3

An Institutional History of Electricity Politics and Climate Inaction

Why, we have just begun to commence to get ready to find out about electricity. This scheme of combustion to get power makes me sick to think of—it is so wasteful. . . .

You see, we should utilize natural forces and thus get all of our power. Sunshine is a form of energy, and the winds and the tides are manifestations of energy. Do we use them? Oh no! We burn up wood and coal, as renters burn up the front fence for fuel. We live like squatters, not as if we owned the property.

—Thomas Edison, 1910[1]

All political institutions are resistant to change. But the regulations governing electricity are particularly sticky. In part, this is because of the nature of the technology. Unlike other goods, electricity supply and demand must match in real time, moment by moment—otherwise, the grid will grind to a halt. But technology is not the whole story. Politics have also made electricity institutions stable. As this chapter will argue, electric utilities have ossified institutions, shaping the regulatory structure to their benefit. To understand why utilities were able to undo policy feedback, we need to examine their privileged position in policymaking (Lindblom 1977).

In a pattern common to other policy areas, from healthcare to welfare to economic policy, a grand bargain was struck between the regulator and the regulated (Hacker & Pierson 2002; Hertel-Fernandez 2019; Jacobs & King 2016). In the early twentieth century, state governments gave private electric utilities monopoly status. In return, these companies would take advantage of economies of scale to provide cheap and reliable energy. This decision locked in an incumbent that relies on outdated technology, leading to significant delays in addressing climate change. As a result, the status quo system increasingly operates at cross purposes with the demands of transitioning the grid toward low-carbon sources. In the electricity sector, as in many others, we see asymmetric organized combat

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with opponents to renewable energy technologies—fossil fuel companies and electric utilities—holding a privileged position. To unpack this dynamic, we need a political history of electricity policy in the United States, from its inception to the present, to provide context for contemporary conflicts over the electricity system. Here, I introduce the political actors who will appear repeatedly in the empirical chapters that follow.

Throughout the twentieth century, governments have structured electricity regulation to meet various public policy goals: price reduction in the early twentieth century, capacity expansion mid-century, conservation and supply diversity in the 1970s, price reduction in the 1980s and 1990s, and environmental goals most recently. These goals roughly correspond to the five historical periods covered in each section of this chapter (Figure 3.1). Drawing on primary and secondary sources, as well as energy historians' research, I explain how key decisions on technology, pricing, and regulation remain important today. I demonstrate that the organized conflict between interest groups over clean energy policies traces its roots to the earliest decisions on electricity pricing and regulation. The last section—climate change and the rise of renewable energy—presents a national overview of the politics unfolding in the empirical cases in the rest of the book.

Despite this rich institutional history, contemporary debates over renewable energy policy tend to be ahistorical. Advocates and opponents advance arguments about the relative merits of policy instruments, the validity of rate structures, and the right way to pay for distributed generation's grid costs without reference to the basis for the status quo regulatory system. Yet, to evaluate these arguments, we need to understand how path dependence led to contemporary

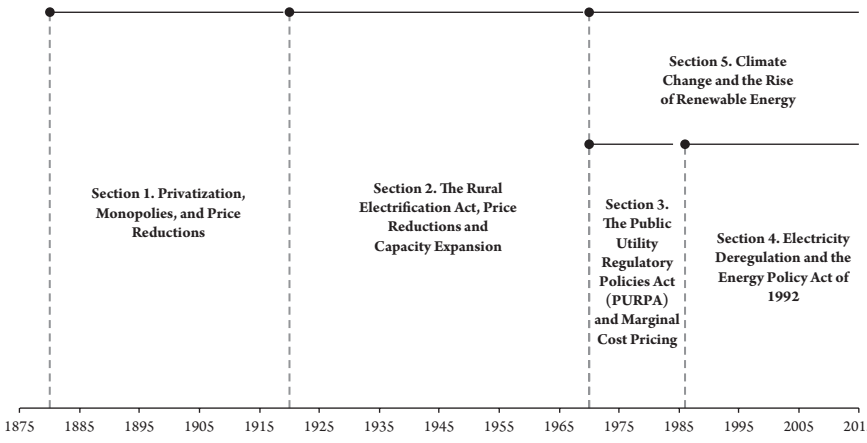

Figure 3.1 Five Periods of Electricity Policy

electricity regulation. This requires understanding the electricity system's institutional history.

History shows us that electricity is priced through political negotiations between utilities and their regulators, with occasional influence from other actors including academics, environmentalists, independent power producers, and citizens. In the United States, the level of government responsible for managing the electricity system has shifted over time. Municipalities were largely responsible in the late nineteenth century, with state governments gaining control from 1907 onward, and the federal government becoming increasingly interventionist beginning in the 1970s.

While utilities have at various times pushed for and resisted these jurisdictional changes, they have most consistently favored state-level regulation. Why? In the early twentieth century, electric utilities managed to secure a regulatory bargain at the state level that allowed them to maintain a monopoly over the power system and a privileged position in policymaking. Utilities used their power to shape policy and technology to their advantage in three problematic ways: they resisted innovation that would disrupt their business model, they shaped the rate structure in ways that exacerbated environmental harms, and they ignored or actively disputed the growing climate crisis and other environmental impacts from the energy system.

First, utilities resisted innovation (Hughes 2004). Once monopoly rights were granted, innovation in electricity technologies slowed. Instead, utilities focused on increasing profits rather than adopting new technologies (Hirsh 1999a). The radical inventiveness that characterized early electricity companies declined as corporate managers took over and focused on existing technologies, building ever larger coal plants. Utilities also used their market power, as the exclusive provider, to price electricity in a way that drove decentralized technology and industrial cogeneration out of business. This had the effect of increasing overall energy consumption and the environmental consequences of the electricity system. Private utilities were extremely effective during much of the mid-century at driving out competition, blocking industrial electricity production, and thereby securing their monopoly status.

Second, utilities, along with their regulators, shaped prices in a way that increased environmental harms. As Karl Polanyi (1944) convincingly argued, markets are fundamentally constructed with and by governments. Thus, electricity pricing is a function of both government policy and interest group privilege; it is not a simple function of economics. Understanding contemporary debates over electricity rate structures requires an understanding of historical electricity pricing decisions.

The rate structure was built alongside the centralized plant model in the mid-twentieth century when fuels were cheap. Until the late 1970s, electricity bills

whose marginal costs *declined* with additional consumption had the effect of increasing the energy system's negative environmental and health impacts (Hirsh 1999a). In other words, the more electricity you bought, the cheaper it got. The government supported this structure because it was focused on building new capacity, particularly in rural areas (Spinak 2013). Utilities supported this pricing structure because it allowed them to expand their capital investments and electricity sales, thereby increasing their profits. Cost-based regulation made this the clearest pathway to increased profits for monopoly utilities. With greater sales, they could build new plants and apply for rate recovery. This kind of regulation creates an incentive to overinvest in capital to increase profits—a dynamic referred to as "gold-plating" or the "Averch-Johnson effect" (Averch & Johnson 2017). As a result, utilities maximized capital costs rather than focusing on efficiency (Boyes 1976). Consequently, private utilities did not prioritize energy conservation and efficiency before governments required it after the 1970s oil crises. And even then, they resisted.

This history shows us that while private utilities sometimes claim otherwise, economically rational electricity pricing has never occurred. It simply does not exist. Despite current reliance on economic arguments to justify their hostility to clean energy policies, utilities themselves have often resisted changes that would bring electricity policy in line with economic principles. Instead of favoring economic principles, like all businesses, utilities favor their bottom line: profit.

Third, for decades utilities have promoted climate denial and cast doubt on the science behind other environmental problems including acid rain and mercury pollution. Throughout the twentieth century, private electric utilities waged an organized denial campaign to discredit environmental science and delay state and federal action. These efforts succeeded in postponing environmental policy that would have mitigated the energy industry's harms.

From the 1980s onward, private utilities—organized through their industry association, the Edison Electric Institute (EEI)—actively spread climate denial. For example, in 1991 EEI and several utilities worked on a public campaign to " 'reposition global warming as theory' and not fact."[2] This denial of climate science continued for three decades. As recently as 2017, Thomas Fanning, the chief executive officer (CEO) of Southern Company, a private utility based in Georgia, claimed that climate change had been happening for millennia and that human emissions were "not the issue."[3] When he made those statements, he was chair of the EEI. And climate change is not the only environmental problem that utilities denied. In the 1980s, utilities claimed acid rain was not real (Oreskes & Conway 2010). Throughout the 1990s, they cast doubt on the science of mercury—a highly toxic element, extremely harmful to human health (Harley 2011). For all three issues, the science was clear during this time period. Denial of scientific facts for the sake of profit continues to permeate electric utilities at

the highest ranks.[4] Like other fossil fuel companies, utilities also allied with and funded conservative think tanks to promote climate denial (Jacques et al. 2008; Layzer 2012).

But it is not just a matter of denying science. Private utilities also waged a campaign to delay environmental policy. Electric utilities successfully blocked the mercury rule, passed under a Republican president, for two decades. And climate policy is perhaps the issue they fought the hardest. Electric utilities engaged intensively in the 2000s to block federal emissions trading, a policy which would begin to address the climate crisis (Mildenberger 2020). As sociologist Robert Brulle (2018) estimates, utilities spent $554 million lobbying on climate policy at the federal level between 2000 and 2016. More recently, electric utilities have turned their attention to resisting state clean energy laws—the focus of this book.

When efforts were made to pass a federal clean energy standard (CES) through Congress in the 1990s and early 2000s, utilities successfully resisted.[5] Targets ranged from 4% to 10% renewables by 2010, with proposals from Representatives Ed Markey and Dan Schaefer as well as Senators Jim Jeffords and Dale Bumpers.[6] The failed Waxman-Markey bill from 2009 contained a renewable electricity standard that would have required 20% renewables for each state by 2020, with efficiency able to meet 8% of the target. While this 12% target was seen as relatively weak, it would have made a difference: in 2018, only 9.7% of the US electricity supply came from renewables, and 34 states fell below the target they would have been required to meet 2 years later.[7]

Interestingly, while the largest coal companies uniformly opposed Waxman-Markey, several electric utilities provisionally supported it, in a compromise to forestall a worse outcome—what we call "strategic accommodation" (Downie 2017; Grumbach 2015; Hacker & Pierson 2002; Kim et al. 2015). Other, coal-dominated utilities, particularly in the Midwest and South, lobbied legislators to weaken the renewable electricity standard.[8] Ultimately, the Waxman-Markey bill failed in the Senate, and no clean energy target has ever passed federally despite decades of effort from advocates. Periodically, politicians in Congress try again to pass a clean energy target—the latest iteration being Senator Udall's Renewable Electricity Standard Act of 2019, which would require utilities to generate 50% of their electricity from renewable sources by 2035. But carbon-intensive utilities have managed to keep this policy from passing at the federal level.

As Amory Lovins (1976) argued in the 1970s, there was a road not taken for American electricity policy. It is not difficult to imagine an alternative history where innovation was privileged over profits, energy conservation was incented, and clean energy was promoted. Such a system would have been much more favorable to renewable energy technologies today. Taking a historical view, we can see that the electricity system developed the way it did—with large and polluting

fossil fuel plants and expensive, privately owned, and poorly maintained electric grids—because it served the interests of private electric utilities and other fossil fuel interests.

