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Environmental jolts, institutional change, and the creation of entrepreneurial opportunity in the US electric power industry

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Abstract

The relationship between institutional change and entrepreneurship is poorly understood. We build the theory in this area by tracing institutional change in the US electric power industry over a 40-year period. Our analysis shows that environmental jolts mobilize actors to reformulate institutions, resulting in increased entrepreneurial opportunity. When the institutional environment is stable, we find that incumbent organizational forms and embedded logics present formidable obstacles to entrepreneurial activity. Environmental jolts, however, catalyze search processes and motivate the evaluation of current institutional logics. Specifically, in the case of the electric power industry, environments of abundance and regulation resulted in homogeneity of organizational structures and strategies, and few entrepreneurial opportunities. Environments marked by scarcity and crisis, however, witnessed heavy scrutiny of existing institutional arrangements that eroded their taken-for-grantedness and symbolic value, resulting in opportunities for entrepreneurial action.

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1. Introduction

Institutional change plays an important role in the generation of opportunities for entrepreneurial activity, yet relatively little research has examined this relationship. Prevailing institutional logics—i.e. sets of socially-constructed assumptions, values, and beliefs—define appropriate structures, practices, and behaviors within organizational fields (Clemens, 1993; Haveman and Rao, 1997; Thornton and Ocasio, 1999), and changes in these logics can lead to

increased entrepreneurial opportunity and ultimately changes in industry structure. In this paper, we examine the relationship between institutional change and entrepreneurial opportunity. Understanding this relationship can, we believe, contribute to the existing literature on technological entrepreneurship, which has generally neglected institutional factors (for notable exceptions, see Tushman and Murmann (1998), Shane (2000)).

We suggest that environmental jolts serve as catalysts for action. Specifically, jolts prompt institutional actors to engage in problemistic search processes that can both delegitimize existing institutional structures and uncover alternative arrangements. While previous theory has linked environmental jolts to the decline of institutionalized structures and practices

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(e.g. Leblebici et al., 1991; Singh et al., 1991; Oliver, 1992; Burns and Wholey, 1993; Davis et al., 1994; Greve, 1995; Strang and Sine, 2002), little connection has been made between environmental jolts, institutional change, and entrepreneurial opportunity. We argue that jolts prompt search processes that erode the taken-for-granted nature of institutions, resulting in the re-evaluation of the costs and benefits of existing institutional structures and the creation of new entrepreneurial opportunities. Our approach links disparate but related research on environmental jolts, organizational search processes, institutional change, and entrepreneurship. We illustrate our approach through historical analysis of the regulation and partial deregulation of an industry that affects every part of modern life, the electric power industry.

2. Theory

There is growing interest among organizational scholars in the relationship between institutional change and entrepreneurial action (DiMaggio, 1988, 1991; Greenwood and Hinings, 1996; Barley and Tolbert, 1997; Fligstein, 1997; Hoffman, 1999). This is a compelling and difficult topic given that institutions are by definition highly resistant to change. Neo-institutionalists describe institutions as routinized structures and behaviors that are taken for granted as “the way things are done,” and therefore, escape day-to-day scrutiny (Berger and Luckmann, 1966; Meyer and Rowan, 1977; DiMaggio and Powell, 1991; Scott, 1995). Institutions are described as decoupled from typical measurable performance outcomes, and their worth is linked more to their historicity and symbolic value than to the relative effectiveness of their technical contributions, which are often assumed by constituents (Berger and Luckmann, 1966; Meyer and Rowan, 1977). Yet, even in highly institutionalized fields, change can occur. In this paper, we seek to elucidate the relationship between institutional change and opportunities for entrepreneurship. Particularly, we examine the complex relationship between environmental jolts, field-level² search processes,

institutional change, and the creation of entrepreneurial opportunity.

2.1. Environmental jolts

Focusing on the organizational level, Meyer (1982, p. 515) defined environmental jolts as “transient perturbations whose occurrences are difficult to foresee and whose impact on organizations are disruptive and often inimical”. Unlike Meyer, however, our study investigates the influence of environmental jolts on entire fields of organizational activity (for similar examples, see Tushman and Anderson, 1986; Kraatz and Zajac, 1996; Haveman and Rao, 1997; Hoffman, 1999). Environmental jolts highlight institutionalized assumptions about the environment, and reveal unexpected relationships between institutionalized practices, technologies, organizational forms, and outcomes that may not be apparent in times of stasis (Strang and Bradburn, 1994). Jolts can prompt field-wide crisis, that is, perceptions by field actors (organizations, regulators, investors, customers, etc.) that fundamental outcomes are in contrast to expectations, and precipitate action intended to avoid dramatic negative outcomes. For example, in the case of the US auto industry, exogenous shocks revealed the reliance of current product strategies on cheap oil (and hence on nations belonging to OPEC, otherwise known as the organization of petroleum exporting countries). This dependency had not been of central concern prior to the 1973 oil crisis. Similarly in the 1970s and early 1980s, intense competition from abroad highlighted the failure of the US auto industry to meet customer expectations regarding quality and efficiency. The result of destabilizing environmental jolts is often a re-examination of institutionalized logics and practices and a reorientation of organizational

² Explaining institutional change requires looking at the broader organizational *field* of actors (Leblebici et al., 1991; DiMaggio, 1991; Hoffman, 1999). The concept of “organizational field”

is similar to that of “industry”, but more inclusive. Whereas, “industry” typically refers to a group of firms producing similar outputs and their economic relationships with buyers and suppliers, an “organizational field” is a social location of interaction between competing firms, suppliers, buyers, regulators and policy makers; that is, the field level includes the “totality of relevant actors” (DiMaggio and Powell, 1983, p. 148) and their social and economic relationships. Examining field-level dynamics is particularly important in the study of the power industry because consumer groups, legislators, and policy analysts are central actors.

strategies and processes with environmental demands (Oliver, 1992).³

2.2. Institutional actors

Institutional theory has generally neglected questions of interests and agency as they pertain to change in organizational fields and the elaboration of new organizational forms (DiMaggio, 1988; DiMaggio and Powell, 1991). This neglect is ironic, given that agency was central to earlier institutional approaches (e.g. Selznick, 1949; Gouldner, 1954). In attempting to address this gap, DiMaggio (1988, p. 14, emphasis added) posited that new institutions arise when actors with sufficient resources see in them an opportunity to realize interests that they value highly. These individuals engage in “institutionalization work” at organizational-field level, which involves the propagation of public theories about labor markets, consumer markets, expertise, and distinctive products or services (DiMaggio, 1988, p. 15; see also Fligstein, 1997). This involves, according to Lounsbury and Glynn (2001, p. 559), the elaboration of culturally-embedded stories about how “resources or ideas will lead to future benefits for consumers and society”. In this paper, we pick up on these general notions and elaborate on how actors operating at the field level create opportunities to build new organizational structures and change institutionalized practices. In particular, we examine the role jolts played in mobilizing legislators, academics, technical innovators, and proponents of environmentally-friendly technology to reform the institutionalized industrial structure of regulated monopolies in the US power industry.

2.3. Institutional logics

Sociologists have argued that culturally-embedded and taken-for-granted understandings play a fundamental role in defining organizational arrangements

and individual actions. These beliefs explain and justify social structures by integrating them into the socially-available stock of knowledge (Berger and Luckmann, 1966, pp. 61–64). We define institutional logics as socially-constructed assumptions, values, and beliefs that define formal and informal rules of behavior and guide interpretation about why certain structures and practices exist (Clemens, 1993; Haveman and Rao, 1997; Thornton and Ocasio, 1999). For example, Haveman and Rao (1997) found that forms of thrifts were underpinned by “theories of moral sentiments,” or institutional logics comprising opinions, beliefs, and judgments about savings and home ownership. Thornton and Ocasio (1999), meanwhile, found that executive attention was guided by current logics that influenced which organizational and industrial variables powerful actors paid attention to and the types of actions they undertook when determining executive succession. In line with this prior work, we argue that institutional logics underlie processes by which “individuals and organizations produce and reproduce their material subsistence, organize time and space, and provide meaning to their social reality” (Thornton and Ocasio, 1999, p. 804). Any change in these logics, in turn, can be expected to shape field level search processes and the creation of entrepreneurial opportunity.

2.4. Problemistic search processes and the “solution bazaar”

A common primary reaction by actors within an organizational field (managers, board of directors, policy makers, political action groups, etc.) to environmental jolts is to instigate search processes in which they scrutinize the symptoms of the crisis and look for its causes (Cyert and March, 1963, p. 121).⁴ This search, we contend, weakens important institutional qualities, resulting in institutional degradation. Once institutional actors identify problems and weaknesses with existing institutions, previously institutionalized logics are disrupted and the search for new logics, forms, and practices begins. Problemistic search processes are usually carried out in the neighborhood

³ Our approach to jolts as catalysts of change bears some similarity to the work of Thomas Kuhn (1970) on the nature of “scientific revolutions”. For Kuhn, novel scientific theories emerge only amid a mounting *state of crisis* caused by the failure of existing paradigms to adequately explain observed reality. Crises are thus a “necessary precondition” for the emergence of new theories (Kuhn, 1970, p. 77). We thank an anonymous reviewer for pointing out this link.

⁴ Although Cyert and March discussed search processes in the context of organizations, we believe that these same principles apply at the organizational field level.

of institutionalized policies (Cyert and March, 1963, p. 122), robbing them of their pre-conscious status as the attention of institutional actors is focused on behaviors that had previously been taken for granted. This process makes embedded assumptions and beliefs concerning institutionalized forms and practices (i.e. institutional logics) more salient and available for evaluation by constituents within the organizational field. Thus, powerful actors that once took foundational logics about institutional practices for granted start to re-examine these assumptions during times of crisis.

