide whether to seek a license renewal, with that owner's decision tied to a plant's economics and operational condition. Since the first license renewal application was submitted in 1998 and approved by NRC in 2000, a total of ten reactor licensees have received 20-year life extensions, and NRC is reviewing the applications of another 13 reactor licenses.[35]

---

[30] Mark Hold and Carl E. Behrens, "Nuclear Energy Policy", *Congressional Research S*ervice, Library of Congress, January 30, 2003, page CRS-1.

[31] *Id*., page 20, and Table 5, page 25. Notably, in 1990, there were 111 operating reactors, with an average annual capacity factor of 68%, producing 19% of United States electric generation; in 2001, there were 104 reactors, with an average annual capacity factor of 90%, producing 767 GWH of electricity – and 20% of the nation's generation. *Id*., Table 7. By contrast, France has 57 reactors, with an average capacity factor of 73%, producing 77% of the nation's electricity generation. *Id*., Figures 14 and Table 9.

[32] Eighteen plant sites have been permanently shut down and are in some phase of decommissioning. NRC, *Fact Sheet on Decommissioning Nuclear Power Plants*, December 2002.

[33] Mark Hold and Carl E. Behrens, "Nuclear Energy Policy", *Congressional Research Service*, Library of Congress, January 30, 2003, page CRS-2.

[34] See <www.nrc.gov/reading-rm/doc-collections/fact-sheets/license-renewal.html>.

[35] Mark Hold and Carl E. Behrens, "Nuclear Energy Policy", *Congressional Research Service*, Library of Congress, January 30, 2003, page CRS-1.

For decades, nuclear energy has been a source of great public tension, and most individual groups still view it as a black and white matter.[36] On the one hand, the norm for nuclear plant construction projects around the United States has been to face a highly organized, vocal, and negative local opposition, based largely on distrust of utility companies and the nuclear regulators; uncertainty about radiological releases, evacuation plans, federally subsidized liability risk, and property tax impacts; and opposition to nuclear technology on principle. At the same time, nuclear plant development also has meant significant employment among many construction trades and property tax payments for local governments, with many communities even courting nuclear plants to be located within their borders.

During the past decade, these local tensions have relaxed somewhat,[37] as no new plants have been proposed since the 1970s, and as there have been no requests by nuclear owners to introduce their investment costs into retail rates. Many communities with nuclear facilities have come to depend upon them to provide a significant share of the local property tax base which supports public schools and other local government functions. Since September 11, however, the threat of terrorism attacks on nuclear plants has once again put these facilities under the spotlight. In one notable example, citizen and environmental groups have recently petitioned NRC to shut down the Indian Point, New York, nuclear plant due to security concerns given its proximity to a densely populated region.[38]

---

[36] "A fundamental concern in the nuclear regulatory debate is the performance of NRC in issuing and enforcing nuclear safety regulations. The nuclear industry and its supporters have regularly complained that unnecessarily stringent and inflexibly enforced nuclear safety regulations have burdened nuclear utilities and their customers with excessive costs. But many environmentalists, nuclear opponents, and other groups charge NRC with being too close to the nuclear industry, a situation that they say has resulted in lax oversight of nuclear power plants and routine exemptions from safety requirements." Mark Hold and Carl E. Behrens, "Nuclear Energy Policy", *Congressional Research Service*, Library of Congress, January 30, 2003, page CRS-8.

[37] In California, for example, a recent opinion poll indicates that state residents favor building more nuclear power plants by a margin of 59% to 35%, as compared to 1984 when 61% of respondents opposed nuclear power plants. Christina Cheddar, "What Now? – Back in Power: Nuclear reactors were once the future; they may be again," *Wall Street Journal*, September 17, 2001.

[38] See November 2001 petition to NRC of the Riverkeeper, Inc., Pace Environmental Litigation Clinic, the Nuclear Control Institute, various United States congressmen and state legislators from New York State, New York City councilmen, and county and town officials from neighboring communities. See

The role and interest of states in nuclear plants have tended to focus on the question of local security and cost. Under the US system of utility laws and regulation, public utility commissions – rather than NRC – have the authority to decide questions relating to the types of costs that go into the rates charged to consumers. Traditionally, in most states, the practice is for a utility to make the investments and expenditures it believes are required to provide reliable service at minimum cost, and then to go to utility regulators to request recovery for those costs in rates. During the 1980s and early 1990s, as electric utility companies were completing construction of various nuclear plants, the owners of those facilities made rate case filings in which they requested that their nuclear investments go into rates. This was the point at which the utility regulators reviewed whether the costs have been prudently incurred and "used and useful" – the standard for allowing recovery of investments and expenditures in rates.