While the historical details in this chapter are specific to electricity, the arguments are generalizable to other policy domains. Healthcare is another highly technical area, driven by regulation. In that case, providers and insurers play the dominant role in shaping policy (Jacobs & Callaghan 2013; Olson 2010). Like electric utilities, they have high upfront capital costs and long investment horizons. Given the technical and esoteric nature of health regulation, the consequences of policy changes can similarly be hard to predict in advance. And the public rarely pays attention. These are both examples of what Pepper Culpepper (2010) calls "quiet politics"—low-salience and high-complexity policy domains that leave significant room for business influence because the public and the media are not paying much attention. As he argues, interest groups are able to control policy in these kinds of domains because legislators defer to interest groups, believing they hold greater expertise. We see the same pattern of quiet politics with electric utilities for much of the twentieth century.

My goal with this chapter is to take a historical institutionalist approach and bring energy and environmental policy onto an equal footing with other policy domains studied in political science and related fields. While understanding electricity policy can be technical, the same can be said for other policy areas. Understanding the eligibility requirements for Medicare and Medicaid, state-by-state rules on firearms and immigration, and financial reform is challenging. Yet, political science and public policy research are able to grapple with these issues. Given the climate crisis and other environmental problems, we urgently need to understand the political dimensions of our energy system. I hope this chapter will serve as a primer for those interested in gaining literacy on this most pressing challenge.

Of course, the topics covered here do not address all aspects of energy or environmental policy; but the goal is to provide a basis for understanding the case studies in the following chapters. And for those already familiar with electricity policy, this chapter will provide a political lens to understanding how our electricity system has evolved over the past century.

Privatization, Monopolies, and Price Reductions (1880–1920)

To understand electric utilities' privileged position and their durable influence on energy institutions and policy, we must begin in the late 1800s, when electricity was a new and expensive commodity. In 1879, electricity was first used

for city lighting in place of natural gas lamps (Bradley 1996; Hughes 1983). Edison himself only formally patented his electric light bulb technology in 1882 (Hargadon & Douglas 2001). During the 1880s, very few homes or businesses had access to electricity because it was very expensive. At the time, private utilities, operating in small urban areas, were attempting to commercialize new technology. Electric utilities were competing against each other and against the established gas light business. It was a crowded marketplace for a new service to become profitable.

Initially, there was no policy framework for managing this new technology. Municipalities debated three different regulatory options. Option one would allow private companies to operate as exclusive monopoly franchises within the city. Private electric utilities largely favored this model. They argued this structure could reduce costs, given electricity's large upfront fixed investments. But it could also lead to anticompetitive behavior from private corporations, which could potentially increase costs. Although it was not recognized at the time, this monopoly-centralized plant model would favor revenue growth over resource efficiency (Yakubovich et al. 2005), exacerbating environmental problems.

Option two was allowing multiple private companies to compete against each other in a given city. This would allow competition to theoretically drive down prices and would likely create more on-site generation rather than grid expansion. Equipment manufacturers like General Electric tacitly favored this option as it would allow them to sell more equipment (Yakubovich et al. 2005). On-site generation would also prove more resource-efficient as both the electricity and the steam from combustion could be used, for heating and lighting, respectively. By contrast, electricity generation led to wasted energy because the steam could not be used for other purposes.

Option three was municipal ownership through publicly owned utilities. Many argued at the time that municipalities could own the system's assets, provide service at a lower price, and generate municipal revenues. In places where municipal utilities were established, they were initially able to provide electricity for lower costs than private utilities (Rudolph & Ridley 1986). Many municipal governments favored this third, public power option. But electric utilities did not want municipal ownership and preferred to operate as private monopolies. They lobbied city councils across the United States for private and exclusive franchise rights, in some cases resorting to outright bribery to block municipalization (Hughes 1983).

At that time, Samuel Insull, a businessman, was the most prominent leader in the electricity industry. He opposed municipal ownership and decentralized systems, favoring vertically integrated utility monopolies. Insull worked for Thomas Edison, helping to found Edison General Electric. In 1892 he became president

of Chicago Edison. Examining Insull's political influence can help us understand the roots of utilities' ability to influence energy policy today. According to one historian, "Insull was for about thirty-five years the most powerful political operator on the American business scene" (Hughes 1983, 205; McDonald 1962). Drawing on his expansive network and by lobbying regulators, Insull created significant innovations in the way electricity was sold and regulated in the United States. Insull shaped electricity in three ways that remain influential today: the technology, the economics, and the policy framework.

Although he is best known as a businessman, Insull made important contributions to technological change. At the time, electricity was generated in the building or through small stations for localized consumption (Hughes 1983). He did not embrace this version of the electricity system, where industry co-generated electricity and steam near where they were consumed through distributed generation. Instead, Insull admired large hydroelectric dams with significant transmission capacity and believed that economies of scale would achieve greater efficiency and profits. Along with other utility leaders, he pushed for an electricity system organized around centralized plants and electric grids. In Chicago, he built his company through ever larger coal plants.[9] He either did not realize the energy efficiency losses and environmental harms he was creating in the process or did not care.

While he shaped electricity technology, he also worked to change its economics through influencing the way electricity was priced. One significant challenge with electricity is that demand can swing over the course of days and weeks: from low and relatively stable demand to high and variable peaks. When demand is low, electricity infrastructure sits idle. This was particularly the case in the early days of electricity in the mid-1890s when it was mostly used at night for lighting. Large idle times without revenue to cover debt created high fixed costs, high prices, and, subsequently, little demand for an expensive commodity.

The first key innovation in electricity pricing was the move away from flat charges per lightbulb toward volumetric charges as measured through a meter. One story claims that Insull visited Brighton in the United Kingdom in 1894 and met a manager of a small municipal station who had begun to charge customers for their actual consumption and their potential peak consumption (McDonald 1962). Using meters, electricity was sold in Brighton on a volumetric basis rather than as a flat charge. When Insull returned to the United States, he began to use meters to sell electricity by volume, calculating consumption in kilowatt hours (kWh), rather than charging by the lightbulb.[10] In the mid-1890s, he also pioneered long-term, low-priced contracts with large customers to grow the customer base and consumption (McDonald 1962). Consequently, demand was

smoothed, the company's load factor grew, and electricity costs dropped. With lower rates, more customers would buy electricity, continuing the positive spiral (Hughes 1983; Yergin 2011).

Through the industry associations he dominated, Insull pressured other utilities across the country to price electricity in the same way. At the time, there were significant debates among utility executives about the best way to price electricity. Two main options were discussed: efficiency-oriented versus growth-oriented pricing (Yakubovich et al. 2005). The efficiency system aimed to make maximum use of existing infrastructure by charging customers not only for the amount they consumed but also for the time of day they used it. Since electricity assets were sitting idle outside of evening hours when demand for lighting was highest, this system would more efficiently use existing assets to gain new customers. Although this was not considered at the time, from an environmental perspective, this approach would have also resulted in greater resource efficiency. Insull, however, was a proponent of the growth-oriented pricing structure, wherein customers were charged the same rates regardless of when they used electricity. This pricing system would push the electricity system toward centralization, vertical integration, and private utility monopolies because it would require greater upfront fixed costs (Yakubovich et al. 2005). Insull preferred increased revenue and growth over efficiency and he worked to convince his peers that this was the correct path forward.

Having convinced the industry, he launched a campaign to convince the regulators. Allied with other utilities, Insull aimed to secure regulatory decisions that would favor private monopolies running large centralized plants. Through the National Electric Light Association (NELA)—the first utility association and the precursor to the EEI—Insull and other utility managers met to discuss pricing, technology, and public policy.[11] In places where municipalities had chosen option two—creating significant competition between different utilities—Insull developed a frame that would come to define regulation. He argued that electricity was a natural monopoly because of its large fixed costs and networked nature. Hence, franchise rights should be limited to a small number of companies in each service area. He viewed replicated infrastructure as unnecessarily costly, contributing to high electricity rates.

The association also aimed to stem the tide of municipal public power, ensuring that private utilities would reign. Of course, many municipalities wanted to own the power system's assets. Consequently, the private utility association began a campaign to move electricity regulation from municipalities' jurisdiction to the states, in a classic example of venue shopping. This move had three goals: first, to facilitate private utility expansion; second, to reduce the number of municipal utilities; and third, to circumvent municipal corruption

(Hughes, 1983, 207). The association aimed to secure monopoly status through state governance.

However, by the early 1900s, monopolies were seen as dangerous economic entities that used their market power to charge high and unfair prices. To gain the monopoly status at the state level, then, NELA and Insull had to concede to greater government oversight. As historian Richard F. Hirsh argues, a "utility consensus" was forged in the early twentieth century between private electric utilities and the states. In return for the right to operate as a monopoly, private utilities would be required to have state oversight to ensure reliable and cheap power. A limited number of companies would have the right to sell electricity, with state regulators overseeing rates (Hirsh 1999a). In this framework, regulation was supposed to guard against monopoly power (Stigler & Friedland 1962). This change also limited growth in public, municipal utilities.

These ideas formed the basis for the public utility commission (PUC), the main regulatory institution for electricity still used today. Beginning in New York, Georgia, and Wisconsin in 1907, PUCs rapidly spread to two-thirds of all states by 1913 and three-quarters by 1922. Commissions became the institutional venue for ensuring that utilities were able to recoup their costs without abusing their monopoly power (Anderson 1981; Stigler & Friedland 1962; Troesken 2006). This was achieved through the PUC overseeing utility costs and allowing utilities to charge "cost-of-service" rates with regulated profits. Rather than municipal governance, PUCs became the primary governing body regulating electric utilities.

Using propaganda tactics from World War I, utilities sold their business model to the people, dramatically increasing acceptance of private ownership and eroding the push for public power (Hughes, 1983, 208). Consequently, municipalities lost significant control over power regulation. In places where public, municipal utilities already existed, they were left outside the PUC process. This decision to allow municipal utilities to operate independently continues to have significant consequences today. Just over 100 years later, municipal utilities see themselves as sovereign self-regulators, exempt from the latest regulatory fashion at the PUC: whether that be deregulation in the 1990s or renewable energy requirements in the 2000s.

Public Utility Commissions remain quasi-judicial, quasi-legislative regulatory institutions led by a group of commissioners. The commissioners are usually appointed by the governor, as is the case in Texas, Ohio, and Kansas; but in a few states, including Arizona, commissioners are elected. The PUC is the implementing agency for electricity legislation. As such, it sets rules and prices, conducts ratemaking proceedings, and oversees contracts. PUCs have long been tasked with overseeing electricity rates and deciding whether utility costs and

investments were reasonable. The fact that utilities would operate as monopolies made consumer protection electricity regulation's central goal during its first 50 years. Meeting this goal came to be defined as efficiency, economy, and reliability. Other goals, such as equity and environmental protection, were largely left off the agenda.