A common outcome of a search process is the discovery of unexpected weaknesses that were not widely known or salient before the crisis. For example, Strang and Bradburn (1994) found that the occasion for re-evaluation of entrenched structures and practices in the healthcare sector was the crisis of a spiraling health budget. As this crisis emerged, it motivated powerful actors to search for practices and organizational forms that were connected with the crisis. They carefully examined their current assumptions about how the health care industry functioned. Strategies and practices connected with healthcare that were taken for granted before became the focus of attention. Increasing costs motivated not only scrutiny of existing practices, but also a search for and evaluation of possible solutions (Strang and Bradburn, 1994).

When institutional actors search for and sanction alternatives outside of institutionally prescribed barriers, they disrupt institutional logics by redefining the set of available solutions (Cyert and March, 1963, p. 123). Search processes, such as these can identify as potential “solutions” structures and practices that, for various reasons in the past, were not considered to be legitimate alternatives. Additionally, the loss of legitimacy of prevailing institutional logics opens up previously-stable organizational fields to entrepreneurs with “packaged” solutions (Cohen et al., 1972). This redefinition of available solutions caused by an institution’s loss of legitimacy creates a “solution bazaar,” where decision makers shop for appropriate solutions and entrepreneurs with solutions (e.g. consultants, innovators, and managers from other industries) sell themselves as the best alternative to decision makers’ needs. This mixture of decision makers and alternatives—solution bazaars—and

the decreased legitimacy for incumbent institutional structures is, we posit, a very fertile environment for entrepreneurship.

In summary, crisis shakes the foundations of organizational fields by motivating scrutiny and search processes for causes and solutions. Crisis environments prompt powerful actors to engage in search processes that can ultimately result in profound institutional change. The resulting loss of taken-for-grantedness, recoupling of outcomes and behaviors, and redefinition and expansion of alternatives renders practices that were once taken for granted as “the way things are done” vulnerable to reform or replacement.

3. Research design

3.1. Research site

The electric power industry is a particularly interesting context for the study of institutional conflict and change because the nature of the structures, practices, and exchange relationships in the industry—what we call its “industrial form”—remained stable and taken for granted for over 40 years, from 1935 to 1978. By the time this regulated-monopoly industrial form changed, most living Americans had never experienced or could not remember a different system for the generation and distribution of electricity. This industrial form is the institution that we examine in this paper. The US electric power industry’s industrial form of regulated monopoly was supported by some of the most powerful organizations in American industry, including organized labor and the electric utilities, yet it changed after a dramatic environmental jolt: the energy crisis of the 1970s. We provide a brief timeline of the industry’s history in Fig. 1, and examine its evolution in detail in the next section.

The case of the electric power industry exemplifies the institutionalization of regulated monopolies in a country espousing free-market policies. For over 40 years, national and regional regulation of large centralized utilities operating in geographically defined monopolies had been accepted as the natural way to generate and allocate electricity (Hellman, 1972; Hyman, 1988; Hirsh, 1989). The electric power industry was distinguished from other institutions by

- 1879 **Advent of Commercial Electricity Generation:** First commercial power station opens in San Francisco and the nation's first outdoor electric light serving a public purpose was installed in the Cornell chapel's belfry in Ithaca, N.Y.
- 1888 **Theory of Natural Monopoly:** Richard T. Ely coins the term “natural monopoly” in “Studies in the Evolution of Industrial Societies” and applies it to public utilities such as water, light, and transportation.
- 1891 **Alternating Current:** The alternating current system is developed by W. Stanley increasing the feasibility of transmission across long distances.
- 1898–1910 **Electric Power Generation as a Natural Monopoly:** Key players in the electric power industry such as Samuel Insull²⁶ and various public figures proselytize the theory of the electric power industry as a natural monopoly and argue for state regulation.
- 1900–1927 **Industry Consolidation:** Consolidation of the industry from several thousand firms to an industry dominated by 7 holding companies.
- 1934 **Public Utility Holding Company Act:** Congress gives the SEC Power to regulate interstate electric utilities. They exercise this power by mandating most interstate utilities to break up utilities that spanned several states
- 1935–1967 **Growth, Cheap Fuel, and Incremental Technological Advances:** Demand growth, inexpensive fuel, and technological advances contain electricity prices.
- 1967 **Northeast blackout:** Utilities ordered to interconnect across state boundaries.
- 1967–1973 **Environmental Movement Gains Power:** The National Environmental Policy Act of 1969 and the Clean Air Act of 1970 authorized the EPA to set and enforce air quality standards.
- 1973–1978 **OPEC Embargo (1973), Increasing Energy Prices and Industry Scrutiny**
- 1978 **Carter Signs the Public Utility Regulatory Policy Act:** This law created a new niche for wholesale electricity markets.
- 1978–1992 **Era of Innovation and Entrepreneurial Opportunity**

²⁶ Samuel Insull was president of the National Electric Light Association and used his position to proselytize his views about electricity, natural monopolies, and regulation.

various boundaries and institutional myths (which we will detail in the next section), and was thus insulated from the spread of market-based structures (Primeaux, 1986). The fact that the institutional logic of regulated monopolies contradicted many of the assumptions the public, the government, and many social scientists had concerning the importance of free enterprise and competition rarely surfaced in discussions in the media from 1935 until the 1970s energy crisis (Primeaux, 1986). Beginning in 1973, petroleum prices and interest rates skyrocketed, greatly increasing the cost of electricity generation (Energy Information Administration, 1993). This resulted in an energy crisis that motivated Congress (Crew, 1985), the academic community (Primeaux, 1986), concerned citizens (Hirsh, 1999), and other stakeholders to search for alternative energy sources and organizational forms (Sine, 2001).

3.2. Data and methods

In the tradition of Leblebici et al. (1991), we use historical analysis to examine the relationship between environmental jolts, field level search processes, and institutional change in the electric power industry. This requires that we first provide evidence that the industrial form of a regulated monopoly was indeed institutionalized within the electric power organizational field. Second we must establish the effect of jolts on field level search processes, particularly the mobilization of institutional actors, such as policy makers, innovators/entrepreneurs, academics, and popular social movements (such as environmental groups and consumer activists). Third, we need to provide evidence that access to policy makers by actors promoting alternative technologies and industrial forms (innovators/entrepreneurs, academics, and social movements) changed as a result of the jolt. Finally, we need to provide evidence that the policy makers' agendas changed in light of alternative logics and technologies, producing rich opportunities for entrepreneurship.

We follow the dominant industrial form of the power industry, the regulated monopoly, from inception in 1935 to the passage of the Public Utilities Regulation Act in 1978, a law that crystallized the decline of the institution of regulated monopolies in the US power industry. We chose these two dates because

they represent years when key legislation was passed that helped create and reform the industrial structure of the electric power industry. Our historical analysis is based on industry histories, archival documents, and interviews with utility analysts, executives of power firms, and policy makers. The first author interviewed 25 executives from utilities and non-utility firms, as well as officials at the Department of Energy, the Federal Energy Regulatory Commission, the California Public Utility Commission, and the New York State Energy Research & Development Authority.

Our primary data sources for our examination of field-level search processes are: (1) the *Congressional Masterfile* (which includes House of Representatives and Senate published and unpublished reports, documents, executive documents, executive reports, committee hearings and prints); (2) *Reader's Guide to Periodicals*, (which reviews some 300 popular magazines and journals, such as *Newsweek*, *Harper's Magazine*, *Readers Digest*, and *Time*); (3) the *Periodical Contents Index* (PCI, 2000), a data base that follows more than 2000 academic journals in a wide variety of disciplines, such as sociology, business, economics, anthropology, political science, and public administration. We analyzed political discussions relevant to the industry by searching the *Congressional Masterfile* for topics related to the electric power industry, cogeneration, and alternative energy during the years 1935–1978. We assessed popular discussion of the industry and its structure by searching for references to the electric power industry, alternative energy, and cogeneration in the *Readers Guide to Periodicals* 1935–1978. Finally, we investigated academic discussions about the industry by conducting a similar search in the *Periodical Contents Index*.

In the following section, we briefly review the events that led to the construction and implementation of regulated monopolies. We then examine the institutionalization of the industrial form in question—large centralized utilities operating in a geographical monopoly—and the various field level structures that increased its resistance to change. Finally, we address the role of the energy crisis in mobilizing institutional actors. In particular, we discuss the search processes motivated by this jolt and the effect of these search processes in delegitimizing the current institution and legitimizing alternative industrial and technological forms for generating power.

4. Environmental jolts and institutional change in the electric power industry, 1935–1978

4.1. Origin and institutionalization

The electric power industry began in the late 1870s, and was characterized by rapid technological development. The industry was essentially technically mature by the early 1900s (McGuire et al., 1993), and operated within a stable paradigm for some 60 years into the 1970s (Samuels and Trebing, 1972). After 1935, the industry was characterized by a regulated monopoly structure with sustained growth and significant economies of scale. Throughout this period, utilities operated essentially as organizational islands, serving their own loads with their own resources (Shapiro, 1989). The advent of this regulated system reflected widespread dissatisfaction with the provision of service in the early years of the industry.

