Implementing Electricity Restructuring: Policies, Potholes, and Prospects

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Abstract

Electricity is one of the last U.S. industries in which competition is replacing regulation. We briefly review the technology for producing and delivering power, the history of electricity policy, and recent state and international experience. We then outline the major questions facing policymakers as they decide whether, when, and how to implement restructuring. We conclude with some thoughts on the California electricity crisis and other political controversies. Although the California experience has come to define what it means for electricity markets to fail, most of the problems it raised are among those we know how to solve or prevent. The still unresolved make-or-break issue remains whether the cooperation necessary to maintain reliability is compatible with the degree of competition necessary to bring about greater efficiency and lower prices. This paper draws upon our forthcoming book, *Alternating Curents: Electricity Markets and Public Policy.*

Key Words: Electricity restructuring, regulation, deregulation

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I. Introduction

As the 21st century begins, the United States, like many other industrialized nations, is in the midst of a revolution in the electricity business. An industry dominated by monopoly utility companies, regulated from top to bottom by the states and the federal government, is seeing competition and deregulation in the generation and sale of electric power. These changes both facilitate and are facilitated by the wider role that new, independent generators play in this sector. In addition, promoting competition has become associated with rules, regulations, institutions, and in some cases divestitures designed to ensure that the power markets operate efficiently and competitively. For that reason, the process of enacting and implementing laws and policies to bring more competition to electric power markets has come to be known as restructuring.

The promise of electricity restructuring is that a competitive market in power, accompanied by effective regulation of distribution and transmission and appropriate policies to ensure reliability, will lead to a more efficient electricity industry. Generators will have incentives to use the least-cost technologies for producing power, and competition will allow those savings to be passed on to consumers. But ensuring that markets achieve their goals requires attention to make sure that competition works well where it can, and that price regulation promotes efficiency where monopoly is inevitable. In addition, policy can help improve the market's performance by ensuring that the prices people pay reflect those social

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costs (e.g., pollution-related harms) and public benefits (e.g., basic scientific research) that may fall by the wayside.

Although the term *restructuring* may be unique to electricity, the sometimes painful process of undergoing a transformation from regulation to competition is not. Electricity is one of the last of a succession of industries in which market forces have been introduced to take over the duties of choosing product characteristics, determining supplies, and setting prices. Our economy has coped with, and in large degree profited from, similar upheavals in banking, transportation, and telecommunications. Opening markets to competition generally gives firms better incentives to control costs, introduce innovations, and seek new ways to serve consumers. Competition among firms means that the benefits of those efforts get passed down to consumers in terms of better services at lower prices. The hope underlying restructuring is that the $220 billion electricity sector will see benefits comparable to those achieved from opening other industries to the market. We begin by identifying some of the specific benefits that might be expected to follow the introduction of retail competition to electricity markets.

Much of what we learned from the upheavals in banking, transportation, and telecommunications is useful in designing policies for restructuring the electricity industry. But electricity has a unique combination of attributes that present unusual and thorny problems for those charged with expanding competition among power producers. To understand those problems, we offer below some background on the electricity industry. We review the technology for producing and delivering power, the structure of the sector, the history of policy and regulation directed toward it, and recent experience with restructuring both in the United States and internationally. We then briefly outline the major questions facing policymakers as they deal with deciding whether, when, and how to implement restructuring. These matters include industry structure, future regulation, maintaining system integrity and reliability, promoting competition, and protecting the environment.

We continue with some thoughts on current economic and political controversies associated with electricity restructuring. The most prominent is the California electricity crisis of 2000 and 2001. We briefly summarize the events in California following the electricity price spikes in June 2000 and the response of policymakers. Although this situation is still unfolding, we describe several factors that may have contributed to the crisis and present some lessons learned. We also present some thoughts on other political controversies associated with electricity restructuring.

However daunting those problems seem, they are similar to problems that society has already addressed in other contexts. More challenging are the factors that make electricity different. In our view, the primary differences arise from the combination of three characteristics: electricity is crucial to the economy; it is technically exacting, in that supply must equal demand at all times; and it is interrelated, in that one firm's inability to serve its customers can bring down the entire network. Putting these characteristics together suggests that the make-or-break issue in electricity restructuring is whether the effective cooperation necessary to maintain reliability in an interrelated and technically exacting industry is compatible with the sufficient competition necessary to bring about greater efficiency and lower prices. The importance of electricity to the economy means that this make-or-break issue deserves the attention of the public and those elected and appointed to serve it.

II. Benefits of Retail Choice

The push for opening retail electricity markets to competition is premised on the idea that competition offers several advantages over traditional regulation. One advantage is the benefit that competition brings to any market: competitive pressure among power suppliers should lead to a lower price overall for electricity.[1] The pressure would start with competition among incumbents; new firms able to construct generators with more advanced technologies would only increase the downward pressure on prices. Savings from competition were in fact forecast; for example, the U.S. Department of Energy estimated savings of about $20 billion, or about 10% of the nation's electricity bill.[2] The expectation of such savings affected the willingness of states to open their markets: states with higher electricity rates (e.g., California and New York) tended to open electricity markets earlier than others.[3]

A second advantage of opening electricity markets is that competition may reduce distortions in pricing and allocation created by the regulatory system. An example is the apparently favorable treatment given to industrial buyers over residential buyers. Through the late 1990s, industrial customers purchased electricity at a substantial discount relative to

[1] It is important to keep in mind that the price savings would be only on the energy and marketing components of the electricity sector. Electricity transmission and distribution will remain regulated for the foreseeable future.

[2] The U.S. Department of Energy estimates savings of "at least $20 billion" from a $212 billion industry (Comprehensive Electricity Competition Plan, http://www.hr.doe.gov/electric/plan.htm).

[3] Ando and Palmer (1998).

residential users. The price differential in 1999, for example, was almost 50%.[4] Some of this price differential may reflect real cost savings for industrial customers arising from user-specific economies of scale, proximity to high-voltage transmission lines, and a willingness to tolerate power interruptions. Another explanation is that some industrial users might generate their own electricity if they do not receive sufficient discounts.

The differential may also arise from large purchasers' bargaining clout, which may extend to political influence in the regulatory system. Well-organized entities often have advantages over dispersed consumers in influencing regulators to act on their behalf.[5] A large actor can even threaten to move offices and production facilities to another state if the public utility commission does not give it favorable treatment. Opening electricity markets to competition would allow new suppliers to aggregate the purchases of consumers in such a way as to match some of the bargaining advantages held by industrial users.

A final advantage to opening retail markets is that it allows innovative options in the purchase and delivery of electricity.[6] One notable example is the marketing of "green power"—electricity generated in an environmentally friendly way—to consumers willing to pay a premium.[7] A second example is bundling power with capital equipment for heating, air conditioning, and lighting systems into a total package of energy management services for both households and businesses. Through these packages, energy companies can best exploit the potential for reducing the costs through less expensive generation or investment in more energy-efficient devices. Competition among providers of these services would, in principle, create pressure to transfer the savings to consumers. In particular, consumers would gain even if they

[4] In 1999, the average revenue per kilowatt-hour paid by consumers was 8.09 cents; the average revenue from industrial users was 4.27 cents (Energy Information Administration, U.S. Department of Energy, Table 53: Estimated U.S. Electric Utility Average Revenue per Kilowatt-hour to Ultimate Consumers by Sector, Census Division, and State, November 2000 and 1999, http://www.eia.doe.gov/cneaf/electricity/epm/epmt53p1.html).

[5] Standard references for this proposition are Olson (1965), Stigler (1971), and Peltzman (1976).

[6] For a more detailed discussion of these and other benefits of retail competition over wholesale competition, see Bohi and Palmer (1996).