These rate cases involving nuclear investments were extremely contentious, in part because of the extraordinarily high cost overruns that had taken place during the construction of most of these nuclear plants, and in part because the introduction of these investments into rates meant significant increases in charges to consumers. In many states, the PUCs denied recovery of millions of dollars of nuclear investment, leading utilities to write off large losses at the same time that they still had high rate increases. This situation also produced broad frustration with a policy environment that could allow continued development of power plants with ever-increasing costs without subjecting them to competition with lower-cost power options, as well as frustration with after-the-fact regulatory review of those costs for rate-making purposes.

These circumstances helped create a policy environment that sought to introduce competitive forces into the decisions of utilities about whether and how to make investments to provide consumers with reliable power, and that sought to reform rate-making policies. Traditional "rate base regulation," under which utilities were able to

---

<www.nci.org/01NCI/11/NRCPetition.htm>.

earn a profit only on capital investment in generation, transmission and distribution infrastructure but not on purchases of power from other suppliers, was seen as having created incentives for companies to undertake – and keep holding on to – large capital investments, such as nuclear plants.

The combined effect of significant cost overruns and regulatory disallowances of nuclear power plant investments caused (a) many regulators to look for a regulatory model that would put greater cost-containment pressure on utilities, (b) many utilities – and Wall Street, moreover – to disavow future investments in new nuclear power plants as too risky financially, and (c) many consumers, especially large industrial customers, to seek to buy power from another source whose rates did not reflect (among other things) the investment costs of nuclear plant. This was one of the key drivers for introducing competition into a restructured electric industry during the mid-1990s.

Today, further expansion of nuclear power plant capacity is widely considered to be inhibited, at least in the short run, by the high costs to construct such plants.[39] The plants that were completed over the past two decades ended up costing between $2-$6 billion (1997 dollars) and $3,000 per kilowatt of generating capacity.[40] Many industry observers believe that unless the economics of nuclear plant construction in the United States become more favorable, there is little reason to expect new plant orders any time soon.[41] That said, the costs to extend the license of existing reactors is more in the order of $10 to $50 per kilowatt,[42] with the expectation that many

[39] Mark Hold and Carl E. Behrens, "Nuclear Energy Policy", *Congressional Research Service*, Library of Congress, January 30, 2003, page CRS-1.

[40] *Id*.

[41] For example, according to a senior official from Exelon, which owns many nuclear power plants, "the cost of building nuclear plants must fall before new construction is price-competitive in a deregulated environment. Building a conventional nuclear plant today would cost roughly $2,000 a kilowatt, while it costs about $1,000 a kilowatt to build a coal-fired power plant, and $500 to $600 a kilowatt to build a natural-gas-fired power plant. If next-generation nuclear power plants can bring down construction costs to between $800 to $1,000 per kilowatt, the plants will be competitively priced." Aaron Zitner, quoting Jack Skolds of Exelon, in "The Nation the Energy Crisis: Bush Touch is a Big Boost to Nuclear Industry Policy: He's proposing ways to build, revitalize plants. But he may be re-igniting old protests," *Los Angeles Times*, May 19, 2001.

[42] "The economics of relicensing a nuclear facility look extremely attractive when compared to building a new combined-cycle natural gas power plant. Relicensing costs are estimated between $10 million and $50 million per plant for an estimated production cost of $10 to $50 per kW, compared with $350

nuclear plant owners will ask NRC to issue license renewals for these plants over the next decade. This expectation has been enhanced to some degree by the strong performance that nuclear plants have accomplished in recent years, with noticeable success in raising the output and overall economic performance of these power plants.[43]

One of the big federal policy questions affecting the prospects for a continuing role for nuclear energy – whether through license extensions or new plant orders – is climate change. With greenhouse gas emissions rising in the United States, in large part a result of the US dependence on coal for over 50% of current electricity production, retirement of significant amounts of nuclear capacity over the next decade could further exacerbate the emissions trend.[44] Virtually any policy to mandate a cap on – much less a reduction of – greenhouse gas emissions is likely to enhance the economic value of nuclear generation. Whether such value is sufficient to change the basic economics of license renewal or life extension for individual nuclear power plants or even render new construction economical, remains highly uncertain at present.