This regulatory bargain between private utilities and state PUCs led to incredible reductions in the price of electricity over time. Although contemporary electricity debates focus on rising prices—particularly with reference to renewables—the larger secular trend over the past century is falling prices. As Vaclav Smil (2003) demonstrates, electricity prices declined 98% over the twentieth century. In 1902, when the first electricity pricing data are available, the national average price was 16 ¢/kWh, equivalent to $2.50/kWh in 1990 dollars (Smil 2003). In 2017 the average price for residential electricity in the United States was a mere 8 ¢/kWh in 1990 dollars.[12] The most dramatic price declines happened between 1900 and 1920, precisely when PUCs and monopolistic regulation were unfolding across the United States. But price declines continued through the 1960s due to technological and managerial innovation, giving governments little reason to re-examine the regulatory consensus (Joskow & Schmalensee 1983).

Through this consensus, the state delegated a critical, societal function to private companies. Although the PUC is theoretically independent, in practice, this bargain empowered utilities to capture the regulatory process as the main and most influential stakeholder (Hirsh 1999a). As long as electricity prices remained low, utilities were welcome to continue to act as monopolies, expanding capacity and increasing their profits.

In the early twentieth century, utilities became a particular manifestation of Charles Lindblom's privileged position of business (Lindblom 1977). Energy was and remains the backbone of American prosperity. This can be seen easily in the correlation between gross domestic product (GDP) and energy consumption.[13] While this tight relationship is weakening over time, energy has and continues to play a foundational role in all societies.[14] This was even more true historically. By the 1920s, electricity production was the biggest industry in the US economy (Carley 2009). Here we see the state delegating a key economic input—electricity—to private corporations rather than requiring public ownership. With this deference, Lindblom tells us, also comes significant power. And so utilities have had a privileged seat at the table in negotiations over energy policy from the 1920s to the present. It was only with the stock market collapse in 1929 and the subsequent depression that we saw the first challenges to private utilities' privileged position.

The Rural Electrification Act, Price Reductions, and Capacity Expansion (1920–1970)

Initially, innovation was at the core of the utility industry's business model. But by the early 1920s, the sector had abandoned its roots in radical invention (Hughes 2012). As Hirsh (1999, 52) puts it, "For the next fifty years [from 1920 to 1970], managers and their allies in manufacturing firms sought to stifle radical inventions that could upset the central station paradigm and threaten established financial interests." Private utilities had turned away from innovation, focusing instead on scaling up through technology and profits. While new technology was largely discouraged, innovative financing models and corporate structures flourished. Insull, in particular, became famous for buying up electric utilities across the country and constructing complex holding companies (Spinak 2014). But he was not alone. At the time, banks were loaning large sums to utilities. Utilities used this money to buy up competitors (McDonald 1962). It was a time of significant consolidation in the sector as corporations attempted to create economies of scale.

With the stock market collapse in 1929 and the resulting economic insecurity in the early 1930s, utility companies' stock eroded (Figure 3.2). Here, New York bankers played a key role. In their attempts to take over the Insull Group's assets, they aimed to devalue its holding companies (McDonald 1962). Under this predatory action, the Insull empire eventually collapsed. However, the bankers largely escaped blame. Instead, the private utilities were seen as highly culpable, due to the complex legal and financial arrangements they had used to drive consolidation in the 1920s. These developments began to upset the regulatory consensus. Utilities were seen as less trustworthy, and their privileged status began to erode. As part of New Deal–era reforms, the federal government stepped in to place significant restrictions on utilities (Hirsh 1999a). Two major changes were made: first, politicians returned to advocating more vocally for publicly owned power; second, the government increased limits on what private utilities could do.

In the 1930s, the federal government began supporting public power through the New Deal. Congress passed the Tennessee Valley Authority (TVA) Act in 1933, establishing the large public utility. The TVA sold power at very low prices across seven southeastern states, aiming to raise citizens' standard of living. It was a social project, steeped in progressive ideals, and directly counter to the notion that private utilities should profit from electricity as a public good (McCraw 1971; Tobey 1996). An executive order by President Franklin D. Roosevelt followed in 1935, creating the Rural Electrification Administration. The aim was

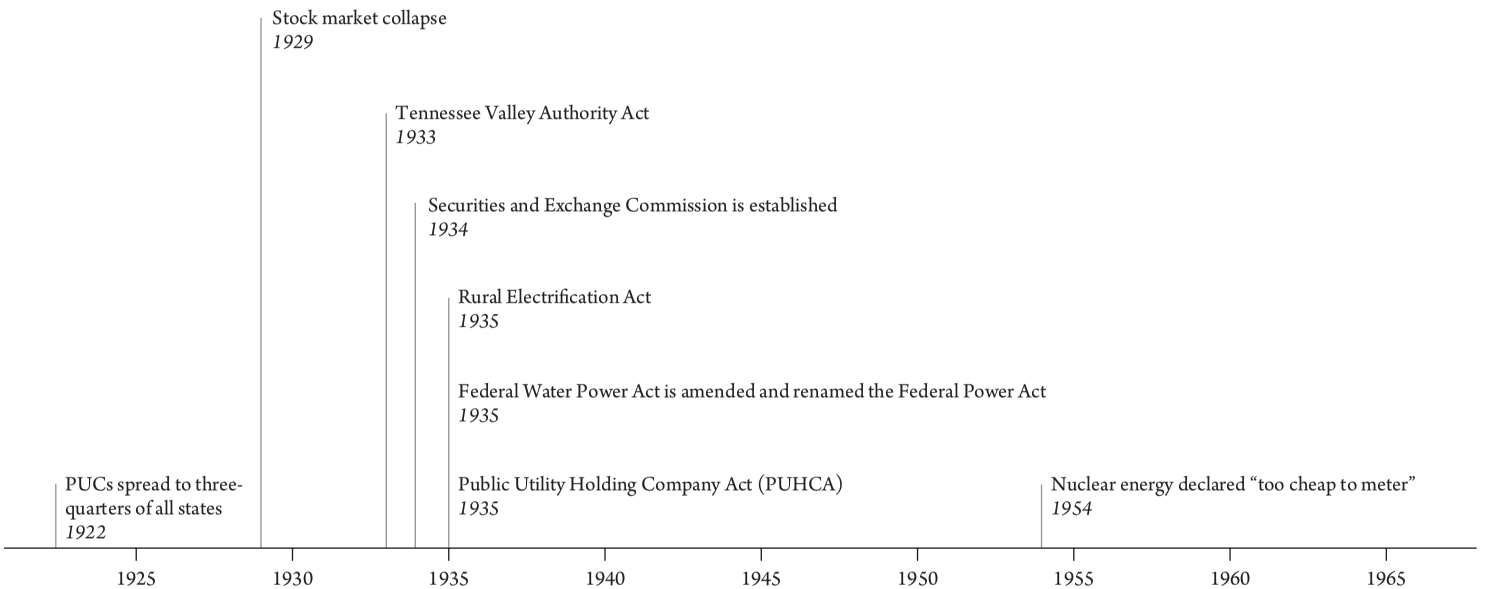

Figure 3.2 Major Events in Electricity Policy, 1920–1970

to provide electricity to parts of the country that private utilities had long neglected, using cooperatives rather than public or private utilities. It is important to note that this was not a new phenomenon—during the 1920s utility managers worked with land grant universities to expand electricity to rural areas (Hirsh 2018). That said, Roosevelt's policy dramatically accelerated rural electrification. It also helped address inequalities in electricity access that cut across both class and racial lines (Harrison 2013, 2016). Congress supported this policy in 1936, passing the Rural Electrification Act. Through these two policies, rural cooperatives—the third main type of utility still operating today—proliferated across the country (Spinak 2014).

The federal government made several other changes to utility regulation and operations during this era that increased federal oversight. In 1934, Congress established the Securities and Exchange Commission (SEC). The SEC included provisions to inspect utilities' financial arrangements. This was followed the next year by the federal Public Utility Holding Company Act (PUHCA), designed to limit the kinds of corporate structures available to utilities (Hirsh 1999a). The PUHCA also limited private utilities' geographic scale in an attempt to increase PUC oversight. These two laws reduced utilities' ability to take large financial risks and to engage in complex financial arrangements. Third, the Federal Water Power Act was amended and renamed the Federal Power Act in 1935, giving the Federal Power Commission—now the Federal Energy Regulatory Commission (FERC)—the authority to regulate all interstate electricity sales and transmission. This law aimed to ensure just and reasonable power prices in the states (Wolak 2003). Together, these laws began the slow march toward federal oversight of PUCs and electric utilities.

But these regulatory modifications were insufficient to disrupt the utility consensus (Hirsh 1999a). State PUCs remained the central governing body. And private electric utilities continued their growth, outpacing public utilities and cooperatives to retain their dominant position. In the post–World War II era, private utilities across the country focused on capacity expansion. Given cost-of-service regulation, the primary way utilities could make a profit was through owning the system's assets and applying for rate recovery through PUC proceedings. As monopolies, utilities were outwardly hostile to independent power producers. Allowing other groups to participate in electricity production would reduce utilities' profits.

Thus, utilities used their monopoly power to drive out competition. For example, they aimed to shrink co-generation, a technology often used at industrial facilities to generate both heat and electricity simultaneously. This technology is more efficient and therefore has a lower environmental footprint. In the mid-twentieth century, utilities offered industrial users low rates to disincentivize

them from making their own efficient electricity through co-generation. These efforts worked, driving a centralized, utility-dominated electricity system. In 1902, 60% of the electricity system's capacity was non-utility assets; but, by the late 1970s, this number had fallen to just 3% (Hirsh 1999a, 82). As they focused on their own profits, private utilities proved ineffective at pursuing economic or environmental goals. In an effort to sell more electricity, a declining block rate structure was used during this period: as customers purchased more electricity, their marginal price would fall.[15] This pricing paradigm incented greater consumption and thereby increased utilities' profits. Utilities favored this structure despite the fact that it poorly aligned with economic principles (Anderson 1981, 66–68) and worked against conservation. Taken together with their drive to eliminate co-generation, private utilities dramatically increased the energy requirements for the US economy during this period—leading to significant waste. But in the postwar period, policymakers believed there were abundant energy resources, and they placed little focus on negative environmental repercussions.

Private utilities' strategy proved successful at meeting one regulatory goal, however: cost reduction. With their monopoly status secured, the utilities invested in economies of scale, and the price of electricity dropped. Between 1952 and 1968, energy prices fell in real terms (Laird 2001). Further cost declines were predicted with the rise of nuclear plants. As the chair of the Atomic Energy Commission famously said in 1954, nuclear energy would be "too cheap to meter" (Bodansky 2008).[16] Nuclear plants were proposed in large numbers across the states, with exponential growth in permits between 1965 and 1975. This was an age of technological optimism—economies of scale would bring low-cost, abundant energy sources. Endless energy would lead to global progress and peace.

However, the age of energy optimism would prove short-lived. Nuclear energy's costs grew alongside opposition to the technology and safety and security requirements at plants. Projects were taking longer and longer to build, with protests and new safety standards. Over time, large cost overruns would be incorporated into rates, increasing electricity prices (Joskow 2006). Additionally, nuclear waste rose in prominence as a thorny political issue (Aldrich 2008; Slovic et al. 1991). Environmental concerns about the entire energy system started to mount as the antinuclear environmental movement grew. At the same time, oil shortages drove up prices. Politicians and regulators no longer saw abundant and cheap energy. With mounting costs, the utility consensus began to erode.