[7] For an instance of policy advocacy of electricity restructuring based on the possibility for green power marketing, see Browner (1999). Whether this option would have a significant impact on the environment remains to be seen. If one consumer is willing to pay for "green" power and another is indifferent, then the former's increase in the use of such power may be matched by a reduction in its use by the latter, resulting in no net protection of the environment. In addition, reliance on green power marketing as an environmental policy tool may not be compatible with justifications for such policies that rely on economic theory (Brennan 2000).

had not calculated how the benefits in reduced electricity expenditures would offset the cost of high-efficiency equipment.[8]

III. Background

A. Industry Characteristics

The electric power industry has several characteristics that complicate the management of restructuring. One is the variety in generation technologies. Electricity is produced using steam generators fired by coal, natural gas, oil, and nuclear power. Other electricity turbines are powered by hot gases produced from burning oil or natural gas. Gravitational power, harnessed through hydroelectric plants, is significant in areas of the country with large rivers. Renewable fuels, such as wind, biomass, solar, and geothermal technologies, are a small but growing part of the electricity portfolio. The contribution of each of these technologies to electricity generation in the United States in 1999 is illustrated in Figure 1.

[8] This possibility is one main reason why opening markets to competition weakens the case for demand-side management policies to subsidize the purchase of high-efficiency appliances and otherwise promote energy conservation (Brennan 1998b).

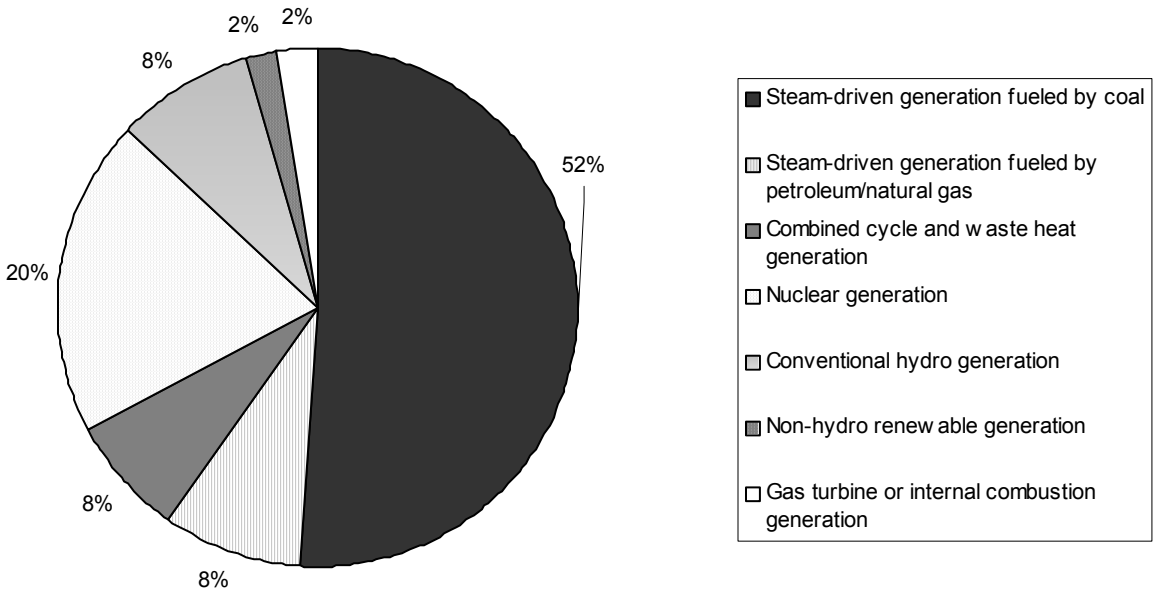

Figure 1. Percentage Shares of Electricity Generation by Technology, 1999.

One reason for the variety in production technologies is geographic. Some generators are near coal mines and railroads; others are near gas pipelines. Hydroelectric power requires large amounts of running water; wind power requires open spaces with the right climate. Other differences are driven by differences in the energy product itself. For the electric power grid to operate, electricity has to be produced continuously to meet consumption levels. Some plants can and should always be running to provide the "baseload" amount of electricity used more or less all the time. Other plants are needed during foreseeable peak periods, whether the variation is seasonal (e.g., demand for air conditioning in summer) or related to the time of day (e.g., business hours versus late at night). Yet other plants need to be available, with different degrees of notice, to adjust supply incrementally or to come on line quickly in case of unexpected surges in demand or plant failure. Some technologies can be brought into service more quickly than others to meet unexpected needs.

Different generation technologies are suitable for different kinds of demand. Plants with high fixed costs and low operating costs tend to be more useful for meeting baseload demand, whereas plants with lower capital cost-to-operation ratios are better suited to meeting peak

demand (Crew and Kleindorfer 1986). A plant designed to power air conditioners during the hottest 80 hours of the year has to recover its capital cost in just 1% of the hours of the year, a hundred times more quickly than a baseload plant.

An increasingly important factor in the choice of technologies for generating electricity involves pollution regulation. Any plant that burns fossil fuel emits carbon dioxide (CO_2), a currently unregulated but important contributor to global warming. These plants also may produce significant amounts of nitrogen oxide compounds (NO_x). Coal plants, particularly those that use high-sulfur coal, emit significant amounts of sulfur dioxide (SO_2).[9] Nuclear plants produce none of these emissions but raise concerns about the disposal of spent radioactive fuel and the fate of the plants themselves, which become radioactive with use. Hydroelectric power, nominally clean, creates concerns about fish spawning routes and flooding of land behind dams. The form and stringency of regulations to address these environmental problems affect the mix of technologies used to generate electricity.[10]

Accompanying the variety in generation technology is variety of organizational forms. Before efforts to open power markets, the electricity industry was composed primarily of investor-owned utilities (IOUs) that were vertically integrated, from electricity generation through long-distance transmission to final distribution and sale. Roughly three-quarters of the electricity in the United States was supplied by IOUs. The remainder reached end users through distribution systems owned by government entities (referred to as public power, municipally owned systems, or "munis") or on a cooperative basis by the customers themselves. Public power companies and co-ops—especially the latter—are found primarily in rural areas; notable exceptions include the Los Angeles Department of Power and Water and the Sacramento Municipal Utility District system. Public power systems may produce their own electricity or obtain it from other sources. They have priority over obtaining power from federally owned electricity producers, the largest of which are the Tennessee Valley Authority and the Bonneville Power Authority in the Pacific Northwest.

[9] For a review of these environmental effects, see Brennan et al. (1996, 112–14).

[10] For some analysis of how environmental regulations of electricity generators can affect technology choice for investment and operation in the sector, see Burtraw et al. (2001a and 2001b).

B. History of Restructuring [11]

Domestic Developments

For most of its history, the electricity industry has been regulated by the federal and state governments. The traditional dividing line between federal and state jurisdiction is that the former controls the "wholesale" side of the electricity industry and the latter controls the "retail" side. Wholesale generally refers to the production, delivery, and sale of electricity to the distribution utilities; retail refers to the prices that residential, commercial, and industrial customers actually pay for power. Because most utilities were vertically integrated from generation through transmission to distribution and sale to final users, the practical consequence was that for the most part, state public utility commissions set electricity rates.

The story became more complicated when the federal government acted to open the wholesale market to nonutility independent power producers. This opening began in 1978 with passage of the Public Utility Regulatory Policies Act (PURPA). In response to concerns regarding energy supplies in the 1970s, precipitated by the growing environmental movement and oil price shocks driven by the Organization of Petroleum Exporting Countries (and exacerbated by regulations), PURPA required utilities to connect so-called qualifying facilities (QFs) to their transmission grids. QFs were primarily facilities that produced power using renewable fuels or industrial "cogenerators" that produced electricity onsite and could supply electricity for use by others. PURPA also required utilities to purchase power from QFs at the "avoided cost" of additional utility generators; the states could determine how high the avoided cost was and thus how much "outside" power utilities would have to buy.