Notably, the National Energy Plan of the Bush Administration calls for policies, such as the development of the permanent nuclear waste repository and streamlined licensing process, to afford an expanded role for nuclear energy in the future.[45] Additionally, the Bush/Cheney energy plan supports, among other things, strict consideration of safety issues by NRC in its review of license renewals and applications for capacity upratings, strong research by the federal government in fuel cycles and next-generation nuclear technologies, as well as examination by EPA of

---

to $450 per kW to build the most efficient combined-cycle natural gas plant." Nainish K. Gupta and Herbert G. Thompson, Jr., "The Market Value of Nuclear Power," *The Electricity Journal*, October 1999, page 38.

[43] High natural gas prices and competitive pressures have also helped the economics of nuclear power plants.

[44] The impact of nuclear retirements on total greenhouse gas emissions trends depends, of course, upon the type of power generation technology and fuel used to replace this capacity.

[45] Bush-Cheney Report of the National Energy Policy Development Group, *National Energy Policy*, March 2001, page XIV.

the ability of nuclear power to facilitate the achievement of air quality laws.[46]

Additionally, increased reliance on nuclear energy would no doubt face highly organized opposition from many environmentalists and citizen groups in the United States, to whom the notion of adding to the nation's nuclear fleet remains anathema. These and other groups would point to heightened concerns about the security of nuclear sites in the wake of the September 11 terrorist attacks on the United States. That said, the climate issue has caused one of the first rays of hope among nuclear advocates in recent years, as well as a growing debate within the environmental community, between those groups that see a need for nuclear energy as one of the ways to address the growing greenhouse gas emissions problem, and those that argue that the global warming challenge has to be solved through other means than continued reliance on nuclear power production. The resolution of this debate is far from predictable today, and is not likely to become clear unless or until there is a proposal to construct a new nuclear power plant in the United States.

Case Study: Climate Change

Ultimately, an effective US approach to controlling emissions that contribute to climate change will require a strong federal program, since many of the potential sources of reduction – including the single largest source, automobiles – can most cost-effectively achieve meaningful reductions through federal action that take effect across all states. But the federal government's reluctance to entertain substantive, non-voluntary control of CO_2 emissions has not deterred states from taking action on their own, and from putting heavy political and legal pressure on the federal government to act sooner rather than later. Consequently, at this point in time climate change is an example of energy and environmental policy being driven primarily by the states. Below we briefly summarize the mechanisms for federal and state action, and the current status of such efforts.

Federal Role and Position

[46] *Id*., at 5-21.

Addressing human-induced global climate change is an area of environmental policy that ultimately will require strong federal action. If the United States is going to achieve emission reductions sufficient to meet the goals of the Kyoto Protocol, or of any other international agreements developed over time, there will need to be a national regulatory framework for binding, enforceable standards to control vehicular, power plant, and other industrial emissions of CO_2, and to encourage the continued development and commercialization of energy efficiency and renewable energy technologies. While individual states may take actions to reduce emissions within their borders, the actual magnitude of such reductions will likely be overwhelmed by growth in emissions from states choosing not to act in advance of federal requirements. Additionally, at some point, state action may create tensions for companies that do business in more than one state and may thus heighten the need for consistent national policies.

Major new environmental initiatives generally require new federal legislation passed by Congress and signed by the President. In turn, new environmental laws generally provide basic standards and/or guidance, but delegate the task of program development and administration to EPA.

However, the current position of President Bush with respect to climate change involves withdrawal from the Kyoto Protocol, and a goal of 18% reduction in greenhouse gas emission intensity,[47] to be achieved through variously defined voluntary efforts. This goal is roughly equivalent to what was in place in the period 1990-2000, a time when emissions significantly increased rather than decreased.[48] Further, while interest in the US Congress for federal action on climate change is growing,[49] there remains a significant level of opposition to binding requirements on

[47] Greenhouse gas emission intensity is defined as the ratio of greenhouse gas emissions to United States economic output. Global Climate Change Policy Book, <www.whitehouse.gov/news/releases/2002/02/climatechange.html>.

[48] David Gardiner and Lisa Jacobson, "Will Voluntary Programs Be Sufficient to Reduce United States Greenhouse Gas Emissions?" *Environment*, October 1, 2002. See also, United States Energy Information Administration, *Annual Energy Review 2000*, Figure 12.1, and Laurent Viguier, *The U.S. Climate Change Policy: A Preliminary Evaluation*, Paris, Ifri, Policy Brief n°1, March 2002.