The Public Utility Regulatory Policies Act and Marginal Cost Pricing (1970s)

After more than 50 years of regulatory stability, utilities' interests in increasing profits and society's interests in maintaining low and stable energy prices came into conflict. Utilities, profiting off of electricity expansion, had no incentive to reduce consumption. With cost-of-service regulation, utilities can grow their rate base by building more plants, then sell more electricity, and thereby increase their profits. With these incentives, utilities expanded capacity and encouraged citizens to buy new appliances to increase demand (Spinak 2014; Tobey 1996). And they eschewed more efficient technologies, like district heating and industrial co-generation.

Overall, the industry stopped investing in improving technologies. Instead, utilities entered a period that historian Richard Hirsh (1989) has called "technological stasis." Electricity prices started rising. Previously, technological improvements had mitigated the effects of inflation (Hirsh 1989). However, the industry's movement away from innovation magnified inflation's effects. With the energy crisis, rising fuel costs exacerbated this problem (Lifset 2014). Electric utilities were no longer supplying cheap power—they were failing to hold up their end of the regulatory bargain (Hirsh 2013).

With private utilities struggling to provide low-cost power, jurisdiction over electricity regulation once again moved up to a higher level of government. After the 1973 Arab oil embargo, the federal government began to question whether all this wasted energy and excess consumption was problematic (Figure 3.3). The Ford administration proposed creating a new agency that would spur alternatives to imported oil, for example, by developing synthetic fuel technologies (Breetz 2013). But Congress rejected this proposal. When the Carter administration took office, the federal government began to actively encourage energy conservation, efficiency, and changes to electricity regulation.[17]

Drawing on economic ideas, most notably from Alfred Kahn, the Carter administration sought rate reform at the federal level. The government wanted to require marginal cost pricing, to align consumer signals with conservation goals—an idea that Kahn promoted. By this time, marginal cost pricing for electricity was already being used in Europe (Chick 2007). And although it was far from the norm in the United States, in the early 1970s, several state PUCs held hearings on the topic, including New York and California (Joskow 1976; Mitchell et al. 1980). Kahn himself served as the chair of New York's PUC when it transitioned to marginal cost pricing. This idea, along with other strategies to drive energy conservation, was advanced through Carter's proposed National Energy Plan (Hirsh 1999a).

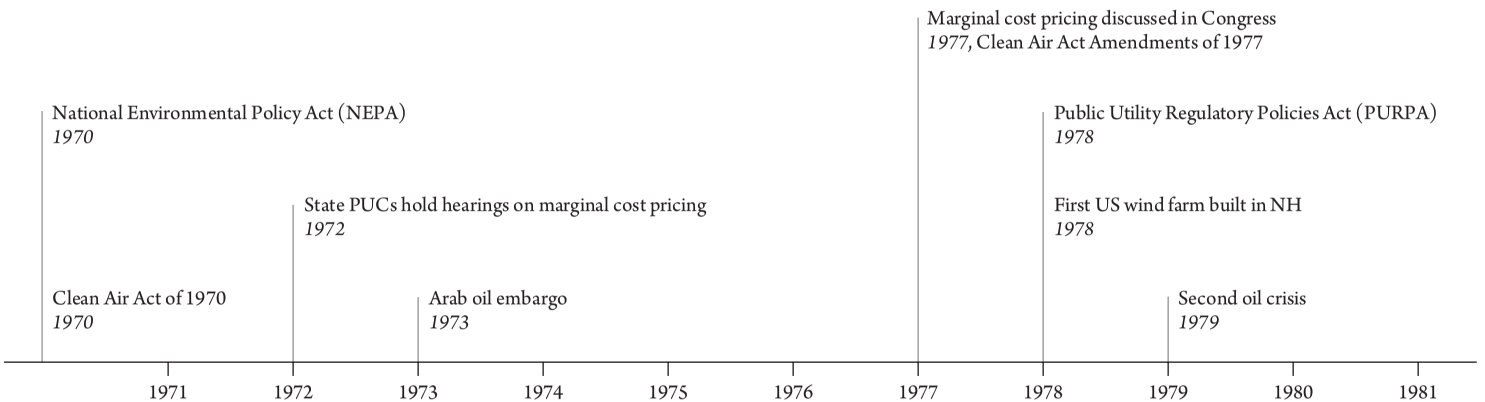

Figure 3.3 Major Events in Electricity Policy, 1970–1980

When President Carter sent the plan to Congress in 1977, however, it proved controversial, with broad opposition from many interest groups (Breetz 2013). Although parts of Carter's blueprint passed the House, the Senate broke up the energy reform into several bills, arguing that the diversity of topics covered was too large for one package. Some of these disaggregated bills aimed to reform the electricity rate structure, while others would impose new taxes on fuel-intensive vehicles. The utilities were largely focused on a debate over whether coal would be converted to oil and natural gas, as well as limiting the electricity rate reform's scope and extent (Breetz 2013). They paid little attention to other bills in the legislative package (Hirsh 1999a, 1999b). Utilities' lack of ability to forecast and their divided attention were key factors in allowing significant reforms to pass. In a pattern we will see repeated in the chapters that follow, the fog of enactment was operating. As with many reforms that have the potential to reshape policy through feedback, these laws' consequences were difficult for incumbent opponents to predict in advance. Further, with a large and complex reform, the utilities could not focus on all the bills' provisions simultaneously.

A largely overlooked bill was included in the reform package—the Public Utility Regulatory Policies Act (PURPA). President Carter's plan aimed to revive on-site production through co-generation plants. The goal was to increase energy efficiency while also expanding supply diversity. PURPA included Section 210, which would allow more small-scale power production. As historian Richard Hirsh lays out in exceptional detail, Republican Senator Charles Percy of Illinois and Democratic Senator John A. Durkin of New Hampshire both played key roles in drafting this section of the bill. Their motivations were diverse. Senator Percy was eager to avoid another oil crisis and viewed renewables as the energy sources of the future (Hirsh 1999a). As a result, the bill was drafted to require 75% of eligible independent power producers' energy to come from biomass, waste, solar, wind, or geothermal (Devine et al. 1987).[18] In the 1970s, renewable energy was still a bipartisan issue.

Senator Durkin's goals were less idealistic. Wheelabrator-Frye Corporation, a company based in his home state, operated a waste-to-energy plant. The company approached him with an interest in selling electricity from co-generation and potentially moving into biomass-based electricity production. Working with lobbyists for this firm, Senator Durkin secured several changes to PURPA's sections 201 and 210 that would aid the company: increasing the maximum project size from 30 to 80 megawatts; ensuring that the federal government would set the rules around pricing, rather than the states; and ensuring that these federal rates included both capital and variable costs. These changes were agreed to largely because utilities perceived this section as unimportant compared to other energy bills' provisions. Senator Durkin's proposals were viewed as constituent-oriented and focused on a niche industry, rather than systemic to the electricity

sector as a whole (Hirsh 1999a). Enacting these federal energy bills took another year. But the House eventually agreed to a resolution that would bind all five bills together to ensure that the entire package passed. President Carter signed the bills in November 1978, noting that the law would ideally kick-start innovation in solar energy in the United States. Here we see our first example of how policy feedback can be started during a time of significant legislative uncertainty and ambiguity, through a fog of enactment. This one small company kicked off a much larger positive feedback cycle—one that was not predicted in advance. Once implemented, this law would come to undermine utilities' monopoly status.

Still, the enacted legislation did not guarantee a new group of independent energy producers that would rival the utilities' monopoly over the electricity supply and their regulators. As I argue, feedback does not take hold until laws are effectively implemented and resources, identities, and preferences are recast. The federal energy regulator, FERC, had to first interpret the law before its transformative effects could be felt.[19] One key issue was how to treat this new class of independent power producers, called qualifying facilities (QFs) under PURPA. After significant deliberation, FERC decided on generous terms. It also removed the requirement for QFs to go through the same bureaucratic approvals as utilities. Given their much smaller size, this lower regulatory burden would prove important for reducing transaction costs. It would also ensure that QFs avoided direct conflict with utilities through PUC proceedings.

The commission made other implementation decisions that bolstered new projects' economic viability. They defined avoided costs to mean the cost of the utility's own power production. This interpretation meant that payments to QFs would not be based on the new plant's costs but on the costs utilities would theoretically avoid spending. This decision held the potential to provide independent producers significant profits. It also enabled a diverse range of technologies to be developed. From FERC's perspective, more generous payments were justified because QFs were taking on significant risk. This stood in marked contrast to the monopoly utilities—they had little to no risk, since the PUC process guaranteed profit margins above their costs. Finally, FERC allowed QFs to buy electricity at the standard consumer rate while selling it at the higher, avoided cost rate. This arrangement was codified over the opposition of utilities, which would have preferred a net metering approach, wherein the power purchased is valued at the same price as the power sold. But FERC argued that QFs should pay the same electricity prices as any other consumer (Hirsh 1999a).[20] FERC's interpretation of PURPA paved the way for significant policy feedback through the creation of a new group of electricity companies that could challenge utilities' policy monopoly. It also acted as the first, proto-feed-in tariff policy.

Once FERC issued these rules, the law faced resistance from opponent utilities. During implementation, the utilities had updated their expectations about the policy's likely effects. They now perceived significant threats to their business from FERC's expansive interpretation. Opponents legally challenged the implementation decisions through two cases, which both went to the Supreme Court. Here we see an example of an opponent interest group trying to stop policy feedback before it takes hold by working indirectly to resist policy through the courts. The first case against FERC came in 1982 in *Federal Energy Regulatory Commission v. Mississippi*. It was brought by the state and its PUC. Mississippi challenged the constitutionality of PURPA Section 210, arguing that Congress did not have jurisdiction to interfere with state PUCs setting rates because of the Tenth Amendment and the Commerce Clause. The Supreme Court ruled with FERC, arguing that utilities were a form of interstate commerce (Martin 1983). The second case, *American Electric Power Service Corporation v. Federal Energy Regulatory Commission*, occurred in 1983. The Ohio-based utility American Electric Power (AEP) argued that FERC's interpretation of the law went too far (Martin 1983). It claimed that QFs should have to go through PUC hearings before interconnecting with a utility and that avoided costs should not have been interpreted as the utility's marginal costs. Drawing on the House–Senate conference report, the Supreme Court again sided with FERC, stating that the law's intent was not to keep prices low but to diversify fuel supply as a long-term safeguard against scarce fossil fuels (Hirsh 1999b). Further, it argued that interconnection approval requirements would paralyze QFs' ability to operate, undermining the law's intention. Through these two Supreme Court decisions, PURPA's strong implementation was secured.

After these cases concluded, state PUCs began to set PURPA rates. FERC had left the specific avoided cost calculations to the states. In practice, a wide variety of methodologies were used. Differences in marginal electricity costs across states also led to significant variation in rates (Loiter & Norberg-Bohm 1999). States like California and New York set high avoided cost rates since their incumbent utilities also had high costs. For example, California's PURPA rate was 3 ¢/kWh (Devine et al. 1987).[21] States with significant hydropower resources, like Washington and Oregon, had much lower rates, between 1 and 2 ¢/kWh (Righter 1996a). This variation in rates, alongside other differences in states' implementation of PURPA and their adoption of complementary policies, would dramatically affect independent energy producers' ability to finance projects in different states. These factors would lead to significant variation in the type and scale of renewable energy projects that were developed across states (Loiter & Norberg-Bohm 1999).