The first significant electric experiments began in Europe in the 1730s, and the first practical applications were invented in the early 1800s. As early as the mid 1800s, arc lighting was used commercially. In January 1879, the nation's first outdoor electric light serving a public purpose was installed in the belfry of Sage Chapel at Cornell University. The first commercial electric generating in the US began with arc lighting service in downtown San Francisco in 1879 at the California Electric Light Company. About this same time, Thomas Edison perfected the incandescent light bulb. Three years later, he operated the Pearl Street Station, which provided reliable lighting service in downtown New York City. Technology increased exponentially in the decades following the construction of Pearl Street Station. By the early 1900s, there were over 3000 private electric generating companies and over 1000 generators owned and operated in the public sector.

The structuration of the industry is an interesting story in and of itself. Early in the industry's development state and federal policy makers tried to foster an environment of competition, by granting nonexclusive competitive franchises and passing laws aimed at preventing price fixing agreements (Hellman, 1972, p. 9). Despite state and local governmental attempts to maintain competition within the industry, large holding companies devoured their smaller competitors,

and by 1907 many areas, such as greater New York, Detroit, and Denver were dominated by a single company (Hellman, 1972). Captive markets were characterized by high rates and price collusion was common between adjacent electricity providers (Kwoka, 1996). New York and Wisconsin were the first states to react to the increasing costs and established state commissions to regulate electricity prices. This practice quickly diffused and by the early 1920s most states had appointed regulatory commissions (Hellman, 1972; Kwoka, 1996).

In order to justify captive markets, early entrepreneurs enthusiastically argued that the business of generating and distributing electric power was a "natural monopoly and should be granted geographical monopolies in order to best serve the interest of the public" (see Hirsh, 1999, pp. 17–29 for a more detailed discussion of this process). The natural monopoly rationale had its roots in the late 1800s and differentiated certain industries from others, claiming that some economic norms (competition) did not apply to certain industries, such as the railroads and water, because large fixed costs and small marginal costs made competition impossible (Varian, 1996; Primeaux, 1986). Generally, this logic became quite pervasive and was used extensively by legislators and academics for decades to rationalize the industry's form (Hirsh, 1999).

Samuel Insull was a key figure early in the industry. His influence shaped electricity generation and distribution for generations.⁵ Insull and many leaders of other large holding companies realized that public sentiment toward electricity providers was growing increasingly negative, and became afraid that the municipalities might revoke their franchises. Hence, they decided to support state regulation, becoming heavily involved in its formulation in various states (Hellman, 1972). They struck an informal public-policy bargain with many state lawmakers in which utilities would operate on a cost-plus basis. Considering possible savings from huge economies of scale, protection from most forms of competition, and virtually unlimited growth, this deal was a coup for Insull and other holding companies.

⁵ See McGuire et al. (1993) for a rich description of the early structuration of the electric power industry.

State regulatory commissions found it difficult to regulate giant holding companies that had complex structures spanning many states. Additionally, the immense power of these companies was often used to influence state governments through donations to political parties and at times for illegal payments to regulators (McDonald, 1962; Ramsay, 1937).⁶ The public remained highly dissatisfied with high prices and rampant corruption within the industry. In response to public outcry, the Federal Trade Commission began a thorough investigation of the industry in 1927 that lasted for seven years. The findings from this study, released in stages beginning in 1928 and continuing through the Depression, increased public outrage as they detailed inflated valuations, watered stock, control of newspapers, and opposition to municipal ownership (Hellman, 1972). When Franklin Roosevelt took over the presidency in 1933, the stage was set for change. At that time, over 60% of the population had access to electricity. Unfortunately, many rural areas had been bypassed by electric utilities, only 10% of which had access to electricity. In reaction to the growing power of a few large holding companies, their abuses, and reluctance to provide power to rural areas (Gioia, 1989), the Congress decided to crack down.

In 1935, a year and a half after Roosevelt's inauguration, he created the Rural Electrification Administration (REA) to promote rural electrification.⁷ In that same year, Congress passed the Public Utility Holding Company Act (public law 74–333), commonly known as PUHCA, that gave the Securities and Exchange Commission broad authority over companies that produce, transmit, or distribute electricity in more than one state. Utilities that operated in only one state fell under state jurisdiction (Energy Information Administration, 1993). The SEC "required holding companies to divest their holdings until they became a single consolidated system serving a circumscribed geographical area" (Energy Information Administration, 1993, p. 19). By 1940, the law was fully implemented, and the industrial structure that would remain dominant for almost three decades was in place.

⁶ Insull admitted to paying US\$ 150,000 to one commissioner.

⁷ The REA provided loans to both private and public organizations that were expanding electricity to rural areas without electrical infrastructure.

4.2. Institutionalization and maintenance: 1940–1965

A variety of environmental factors contributed to the institutionalization of the electric power industry's structure, such as its designation as a "natural monopoly," low fuel prices, and rapidly advancing technology. This resulted in low electric rates, and political and popular satisfaction with the industry. Any real impetus to scrutinize the appropriateness of the power industry's structure of regulated regional monopolies was ultimately lacking. As Cyert et al. (1965) explained, search processes are motivated by either dissatisfaction or conspicuous alternatives. The static environment between 1940 and 1965 provided neither. In this section, we review the factors that contributed to this stability.

4.2.1. Increasing demand

During WWII, the war industry needed vast amount of energy to produce planes, tanks, guns and other necessary equipment. Increasing demand invigorated the industry after the Depression (Fenn, 1984). It continued to thrive after WWII as the booming postwar economy resulted in a dramatic increase in both industrial and household use of electricity. Consumers in search of the American dream bought large numbers of household appliances, such as refrigerators, that demanded energy both to manufacture and use on a daily basis (Hyman, 1988). Increased demand and large monopolies enabled utilities to reduce costs by building large power plants, thus taking advantage of economies of scale to keep rates relatively low.

4.2.2. Technological advances

Additionally, various technological advancements in the electric power industry were made possible by wartime improvements in materials (metals) that were stronger and more resistant to aggressive steam conditions (Hirsh, 1989, p. 64). Cooling technology also improved after 1940. Between 1940 and 1965, technological advances enabled utilities to take advantage of their captive markets by building plants with larger capacities, and profiting from economies of scale. For example, in 1935 the largest generator produced 208 MW, and this rose to 300 MW in 1956 and 1000 MW in 1965 (Fenn, 1984). The greater the

capacity of a generator, the fewer generators needed to produce the same amount of electricity, and given the same efficiency and down time, greater savings. Moreover, thermal efficiency continued to increase during this time period resulting in lower retail prices⁸. Average adjusted prices for a kilowatt-hour declined over 50% between 1940 and 1965 (Edison Electric Institute, 2002).

4.2.3. Fuel prices

Fuel prices were also favorable to the industry and declined after WWII, as cheap foreign oil flooded the market (Hyman, 1988). The abundance of fuel, advancing technology and economies of scale enabled utilities to maintain or lower their prices and reap good profits for many decades.

4.2.4. The myth of a natural monopoly

“The institutional world requires legitimation, that is, ways by which it can be explained and justified” (Berger and Luckmann, 1966, p. 61). The academic explanation of natural monopoly provided the electric power industry’s structure with a *raison d’être*. It was frequently used by proponents of the system as an explanation for why the industry deserved monopoly status⁹, and served as a powerful legitimator. Although this was the prevalent view, however, not all economists viewed electricity generation and distribution as a natural monopoly, and there always remained a few skeptics tucked away in academia¹⁰ (Gray, 1940). (See Primeaux (1986) for a detailed

history of the natural monopoly rationale as applied to the electric power industry.)

4.2.5. Monopoly and monopsony

The structural power of the utilities helped assure the absence of legitimate alternatives both to utilities and to their preferred technology, large centralized fossil fuel plants and large hydroelectric power plants.¹¹ Because utilities were the only distributor and wholesale buyer in a specified area, this created a monopsony environment giving utilities the ability to decide who could connect to the grid. This power enabled utilities to keep other sources of electricity off the grid. In the few cases that entrepreneurs tried to build competing generators using alternative forms of power generation, such as cogeneration technology,¹² utilities either refused to purchase or distribute the power for a reasonable price.

The regulated monopoly structure also gave the industry the ability to decide how power would be generated for their clients and how research and development budgets would be allocated. This enabled the industry to influence the type of technology that would be developed and implemented in the future. Because the premise of natural monopolies is based on building larger and larger centralized plants in

⁸ Thermal efficiency increased from 2.5% early in the industry’s history to over 33% by 1965 (Fenn, 1984).

⁹ Legislators and academics rationalized the industry’s structure as a “natural monopoly, despite the existence of several examples in the Northwest where competition among generating facilities was very successful and resulted in lower prices (Primeaux, 1986).

¹⁰ In retrospect, Primeaux noted that “upon close examination, conditions cited as characteristics of natural monopolies are either non-existent or unimportant” in electricity generation (Primeaux, 1986, p. 1). The monopoly structure of the electric utilities was not a natural state, but merely the outcome of institutional factors such as contracts, laws, investor influence, etc. (Primeaux, 1986, pp. 1–18). After the original goals of the electric power industry’s regulatory structure had been fulfilled, it remained rationalized as a “natural monopoly.” Thus, the formal organization of the electric power industry became institutionalized, reflecting more the “myths of (its) institutional environment instead of the demands of (its) work activities” (Meyer and Rowan, 1977).

¹¹ Between 1935 and 1978, utilities nationwide had very homogenous technological strategies, relying almost exclusively on large centralized coal, oil, natural gas, and large hydroelectric generators. The amount of power generated by utilities using alternative energy sources and technology such as solar, cogeneration technology, wind, small hydroelectric, or biomass was virtually zero through 1973. In the early 1960s, the utilities also began to generate power using nuclear technology, but this accounted for less than one-half of 1% of energy generated in the US. Utility technological strategies were very homogenous during the time period examined in this paper (Energy Information Administration, 1993).