PURPA's effects were not entirely benign. Its implementation in many states led utilities to sign long-term contracts with renewable power providers at prices that turned out to be considerably in excess of the cost of generating power from conventional facilities. But inadvertently, PURPA also showed that wholesale electricity markets could function if nonutility generators had access to utility-owned transmission facilities and could get their power to

[11] Much of this summary is from Brennan et al. (1996, chapter 2).

buyers.[12] In 1992, Congress passed the Energy Policy Act to extend PURPA's open-access policies to all generators, not only PURPA-defined qualifying facilities. The result of that process was Order 888 from the Federal Energy Regulatory Commission (FERC) in summer 1996, which essentially created wholesale power competition throughout the United States.[13]

In addition to ordering utilities to open their transmission grids to unaffiliated generators, Order 888 requires that the utilities "functionally unbundle" their generation and transmission businesses, to prevent anticompetitive favoritism in granting access to affiliated electricity producers.[14] The form of such unbundling is not specified. It may include anything from separate books of account to outright divestiture. The preferred form of organization has been the independent system operator (ISO), in which utilities continue to own transmission facilities but cede operational authority to an independent board. Order 888 includes desirable rules for ISOs, and FERC retains authority to approve or disapprove the specific procedures ISOs choose, but it does not mandate ISOs.

Because it considered the development of ISOs too slow and narrow, FERC issued its Order 2000 concerning regional transmission organizations (RTOs), a variation on the ISO theme.[15] Each utility that owns an interstate transmission facility was required to propose or

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[12] Literally, the power produced by a particular generator does not go to that generator's customer. More precisely, if a generator sells N kilowatts of power to its customer, it is committing to inject N kilowatts of electricity into the overall electricity system at the same time that the customers are taking N kilowatts out. It is as if Starbucks sold M cups of coffee by dumping M cups into a common vat, from which its customers had the right to pour M cups of coffee.

The precise description of the market has two notable consequences. The first is that the opportunities to differentiate one's electricity product itself are limited. One cannot sell "higher power" electricity or current that alternates at a different speed. Thus, opportunities to differentiate the product have to be based on other factors, such as how the power is generated (e.g., renewable versus fossil fuel) or whether it is provided in conjunction with capital equipment.

A second consequence is that the distinction between the central system (the grid) and the power pooled within it can become blurry. If coffee were sold as suggested in the Starbucks scenario, the owner of the vat might seek to become involved in the wholesale purchase and retail sale of the coffee in it. This blurriness could be especially pronounced if the vat owner became responsible for the quality of the coffee supplied—that is, making sure that the caffeine jolt was "reliable." We discuss below how these considerations have affected and may continue to affect the development and feasibility of competition in electricity markets.

[13] At the same time, FERC issued Order 889, requiring utilities to institute an Open Access Same-Time Information System (OASIS) so that generation companies would have up-to-the-minute information on transmission line prices and availability.

[14] See n. 8 *supra* and accompanying text.

participate in an RTO, or explain why it would do neither, by January 15, 2001. In July 2001, FERC expressed an intention to collect the transmission facilities under its jurisdiction into four RTOs covering virtually the entire continental United States, reflecting the regional nature of wholesale electricity markets.[16]

FERC's initiatives in the past five years speak only to wholesale markets, in which generation companies compete to sell electricity to firms that resell to final customers. The decisions whether, when, and how to extend competition to electricity sales to those final consumers—that is, to let households, businesses, and factories choose their power suppliers—fall to those with authority over retail electricity markets: the states. As of late 2001, about 16 states (shown in dark gray) were actively engaged in or pursuing electricity competition. In addition, seven states (shown in light gray) that had previously decided to implement competition have decided to delay implementation. California has suspended retail competition for the indefinite future.

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[15] FERC, Regional Transmission Organizations, Order 2000 (January 6, 2000), http://www.ferc.fed.us/news1/rules/pages/order2000.htm.

[16] FERC, Regional Transmission Organizations, Order Initiating Mediation, Docket No. RT01-99-000 (July 12, 2001), concurring statement of Commissioner Massey at 4, http://www.ferc.gov/Electric/RTO/rto/issuance/rt01-99-000july.pdf. Note that Texas has a self-contained transmission grid, which is regulated by the state and not by FERC.

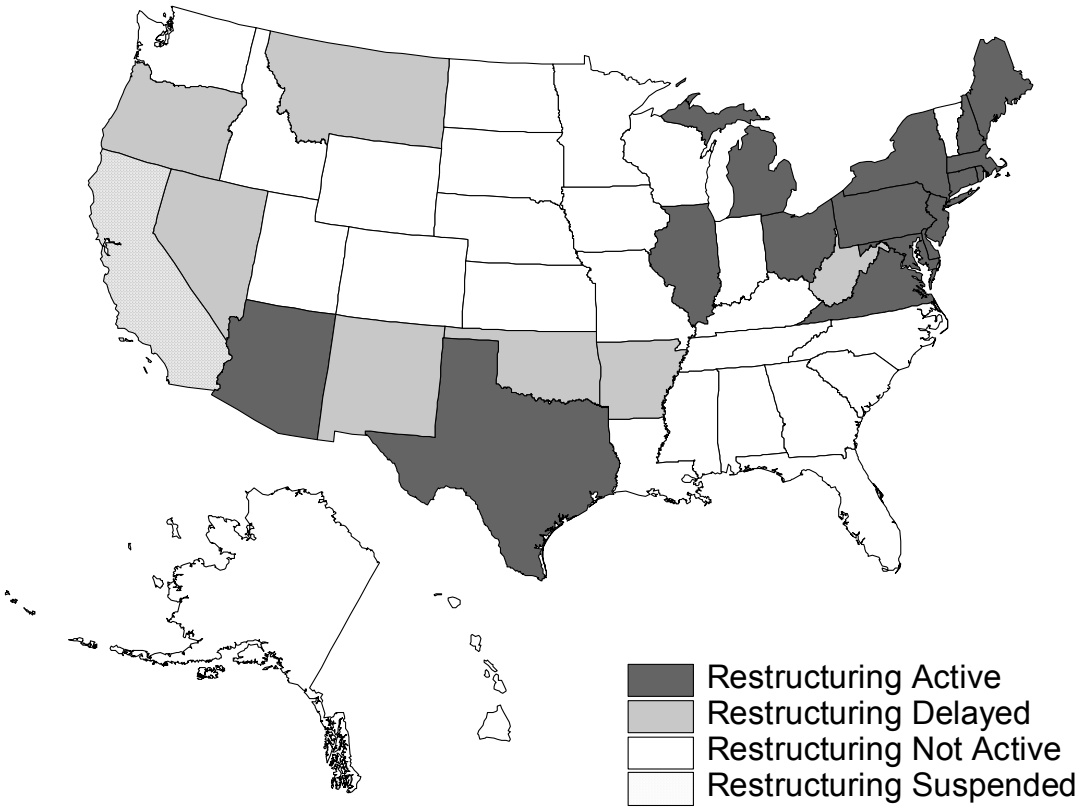

Figure 2. State Deregulatory Efforts (DOE).[17]

International Developments

The United States is not the first country in which electricity competition is being attempted. Important initiatives have taken place in several other countries, including Chile, New Zealand, Australia, Norway, Sweden, and the United Kingdom.

One important distinction between restructuring in the United States and electricity market reforms abroad is the starting point for these reforms. In the United States, most of the electricity has historically been supplied by government-regulated IOUs. Elsewhere, most electric utilities have been government owned and operated. Reforms currently underway

[17] Energy Information Administration, U.S. Department of Energy (November 1, 2001), http://www.eia.doe.gov/cneaf/electricity/chg_str/regmap.html.

involve not only a move from regulation to competition but also, in most cases, a move from public to private ownership. How to transfer assets (and which assets to transfer) to private ownership, whether to privatize transmission and distribution, and how many generating plants to offer up in a package can have important implications for the performance of the restructured market.

Countries have adopted different approaches to restructuring and have experienced different results. Australia, for example, set up a centralized spot market to handle all sales of electricity; New Zealand is relying almost completely on decentralized bilateral markets. When it initiated restructuring in the early 1990s, the United Kingdom set up a centralized spot market, known as the Pool, to handle all electricity trades, but recently the Pool was abandoned for all electricity transactions except those that take place in real time to balance electricity supply and demand. This change was made in part to address concerns about the manipulation of the electricity spot market by large generators during peak periods and the role of the centralized market in making that possible.[18] U.K. prices are roughly 20% higher than before the markets were opened.[19] In other countries, however, opening markets has brought falling energy prices.[20] In anticipation that competition will produce favorable results in the rest of Europe, the European Commission is proposing that all consumers in the European Union be able to choose their power supplier by 2005.[21]

IV. Eleven Leading Issues

Knowing something about generation and delivery technology, regulatory history, and recent restructuring experience allows us to provide some answers to the most compelling questions facing electricity policymakers today.