Once states' rates were finalized, hundreds of stalled energy projects started moving. Within a few short years, PURPA was used to develop renewable energy projects. The first wind farm in the United States was built in New Hampshire in 1978 when U.S. Windpower (later called Kenetech) erected 20 windmills (Righter 1996a). Shortly thereafter, California began the largest investment in wind energy in the world up to that time.

PURPA represents a classic case of positive feedback. The law undermined utilities' monopoly status by creating a new set of actors with divergent interests. Utilities tried to stir controversy over these new independent power producers, asserting unwarranted costs and capacity (Lesser & Su 2008). But they were largely unsuccessful. Through this law, utilties had lost "much of the power they once held in the utility system" (Hirsh 1989, 100). These independent energy companies began to cultivate influence with politicians, and they held different goals for energy policy from the utilities. While electricity policy would continue to be dominated by interest group preferences, there was no longer *one* interest group at the PUC. As the next two sections will show, these independent power producers would prove critical in the coming decades, both to debates over deregulation and to the rise of renewable energy.

Electricity Deregulation and the Energy Policy Act of 1992 (Late 1980s–2005)

While earlier challenges to the regulatory consensus focused on *increasing* utility regulation, by the 1980s the aim had reversed. Now politicians wanted to *reduce* regulation. Alfred Kahn was key to getting deregulation on the agenda when he published an influential, two-volume book, *The Economics of Regulation*, in the early 1970s (Kahn 1971). The work advanced a theory that government regulation should prioritize economic efficiency and that institutional arrangements should be crafted to best meet this goal. In addition, Kahn re-examined the case for monopolies. He argued that in many instances utilities provide a mix of goods: some parts of utility's products were true monopolies, while others could be sold through competitive markets. He targeted numerous monopoly industries, from telecommunications to natural gas transmission to air transportation. Kahn would go on to become the chair of the Civil Aeronautics Board, which was in charge of deregulating the airline industry—a deregulation that both Republicans and Democrats lauded as wildly successful (Stelzer 1982). The Carter administration drew on Kahn's work to push marginal cost pricing for electricity in its late-1970s energy reforms. His ideas proved extremely influential—not just at the federal level but also with state legislatures and PUCs.

In the electricity sector, these ideas helped put deregulation on the agenda.[22] Public Utility Commissions typically oversee a wide variety of utilities, including telecommunications and natural gas. After these industries underwent successful deregulation, electricity appeared to be a natural next step for state regulatory reform. Key justifications for monopolies in the electricity sector included economies of scale, difficulties of obtaining capital, and market efficiency. However, all of these principles were challenged once PURPA was implemented in the early 1980s. Independent power producers had clearly demonstrated that they could provide power cheaply, for as little as a few cents per kilowatt hour. The burden of proof now fell to utilities to justify their monopoly status. Through policy feedback, PURPA's successful implementation had reshaped the political landscape, changing the balance of power across interest groups.

By the early 1980s, a handful of economists were applying Kahn's work to the electricity system. Using engineering-economic models developed in the 1970s at the Massachusetts Institute of Technology and the University of Texas at Austin, academics started to examine what restructuring would look like in practice (Baughman et al. 1979). Paul Joskow and Richard Schmalensee, in particular, began questioning whether electricity required monopolies. They did so first in a report to the DOE in 1982, and later in their 1983 academic book, *Markets for Power* (Joskow & Schmalensee 1983). Electric utilities had secured their vertically integrated monopoly status by arguing that their good was a natural monopoly that only required one set of wires to be transmitted to market. Like Kahn, Joskow and Schmalensee instead argued that this monopolistic structure made utilities' electricity expensive and that a market would bring efficiency through competition. They believed that while some parts of the electricity sector might be monopolistic in nature—namely, distribution and transmission systems—generation could theoretically be run through a competitive market. Separating out these functions and creating competitive markets was seen as one solution that would enable restructuring.

Joskow and Schmalensee wrote their book on the heels of a decade of financial woes in the electric industry. By the late 1960s, electricity price declines and coal power plant efficiency had both stagnated (Smil 2003). Utilities were no longer lowering their costs. Given that cost-of-service regulations guaranteed cost recovery plus profit, electricity prices stopped declining. Instead, prices began to rise as utilities invested in excess capacity and nuclear plants with cost overruns (Devine et al. 1987). With nuclear power, it was no longer clear that increasing the plant's scale would decrease the average costs (Grübler 2010; Trancik & Cross-Call 2013). Further, the costs of utilities' existing coal investments rose as new environmental regulations were implemented in the 1970s. Although there were technological innovations in natural gas combined-cycle turbines, utilities were not building these plants. Without increasing demand, they had

little incentive to develop new infrastructure, even if it would lower operating costs or make plants less polluting. Notably, these dynamics are still at play today: throughout the South, uneconomic coal plants continue to operate despite the availability of cheaper and cleaner alternatives. Since utilities have sunk debt and equity into these plants, they want to keep them open.

Given that utilities had stopped innovating or reducing costs, economists argued that their monopoly status was outdated and inefficient. They believed that introducing competition would help fix some of these problems. If independent power companies built the latest technologies, they could offer lower electricity prices (Hirsh 1999a). Moreover, the latest natural gas technologies no longer showed economies of scale, further undermining the argument that monopolies were necessary in this sector. Together, these facts eroded the case for monopoly electric utilities. Private utilities were increasingly viewed as stagnant, uneconomic, and harmful to human health and the environment.

While the idea gained traction and the Reagan administration became a strong advocate for deregulation across the economy, little progress was made on electricity restructuring in the 1980s. Instead, a number of states began implementing centralized government planning through integrated resource plans (IRPs) in late 1980s (Duane 2002). This approach put an emphasis on both supply- and demand-side concerns. As social and environmental costs figured more prominently in IRPs, both regulators and environmentalists grew in power, and the utility consensus further eroded.

It was only during President George H. W. Bush's administration that electricity deregulation reached the federal policy agenda (Figure 3.4). In part, the decision to proceed with restructuring in England and Wales in 1990 influenced US policy (Joskow 2003). But more directly, yet another oil crisis—triggered by the 1990 Gulf War—opened a policy window (Hirsh 1999a). In response, President Bush announced a national energy strategy in 1990 and again in 1991, focusing significant congressional attention on energy policy.

These ideas were taken up in Congress in 1992 through the proposed Energy Policy Act (Stokes & Breetz 2018). This complex bill had a large number of provisions on electricity deregulation. It proposed competition in power generation at the wholesale level. It also allowed states to choose whether they would implement retail competition—enabling customers to choose their electricity supplier. The bill also proposed modifications to PUHCA, to allow utilities to operate in larger geographic areas. It would also modify PURPA, extending the exemptions QFs were receiving to other independent power producers and creating a new class of actors, exempt wholesale generators. With these changes, independent power producers would be able to operate more broadly, even outside of PURPA's purview (Hirsh 1999a). The bill also proposed changes to electricity transmission rules. To enable generators to get their power to market,

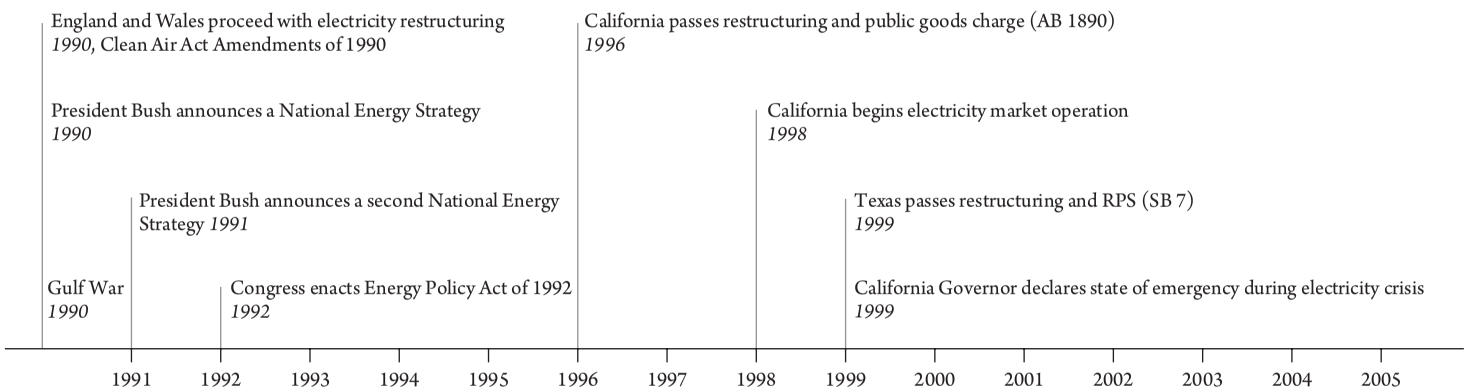

Figure 3.4 Major Events in Electricity Policy, 1990–2002

transmission would need to be open-access. Up until this point, utilities owned and operated transmission for their own use, voluntarily "wheeling" other utilities' power across their lines (Duane 2002). The bill would change that, allowing other providers to use the lines, like cars driving on a public highway (Watkiss & Smith 1993). Together, these changes would dramatically restructure the electricity sector after 80 years of institutional stability.

Utilities opposed the electricity reforms in the bill under the banner of reliability (Hirsh 1999a). They claimed it would be difficult to supply power consistently under this deregulated system. The private utility association, EEI, particularly opposed the transmission provisions. But by this time, utilities had lost considerable influence, including at the federal level. Electricity prices were no longer declining. And energy crises were increasing the attention Congress and presidents paid to these issues (Carlisle et al. 2016). Eventually, and despite utility opposition, the Energy Policy Act of 1992 passed—albeit with slightly more generous terms for the incumbent utilities on transmission rights.[23]

Still, the federal law did not immediately create a cascade of deregulation across states' electricity sectors. First, FERC would have to interpret and implement the law; and second, state PUCs across the country would have to decide whether or not to move forward and, if so, what form deregulation would take in their state (Joskow 1997). By October 2000, 90% of the states had begun restructuring their electricity sector to some extent, as shown in Figure 3.5 (Hirsh 2013).

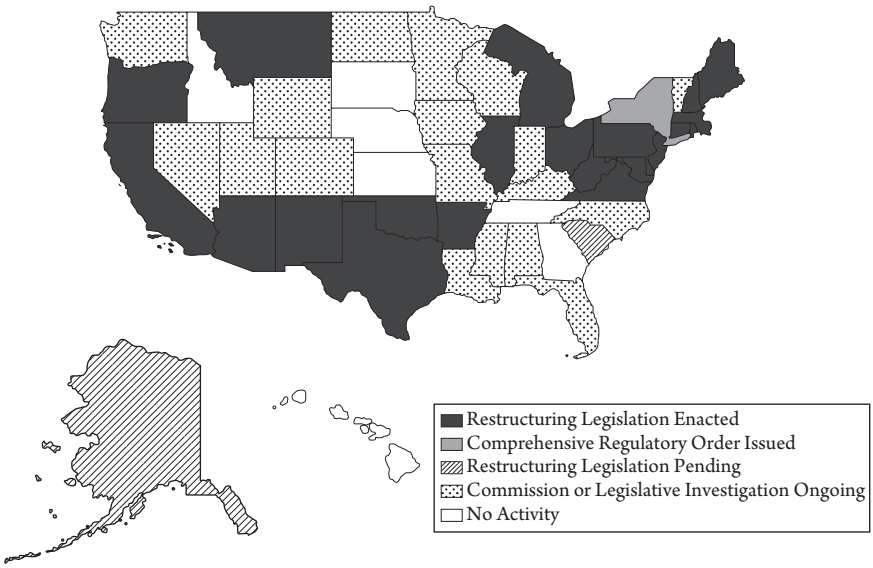

Figure 3.5 Status of Electricity Restructuring by State, October 2000.
(Source: Hirsh 2013.)