¹² Utilities tried to undermine these attempts at expansion despite the fact that onsite cogeneration accounted for up to 15% of the power generated in the US in 1950 as many firms used this technology to decrease their energy costs (Pierce, 1995). Because utilities had captive markets, there were few incentives to motivate strategic alliances with non-utilities. Utilities used several strategies to discourage non-utilities from generating power, such as denying them interconnection, charging them higher than normal prices for backup electricity, or offering them sub-market prices for electricity produced (Energy Information Administration, 1983). Thus, the total amount of electricity sold by cogenerators to the grid prior to 1978 was insignificant. A study conducted in 1981 of purchases of power by public utilities from cogenerators could not identify a single purchase (Resource Dynamics Corporation, 1983).

order to take advantage of economies of scale, and because existing plants predominantly used coal and oil as fuels (and in some cases large hydroelectric plants), utility research and development focused on these technologies (Hirsh, 1989). Utilities failed to seriously consider or develop promising alternatives,¹³ such as cogeneration,¹⁴ wind, geothermal,¹⁵ and solar technologies.¹⁶ The utilities' structural power

¹³ Wind, geothermal, and biogas were not considered by large utilities as legitimate methods for generating electricity and therefore little money was spent on research and development. Independent companies that did try to develop wind, geothermal, and solar power after 1935 did not have access to the grid and were rejected by large utilities (see Righter, 1996). The only clients of these manufacturers were farmers without access to the grid. Most of these companies quickly died as large centralized utilities used government funding to build power lines to rural areas.

¹⁴ For example, while other developed countries around the world were capturing wasted energy from factories through cogeneration (Energy Information Administration, 1983) and experimenting with alternatives to petroleum and hydroelectric sources of energy such as solar, thermal and wind, the US electric power industry's strategy remained remarkably stagnant and unidirectional. When the US policy makers finally got around to studying alternatives to centralized power, studies of relative energy efficiency conducted in the late 1970s "revealed that countries using cogeneration experienced higher electricity conversion efficiencies than did the United States" (Energy Information Administration, 1983, p. vi). *The total amount of oil used in a cogeneration plant is less than the oil used by utilities and manufacturers in separate operations* (Energy Information Administration, 1983, p. 6). In fact, advocates of cogeneration have argued since the early 1930s that cogeneration has inherent thermodynamic advantages over even the most advanced condensing plants of the time (Pierce, 1995).

¹⁵ Italy provides another example of the far sightedness of Europe on approaches to alternative power generation. Italy began using geothermal energy as early as 1904 and was the largest producer of electricity by geothermal means up to 1976. Other countries that used significant amounts of geothermal resources included Iceland, New Zealand, and the Soviet Union. Prior to the 1970s, the US had approximately four geothermal units. Despite adoption by other countries, the electric generating industry in the US spent virtually no effort on developing geothermal resources in the US.

¹⁶ Photovoltaic technology was first developed in Britain in the early 1900s with a very low efficiency. This changed in 1954 at Bell Laboratories when they produced a silicon cell that converted light energy into electricity at an efficiency of 5%. The US Government purchased 10 million small cells for satellites and spacecraft. However, the electric generating industry ignored the potential use of this medium, and the lack of any sizable market kept photovoltaic cell prices high for years (Pryde, 1983). Other countries quickly adopted the technology and between 1955 and 1973, Japanese and French companies led the world in research, production, and use of electricity from photovoltaic electricity (Pryde, 1983).

increased the homogeneity of industrial processes and technology and ultimately decreased the number of alternative technologies that were available when the environment changed. For example, between 1935 and 1973, 99.9% of power generated by electric utilities used one of four energy sources, coal, oil, gas, or large hydroelectric. Moreover, the records we have from this time period indicated there were virtually no non-utility private firms generating power and selling it to the grid.

4.2.6. *Legislative and popular scrutiny, 1940–1965*

The lack of public and political discussion and scrutiny of the industrial structure of the electric power industry is reflected in the low number of articles in the popular media and the paucity of legislative discussion between 1940 and 1965 about the current industrial structure and alternatives to this structure. This lack of scrutiny provides evidence of the taken-for-grantedness of the electric power industry's industrial form (Figs. 2–4).¹⁷ Similar to other institutional theorists, we interpret the taken-for-grantedness as an indicator of institutionalization (Berger and Luckmann, 1966; Tolbert and Zucker, 1983), and point to both the taken-for-grantedness and ubiquity of the regulated monopoly structure during this time frame as evidence that this industrial form was highly institutionalized. A study of media discussions about the electric power industry in popular outlets surveyed by *Readers' Guide to Periodicals* (Fig. 2) demonstrates a paucity of public discussion about the monopoly structure of the electric power industry from 1940 to 1965. Besides the slight increase in the mid 1950s,¹⁸ there was an astounding absence during 1940–1965 of federal legislative scrutiny of the merits of the electric power industry structure. This is especially surprising in light of the fact that according

¹⁷ Our approach here is similar to Tolbert and Zucker (1983), who measured the degree of institutionalization of civil service reform as an inverse function of the level of debate in the popular press.

¹⁸ A slight increase in articles published on this topic in 1953 is related to a surge in electricity demand during this period and a healthy public discussion about how and where dams would be built to fill this need rather than critiques of the standing industrial structure. Likewise, Fig. 3 depicting Congressional hearings and reports on the industry, shows a slight increase in roughly the same time period, again reflecting concerns about the demand increases and Congressional concern about where to build dams to provide electricity for the increased demand.

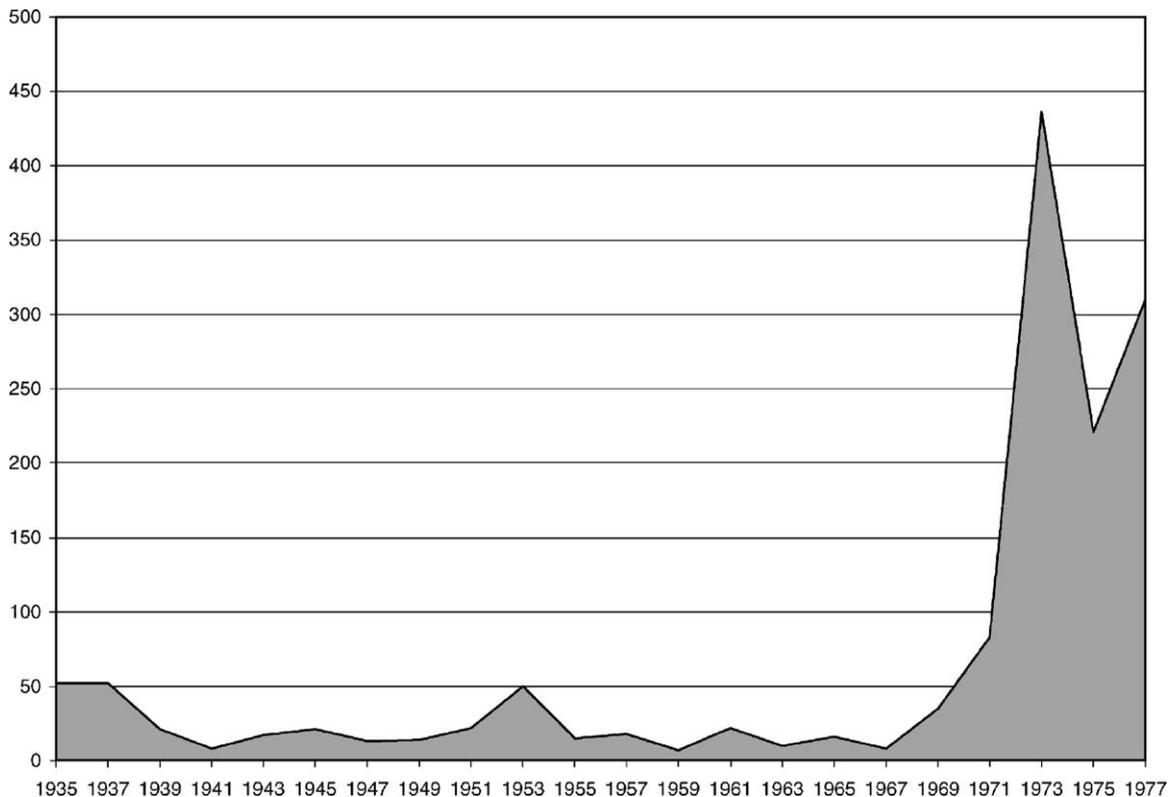


Fig. 2. Popular press articles on the public utility industry from *Readers' Guide to Literature*, 1935–1978.

to Vital Statistics of the US Congress, Senate activity, measured by the number of Senate committee and subcommittee meetings and reports, increased 60% from the 84th Congress (1955–1957) to the 94th Congress (1975–1977). Activity in the House of Representatives increased by 40% over that same time period (Ornstein et al., 1992). Fig. 4 shows that between 1945 and 1965 we found no Congressional investigations aimed specifically at evaluating the monopoly structure of the electric power industry. The failure of policy makers to ask fundamental questions about the industry was both a result of its institutionalization and also reinforced the maintenance of this institution. It is important to note that the decision to continue with this structure was one made by default, not by deep comparative studies of alternative structures. Arguing that the structure was maintained because it was the “best alternative” is misleading, because the public record demonstrates that few other

alternatives were seriously considered on a national basis (see Fig. 4). In other words, the electric power industry’s structure was taken for granted at that time, reflecting its high degree of institutionalization.¹⁹

It is important to note, however, that this absence of serious consideration in both the public media and congressional hearings of alternative means for generating power did not mean that alternatives did not exist. In fact, throughout this time period, innovators and entrepreneurs in both the US and abroad were experimenting with alternative methods, in some cases very successfully, but could neither enter the market nor catch the attention of policy makers or the popular media.