[49] For example, Senators John McCain and Joseph Lieberman have introduced to the United States

emissions of greenhouse gases, and there is certainly not the two-thirds Senate majority required for ratification of US participation in international agreements.

In the absence of new legislation, there is little that EPA is likely to do on its own with respect to the implementation of enforceable greenhouse gas emission reduction requirements. This is primarily due to the fact that the Administrator of EPA is appointed by, and serves at the will of, the President. However, the question remains whether EPA can be forced to develop greenhouse gas emission reduction programs under existing law. As discussed below, a coalition of the Attorneys General of several states, frustrated with federal inaction on this front, has announced intentions to file a lawsuit against EPA to test this issue in federal court.

State Initiatives

As described above, federal inaction on climate change does not prevent states from controlling emissions of CO_2 and other greenhouse gases at sources within their state boundaries, since any program to control these emissions could not reasonably be viewed as reducing the stringency of other federal emission control requirements. Recognizing that past federal environmental programs have found their roots in state action, and frustrated with the Bush Administration's withdrawal from Kyoto and refusal to institute binding control requirements, several states have begun to implement programs to control emissions of greenhouse gases from power plants and other sources, and have announced plans to take legal action against the US EPA to force regulation of greenhouse gases under the terms of the existing CAA.

For example, in April 2001, the Department of Environmental Protection in the state of Massachusetts issued comprehensive multi-pollutant emission control requirements for oil- and coal-burning power plants within the state, including a maximum permissible rate for emissions of CO_2. The emission rate was set at 1800 pounds per megawatt-hour generated on an annual average basis, representing a 10% reduction from historical emissions of CO_2 from the facilities subject to the

---

Senate draft legislation to enact economy-wide caps on emissions of CO_2 and five other greenhouse gases. See The Energy Daily, *McCain, Lieberman to Push Greenhouse Plan on Energy* Bill, ED, vol. 31, n° 83, May 2, 2002.

regulation. By this action Massachusetts became the first state in the United States to control emissions of CO_2 from power plants; since then other states have passed similar multi-pollutant regulations.[50]

In addition, states and provinces in the Northeast United States and Canada have demonstrated a commitment to taking coordinated action on climate change, and have begun to develop specific plans and policies to satisfy this commitment. In August of 2001, the Conference of New England Governors and Eastern Canadian Premiers approved a "Climate Change Action Plan," calling for the "reduction of and adaptation to negative social, economic and environmental impacts of climate change…"[51] The Governor of the state of New York has recently seized on this opportunity to push for broader regional cooperation by requesting that the 13 states of the Northeast United States agree to institute within two years a CO_2 cap and trade program for electric power generating sources in the region.[52]

In July of 2002, the Governor of California signed a bill, which had previously been passed by the state legislature, requiring the state environmental agency to develop carbon pollution standards for vehicles sold in the state beginning in 2009.[53] This bill was passed in the midst of ongoing federal debate over whether to increase existing federal fuel economy standards, which establish a minimum average fleet mileage requirements for all cars sold in the United States.

Finally, in a step that could have the most significant impact on federal climate change policy, in January of 2003 the state Attorneys General from Massachusetts, Connecticut, and Maine announced plans to file a lawsuit in federal court to require the US EPA to regulate emissions of CO_2, stating "[i]n the face of continued inaction, we, at the state level, have no choice but to use the remedies available to us to fill the

[50] See Lucy Johnston, *Multi-Pollutant Approaches in Certain OTR States*, prepared for the Ozone Transport Commission, June 25, 2002.

[51] Conference of New England Governors and Eastern Canadian Premiers, Resolution 27-7, Resolution Concerning Climate Change, August 2001 (available at <www.cap-cpma.ca/reports_08_2002/27-7_climate_change_e.pdf>).

[52] Governor George E. Pataki, *Governor Calls on Northeast States to Fight Climate Change*, April 25, 2003 (available at <www.state.ny.us/governor/press/year03/april25_2_03.htm>).

[53] State of California, *Press Release from the Office of Governor Gray Davis*, "Governor Davis Signs

void left at the federal level…" [54] As described above, the CAA requires that EPA establish air quality standards for "criteria pollutants" – pollutants considered harmful to public health and the environment. By filing suit, the Attorneys General plan to demonstrate that EPA is legally obligated to regulate carbon dioxide as a criteria pollutant, and that by not doing so it is in violation of the CAA. Using a similar legal challenge, EPA was forced in 1976 to list lead as a criteria pollutant, and establish maximum permissible standards for that pollutant.