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[18] For an alternative view of the problems in the U.K. market and how they compare with problems in California, see Green (2001).

[19] Competition Commission, AES and British Energy: A Report on References Made under Section 12 of the Electricity Act 1989 (2001): 126, http://www.ofgem.gov.uk/docs2001/compcommp2.pdf (chapter 7, The England and Wales Wholesale Electricity Market); http://www.ofgem.gov.uk/docs2001/compcommp1.pdf (introduction to the report).

[20] For the experience in Norway, see Statistics Norway, Electric Energy Prices, 4th quarter 2000, http://www.ssb.no/english/subjects/10/08/10/elkraftpris_en/.

[21] See http://europa.eu.int/rapid/start/cgi/guesten.ksh?p_action.gettxt=gt&doc=IP/01/356|0|RAPID&lg=EN.

1. How—and why—do we draw a line between regulated and competitive sectors of the electricity industry?

In many industries where we have elected to replace regulation with competition, such as trucking or banking, we have been able to free most of the industry from continued regulatory oversight. But in some sectors—telecommunications, for example—the process of deregulation has been only partial, with continued regulation of some segments. If we could just deregulate and walk away, the policy task would be much simpler.

In the electricity industry, only the generation and marketing sectors are ripe for deregulation. In those sectors, scale economies appear sufficiently small relative to the size of the market to allow multiple vendors to compete.[22] The same cannot be said of the wires sectors—that is, local distribution and long-distance transmission. Local distribution is a monopoly service largely because one set of lines, poles, and conduits is sufficient to supply electricity to consumers. It would be wasteful for another provider to install its own distribution grid over the existing one.

Transmission is also a monopoly because of the interconnected nature of the transmission grid and the high cost of routing electricity across specific lines. Those facts mean that electricity essentially takes all uncongested paths from where it is generated to where it is used. Consequently, one utility's ability to transmit electricity depends on the capacity of lines owned by others. The grid in practice acts as a single productive facility, even if parts of it are nominally owned and operated by separate utilities.

Until "distributed generation"—that is, the ability of consumers to meet their power needs by producing electricity on their premises—becomes more economical, local distribution and long-distance transmission are likely to be regulated for the foreseeable future.

2. Should the same companies own and control both regulated "wires" and competitive generation?

Electricity is not the first deregulated industry to be split into regulated and competitive sectors. In the telecommunications industry, all prices were formerly regulated; then, markets for telephone equipment and long distance service were opened but local telephone service was,

[22] Whether this is in fact true when demand is high relative to capacity in the market is a question we consider below.

until very recently, treated as a regulated monopoly. Our experience with that sector indicated that letting a regulated monopoly operate in unregulated markets could subvert competition. The regulated firm might favor one customer or make its customers bear the costs of its competitive ventures. Ultimately, such situations led in 1984 to the draconian solution of keeping most regulated local telephone companies out of the long-distance business, a restriction that has begun to change only since the Telecommunications Act of 1996.

In electricity, state and federal policymakers must wrestle with similar questions. Should regulated "wire" monopolies be prevented from owning generation facilities? Can other operational institutions and rules ensure that transmission and distribution monopolies promote competition without forcing utilities to divest all their generators?

The widespread use of the term *restructurin*g to describe the introduction of competition into the electricity industry illustrates just how fundamental the concerns are. FERC's promoting of ISOs and RTOs shows its interest in addressing those issues, although it has yet to order utilities to form such organizations. However, numerous states implementing retail competition plans have ordered their utilities to spin off generation, partly to separate generation from transmission and distribution, and partly to promote competition between generation companies, as noted below

3. Since we have to regulate prices for the "wires," how do we set their rates?

Prior to restructuring, most regulatory effort was devoted to setting the electricity rates that users pay. With restructuring, power prices will be set by the market, and prices will directly or indirectly include the power prices plus the regulated charges for delivering electricity from the generator to the customer. Methods for setting rates for transmission and distribution include both traditional "rate-of-return" regulation and new "incentive-based" methods that could lead to lower costs and more efficient operation.

Although the two methods apply to both distribution and transmission, the latter presents difficult problems. A generator may have to go through lines owned by several utilities in multiple states. Consequently, policymakers have to consider whether transmission prices should be set by broad geographic regions and be independent of distance, or include charges that increase with distance or the number of times the path crosses a state line or uses a different utility's facilities. Absent congestion, and apart from energy losses borne by the generators, the marginal cost of using a transmission grid is virtually zero. Rates might nonetheless be based on distance to provide some appropriate incentives about where to locate new generating plants.

When lines are congested, theory suggests route-based or "nodal" pricing, reflecting complexities related to the physical laws that determine how electricity flows over multiple interconnected paths from generator to customer. If transmission providers keep congestion rents, they have incentives not to expand lines. Transferring rents away (e.g., to generators through markets in "congestion rights") may leave ISOs or transmission companies with insufficient funds or incentive to expand.

4. How do we keep electricity markets competitive?

The belief that opening retail markets will lead to lower prices and better service for households, offices, and industrial users is predicated on the belief that electricity generation markets will be competitive. Such markets may fail to be competitive if only one or a small number of firms supply power to a particular area, or if the power producers agree among themselves not to compete. As we observe an industry in flux, with numerous mergers, divestitures, entrants, and volatile prices, how to ensure competition becomes an ever more pressing question.

The antitrust laws are the main legal devices in the United States for keeping markets competitive. But those laws were not designed to control markets like electric power, where monopolies arose as a matter of prior regulation. A first policy step to promote competition, already implemented in some states, could be to require divestiture of power plants to increase the number of independent competitors.

One concern, presented by the California electricity crisis, is that generators may unilaterally find it profitable to withhold output in order to raise prices, even when the markets appear competitive by conventional structural indicators. Such concerns have been behind calls for temporary federal caps on wholesale prices. As we note below, however, evidence supporting assertions of market power needs to be interpreted with care, and wholesale price caps, particularly during peak periods, could become a permanent feature of "deregulated" wholesale electricity markets.

Mergers among some former competitors could enable the merged firms to raise prices on their own, facilitate collusion among all the competitors, or make competition less intense. Deciding whether to block a merger requires understanding who competes with whom, how competitive the market might be, and who might enter if the price goes up. Fluctuations in short- and long-term demand across locations coupled with the physical characteristics of the electricity grid complicate evaluations of proposed mergers in electricity. In some cases, mergers between a

generation company and a gas supplier could cause problems if the gas company is a primary supplier to that generation company's competitors. Finally, while the industry is in transition, merger evaluation could be so speculative that antitrust authorities may be unable to prove that a merger may be harmful.

5. Who should be responsible for keeping loads balanced and dispatching power?

With electricity, unlike virtually every other commodity, disaster can strike unless producers supply exactly the amount that people want to buy at any given time. A first question is whether each generation company should be responsible for keeping its own power supply in balance with its own customers' desires. Since failure to meet power demands causes a breakdown of the system as a whole, and not just a blackout to that company's customers, letting the market take care of it may not suffice. Generators may need to meet standards for maintaining power and having reserves available, or they may need to be held liable when their inability to meet demand brings down the larger grid. If those standards prove inadequate, distribution and transmission companies may need to take on the responsibility of providing ancillary services and holding power in reserve.

Involving grid operators in the business of maintaining loads has led many states and regions to involve them in the overall management of power markets, through taking bids from producers and users and dispatching generators as needed. Examples include the PJM independent system operator in the mid-Atlantic states and the New England and New York ISOs. The grid need not be involved in this aspect of controlling generation costs; the electricity market, like any other, can handle that through letting generators compete for customers. But whether such a market is compatible with keeping loads balanced and systems secure is perhaps the crucial question facing electricity policymakers. We return to this issue below.