¹⁹ Other evidence of the institutionalization of the industrial structure of regulated monopolies in the power industry is that its adoption at the state level was 100%. Only a few cities nationwide had a system in which generating firms competed (Primeaux, 1986).

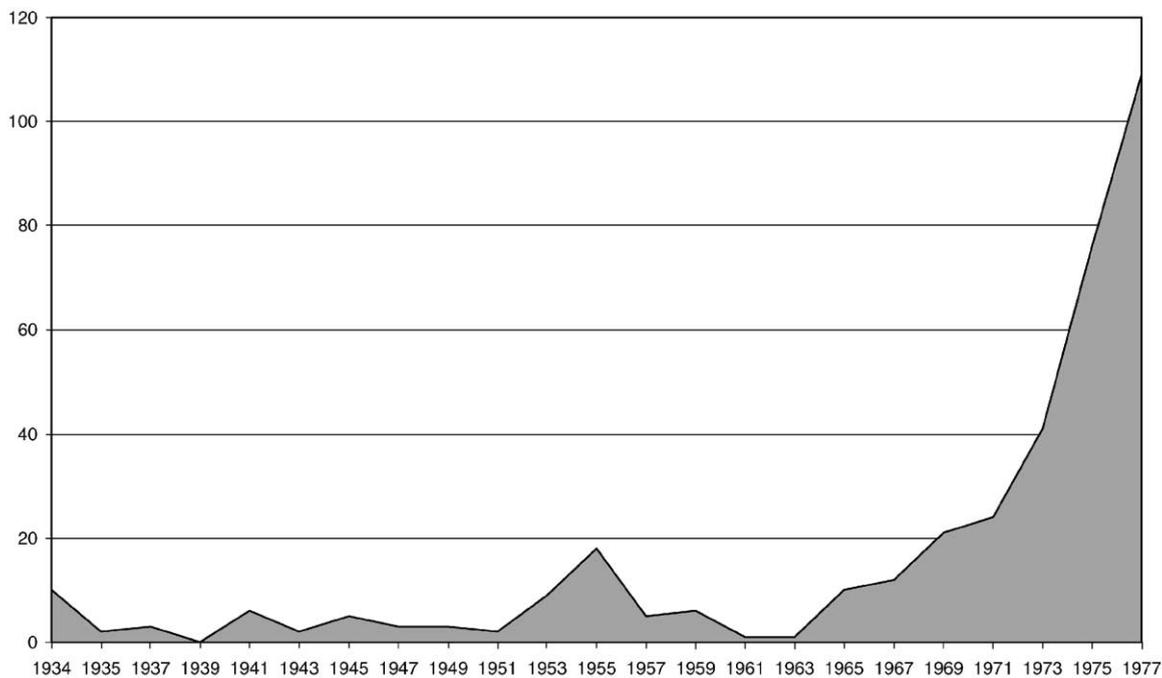


Fig. 3. Congressional hearings and reports of the electrical utility industry, 1935–1978.

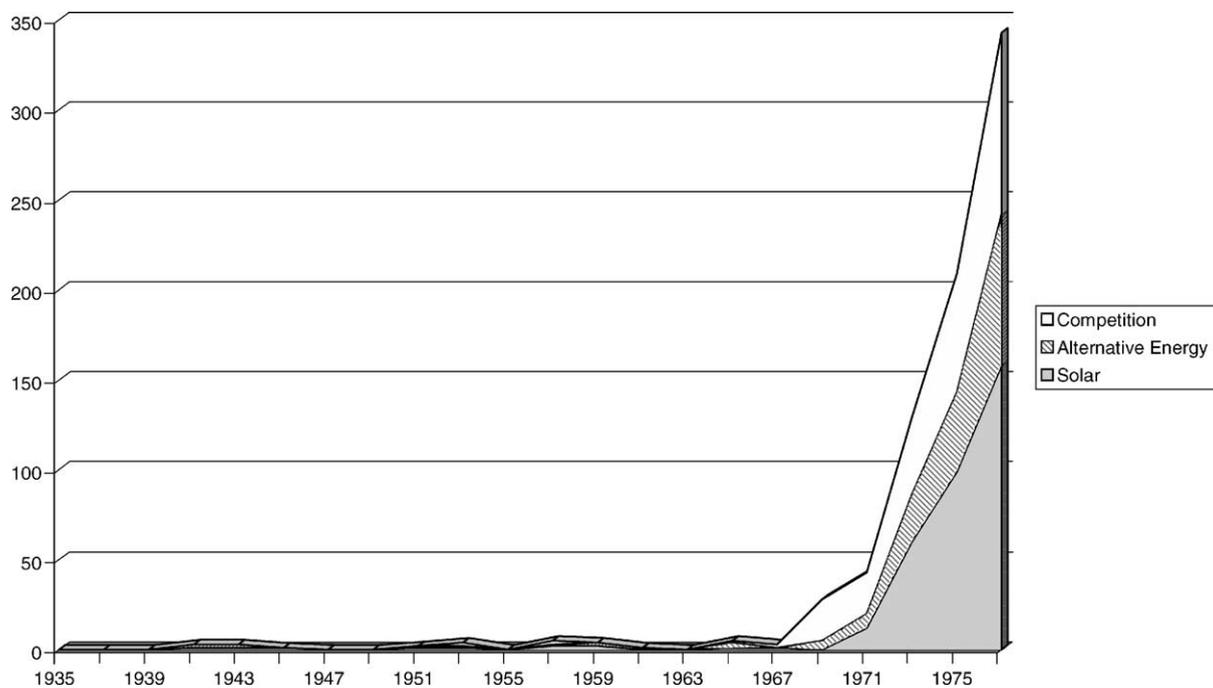


Fig. 4. Congressional hearings and reports on alternative energy, cogeneration and competition in the EUI, 1935–1978.

4.2.7. Summary

The industrial form of geographic monopolies was originally implemented for very specific purposes. Yet after the first decade, the supporting rationale for this form changed from functional to symbolic (Tolbert and Zucker, 1983). Geographic monopolies—originally used to promote technological coherence, rural electrification, and lower prices—were later rationalized as appropriate and natural; soon thereafter, public discussion on the structure of the electric power industry became exceedingly rare. Technological advances and decreasing fuel prices provided the industry with a great deal of slack resources that hid inefficiencies from constituents, such as customers, government regulators, suppliers, and industry leaders. To the average consumer, between 1940 and 1965, the electric power industry seemed very successful. Without obvious signs of crisis, the regulated form became taken for granted. It was no longer a salient issue, even though it contradicted widely supported economic principles. It was simply accepted as the way things were done.

4.3. Environmental changes, 1965–1972

The year 1965 was important for the industry: “electric utility prices peaked, rate reductions were at the lowest since Vietnam” (Hyman, 1988, p. 97). The year ended with a large blackout in the Northeast affecting 30 million people distributed over roughly 80,000 square miles. Utilities responded to this event by installing interconnections that allowed generators to transfer energy throughout the country and began emphasizing reserve generation.²⁰ However, the massive blackout shook many customers’ faith in public utilities. The outage drew the attention of academics, politicians, and consumers. The Federal Power Commission (FPC) immediately launched several investigations that uncovered a history of small power outages and a need for massive investment in infrastructure.

Electricity costs also began to rise in the late 1960s and early 1970s, due to a minor increase in fuel costs and interest rates. As these costs were passed on to

customers and rising prices motivated rumblings in the popular press, Congress held several hearings between 1967 and 1972 to investigate pricing policies. However, Congressional hearings and publications were focused on incremental reform of the current structure and ignored important questions, such as whether the current industrial structure was better than alternatives. Price increases also caught the eye of the academic community. A few social scientists published papers and books during this time critical of the non-competitive structure (Kahn, 1970; Landis, 1960). An important contribution in 1971 was a critical study by an economist that compared the effects of electric utility regulation with a few US cities that used a more competitive structure (Primeaux, 1986, p. 10). Its highly critical results had little impact at that time, however. Those in a position to change the system focused their deliberations (Congressional hearings, reports, etc.) on pricing policies instead.

The late 1960s and early 1970s were a time of social unrest and loss of public confidence in public institutions. This distrust was driven by the unpopular Vietnam War and the Watergate scandal and exacerbated by economic difficulty, fuel rationing, and huge jumps in utility costs (Derthick and Quirk, 1985). Additionally, growing awareness of the environmental destruction occurring at the hands of regulated utilities increased the hostile attitude of many environmental groups (Fenn, 1984, pp. 51–52). Environmental activists in the late 1960s and early 1970s pressured government agencies to investigate the environmental impact of the growing electric power industry. These groups succeeded in working with policy makers to craft the National Environmental Policy Act of 1969 that required utilities to prepare and defend environmental impact statements.

In sum, the period 1965–1972 was characterized by a large power failure, increasing electricity prices and greater levels of scrutiny by both academics and environmental activists. Although, during this period, both the concept of natural monopoly and the industrial structure of regulated monopolies were being heavily scrutinized by fringe actors, congressional records show very little discussion of changing the current industrial structure. Moreover, debate about whether or not power generation actually met the definition of a natural monopoly was not widespread, but rather confined to various academic publications.