These four actions are not the only examples of states beginning to take action on climate change, but they do represent the most significant pressure to date by states for action at the federal level on control of CO_2 emissions from power plants, automobiles and other sectors, including the ultimate remedy of legal action.

Historic Global Warming Bill," July 22, 2002.

[54] State of Massachusetts, Press Release from the Office of Attorney General Tom Reilly, "State Attorneys General: Bush Administration is Legally Obligated to Address Carbon Dioxide, Global Warming," January 30, 2003.

Conclusion

In this paper, we have summarized the characteristics of the federal/state jurisdictional and institutional framework in which American electric industry policy is shaped. There are a number of themes that we observe, the primary observation being that economic and environmental policy affecting the electric industry evolves through complex legal and political machinations that play out at both the federal and state level. Within this structure, US electricity policy emerges as a patchwork quilt with common threads, fashioned over time by (1) strong economic and environmental concerns, (2) significant state and regional variations in indigenous resources and thus fuel mix for electricity generation, and (3) progressive policy evolution driven by these concerns and regional variations, and more importantly by the resultant interaction of state and federal jurisdictions.

In the absence of a single coherent central planning function for the industry, the tensions associated with gaps and redundancies between state and federal jurisdictions – and between economic and environmental jurisdictions in federal government and within states – play out in various ways with respect to the evolution of industry structure. Where jurisdictional responsibilities are overlapping or not well-defined, policymakers get pushed and pulled in different directions by public and market interests, sometimes introducing inefficiencies and lack of policy coordination and alignment within and among states. On the other hand, there are clear examples where state or federal agencies have stepped in where there is questionable jurisdiction or policy resolve at other levels of government. For example, the federal government has stepped in where state action is insufficient or impractical (e.g., wholesale market design, structure of Regional Transmission Organizations, and policies to address regional environmental problems, such as acid rain). On the

other hand, state governments have taken action where federal action is inadequate or slow to materialize, which is useful both for applying pressure for federal action, and for nurturing program design. Examples include policies to encourage energy efficiency and renewable energy, as well as recent state initiatives to reduce emissions of greenhouse gases.

In recent years, the United States has begun to unravel the tight regulatory structure of its electric industry at the federal and state levels, with mixed results at best. While electricity is a commodity, it is proving to be different from other commodities in terms of the expectations of the public (and of politicians) concerning prices, price volatility, guarantees of universal service, and so forth. Moreover, whatever stability existed in the relationship between agencies at the state and federal levels will need to be reestablished after the new competitive wholesale and retail market structures are closer to being finalized. There are still many uncertainties about if and when the new industry structure will reach a steady state, and, if so, what combination of regulation and competition will prevail over time and across space in the United States.

References

Brennan, Timothy J., Karen L. Palmer, Raymond J. Kopp, Alan J. Krupnick, Vito Stagliano, and Dallas Burtraw*, A Shock to the System: Restructuring America's Electricity Markets*, Washington, D.C., Resources for the Future, 1996.

Brennan, Timothy J., Karen L. Palmer, Salvador A. Martinez, *Alternating Currents: Electricity Markets and Public Policy,* Washington, D.C., Resources for the Future, 2002.

Bush-Cheney Report of the National Energy Policy Development Group, National Energy Policy, March 2001.

Cavanagh, Sheila M., Robert W. Hahn, and Robert N. Stavins, *National Energy Policy During the Clinton Years*, Washington, D.C., Resources for the Future, Discussion Paper 01-38, September 2001.

Commonwealth of Massachusetts, Department of Environmental Protection, Statement of Reasons and Response to Comments for 310 CMR 7.00 et seq.: 310 CMR 7.29 – Emission Standards for Power Plants, April 2001.

Fox-Penner, Peter, *Electric Utility Restructuring: A Guide to the New Era*, Public Utility Reports, 1997.

Gardiner, David, and Lisa Jacobson, "Will Voluntary Programs Be Sufficient to Reduce US Greenhouse Gas Emissions?", *Environment*, October 1, 2002.