6. As utilities compete, how can we ensure reliability?

The U.S. electric power system has had a strong record of uninterrupted service made possible through the cooperative efforts of the utilities linked on its three major transmission grids. Since the establishment of the North American Electric Reliability Council and its regional affiliates in 1968, electric utilities throughout Canada and the United States have worked together to establish and implement voluntary operating rules and procedures to keep power flowing continually throughout the region. As the electric power industry becomes more competitive, this voluntary approach to ensuring reliable service is threatened at the same time that the transmission system is facing greater stress from more intensive use.

Restructuring poses challenges for the reliability of both the distribution system and the bulk power transmission system. The threats to its integrity and the consequences of failure are greater for the transmission system than for a local distribution grid. To maintain the security of the bulk power transmission system, power control area operators and security coordinators may need to interfere with the commercial transactions on the electricity grid. Distinguishing an action taken to protect system security from an action taken for other reasons, perhaps anticompetitive ones, may be difficult.

Given the potential threats to reliability posed by electricity restructuring, legislators and energy regulators should develop a strategy for protecting system reliability as they design and implement policies that set the course for electricity markets in the future. Such a strategy is likely to include expanding the role of industry reliability councils, regional transmission organizations, and federal regulators in overseeing reliability, and using incentives to promote efficient use of the transmission and distribution systems.

7. Should the states or the federal government set the course of retail electricity competition?

So far, state governments have been the key actors in developing and implementing policies to encourage retail electricity competition. A policy question has been whether states are acting quickly enough, or whether the federal government should step in to encourage or force them to open markets by a particular time.[23]

Keeping control with the states allows the nation as a whole to learn from what works (and what doesn't). One size may not fit all, and the benefits of opening markets may be considerably greater in some states than others. Indeed, in other countries with federal governments, including Canada and Australia, electricity restructuring was initially delegated handled at the provincial or state level.[24] In addition, imposing a federal solution would require

[23] The Clinton administration's Comprehensive Electricity Competition Plan would have forced states to either open electricity markets by January 2003 or formally "opt out" through some sort of public proceeding. For a summary and evaluation, see Brennan (1998a). A version of this plan was introduced by Senator Murkowski as the Comprehensive Electricity Competition Act (S. 1047) in 1999. It did not pass.

[24] In Australia, a national wholesale market was subsequently established beginning in 1997 with the harmonization of the Victorian and combined New South Wales–Australian Capital Territory wholesale electricity markets (Industry Science Resources 2001).

amending or reversing the delicately balanced solutions achieved by states that are already opening their retail markets.

However, a presumption that state actions reflect a proper balance of interests is less convincing when that state's decisions have effects that go beyond its boundaries. When interstate effects are significant, the federal government can help improve policies by serving as a venue where each affected party has a say. Specific areas in which the federal government can play an effective role include reforming federal laws that may inhibit competition, regulating interstate transmission grid prices and operation, ensuring market liquidity, enforcing antitrust and environmental laws, and coordinating commercial standards and practices. Also, states themselves may be able to negotiate solutions and set up regional authorities to manage issues that affect an entire region but not the nation as a whole.

8. What should be the role of public power after restructuring?

Unlike most of the other industries that have made the transition from regulation to competition, the electricity sector has a substantial nonprofit component. Roughly 25% of all retail electricity sales in the United States comes from publicly or cooperatively owned utilities. The combination of privately and publicly owned utilities (at local, state, and federal levels of government) operating under different objectives and rules greatly complicates the task of restructuring this industry.

The debate over bringing competition to electricity generation and retail sales markets has highlighted several differences between publicly and cooperatively owned utilities and investor-owned utilities. These differences can be categorized into three types:

- *Financial.* The privileges granted to public utilities and cooperatives include preferential access to low-cost hydroelectric power produced at federally owned facilities, the ability to issue tax-exempt debt, and exemption from income tax payments.
- *Regulatory.* Differences include limits on the ability of publicly and cooperatively owned utilities to participate in the operation and governance of ISOs and RTOs.
- *Purpose.* Many federally owned hydroelectric facilities have multiple purposes, such as flood or navigational control, in addition to electricity production.

How public power will evolve in this era of competition remains an open question to be decided at different levels of government. Policymakers need to address the above differences as

they seek to promote competition and efficiency. The federal government will be responsible for redefining roles for the federal power marketing authorities and for the Tennessee Valley Authority. Decisions about whether municipal utilities or rural cooperatives will continue to hold an exclusive franchise for retail electricity sales are best made at the local level.

9. Will it cost utilities to adapt to competition, and if so, who should pay?

Prior to the California electricity crisis, perhaps the most controversial issue associated with opening electricity markets to competition was whether and how to compensate utilities for capital expenses they incurred during the regulatory era. If competition brings about lower prices, as its advocates hope, utilities fear that they may not make enough money to recover some costs—hence that these costs would be stranded. The primary sources of stranded costs, once estimated at more than $135 billion, are associated with nuclear power plants and long-term contracts to purchase renewable and cogenerated power under PURPA.[25]

Utility advocates argue that a "regulatory compact" implicitly guaranteed cost recovery as part of the utilities' obligations to provide service. Those opposed to stranded cost recovery allege that utilities should not be rewarded for unwise investments, and that forcing consumers to pay for stranded costs will thwart the objective of reducing electricity rates. In principle, the resolution should turn on a determination of whether regulators or utilities were in the better position to foresee restructuring, and which of them were better able to adapt to the prospect of competition.

As a practical matter, stranded cost recovery has generally been part of the package necessary to build sufficient political support to open retail markets. In addition, the federal government supports stranded cost recovery—perhaps not incidentally because the federal government is itself exposed by virtue of its ownership of electricity generation in the Tennessee Valley and Pacific Northwest. Surcharges on electricity purchases used to recover stranded costs should preserve competitive neutrality—that is, the recovery mechanism should not create artificial cost advantages for either incumbent utilities or new merchant generators. Designing such a recovery system may be easier said than done.

[25] For a more extensive discussion of the economic issues associated with stranded cost recovery and the interpretation of incomplete contracts between regulators and utilities, see Brennan and Boyd (1997).

10. What are the implications of restructuring for environmental protection?

Electricity generation is a major source of air pollution in the United States. Electricity generators that burn fossil fuels contribute substantially to urban ozone and other pollution problems in U.S. cities, to acid rain in the Northeast, and to regional haze and visibility problems in some rural areas. They also contribute to the buildup of greenhouse gases in the earth's atmosphere, and thus ignite concerns about global warming. Generators that burn coal, fuel oil, or municipal solid waste emit mercury, exposure to which has been linked to neurobehavioral dysfunction.

The contribution of electricity generation to emissions of specific pollutants is illustrated in Figure 3.

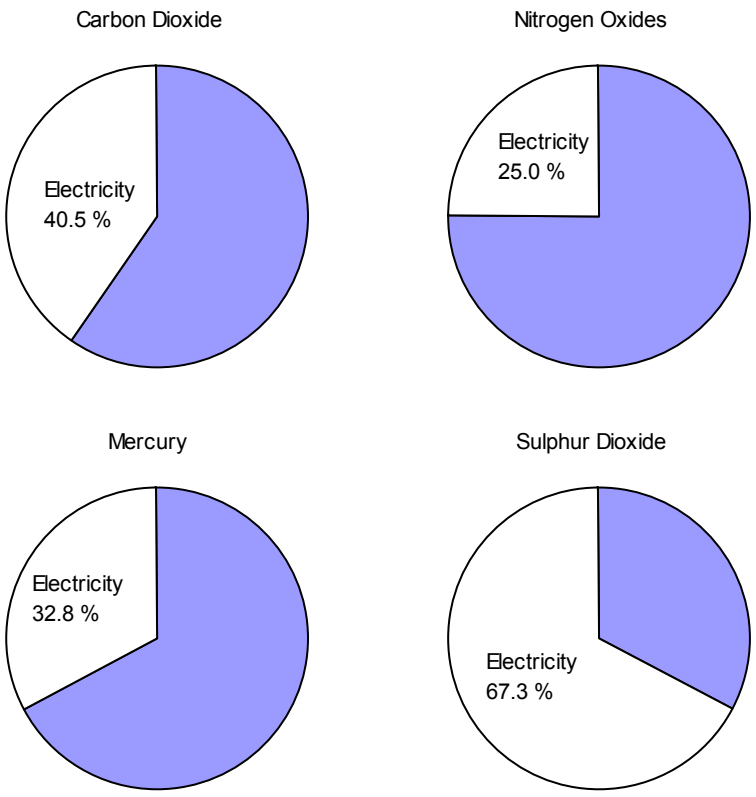

Figure 3. Electricity Industry Share of Total Emissions of Four Pollutants in 1998.