Ultimately, both California and Texas are well known for adopting restructuring policies in the late 1990s—policies that had nearly opposite results. California, ever a front runner in electricity policy, acted first by passing AB 1890 in 1996. Its market began operating in 1998. However, in California deregulation ended in disaster, with high electricity prices, rolling blackouts, a utility declaring bankruptcy, and the governor declaring a state of emergency. The crisis had many causes: low rainfall, high natural gas prices, and Enron engaging in price fixing (Hirsh 2013). It ultimately cost around $40 billion, with the California government stuck holding costly long-term contracts for electricity (Borenstein 2002; Joskow 2001). It also cost Governor Gray his position in a 2003 recall election. After this highly publicized failure, six other states suspended their restructuring programs, including neighboring Arizona.

Texas, by contrast, had already moved forward with restructuring in 1999. Its system is often seen as a success, particularly for retail competition (Joskow 2006). The Northeast, parts of the Midwest, and Oregon all restructured their electricity systems to various extents from the late 1990s onward (Figure 3.6). Across the country, deregulation proved a mixed success, with retail participation rates—the share of people signing up to change their electricity provider—hovering around 5% for most states by 2009 (Hirsh 2013). With these results, deregulation stopped being the central policy issue at PUCs by around 2005. Instead, renewable energy and climate change took center stage in state electricity policy, becoming the largest challenge to utilities' dominance over electricity policy.

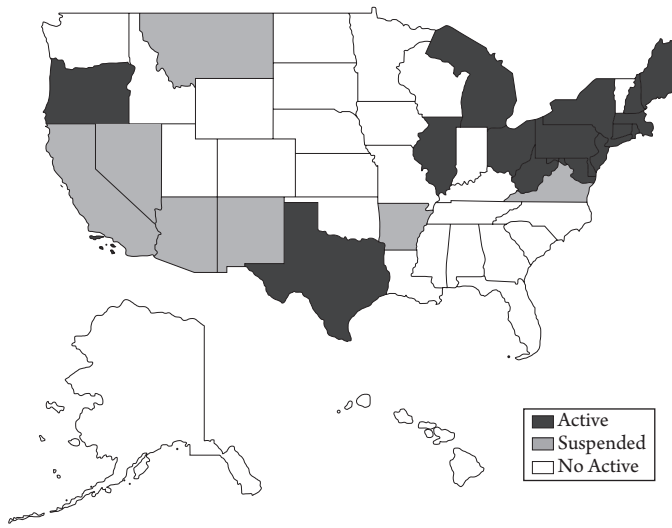

Figure 3.6 Status of Electricity Restructuring by State, September 2010. (Source: Energy Information Administration, 2010.)

Climate Change and the Rise of Renewable Energy (1970s–2015)

To understand how debates over renewable energy came to eclipse deregulation as the main issue on states' electricity policy agendas, we need to look back further in time. Utilities' decisions during the mid-twentieth century exacerbated the energy system's environmental harms. Initially, state regulators did little to address this growing problem. By the 1960s, extreme smog events were killing hundreds of citizens at a time, particularly in New York City, Pennsylvania, and Los Angeles (Greenburg et al. 1967; Jones 1975). Some states responded to these crises by passing clean air laws, including California (1947) and Texas (1965). But it was only with federal action that significant progress on air quality was made.

The 1970s were a watershed period for federal environmental laws. The decade began with a massive demonstration of 20 million Americans for the first Earth Day. This large scale social mobilization resulted in landmark environmental legislation being passed at the federal level. Given that the energy system contributes heavily to environmental problems, many of these landmark environmental policies applied to electricity (Laird 2001). In 1970, President Nixon signed the National Environmental Policy Act, requiring environmental assessments before construction of new power plants (Johnstone 2011). Later that year, the federal government created the Environmental Protection Agency (EPA) and Congress passed the Clean Air Act. This law, which remains crucial today, was aimed squarely at the power sector. It required new power plants to start dealing with the negative harms they caused, through installing best available pollution control technology (Layzer 2012).

In the wake of the 1973 oil crisis, one environmental activist, Amory Lovins, seized upon the moment, promoting a singular vision for a new energy system (Lovins 1976). As Lovins saw it, the United States was at a fork in the road—it could either take the "hard energy path," prioritizing environmentally harmful technologies including fossil fuels and nuclear, or it could take the "soft energy path," turning toward renewables and energy efficiency. It was unclear which path the United States would take.

During the 1970s, the federal government began supporting renewable energy technologies through tax credits. In 1973, a small, $300,000 program kicked off federal investments into wind energy (Galbraith & Price 2013). Under President Carter's administration, renewable energy's importance expanded. Funding for wind energy grew from 1977 onward, peaking at around $160 million annually in 1983. However, this did not represent a wholesale adoption of new technologies. Federal funding for renewables paled in comparison to

nuclear energy investments, which peaked in the early 1980s at $3.5 billion annually (Nemet & Kammen 2007).[24] The so-called energy transition from utility-supported technologies with polluting side effects—oil, coal, natural gas, and, to some advocates, nuclear and even hydropower—toward renewables and energy efficiency had hardly begun by the end of the 1980s. Despite two decades of advocacy, the utilities with their polluting technologies maintained political dominance (Hirsh 1999a).

Still, the 1970s and early 1980s was a period of important experimentation for renewables and energy efficiency, particularly in California. When Governor Jerry Brown was first in office, the state focused significant effort on energy efficiency (Charles 2009). In 1982, California introduced "decoupling," wherein the relationship between utilities' profits and their sales volume was broken. This allowed utilities to promote efficiency without eroding their revenues. The policy proved wildly successful, allowing California to grow its economy dramatically but keep electricity consumption flat. While decoupling has been on the agenda in other states for decades, the movement largely did not see progress until the 2000s.[25] As of March 2019, 24 states have undertaken rate reforms that decouple utility revenues from sales.[26]

California was also an important early leader in renewables. In 1978, Governor Brown supported a bill to create state renewable energy income tax credits (Righter 1996b). California's incentives, combined with the federal tax credits, allowed for a potential 50% tax write-off. And that was in addition to PURPA payments. Given these favorable terms, by the mid-1980s, California had developed the largest amount of wind energy, geothermal, and biomass technologies anywhere in the world (Morris 2000; Righter 1996a; Sawyer 1985). These technologies were new and expensive. But they represented the biggest attempt yet to move away from the polluting, centralized plants the electric utilities had promoted for the past century. Had we watched these developments in the late 1970s equipped with policy feedback theory, we would have predicted stable or growing government support for this budding industry.

However, by 1986 both state and federal policies supporting renewables were retrenched. Even though these policies had enabled the United States to become *the world leader* in renewable energy technologies, there was no path dependence. Instead, the policies that kept these businesses alive collapsed. Under the Reagan administration, renewables were not promoted. While solar and geothermal technologies had some minor tax credits extended, these expired in 1988. After the oil crisis ended, Congress paid less attention to the energy problem and even less federal funding flowed toward renewable energy research and development (Carlisle et al. 2016). The lack of policy stability had catastrophic effects on the nascent renewable energy industry and its ability to innovate and bring down technology costs. As a result, little non-incremental innovation occurred in wind

energy technologies (Nemet 2009). Similarly, the solar hot water boom, fueled by tax incentives, left little innovation behind. Instead, there were a number of bankrupt companies and many poor-quality, leaking systems (Nemet 2012). During this period, the United States lost much of its human capital and technological advantage in renewables. The lucky companies were sold for 10 cents on the dollar, and Europe rapidly pulled ahead in renewables technology (McDowall et al. 2013). In the 1980s, the United States ultimately failed to drive renewables adoption, innovation, or cost reductions.[27]

But despite the policy rollback—and the loss of technology and human resources—renewable energy technologies remained important because they solved a number of challenges the electricity sector was increasingly facing: high costs and environmental problems. In terms of costs, conventional technologies presented growing challenges. Nuclear was declining in popularity among both the public and regulators, particularly after the Three Mile Island accident in 1979. And by the late 1980s, it was clear that nuclear energy was no longer showing declining costs as the technology increased in scale. Instead, constructing new nuclear plants was become more expensive (Grübler 2010; Lovering et al. 2016). Many nuclear projects ran years over schedule and billions over budget.

Supply diversity and fuel costs were growing concerns in the energy sector. Given repeated energy crises, there was widespread concern over "peak oil" and secular declines in other fossil fuels. Although it would eventually become clear that a stable climate was the true limit on fossil fuels, not resource availability (Rogner 1997), this was not clear to many political actors in the 1980s.[28] Instead, there were concerns that fossil fuel's costs would grow in the future. Throughout the mid-twentieth century, coal plants' capital costs declined through experience, as predicted by the learning-by-doing hypothesis (Arrow 1962). This helped bring down electricity prices. However, coal *fuel* costs showed a flat trend. This meant that the price of coal created a floor on coal-fired plants' costs (McNerney et al. 2011). This trend extended to other fuels, whose prices had remained largely flat or even increased over time in real terms (Smil 2003). Since all fossil fuel–based electricity sources by definition require fuel, this trend suggested that further cost reductions in fossil fuel sources were unlikely.[29] When fuel costs spiked, so too would the price of power.

Environmentalists also understood that the electricity system posed significant threats for climate stability and human health. By the late 1980s, climate change had emerged as an important environmental problem. Dr. James Hansen testified in front of the Senate Energy and Natural Resources Committee in 1988, explaining that fossil fuel combustion was leading to global warming (Layzer 2011). Concerns about conventional air pollution were also heightened. In response, in 1990 the Clean Air Act Amendments passed, requiring tighter controls for nitrogen oxide, sulfur dioxide, and mercury.

Advocates framed renewable energy technologies as solutions to climate change, air quality, and a lack of supply diversity. Renewable energy technologies typically do not emit carbon and other kinds air pollution. And, unlike conventional fossil fuel technologies, they do not require fuel as an input.[30] Advocates were particularly interested in getting the government to support new and more expensive technologies that had lower environmental impacts: wind, solar (photovoltaic, thermal, and concentrated solar power), geothermal, and biomass. Since these technologies were young, innovation in manufacturing and installation could theoretically still bring large cost reductions.

Initially, electric utilities, like other fossil fuel companies, understood and accepted the science of climate change. Like the fossil fuel industry, the electric utility industry undertook research on the greenhouse effect and consistently found that the earth was warming (Anderson et al. 2017). In 1977, the Electric Power Research Institute (EPRI) testified in front of Congress that if climate change "turns out to be of major concern, then fossil fuel combustion will be essentially unacceptable, an important justification for expanding the nuclear and solar energy options."[31] Throughout the 1970s and 1980s, many articles ran in the utility industry's trade magazines that confirmed the scientific consensus of climate change (Anderson et al. 2017).