²⁰ This added infrastructure turned out to be vital to the future competitive market. It allowed generators to be in different locations than distributors and to transmit energy to central retailers.

The institutional structure of power generation as a natural monopoly remained stable and entrenched.

4.4. Oil crisis

In October 1973, the electric power industry was hit by a sudden environmental jolt. OPEC, a multi-national Arab-dominated organization that had been established to coordinate oil prices, retaliated against the US for its support for Israel during the Yom Kippur War by temporarily cutting off oil supplies and then raising its price by over 200%. OPEC continued to raise prices, from US\$ 3.00 per barrel in 1973 to US\$ 30 in 1980. Increased fuel costs were passed on to both industrial and home consumers, raising electric energy prices sharply. Electric utilities reacted by reducing reliance on oil through conversion to more expensive solid fuel plants and by building large nuclear facilities. This required huge capital investments at a time when interest rates were very high²¹ making the already expensive fuel substitution programs even more costly. Attempts by electric utilities to diversify fuel types during the energy crisis of the 1970s resulted in huge, expensive production facilities (nuclear or coal) that took many years to build and in the case of nuclear facilities, when finished were substantially over-budget,²² sometimes by more than a billion dollars. The new nuclear facilities were often not cost-efficient relative to other forms of generation (Michaels, 1996).

OPEC's embargo and the resulting increase in oil prices created two major problems for the industry. First, the embargo disrupted the economy on a national scale. "The economic disruption resulting from the oil embargo and the inflation crisis resulted in a more fragile national economy, with less stability in prices, interest rates, and inflation" (Crew, 1991, p. 6). The oil embargo and its subsequent effect on the national economy were interpreted as not only an economic issue but also as a national security dilemma. As long as the US was dependent on foreign oil, it

would be vulnerable to the political whims of the Near East. Second, consumers (i.e. voters) were extremely dissatisfied with the energy crisis in general and with the huge jumps in electric prices in particular. In reaction to rising prices, consumer organizations, such as POWER (People Outraged With Energy Prices) sprang up all over the country to pressure Congress and state governments to act (Primeaux, 1986, p. 238).

4.5. Problemistic and solution searches

As Kuhn (1970) has noted in the context of scientific revolutions, a response to crisis is typically the initiation of a search for a replacement for the discredited paradigm. In the electric power industry, a variety of searches for solutions to the problems described above were initiated in the public, non-profit, and private sectors. These included searches within the current system in the US as well as outside of the US electric power industry. State regulatory agencies scoured utility operations, scrutinizing operational procedures, costs, and billing practices. Many state regulatory commissions responded to the crisis by increasing ex-post prudence reviews of building costs, that is they reviewed building costs and disallowed the recuperation of portions of the cost that the commission felt were inflated or due to negligence on the part of utility managers. Between 1945 and 1975, there were less than a dozen ex-post prudence cases in the entire country; after 1975 prudence reviews became common (Joskow and Schmalensee, 1983, p. 160).

Congressional committees called utility managers and state regulators to fact finding hearings. Searches within the electric power industry for the causes and solutions to the high cost of electricity revealed no obvious answers but uncovered a slew of problems, such as the inefficiency of nuclear energy and the dearth of solutions entertained by the current electric power industry, thus intensifying the impetus to find a solution (Munson, 1985). Congress, the President's advisors, state regulators, and policy makers engaged in more complex searches, both geographically and technologically, scouring the world for possible solutions. For example, soon after OPEC's announcement, Abraham A. Ribicoff (D-Conn.), on behalf of the Committee of General Affairs, went on a fact finding trip where he toured a number of European nations in an effort to understand their systems and find alternatives to the

²¹ Ironically, high interest rates were in part caused by federal government anti-inflation policies in response to increasing prices, which in turn were partially caused by high oil prices.

²² Economist Charles Komanoff estimated cost overruns and cancellations of nuclear plants topped the US\$ 100 billion mark and resulted in rate increases of up to 30% for every household in the nation (Rudolph and Ridley, 1986, p. 185).

current crisis (Committee on General Affairs, 1973). Presidential advisors created various reports outlining alternative options and Congressional committees called over 50 hearings about the electric power industry between 1973 and 1978 (compared to five over the previous five years; see Fig. 3). Each hearing lasted from several days to several weeks and represented months of preparation and work by its participants. The committees involved, ranged from the Committee on Commerce Science and Transportation to the House Means and Ways Committee and the Committee on Labor and Human Resources. Congressional committees invited academicians, professionals, and representatives of foreign systems to write reports and suggest alternatives. Committee members called on various bureaucrats from regulating agencies (such as the Securities and Exchange Commission and the Environmental Protection Agency) to testify about the current state of the industry and suggest alternatives. Regulating agencies in turn searched the academic and industrial sectors for solutions to the crisis and presented them to Congress.

It soon became clear to policy makers, based on forecasts by experts within and outside of the industry, that prices were going to continue to rise and the current structure of the electric power industry had created a climate where organizations were unable to “fully respond to the political pressure to insulate consumers from dramatic cost increases” (Joskow and Schmalensee, 1983, p. 159). The electric power industry’s structure and strategies that had been taken for granted for so long were no longer taken for granted, but were now the focal point of deep scrutiny and criticism.

During this scrutiny processes, many myths about the electric power industry were dispelled. It was no longer taken for granted that the generating industry was promoting the best interests of the public. The increased number of instances where construction costs for new plants were disallowed exemplified regulatory distrust for the industry. Growth strategies advocated by power companies were no longer merely accepted by regulators and the public as the best alternative. Moreover, it was not just the strategies and policies of the industry that were under attack, but also its fundamental structure. In several hearings, economists testified that electric utilities were not necessarily a natural monopoly (Primeaux, 1986; Hirsh, 1999).

The many search processes catalyzed by the energy crisis coupled negative outcomes, such as high prices, inflexibility, and inefficiency with the structure and practices of the electric power industry, eroding its legitimacy. Critics of the industry whose voices had long been silent or largely ignored were heard and considered after 1973. Consumers, regulators and politicians intensely scrutinized every aspect of the industry, criticizing its structure, strategy, and management (Fenn, 1984; Hirsh, 1989).

4.5.1. *A new set of alternatives*

The oil crisis changed the set of strategies and solutions to power generating problems considered by regulators and legislators. Fringe energy experts and environmentalists, who had for years advocated conservation instead of growth strategies and soft alternative energy instead of fossil fuels and nuclear power, were granted access to the political elite and suddenly found themselves explaining their ideas in Congressional committees (Hyman, 1988; Hirsh, 1999). Experts in cogeneration and alternative energy educated policy makers at all levels about various pockets of resources that the industry had been ignoring for decades. For example, between 1968 and 1972 cogeneration and alternative energy sources were discussed briefly in committee meetings only four times (all in 1972), while during the next 4 years, they were a topic in 74 hearings and a focus of 28 committee prints and three reports (Fig. 4). Before 1973, many alternative energy experts were unable to present their ideas to key legislators (Richter, 1996). Economists arguing against the standard conception of the electric power industry as a natural monopoly became highly involved in discussing alternative industrial forms with policy think tanks (Primeaux, 1986). Most of the solutions considered by policy makers in Congressional committees during the crisis were not recent discoveries. Instead they were either from fringe areas of the industry or borrowed from other industries; in effect, they were pre-packaged. This is similar to what Kuhn (1970, p. 75) noted in his discussion of scientific revolutions: the solutions in question had “at least been partially anticipated during a period when there was no crisis ... [but] in the absence of crisis those anticipations had been ignored”. In other words, the jolt of the oil crisis did not create a new set of solutions, but merely altered

the focus of the public and policy makers to include pre-existing solutions as legitimate alternatives.

4.5.2. *A new policy agenda*

Early on in the search process, two themes emerged in the hearings: the country needed to conserve what energy it had, and it needed to find alternative sources and strategies for electricity generation besides those offered by the large public utilities (e.g. large coal, oil and nuclear facilities). Both cogeneration, a technology that harnesses excess energy (usually in the form of heat) from large industrial plants and converts it into electricity, and small power plants fueled by alternative energy sources (e.g. solar, wind, geo-thermal, small hydroelectric, etc.), that had been advocated by independent power enthusiasts and environmentalists for several years but were largely ignored, frequently surfaced during committee hearings as possible solutions after 1973.

This new energy agenda focused on moving away from the use of oil and natural gas, decreasing the environmental impact of energy generation, and increasing the variety of organizations participating in the generation industry. In 1977, the Carter administration delivered the National Energy Plan to Congress, a 283-page bill that contained over 100 different pieces of legislation that, among other things, advocated rate reform, wholesale power markets, power generation by small power plants and cogenerators, and required electric utilities to buy electricity from independent power firms and distribute it. Moreover, this bill stipulated that cogenerators and small power plants, unlike utilities, would be unregulated. This bill, if passed, would open the door to non-utility producers and limited wholesale competition. The portion of the bill that advocated alternative power generation would later be known as the Public Utility Regulatory Policies Act.

Although many members of Congress were supportive of the bill, electric power industry representatives launched a powerful lobbying campaign against most measures of the bill. Their key concerns centered on rate restructuring, coal conversion, and natural gas use. Generally, utilities felt that there was little to fear from small peripheral actors advocating cogeneration and alternative power. Thus, while provisions of the bill related to rate restructuring and fuel use were severely weakened in committees, advocates of alternative power generation, such as Senator Percy of Illinois, a

founding member of the alliance to save energy, and Senator Durkin of New Hampshire were able to protect provisions intended to foster alternative methods of power generation (See [Hirsh, 1999](#), pp. 74–82 for an excellent description of the political processes behind the 1978 passage of the National Energy Act (NEA)).