In the midst of searching for new ways to reduce air pollution in general, environmental regulators and other policymakers are eager to understand how increased competition in electricity markets is likely to affect the size of that sector's contribution to different air pollution problems. The effect of electricity restructuring on the amount of air pollution emitted by electricity generators will depend on the amount of electricity produced and the mix of technologies used to produce it, along with the form of existing environmental regulations governing electricity generators. If prices fall and demand increases, emissions will rise, *ceteris paribus.* If competition leads to greater use of older generators that face fewer pollution restrictions, emissions will again rise. On the other hand, if restructuring encourages investment in new, cleaner generators, emissions will fall. If total emissions are capped, as they are for SO_2, restructuring will have no effect on emissions.

Prior research suggests that competition could lead to greater emissions of pollutants not subject to strict caps, such as carbon dioxide, unless additional policies make the use of renewables and other low-emitting technologies more attractive (Palmer 1997; Palmer 2001; Burtraw et al. 2001). Opening electricity markets is also likely to affect the performance of environmental regulation. Competition will likely limit voluntary actions to reduce emissions. At the same time it will enhance incentives for electricity generators to take advantage of emissions trading.

11. What happens to utility-funded "public benefit" programs in a competitive electricity market?

Regulated electric utilities have historically performed several public service functions in addition to selling electricity. These include energy conservation (demand-side management, or DSM) programs, industry-wide research and development (R&D) of more efficient generating technologies, support for renewable generating technologies, and subsidies for low-income consumers. All of these programs existed because regulators have, for the most part, allowed the regulated utility to recover the costs in the prices that it charged.

In the newly competitive environment, utilities face greater pressures to reduce costs and are therefore reducing discretionary spending on activities that don't contribute directly to profits. At the same time, competition brings with it important changes in the incentives facing electricity suppliers and consumers that could eliminate or reduce the need for certain public

purpose programs.[26] For example, competition is expected to lead to more time-of-day pricing of electricity and a closer association between electricity prices and marginal costs, thereby reducing the need for DSM programs to encourage efficiency-enhancing energy conservation. Competition could bring more consumer awareness and understanding of the value of the savings associated with energy efficiency investments—the lack of which has long justified utility support. Restructuring could also result in more R&D into process innovations and new products that promise higher returns to competitive firms; but it might also discourage research that benefits the public and thus justify public R&D programs. The other public purpose programs, such as low-income support, remain largely unaffected by restructuring, although the number of households in need of assistance could be smaller if restructuring significantly lowers electricity prices.

Restructuring will also require change in the funding for some public purpose programs to make them feasible and competitively neutral.[27] The most common funding mechanism that states have used is the nonbypassable wires charge levied on all retail electricity customers who take electricity off the distribution system. Tying the funding mechanism to a regulated service that even self-generators must use for backup power makes it virtually impossible to bypass, unlike mechanisms that tie funding to sales of electric power by utilities but not by their competitors. Another mechanism being adopted in some regions to promote renewables use is a renewable portfolio standard (RPS), a standard that specifies the minimum percentage of all electricity generated (or sold) within a region that must come from renewable sources. The RPS can be combined with a system of tradable renewable generation credits allowing the market to identify the least-cost way to satisfy the renewable obligation.

[26] For a more complete discussion about the role of utility DSM programs in a competitive electricity market, see Brennan (1998b).

[27] For an in-depth discussion about the role of public purpose programs in a restructured electricity market, see Fox-Penner (1997).

V. The California Crisis[28]

A. What Happened

Electricity restructuring in California began in April 1998. California Assembly Bill 1890, the law that opened entry into retail markets, established two new institutions: an ISO to manage the California transmission system and procure power as needed to maintain load balances in real time, and an independent Power Exchange (PX) in which most power would be traded. The legislation also established a nonbypassable transition charge that would allow incumbent utilities to recover stranded costs. Retail prices charged to electricity consumers were capped until the incumbent distribution utility collected sufficient revenue to recover its stranded costs, at which point retail prices would be completely unregulated.

For about the first two years, restructuring worked well from the standpoints of prices and reliability. Figure 4 indicates that until June 2000, electricity prices in California remained fairly low. Wholesale prices ranged roughly between 1 cent and 3.5 cents per kilowatt-hour off-peak, and peak prices were roughly a penny higher.

[28] This discussion is taken largely from Brennan (2001).

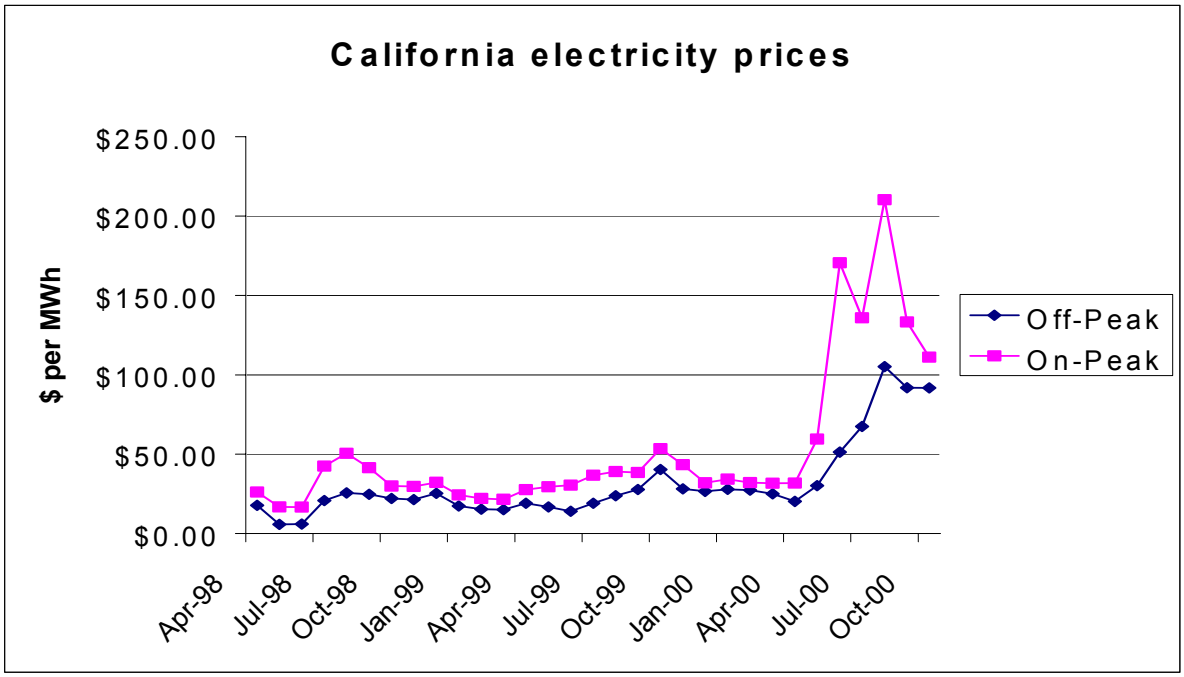

Figure 4.California Wholesale Electricity Prices, April 1998–October 2000.

A similar sense of the performance of the market can be gleaned from looking at the number of times reserves were declared to be precariously low, referred to by the California ISO as "staged emergencies." Figure 5 shows that before summer 2000, such emergencies were virtually nonexistent; they occurred only during summer months, and the most declared in any one month was three. At no time during that period did blackouts related to systemic imbalances occur.