Holdren, John P., *Improving US Energy Security and Reducing Greenhouse-Gas Emissions: What Role for Nuclear Energy?*, Testimony of John P. Holdren for the Subcommittee on Energy and Environment Committee on Science, US House of Representatives, Washington, D.C., July 25, 2000.

Johnston, Lucy, *Multi-Pollutant Approaches in Certain OTR States*, prepared for the Ozone Transport Commission, June 25, 2002

Joskow, Paul L., *Energy Policy in the 1990s*, presented at the JFK School of Government, Harvard University, July 11, 2001.

Justus, John R., and Susan R. Fletcher, *Global Climate Change*, Washington, D.C.,

Issue Brief for Congress, Congressional Research Service, updated January 3, 2003.
Laurent Viguier, *The U.S. Climate Change Policy: A Preliminary Evaluation*, Paris, Ifri, Policy Brief of CFE n° 1, March 2002
Smith, Douglas W., Robert R. Nordhaus, Thomas C. Roberts, Mark Chupka, et al., *Designing a Climate-Friendly Energy Policy: Options for the Near Term*, Arlington, Pew Center on Global Climate Change, July 2002.
The Energy Foundation, *The Bush-Cheney Energy Plan: How It Fares in the 21st Century*, San Fransisco, The Energy Foundation, July 2001.
Tolman, Michael A., (ed.), *Climate Change Economics and Policy: An RFF Anthology*, Washington, D.C., Resources for the Future, February 2001.
US Energy Information Administration, *Changing Structure of the Electric Industry 2000: An Update*, Washington, D.C., US Energy Information Administration, October 2000.
US Energy Information Administration, *Annual Energy Outlook 2002*, Washington, D.C., US Energy Information Administration, December 2001.
US Environmental Protection Agency, *The Plain English Guide to the Clean Air Act*, Washington, D.C., US Environmental Protection Agency, April 1993.
US General Accounting Office*, Air Pollution – Implementation of the Clean Air Act Amendments of 1990, Testimony of David G. Wood*, Washington, D.C., US General Accounting Office, May 17, 2000.
Wooley, David R*., A Guide to the Clean Air Act for the Renewable Energy Community*, San Fransisco, The Energy Foundation, Renewable Energy Policy Project, February 2000.

The Authors

This report was prepared by Susan F. Tierney and Paul J. Hibbard of Lexecon Inc., Cambridge, Massachusetts. The authors would also like to express their sincere gratitude to Jonathan Greven and Sally Caraganis of Lexecon for their assistance with research and the editing of this report.

Susan F. Tierney

Susan Tierney is a Senior Vice President at Lexecon, where she provides economic, environmental and policy consulting to businesses, government agencies and other organizations involved in energy industries. She focuses on wholesale power market policy and analysis, electric and gas infrastructure siting, and environmental policy and analysis. Prior to joining Lexecon, Dr. Tierney held several senior government positions, including Assistant Secretary for Policy at the US Department of Energy; Secretary of Environmental Affairs for the Commonwealth of Massachusetts; Commissioner of the Massachusetts Department of Public Utilities; Executive Director of the Massachusetts Energy Facilities Siting Council; Senior Economist at the Massachusetts Executive Office of Energy Resources; and Assistant Professor at the University of California at Irvine. She has authored numerous articles and reports on energy markets and policy issues, and has testified before the Federal Energy Regulatory Commission, state public utility commissions, and congressional committees. She serves on numerous corporate and non-profit boards of directors. She has a Masters degree and Ph.D. from Cornell University.

Paul J. Hibbard

Paul Hibbard, a Senior Consultant at Lexecon, specializes in economic and environmental policy consulting related to the energy industry, particularly electricity,

and focuses on market structure and competitive analysis, public policy, and environmental regulatory analysis and policy. Mr. Hibbard joined Lexecon after more than ten years developing state energy and environmental policy in Massachusetts. Most recently, he worked in the state's environmental agency with responsibility for developing policy positions and regulations governing state compliance with the Clean Air Act, state-based advanced emission control requirements on the highest-emitting power plants, and administration of state portfolio standards such as information disclosure and renewable and emission performance standards. Prior to that, Mr. Hibbard worked at the public utility commission in Massachusetts, focusing on industry restructuring, stranded costs, NEPOOL structure and reform, economic valuation of power plant environmental impacts, company-integrated resource management and conservation plans, and nuclear plant decommissioning cost estimates. He has an M.S. in Energy and Resources from the University of California, Berkeley, and a B.S. in Physics from the University of Massachusetts, Amherst.