In 1978, the Congress passed President Carter's five-part National Energy Act (Public Law 95–617), the national policy response to the energy crisis. The legislation was intended to reduce reliance on imported oil and natural gas through conservation, the development of renewable energy resources, expanded use of coal, and to increase efficiency of utilization when oil and gas must be consumed. The Public Utility Regulatory Policies Act (PURPA) was arguably the most significant portion of the NEA (DOE/EIA-0562, 1993: 22). It provided for non-utility entities to construct new power generation facilities free from the constraints of regulation, and as such introduced limited competition into the generation aspect of the utility industry.

This change in institutional logic created enormous opportunities for entrepreneurs. Since the passage of the bill, thousands of independent power generators have been built and the power supplied by non-utilities has grown to approximately 10% of the US market ([Sine, 2001](#)). As a result of PURPA, renewable forms of energy have increased from virtually 0–3% of the nation's overall electricity production. This is a significant increase in absolute terms, considering the size of the energy market in the US (3706 billion kW/h). In sum, in the advent of crisis the dominant institutional logic of regulated monopolies was significantly eroded, and alternative power generation technology and logics that had been relegated to the fringes of the field became salient and widely adopted.

5. Discussion

The deregulation of the utilities is a case where some of the most politically potent of American industries, in collaboration with organized labor, fought as hard as they could to protect their interests and lost. ([Derthick and Quirk, 1985](#), p. 12)

The electric power industry exemplifies the role that environmental jolts can play in institutional change.

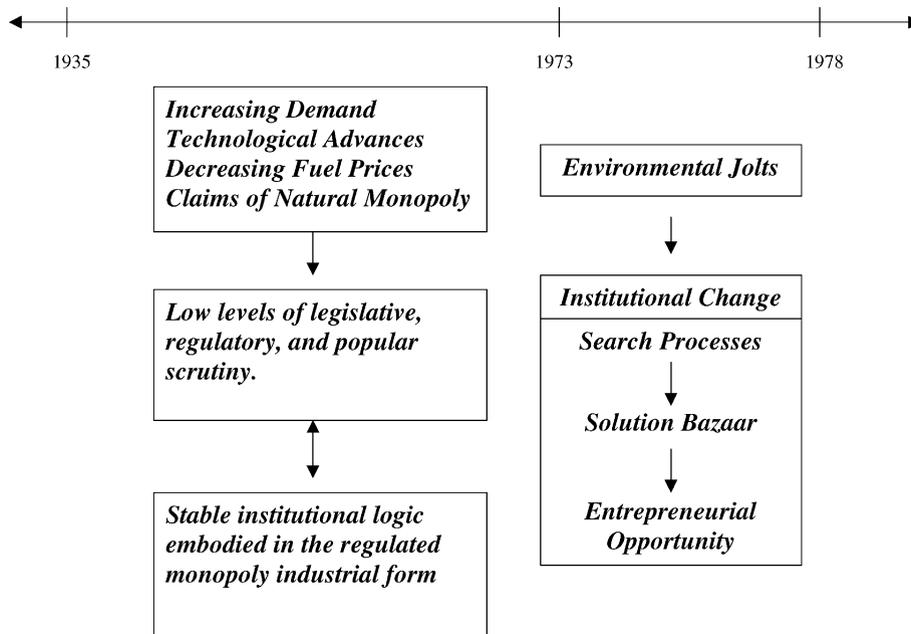


Fig. 5. Institutionalization and erosion of the regulated-monopoly industrial form in the US electric power industry.

In this paper, we have illustrated the strong relationship between environmental jolts, field level search processes, changes in institutional logics, and the generation of entrepreneurial opportunity. We summarize our model of these relationships in Fig. 5.

As this figure shows, regulated geographical monopolies were the norm for electric utilities for over 40 years, from 1935 to 1973. This form was embedded in the social fabric and everyday reality. Most users did not question the lack of competition or the unidirectional strategy of the electric power industry. Utilities situated in regulated geographical monopolies, with centralized mega-generators, were the “current theory in use” (Strang and Bradburn, 1994), espoused by economists, professional managers, investors, and public servants. It was rationalized by academic publications and industrial journals as the most efficient, fair, and just system. The academic and popular press reinforced the important theoretical points (of non-competitive regulation) for decades, labeling it a natural monopoly. While a few dissenters questioned the legitimacy and effectiveness of non-competition in the electric utilities, their voices were rarely heard or heeded.

As several crisis rocked the nation and its leaders, various fringe movements (i.e. environmental, alternative energy, cogeneration, etc.) gained in influence, size, organization and power. Academics, reporters, political analysts, policy makers and their staffs reacted to the crisis by searching for inefficiencies within the electric power industry that might cause or exacerbate the high prices. During this period of scrutiny, inefficiencies were recoupled with the industrial structures that promoted them, resulting in an increased distrust and delegitimation of the existing logics supporting the structure of regulated monopolies. Once weaknesses were discovered, solutions were sought. Fringe voices that had long been excluded from the national spotlight were sought out and heard. Intellectual as well as financial resources were funneled to organizations that supported alternative strategies and structures. Because of the attention focused on the industry, policy makers, academicians, investors, potential entrepreneurs, and other members of the public became more informed of the weaknesses of the electric power industry, as well as the existence of alternatives. The public redefinition of the set of strategies and structures available to combat

the crisis changed the institutional landscape from that of homogeneity to diversity and competition between solutions. The energy crisis did not force the abandonment of the current industrial structure (regulated geographical monopolies) and its accompanying power generation strategies (reliance on centralized generators using fossil fuels, nuclear, and large hydro). Instead, their prominence was degraded dramatically, as their status changed from being viewed as the only or natural way of fulfilling US energy demands to one of many methods for fulfilling demand. This shift in institutional logic, we contend, created a fertile environment for entrepreneurship, and ultimately a new set of organizational forms and practices.

Our account has several implications for theory, which we now discuss.

5.1. Exogenous versus endogenous disruptions

Our research differs from past explanations about the source of jolts or crisis. For instance, Kuhn (1970) argued that crisis results from anomalies that arise in the course of everyday, normal activity; in other words, the source of crisis is endogenous to the field in question. Other theorists have tended to focus on endogenous technological shocks (e.g. Schumpeter, 1942; Tushman and Anderson, 1986). In contrast, we examine exogenous, environmental jolts, i.e. crisis that originate outside the focal sector of activity. Although endogenous technological shocks and environmental jolts have similar effects—that is, they hasten change—our research echoes findings by Cyert and March (1963) and Leblebici et al. (1991) about the sources of change. We show that exogenous jolts disrupt institutional logics and structures by motivating search processes that create awareness of flaws in the current arrangement and increase the salience of alternatives. While Schumpeterian technological shocks and ensuing change are caused by the advent of new technology, resulting in “creative destruction” (Schumpeter, 1942), we find that crisis resulting from exogenous jolts did not result in the creation of new technological alternatives so much as the delegitimation of existing institutional logics, and increased awareness of pre-existing technological solutions (e.g. alternative energy and cogeneration).

5.2. Institutional logics and industrial change

We found that institutionalized logics play an important role in the persistence of industrial structures because they shape search processes, empower incumbent actors, and shape organizational and technological strategies. We expand on these below.

5.2.1. Institutional logics shape search processes

We found that industrial structures are embedded in institutional logics that shape search processes and legitimate the authority and expertise of incumbent actors, and that the disruption of these logics by disconfirming environmental jolts weakened institutional maintenance processes. Similar to Thornton and Ocasio (1999), we found that the actors’ ability to reform or replace industrial structures and processes is highly dependent on current institutional logics. Prior to 1967, it is clear from congressional records that most members of Congress were generally satisfied with the electric power industry²³ and gave little heed to the few innovators and social scientists working on the industry’s periphery. Congressional hearings and studies rarely asked fundamental and critical questions about the industrial structure because policy makers were not aware of fundamental structural flaws and their implications. Policy makers were not aware of reform opportunities because their examinations of the industry were cursory and shaped by the logic of “natural monopolies”. Thus, taken-for-granted assumptions influenced information-gathering processes in a way that reinforced institutional logics rather than challenging them because these logics determined the boundaries of information gathering, such as what questions would be investigated, who would be contacted for information, who would testify in congressional hearings, etc. Institutional logics, therefore became self-reinforcing. Opportunities for industrial reform and technological change were missed because they were not recognized. Opportunities were not recognized because legislative inquiries rarely transcended prevailing institutional logics about the industry, its structure, strategies, and technical practices. This resulted in circular information gathering processes that reinforced rather than questioned

²³ Instances of dissatisfaction typically had to do with operational details of the current system such as rate structures.

institutionalized logics, leaving actors within the field ignorant of weaknesses inherent in the status quo.

The oil crisis, however, disrupted circular information gathering processes and mobilized advocates of alternative structures and technology. When it became clear to legislators, regulators, consumer advocates, and energy consuming businesses that the current industry did not offer solutions to the current crisis, this catalyzed broad search processes that resulted in increasing access for peripheral actors to central policy makers. Powerful institutional actors, such as firms with cogeneration potential and some state regulators, in alliance with peripheral players (alternative energy advocates, environmentalists, and advocates of competition and rate reform), presented their arguments to federal and legislative fact finders in an effort to reframe those institutional logics that provided the foundation for the current industrial structure and hence influence legislation, thereby opening up new opportunities for entrepreneurs. The records of policy makers after 1973 are rich with testimonies from diverse actors trying to make convincing arguments that would result in paradigmatic change. Thus, a solution bazaar was created as policy makers looking for solutions and advocates of alternatives interacted. The legislation ultimately presented by President Carter was forged from information gathered from diverse movements and groups, such as the environmental movement, alternative power advocates, economists, entrepreneurs, captains of industry, utility managers, regulators, scientists, and engineers. Many of these actors were actively engaged in explicit institution building.