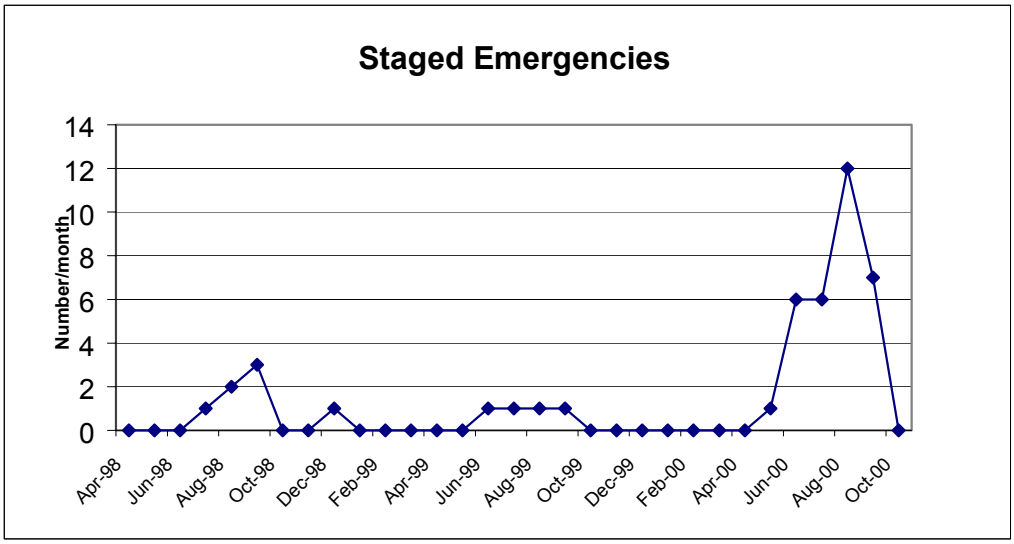

Figure 5. Staged Emergencies in California, April 1998–October 2000.

As the figures show, the turn for the worse began around June 2000. Peak and off-peak wholesale prices began to spike to levels nearly ten times those reached during the previous two years. Because San Diego Gas and Electric Company's retail rates had been deregulated, these wholesale prices prompted reports of a near tripling of retail electric bills compared with summer 1999, leading to reregulation in September 2000, retroactive to the previous summer. Then came a threat of blackouts throughout the state.

While wholesale electricity prices ballooned, retail price ceilings on the IOUs left the utilities unable to cover their expenses, and by fall the deficit exceeded $14 billion. As the utilities teetered closer to bankruptcy, power producers became less willing to sell them electricity. Prices in winter 2001 continued at levels about ten times the 1999 average, even though winter is typically an off-peak season for electricity demand in California.

Alerts became much more frequent, with increasing power interruptions and some rolling blackouts in northern California. Citing a FERC order forcing it to "implement a $150 breakpoint" that, apparently, was below the price at which generators were willing to offer power, the California PX suspended operation on January 31, 2001.[29] Within two weeks, a

[29] California Power Exchange press release, CalPX to Suspend Day-Ahead, Day-of-Market Operations, January 30, 2001. On March 9, 2001 the PX filed for Chapter 11 protection under the bankruptcy laws.

federal district judge forced generators to continue to sell power to the utilities, despite the utilities' failure to maintain an "approved credit rating."[30]

B. California and FERC Responses

As the financial status of the distribution utilities worsened, the state government reluctantly began to act. The legislature authorized the state to purchase power, finance plant construction and retrofitting, fund conservation programs, and sell power directly to retail customers.[31] The governor further proposed that the state would apply cost-plus regulation to power supplied by utility-owned plants, and consumers who purchased from those utilities would be unable to switch.[32] To alleviate some of the pressure on the market created by caps on NO_x emissions, California regulators lifted limits, allowing generators to emit NO_x at a price of $7.50 per pound, one-fifth the price to which NO_x emissions allowances had risen during the crisis (Joskow and Kahn 2001a). The California Public Utility Commission decided that to cover the cost of electricity, it would raise power rates, particularly to industrial and commercial customers, by 40% (Lazarus 2001).

California and the federal government, primarily FERC, continued to dispute the degree to which generators had violated federal statutes requiring that wholesale electricity prices be "just and reasonable." In March 2001, FERC found evidence of overcharging during peak demand periods and ordered $69 million in refunds for overcharges during emergency conditions in January 2001.[33] Disagreeing, the California ISO provided studies indicating that prices were high all the time and estimating overcharges during that month of $1.364 billion, almost 20 times FERC's estimate (Hildebrandt 2001). For Pacific Gas and Electric, the utility that serves much of northern California, these responses may have been too little, too late; it filed for Chapter 11 bankruptcy protection on April 6, 2001.

Later in April 2001, FERC issued an order requiring power producers to bid on all available power to the ISO and capped wholesale electricity prices in California during periods

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[30] *California ISO* v. *Reliant Energy et al.*, No. CIV. S-01-238 (E. Dist. California, February 8, 2001). This and related decisions are available at www.caed.us.courts.gov.

[31] AB 1X, passed January 31, 2001.

[32] Transcript of press conference, Governor Gray Davis (February 16, 2001).

[33] Order Directing Sellers to Provide Refunds, *San Diego Gas and Electric Co.* v. *Sellers of Energy,* FERC Docket No. EL00-95-017 (March 9, 2001).

when unused reserve capacity was tight.[34] About two months later, FERC expanded this policy to set caps on wholesale power at all times, throughout all of the western United States rather than just California.[35] When reserves were low, the cap would be based on the cost of the most expensive gas-fired generator; at other times, the cap would be 85% of the price set during the most recent preceding period of low reserves. The price caps are scheduled to remain until September 2002.

While FERC was taking a stronger role in the market, it continued to be embroiled in the dispute regarding the size of refunds due California. Under the auspices of FERC's chief administrative law judge, settlement talks between California and the generators took place in June and July 2001. The talks proved unsuccessful: representatives of the state sought refunds more than ten times what the generators, in the aggregate, were willing to pay.[36]

As summer 2001 began, reliability experts forecast that California might suffer as much as 260 hours of rolling blackouts (NERC 2001). Surprisingly, California got through the summer without a power outage, with August prices falling to $53 per megawatt-hour, about a third to a quarter of levels the preceding year.[37] The ability of the state to avoid serious problems was attributed to a variety of causes. Some of the credit goes to an unusually effective conservation campaign, which reduced electricity consumption in California more than 12% compared with the previous summer (NRDC 2001). Another major contributor was milder-than-expected weather (Kahn 2001). Nevertheless, the state continued to walk away from its deregulation efforts. On September 20, 2001, the California Public Utility Commission voted to end giving electricity consumers the ability to choose their electricity suppliers (Gaudette 2001).

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[34] Order Establishing Prospective Mitigation and Monitoring Plan for the California Wholesale Electricity Markets and Establishing and Investigation of Public Utility Rates in Wholesale Western Electricity Markets, *San Diego Gas and Electric Co.* v. *Sellers of Energy,* Federal Energy Regulatory Commission Docket No. EL00 95-031, issued April 26, 2001, at 10, 14–15, available at http://www.ferc.gov/electric/bulkpower/el00-95-012A.pdf.

35 Order on Rehearing of Marketing and Mitigation Plan for the California Wholesale Electricity Markets, Establishing West-Wide Mitigation, and Establishing Settlement Conference, *San Diego Gas and Electric Co.* v. *Sellers of Energy,* Federal Energy Regulatory Commission Docket No. EL00 95-031, issued July 12, 2001, at 4–7, 24–25, 35–36, 41–42 , available at http://www.ferc.gov/electric/bulkpower/el00-95-031-6-19.PDF.

36 Report and Recommendation of Chief Judge of Record, *San Diego Gas and Electric Co.* v. *Sellers of Energy,* Federal Energy Regulatory Commission Docket No. EL00 95-031, issued July 12, 2001, at 3, available at http://www.ferc.gov/electric/bulkpower/EL00-95-031_7-12-01.pdf.