But by 1989 the private utilities were actively promoting climate denial. As climate policy began to gain traction on the national agenda, electric utilities understood that they could stand to lose a lot of money. Dealing with the environmental harms from coal and natural gas plants was inconvenient. Hence, utilities waged a war on environmental science, casting doubt on climate change, acid rain, and mercury pollution (Anderson et al. 2017; Oreskes & Conway 2010). Particularly active utilities in climate denial included Southern Company, AEP and Duke Energy, as well as the association of private utilities, the EEI.

Beginning in the mid-1970s, AEP ran advertisements in *The New York Times* and *The Washington Post* arguing that coal use should be expanded. In 1991, EEI alongside the utility Southern Company started a public campaign to "'reposition global warming as theory' and not fact."[32] They designed ads that said climate change was like Chicken Little—claiming there is "no hard evidence it is occurring."[33] From 1989 and throughout the 1990s, electric utilities—alongside EEI, EPRI, and the National Rural Electric Cooperative Association—were part of the Global Climate Coalition (GCC), a prominent climate denial organization. Participating utilities included AEP, Ameren, Consumers Power Company, Duke Energy, PG&E, and Southern Company. Southern Company played a particularly active role, for example, hosting meetings for the GCC in 1996. Southern Company, Duke Energy, FirstEnergy (then Ohio Edison, later Energy Harbor) and EEI were all on the board of the GCC in the 1990s, along with the National Rural Electric Cooperative Association.[34] These utilities also attended

workshops, developed climate denial policy memos, and helped disseminate misinformation, particularly in the mid to late 1990s.

Even after the GCC disbanded in 2002, utilities continued to deny climate science. For example, the Intermountain Rural Electric Association circulated a memo in 2006 challenging "the legitimacy of the 'alarmist' science about climate change." The memo specifically mentioned that Koch Industries, AEP and Southern Company were working together on producing climate denial content.[35] Until 2015, Southern Company funded a prominent climate denier, and in 2017 their CEO publicly disputed climate science on television (Anderson et al. 2017). Recent utility efforts to delay climate action have been organized through the Utility Air Regulatory Group (UARG), the American Legislative Exchange Council (ALEC), and other groups. Through their denial campaign, electric utilities successfully managed to delay policy enactment for decades. This history is all the more problematic given that monopoly utilities funded their denial campaigns using guaranteed profits from captured customers who could not choose to buy their power from other, more ethical companies.

Still, in the late 1980s there was reason to hope for action on climate change. Under President George H. W. Bush, energy prices began rising once again, focusing federal attention on the issue. In 1991, a large omnibus bill, the Energy Policy Act, began wending its way through Congress, passing in 1992 (Stokes & Breetz 2018). Controversial provisions in the bill—on nuclear energy regulation, oil development of the Arctic National Wildlife Refuge (ANWR), and emissions standards for cars—captured lawmakers' attention. By contrast, a small provision on renewables received little notice. Through a production tax credit (PTC), the bill proposed to create a 1.5 ¢/kWh tax credit for 10 years for eligible renewable energy projects, most notably wind.[36] This would turn out to be one of the most important parts of the complex law, though opponents missed its far-reaching consequences during the negotiations. In other words, the fog of enactment was operating.

Unlike fossil fuel subsidies, this meager funding for renewables was not permanent—it would need to be renewed regularly by Congress. The federal PTC would lapse and be extended many times over the coming decades. Combined with state policies, it would prove critical to financing renewable energy projects (Bird et al. 2005). But that fact was difficult to foresee in 1992. More than a decade had already been spent trying to kick-start renewables with very little success. Constantly shifting policy incentives at both the federal and state levels undermined progress. Outside of California, few renewable energy projects had even been piloted. Hence, advocates and analysts began to call for policy stability as one crucial ingredient in any renewable energy revolution (Rader et al. 1989; Rader & Hempling 2001; Wiser & Pickle 1997).

At the state level, there were few renewable energy projects in the pipeline by the early 1990s. Instead, advocates focused their attention on blocking coal plants. Before deregulation, many states had transitioned to IRP processes. In theory, this planning approach was supposed to bring public benefits like environmental harms into utilities' proposals. It largely worked: advocates advancing energy efficiency and renewables in IRPs were often winning. But with deregulation, the IRP process would disappear from many states (Duane 2002; Wiser et al. 2000). Thus, advocates had to change tactics and find new policy ideas that could be tacked onto the agenda of the day: electricity restructuring.

Advocates working through a cross-state network saw restructuring as a policy opportunity. The Energy Foundation—a foundation started in 1991 that provides grants to clean energy advocates—funded this advocacy network.[37] The group met regularly to discuss policy ideas and political strategies. To build capacity offline, the foundation set up a list-serve where members could share and debate. Key groups in this network in the mid-1990s included the American Wind Energy Association (AWEA), the Environmental Defense Fund (EDF), the Natural Resources Defense Council (NRDC), Public Citizen, the Sierra Club, the Union of Concerned Scientists (UCS), and the Utility Reform Network (TURN).

In specific states, the foundation would strategically fund groups when policy opportunities arose. This funding strategy involved a blend of insider groups, who could sit at the table and negotiate policy; and outsider groups, who could build grassroots campaigns to pressure the negotiations externally. Over time, this strategy evolved, and eventually the Energy Foundation saw itself as funding three kinds of groups: pillars, specialists, and local groups.[38] Pillars led regional efforts across the country, providing professional staff and technical expertise—these groups included UCS, the Renewable Northwest Project and the Conservation Law Foundation. Specialist groups had a narrow focus, only working on one topic such as energy efficiency. Local groups had relationships and credibility in a given state and the ability to drive grassroots mobilization. In practice, this funding model sometimes failed to incorporate local groups into national campaigns or would result in national groups parachuting into local debates last minute. That said, even those groups that did not receive foundation funding, such as state Public Interest Research Groups and Environment America, built relationships with the network and provided critical grassroots support. Many of the EF-funded groups also worked together to try to get a federal clean energy target on the agenda during the 1990s, although that effort ultimately failed.

The advocates struggled in the early days of this foundation network to agree on which policy to advance (Wiser et al. 1998). There were three main options: voluntary green power purchasing, a systems benefits charge, and

the renewable portfolio standard (RPS). Voluntary green power purchasing would allow consumers to choose to buy clean energy, by paying more on their electricity bills. This view fit the ideals of the day, pushing the system toward "markets, not mandates." Today, these ideas are echoed in companies that sell power with higher renewable energy content, as well as current movements in California to create community choice programs.

A second group of advocates favored a system benefits charge.[39] This policy involves collecting small, volumetric charges from customers and creating a fund for renewables. The approach catalyzed energy efficiency in the late 1980s and early 1990s through programs that included customer loans and incentives. Some advocates wanted to expand this policy for renewables, and they succeeded in many states. By 2013, 16 states had public benefits funds, with most created during the 1990s when this network of advocates was active (Hirsh 2013; Wiser et al. 2000).

A third group wanted to create a new policy, called a Renewable Portfolio Standard or RPS—a term coined in the early 1990s by a California advocate, Nancy Rader (Lauber 2004; Rader & Norgaard 1996). This policy would require the state to meet targets for the amount of renewables built by a certain date. Whereas UCS supported the policy from the start, other groups such as EDF and NRDC, were initially opposed to advocating for RPS policies. Eventually, this policy would prove the most successful of the three ideas. According to one foundation employee, "RPS was our go to policy because it solved problems. It broke down the resistance to buying higher priced power sources in the utility procurement process."[40] Ultimately, the foundation coordinated the effort to push for state RPS policies and supportive federal policy throughout the 1990s.[41]

But it was not clear at the time that the RPS would prevail. It both fit and clashed with the dominant policy agenda of the day: restructuring the electricity system. On the one hand, an RPS was a "mandate." It did not trust a market to fix the problem of a dirty energy system. Hence, it fit more squarely within a centralized IRP process than a market-based system.[42] On the other hand, the RPS could facilitate greater competition since it would require new technologies that incumbent utilities were less familiar with and largely uninterested in developing. Since renewable energy technologies are usually smaller in scale, independent power producers could build them more easily. Ideally, investment would also bring their costs down over time. But the most important factor for RPS policies' success was its simplicity. It was easy for politicians to understand and simple to sell to the public. The RPS also didn't highlight costs—as a systems benefits charge would, through a new line item on customers' bills. As one advocate put it, "it's easier to build a campaign around an environmental goal [than a new electricity bill cost]."[43]

Ultimately, many renewable energy advocates were able to use restructuring as a policy window to push clean energy policies, with the RPS proving the most successful. When the California PUC endorsed an RPS in the mid-1990s as part of its deregulation plan, this increased renewable energy advocates' interest. It was now seen as a politically viable policy to include in restructuring laws. Eleven states would pass RPS policies between 1994 and 2002, mostly in electricity restructuring laws, with Massachusetts enacting the first modern RPS and a system benefits charge in 1997 (Hogan 2008). As the next chapter will explore, in 1999 Texas passed its RPS policy as part of its deregulation bill. Similarly, Ohio passed its RPS policy in a revision to its restructuring law in 2008. Through this issue linkage, deregulation came to benefit renewable energy (Kim et al. 2014). Once electricity restructuring fell out of favor, many states enacted standalone RPS policies.

In the 1990s, advocates also began to push legislatures to enact another policy that would prove crucial for solar energy: net metering. Net energy metering (NEM) allows individuals to connect small systems to the grid and get compensated for the power they provide. The rate they are paid to sell electricity is the same as the rate they paid to buy it—hence, it is a "net" accounting system. When these policies were enacted, it was unclear how important they would be for solar's development across the United States. Since there were very few small-scale solar projects and even fewer that were grid-connected, it was difficult to anticipate how many people would choose to have utilities buy the power they produced. The utilities at this point subscribed to a paradigm that renewables would struggle to develop, so they were not very threatened by NEM laws. As one advocate put it, "[Net metering] it's so simple, it's elegant and fair. The utilities were victims of their own beliefs. They thought that renewables were some tiny markets that would never grow. And they passed many of those net metering laws with limits to ensure they wouldn't be too big anyway."[44]

Before 1995, only a handful of states had NEM policies on the books (Stoutenborough & Beverlin 2008). By the late 1990s, net metering grew rapidly, with 16 states adopting laws between 1997 and 1999 (Carley 2011). Grassroots, state, and national renewable energy advocates fueled their growth, with help from EPA regional offices (Faden 2000; Stoutenborough & Beverlin 2008). Again, the Energy Foundation funded one particularly important advocate based in California, Tom Starrs.[45] He was effective, going state by state to promote and pass net metering laws in numerous legislatures in the 1990s. After this initial wave of adoption, many other states copied the idea. And when the federal government required states to consider the policy, even more acted. By 2011, 43 states had net metering policies. Most of these policies were passed without significant opposition from utilities. It was clear

that utilities did not believe net metering would be a consequential policy. And for two decades, it wasn't.