5.2.2. *Institutional logics authorize incumbent actors*

This research also reinforces previous work on the importance of culturally-embedded logics, which argues that cultural explanations play a central role in embedding new practices in societal structures, rationalizing them as part of the larger universe, and authorizing incumbent actors to maintain existing institutions (Berger and Luckmann, 1966; DiMaggio, 1982, 1991; Thornton and Ocasio, 1999; Lounsbury and Glynn, 2001). We found that between 1935 and 1973, various fringe entrepreneurs, inventors, and economists tried to persuade the public and policy makers to consider alternative structural and technological paradigms, yet failed at gaining the attention of powerful actors and making fundamental changes

in prevailing institutionalized logics and practices until the energy crisis hit.²⁴ Legitimate incumbent utilities used their status as the de facto experts on power to create the rules or laws surrounding electricity production and distribution. They used their influence with legislators to draft laws that promulgated the interests of utilities at the expense of independent producers (Richter, 1996), thus increasing the difficulty, expense, and infeasibility of independent startups. The ability of the utilities to resist change was increased by the utilities' power that was partially derived from their legitimacy as "natural monopolies". Institutional change was more likely once the legitimacy of incumbent actors and hence their power to shape policy was disrupted. The energy crisis and related search processes provided disconfirming evidence of the viability of current logics, decreasing the legitimacy of both the logic of natural monopolies and the organizational actors that it empowered.

5.2.3. *Institutional logics shape adoption of technology*

Technological advances do not always result in immediate entrepreneurial activity, but instead are mediated by institutional logics. In the case of the power generation industry, the technical opportunities for producing power in a multitude of ways had existed for years, but the institutional conditions were not ripe for change. Important technological developments in turbine, geothermal, and other alternative generating methods occurred long before waves of entrepreneurs emerged to implement these technologies. The geographical monopoly structure and accompanying institutional logic, natural monopoly, that defined how power should be produced and distributed created almost insurmountable barriers for new ventures, impinging on their ability to obtain financing and profit by selling power to the grid. Entrepreneurial opportunities to implement technical power generation alternatives depended upon first persuading powerful actors, such as legislators, regulators, and potential investors, and other relevant stakeholders, of the weaknesses of the taken-for-granted industrial structures and strategies and potential opportunities for increasing the effectiveness of the current system.

²⁴ For example, see Richter (1996) for a discussion of wind entrepreneurs and their inability to influence prevailing logics.

Moreover, powerful actors had to be motivated to engage in institutional reform. That is, actors, such as legislators, regulators, equipment manufacturers, and other important stakeholders needed to create an economic, social, and technical environment that enabled innovative risk takers to organize resources, generate, and sell electricity to the grid. Environmental jolts and resulting search processes both elucidated structural weaknesses and innervated actors to make institutional changes. As Hirsh put it, “the energy crisis caused politically powerful individuals to challenge the standard business strategies of utility elites . . . After blindly supporting managers’ actions for decades . . . presidents, federal and state legislators, and regulatory commissioners became more activist” (Hirsh, 1999, p. 69).

5.2.4. *Interdependence of structure and strategy*

This study highlights the interdependence of organizational strategy and industrial structure. In this case, industrial structure and institutional processes shaped the set of organizational strategies used within the industry, resulting in homogeneity. Regulated monopolies created an environment antithetical to entrepreneurship. Moreover, the logic of economies of scale, closely linked with the logic of natural monopoly, dictated that the best way to take advantage of this particular structure was through large centralized power plants. These strategies precluded the use of alternatives, such as alliances with industrial partners to produce power through cogeneration and smaller decentralized generation technology, such as small hydroelectric, solar, biogas, and wind power. The institutionalized logic of natural monopoly advocated the regulated monopoly structure. This structure led to a series of strategies that overlooked conservation, as well as decentralized generation technologies, such as most green power alternatives (biomass, wind, solar, and small hydroelectric) and cogeneration. Thus, research and development in the power industry focused, for decades, on specific technology types while overlooking technology that could tap alternative energy resources. Moreover, utilities resisted buying and distributing electricity from independents using alternative generating technology, and also refused to develop alternative generating methods besides nuclear power. It was up to each utility to decide how much money to spend on research and

development and which technologies to pursue. It is not surprising, then, that most electric utilities did not pursue alternative technologies that might compete with their existing technological strategy or possibly play an important role in a more decentralized market. In other words, strategies at the organizational level were strongly influenced by the institutionalized industrial structure that existed for over 40 years.²⁵

5.2.5. *Environments of stasis and innovation*

Finally, we find a strong inverse relationship between environments of stasis and innovation. We argue that in the electric power industry, frame-bending technological change between 1935 and 1973 was rare, not necessarily because equally-promising technology was not possible, but instead because dominant logics and powerful incumbents reduced resources and incentives for radical innovations and access to markets for fringe innovators and entrepreneurs. It took only a year after the Supreme Court upheld PURPA for dramatic changes in generation technologies to surface in the form of combined cycle-gas turbines which almost doubled generation efficiencies. This technology was not really new—it had been around for at least a decade before PURPA—but it had never been adapted to generate power for the grid. Pre-PURPA, the monopsony environment and lack of investment in alternative technologies limited the possibilities of refining this technology and applying it to the power industry.

The institutionalized logic of power generation as a natural monopoly was based on the assumption that firms with captive customers could maximize utility by building large centralized plants. Thus, the type of technology used and developed by electric utilities was as much defined by the logic of natural monopoly, as was the principle of captive customers.

²⁵ In this sense, our findings are in accord with the well-known perspective on industry structure elucidated by Michael Porter (1980), whose framework would predict high barriers to entry, low buyer power, and low rivalry during the period 1940–1972. Our focus however, while not inconsistent with Porter, differs somewhat. His framework is explicitly intended to predict the profitability of industries and to prescribe organizational-level strategies under various industrial structures. In contrast, we seek to explain the sources of radical change within fields of activity that are highly institutionalized, and to predict the emergence of entrepreneurial activity in areas that have long been stagnant.

These two basic pieces of the logic underlying the legal structure of the power industry shaped technological development and entrepreneurial opportunity (or the lack thereof) for over 40 years. In contrast, the 15 years following the passage of PURPA was ripe with technological advancement and entrepreneurial opportunity as entrepreneurs applied for permits to build over 5000 non-utility generators in a variety of sizes and using many different technologies including solar, biomass, wind, cogeneration, etc. (Sine et al., 2002).²⁶

5.3. Limitations

The generalizability of our analysis merits discussion. First, we argue that powerful environmental jolts will mobilize actors and generate search processes regardless of the industrial structure and the extent to which the feedback loops within the industry are self-reinforcing or far reaching. In terms of generating change, however, these search processes will have the biggest impact on industries that are dominated by a single institutionalized structural and technological logic, and hence, are somewhat closed to alternative ideas. While jolts in diverse and dynamic industries will also mobilize actors and generate search processes, jolts in these environments will be less likely to result in radical change because we assume that in a dynamic industry powerful actors have greater awareness of fringe alternatives and fringe actors are already mobilized to some degree.

Second, our definition of an environmental jolt, adopted from Meyer (1982) as a difficult to predict disruptive environmental perturbation, does little in helping us to identify such events a priori and is quite context dependent. Clearly, stasis and crisis are two points on a continuum of environmental stability, and a difficult question we do not fully answer is how large of an environmental jolt is required to move an industry from stasis to radical change. In our analysis, we find that small perturbations in the power industry in the mid-1950s and late-1960s motivated search processes, yet the associated discussions were

more focused on incremental change rather than fundamental paradigmatic reform. The taken-for-granted logic of natural monopoly was never successfully challenged in these debates. Our study suggests that the breadth of the search processes motivated by an environmental jolt is related to several factors, such as the degree to which the current paradigm is taken for granted, the extent to which the jolt disrupts “normal” day-to-day routines and threatens the interests of powerful actors. Thus, issues about dam site locations and rate formulae in the 1950s led to discussions of process and rate reform, leaving fundamental issues, such as competition and fundamental changes in generation technology untouched. Not until the oil crisis of the 1970s did meaningful change ensue.

6. Conclusion

In conclusion, the shock waves of the oil crisis continue to reverberate throughout the US Weaknesses highlighted during the crisis drive continuing scrutiny and deregulation of the electric power industry. Both state and national legislation are presently recreating the industry, and a national market that treats electricity as a commodity has developed. Moreover, thousands of new firms have entered the industry at all levels: generation, distribution, commodity markets, etc. Although there are still many barriers (such as infrastructure and state laws) to a market where electricity is freely traded and distributed throughout the country, the US is moving very quickly towards this model. The current turbulence in the electric power industry can be traced to the oil crisis of the 1970s, which continues to drive a diversification of alternative structures and strategies for power production and distribution. It is to these alternatives that we turn our attention in subsequent work already underway.

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²⁶ The US Office of Technology Assessment reported in 1985 that the independent power industry created by PURPA served as the major source of innovation in power generation technology in the US between 1980 and 1985. This is remarkable given that by 1985, this sector produced only 5% of US power and thus controlled only 5% of revenues derived from electric generation.

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