But federal policy changes in 2005 revealed net metering's hidden potential. The Energy Policy Act of 2005 raised the existing 10% tax credit to a 30% investment tax credit (ITC) for commercial and residential solar (Stokes & Breetz 2018).[46] Tax credits for residential projects were capped at $2,000. While the ITC was only authorized for 2 years, the financial crisis created a policy window, enabling an 8-year policy expansion as well as the removal of the residential cap. The policy would have expired again at the end of 2016—but by then it had created new actors: solar leasing companies. In the late 2000s, solar leasing companies began cropping up, particularly in California. As the Arizona case explores in detail, these companies combined the federal ITC policy with state net metering policies to finance residential solar projects. When customers enter a solar lease or power purchase agreement with these companies, in effect they "rent" a solar panel and agree to pay a fixed monthly amount rather than paying the upfront costs of installation. This business model made it much easier for many homeowners to adopt solar. With these policies and this financing model, the solar industry grew dramatically. Here we see how federal and state laws can interact in ways that are hard to predict in advance. When the federal policy was set to expire in 2015, the now much larger solar industry successfully lobbied for a long-term extension of the ITC through 2021. In other words, these laws kicked off policy feedback.

The financial crisis also opened a policy window for wind energy developers. While the federal tax credits were useful, they required projects to pay the full costs of the project upfront and to find tax liabilities. By contrast, a government grant would provide developers with easier to access capital. The American Recovery and Reinvestment Act of 2009 created a new policy: the 1603 grant, which lasted until 2012 (Aldy et al. 2018). If developers chose the 1603 grant option in lieu of the ITC, they received a cash payment of 30% of their investment costs. The program helped to propel 100,000 projects, of which 98% were solar projects. Still, given wind energy's higher capital costs, half of the program's expenditures were spent on wind projects. The total government investment through this program was $26 billion. Given California's aggressive focus on clean energy during this period, it benefited the most from these grants.[47]

Once these state and federal incentives were in place, solar and wind projects expanded significantly. By 2007, there was a new solar installation every hour.[48] State RPS policies combined with federal incentives spurred large growth in wind projects. Consequently, the price for both solar and wind came down throughout the 2000s as a result of innovation and learning (Arrow 1962; Fri 2003; Nemet 2009). This innovation occurred not just because of US deployment but also because of significant investments made around the world,

especially in Germany, Spain, Italy, and China (Candelise et al. 2010; Nemet 2006; Reichelstein & Yorston 2013). By 2014, investments in other countries had brought down costs for solar and wind projects in US states, making some projects competitive with fossil fuels (International Renewable Energy Agency 2015). Finally, clean energy could start to compete financially.

But just as the economics began to make sense, opposition against renewable energy policy mounted. Utilities and other fossil fuel companies began attacking RPS policies, believing these laws would limit their ability to make profits off of their existing assets. In 2012, ALEC and the Heartland Institute drafted the "Electricity Freedom Act" model bill, and promoted it in legislatures across the country.[49] Koch Industries likely played a role in this model legislation, as many of the organizations participating in this effort had ties to Koch (Leonard 2019). This model bill was introduced in many states, including Ohio. Utilities in that state simultaneously attacked RPS targets and requested subsidies to keep their coal and nuclear plants open. They claimed that renewables were too expensive. In fact, research has shown that inexpensive natural gas is more important to making utilities' other assets unprofitable, for example, driving nuclear offline (Jenkins 2017). But utilities were happy to scapegoat renewables and their government "mandates."

Over time, utilities' opposition to net metering also grew. As consumers began to use state and federal incentives in greater numbers to deploy small-scale solar, pressure began to mount on the electricity rate structure. As a result, distributed solar started to pose a threat to utilities' conventional assets. Customers opting out of receiving electricity from the grid most of the time reduced their payments to the utilities. Utilities went to their regulator to argue that the grid's fixed costs would have to be recuperated from a smaller number of customers. As these remaining customers' rates increased, utilities became fearful that more customers would opt out as well, choosing to produce their own energy and further exacerbating their ability to recuperate their fixed costs. By 2011, this dynamic—termed "the death spiral"—became a major issue at utility conferences (Blackburn et al. 2014; Kassakian & Schmalensee 2011). Utilities increasingly saw net metering as a Trojan horse that would fundamentally challenge the utility model. If individuals and independent power producers owned the electricity system's assets, utilities would lose their monopoly in generation—and the regulated profits that came from it. Compounding these problems, utilities also faced flat or declining sales and aging infrastructure that needed investment.[50]

As a result of these factors, many utilities became hostile toward NEM policies and distributed generation customers. In January 2013, the EEI published a prominent report called *Disruptive Challenges* (Kind 2013). The report noted the rapid decline in the cost of solar photovoltaics—falling 77% in

4 years.[51] Combined with increased utility rates in some parts of the country, by 2013 solar was competitive in around 16% of the US retail electricity market, where prices were 15 ¢/kWh or greater. Of course, the report neglected to note that this rise in utility prices was, largely, utilities' own making. And while tax incentives had been available to corporations for decades, the fact that they were now available for citizens through solar leasing companies threatened utilities. Given these cost declines and the increase in ratepayers' ability to access solar, the report painted a dire picture for monopoly utilities. It was an alarm bell—utilities realized they needed to mount a challenge to renewable energy laws. In late 2013, EEI began working with ALEC to draft a model bill on net metering repeal, innocuously called "Updating Net Metering Policies."[52]

In the interest of their profits, utilities have come to argue that NEM policies are inequitable, leading to cross-subsidization between solar and non-solar customers. Of course, this narrative neglects the fact that the electricity system has long set rates with cross-subsidization in mind, albeit across income groups through "rate tiers" and across sectors through "customer classes" (i.e., residential, commercial, industrial). Nevertheless, utilities commissioned studies that used economic models to demonstrate that solar customers imposed large costs on their neighbors. In response, solar companies—particularly California-based solar leasing companies—argued that they provided valuable services, such as emissions reductions, that were not adequately priced in these studies. They wrote rival reports whose economic models demonstrate that solar photovoltaic's benefits exceed the retail rate. Depending on the politics of the state and the political makeup of the PUC, the utilities' or the solar companies' narratives prevailed. Given these rival reports, in 2016 Congress asked the Department of Energy to review recent studies on net metering. The resulting 2018 report by the ICF found that of the 15 studies conducted since 2014, only three factors were consistently included—avoided energy generation, avoided generation capacity, and avoided transmission capacity.[53] Few studies included environmental benefits from solar, such as the benefit of avoiding carbon pollution.

Over time, attacks on net metering laws have grown considerably. Utilities have asked PUCs for large fixed charges on customers' monthly bills related to net metering: in 2015, there were 61 requests for bill increases, and by 2018 the number rose to 77.[54] Since 2014, around 125 utilities in 34 states have requested fixed charge increases.[55] Overall, a majority of utilities have succeeded in getting at least some of the charges they requested. For example, of the requests PUCs received from investor-owned utilities (IOUs) in 2018, PUCs granted increases about two-thirds of the time.[56]

The dynamic whereby utilities have attempted to place large, monthly charges on NEM customers will be explored further in the Arizona case. But the key point here is that arguments over who should pay for using the grid must be

rooted in a historical understanding of the electricity system. One could argue that utilities received adequate payments to build the grid while the utility consensus dominated regulation. Such an argument could be grounds for making the grid a public asset, an idea that was seriously considered in the wake of the California electricity crisis (Duane 2002). Had such a policy been implemented, a very different political dynamic for distributed generation would likely have emerged across the United States.[57] Similarly, governments could invest in the grid and require that all generators—commercial and retail alike—have access to it. In some ways, Texas undertook just such an investment in transmission starting in 2005. This alternative pathway for the electricity system could ameliorate significant conflict between private utilities and renewable energy, particularly for small-scale distributed generation.

Conclusion

Who sets the rules for our energy system and, through them, the harms our energy system imposes on people and the planet? Throughout most of the twentieth century, it was private, profit-motivated electric utilities and their largely captured regulators. Operating as economic monopolies and providing a fundamental input for the US economy, utilities and other fossil fuel interest groups held a privileged position. They maintained a near monopoly over the policy agenda across the states. Richard Hirsh (1999a) has called this stable regulatory structure the "utility consensus."

But by the 1980s, this consensus began to erode. Economists first critiqued monopoly utilities for failing to provide low prices. Environmentalists added that they were failing to innovate, exacerbating environmental harms, and resisting new regulations. While these attacks have made a dent in private utilities' power, they still exert considerable control over policy. Utilities remain the dominant interest group in electricity policy debates. The rest of this book will show how utilities, across various states, have used their power to rollback clean energy laws and prevent their expansion.

With this history in hand, it should not be surprising that utilities have often won policy battles. Renewable energy advocates are small, fledgling actors compared to these large private utilities receiving guaranteed profits from the state. In 2017, the private utilities' association, EEI, had operating revenues totaling $364 million. That was 17 times and 50 times higher than the wind and solar energy associations' revenue, respectively.[58] In policy feedback, the deck is not evenly stacked for new advocates compared to incumbent opponents. Or as historian Thomas Hughes (1969) put it, once an existing technological system has momentum, it becomes more difficult to change.

Although this analysis places significant blame on utilities for resisting clean energy policies and technologies, regulators also hold responsibility for their failure to address climate change. Public Utility Commissions, like the utilities themselves, resisted changing their operations—whether to accommodate renewables or increase competition. Thus, it is not economics alone that has driven decisions in this sector but also politics. As Paul Sabin, an energy historian put it,

> The supply and demand of energy—the price of energy—has a deeply political history. . . . The rhetoric of price shares the common assumption that cost is a meaningful independent variable, which we can calculate easily and compare. In this capitalist ideal, a free market determines prices, except when government intervenes through regulation or subsidies. But . . . the free market, supposedly independent of government interference, is a mythical concept that we should have discarded long ago. (Sabin, 2005, xiv–xv)

The government has worked with utilities to get us into this mess—where we now have very little time to address the climate crisis. Regulators have advanced narrow goals, including capacity expansion and economic growth, at the expense of innovation, public health, and climate stability. They have a responsibility to change that, and start valuing climate stability and air quality more highly.

Still, whatever little progress we have seen so far in clean energy is a credit to advocates and the government, not electric utilities. Mandating that private utilities generate a portion of the supply from renewables has proven critical to our meager action on climate to date. Yet it is not just private utilities that are a problem. In one-third of states with binding RPS laws, public utilities and cooperative utilities have avoided having to comply, in part because they are not subject to PUC oversight. In two-thirds of states with net metering laws, these same utilities are not required to participate.[59] Overall, private, public and cooperative utilities and made little progress. History shows us that utilities simply would not have switched to renewables on their own. Instead of acting on climate change, private and, to a lesser extent, public utilities, have promoted climate denial and delay from the 1980s onward (Anderson et al. 2017).

With this background on the US electricity system's history and institutions, it is now possible to examine how policy feedback has failed in the electricity sector, looking at specific cases. As was the case with PURPA and federal renewable energy tax incentives, in each state the politics of enacting a clean energy law

have differed from the politics of implementation. While advocates have managed to enact modest clean energy laws in many states, these laws have not fundamentally restructured utilities and other fossil fuel companies' power. Instead, these organizations have used their privileged position to rollback clean energy laws, delaying progress on addressing the climate crisis.