37 California Power Costs Continue to Tumble in August, Reuters (September 19, 2001), http://biz.yahoo.com/rf/010919/n19218251_1.html.

C. Explanations for the Crisis

Many explanations have been offered for what happened in California. Were it possible to convert explanations into electricity, California's dilemma would disappear. Clearly, no single explanation is sufficient; the blackouts and price spikes were the result of numerous factors. We identify ten potential culprits (listed in no particular order):

- *Supply-and-demand imbalances.* The capacity to produce and deliver electricity to users in California failed to keep up with growth in demand. During the 1990s, demand for electricity in California grew more than 11% while capacity fell slightly. The supply crunch was exacerbated by a lack of rainfall in the western United States, reducing hydroelectric power supplies in summer 2000 to less than 75% of 1999 levels. These factors, combined with the very inelastic demand for power and the inability to store electricity, provided a sure recipe for significant increases in wholesale prices and blackouts.
- *Higher fuel costs.* Prices for power rose because the fuels used to produce it, particularly natural gas, became more expensive. According to FERC, natural gas prices nearly tripled in the western United States during 2000. This fuel price increase, combined with the need to bring particularly inefficient plants on line to meet demand during peak periods, contributed to the increase in electricity prices.
- *Supply-reducing regulations.* Rules restricting the construction of generators and emissions of particular pollutants reduced electricity supplies and raised generation costs. As electricity became more expensive, demand for permits to emit nitrogen oxides in the south coastal region of California rose, allowing those who owned permits to earn scarcity rents. Rules governing power plant siting and requiring emissions offsets may have also inhibited investment in new generators. Some environmental advocates, however, deny that environmental regulations have had much effect on power plant construction and suggest that general regulatory uncertainty may be a bigger factor in inhibiting investment.
- *Wholesale price regulation.* Beginning in December 2000 and continuing until June 2001, FERC issued a series of increasingly stringent price controls. These caps may have helped alleviate a politically undesirable redistribution of wealth from consumers to generators. Limiting or threatening to cap the prices a generator could charge for power, however, can discourage supply. Unwillingness of generators to

abide by caps imposed in December 2000 led in part to the closure of the California Power Exchange in late January 2001.

- *Retail price controls.* Holding down retail prices kept demand high during peak periods and brought distribution utilities to or over the brink of bankruptcy when they had to purchase wholesale power at high prices. Low retail rates also discouraged conservation that might have eased the stress on the power system. Utilities lost billions of dollars when they had to purchase wholesale power at prices five times or more the capped retail rate. The political turmoil associated with the still undetermined question of who will cover the utilities' losses contributed as much as anything to California's crisis.
- *Inframarginal rent transfer.* Competition makes prices, and hence costs, visible to consumers. Under regulation, peak costs were not visible because prices were calculated by averaging them with lower costs in off-peak periods. Moving from regulation to competition implied that when prices began to rise to cover the cost of the "marginal" firm, all suppliers were able to charge that high price, redistributing wealth from consumers to producers. This transfer is politically upsetting, as seen in the uproar over higher retail rates in San Diego during the three months in 2000 when rates were unregulated. The long-term solution is for more plants to come on line, reducing off-peak power prices and bringing revenues during peak periods to a level just sufficient to cover capital costs.
- *Absence of real-time metering* Electricity may cost ten or more times as much to produce on a hot summer afternoon as it costs later the same evening. But standard meters, which tell only how much electricity one uses per month, do not allow time-of-day pricing. This precluded setting power prices high during peak-use periods and thus removed an important incentive to conserve power and reschedule uses for times when electricity was more plentiful (Borenstein 2001).
- *Lack of long-term contracts.* Rules requiring distribution utilities to buy power from the PX discouraged them from insuring against high wholesale prices through long-term contracts. If the dramatic increase in wholesale prices in summer 2000 had not been predicted, the utilities might have been able to obtain favorable long-term supply contracts at reasonably low prices and thus avoided the financial strains of having to buy power in the short-term market. A more salient question may be whether the absence of long-term contracts hurt electricity production. Long-term

contracting for electricity could encourage greater consumption at a lower contract price and discourage conservation.

- *Auction design.* Instituting an auction in which suppliers get the highest bid price may have created incentives to "game" the system. The PX ran an auction in which, for every hour of the day, each generator could specify up to 16 prices and the amounts of electricity it would sell at those prices. The PX would find the price at which the amount generators offered equaled the quantity demanded, and each generator would get the market clearing price for each kilowatt-hour produced. Although it is efficient to give all bidders the market clearing price, the auction structure may have given generators a strategic incentive to bid a little bit of power at a very high price. If the bid for that power is not taken, the generator loses the profits from only a small amount of sales. If the bid is taken, the generator reaps a windfall, receiving that high price on all of its output.
- *Market power.* Through collective action or unilateral conduct, generators may have charged prices substantially above the competitive level. In principle, fixing prices of electricity, a standardized commodity, may be relatively easy. But the sheer number of competitors in the California wholesale market would seem to make collusion difficult. A more likely possibility is that generators unilaterally had the ability and incentive to withhold output and raise prices. Some studies find that electricity prices were above the average variable cost of generating power, but these need to be interpreted with care (Joskow and Kahn 2001a, 2001b). Peak-period prices would normally cover not only variable costs but capital costs as well. Moreover, the prices charged may have been inflated to compensate for the possibility that bankrupt utilities would not be able to pay their bills.

D. Lessons from California

The main question on the minds of observers is whether the situation in California will be repeated elsewhere. Perhaps the most crucial determinant is the overall supply-and-demand situation in each state or region, taking into account generation capacity, fuel prices, and transmission availability on the supply side and population and economic growth on the demand side. These factors may have little to do with restructuring. The California experience does offer some lessons, however, that those charged with implementing retail competition might consider.

Retail Price Controls

A first suggestion would be to lift retail price controls. If there is sufficient concern about retail market power to warrant retail price caps, lest incumbent utilities or their spinoffs dominate retailing and discourage potential competitors, continued regulation should allow pass-through of wholesale prices, particularly during periods of peak demand. If peak-period prices continue to be held below cost by regulation, use nonmarket mechanisms to encourage conservation (e.g., public demand-side management programs directed at peak-use equipment). If peak-period rolling blackouts cannot be restricted to relatively low-valued uses of electricity, consider ways to encourage variable pricing or its equivalent (e.g., subsidized real-time meters and interruptible service contracts).

Market Design

A first step in improving market design would be to remove any regulatory impediments to long-term contracting between retailers and generators. To discourage anticompetitive conduct, opportunities for long-term contracting should be offered first to retailers not affiliated with distribution utilities. If long-term contracting among unaffiliated retailers is not adequate, consider ordering distribution utilities to divest their retail operations to become passive, regulated-wires companies. Such a divestiture could create more than one retail company, to limit the need for retail price controls. A second solution would be minimum bid quantity requirements, to increase the risk associated with bidding in a small amount of power at a very high price.

Given the merits of direct dealing between purchasers and suppliers of electricity, one might want to eliminate central auctions for everything but ancillary services and information provision necessary to maintain system integrity. If such auctions need to be retained, consider requirements that a substantial minimum quantity be bid in at any given price, or that a supplier must bid in all of its output at the same price to prevent gaming.

Peak-Period Pricing

Regulators should consider eliminating impediments to allowing utilities to set power prices on a time-of-day basis. A major reason price spikes are so severe during peak periods is that consumers who pay average power prices will act as though the cost of power is always the same. Time-of-day pricing can lessen the severity of price spikes and encourage conservation by reducing wasteful uses of power during peak periods. Subsidizing time-of-day metering might be

justified if the alternative is to ration power through blackouts. Making users more sensitive to price may also discourage generators from withholding output in order to raise prices.

Environmental Policy

It may be necessary to factor higher electricity prices into the cost-benefit calculation in assessing environmental regulations involving pollution. This should not be a license to ignore environmental costs, any more than we should ignore the costs of building power plants, the fuel to feed them, and the labor to operate them. But these benefits should be balanced against the cost of making electricity more expensive to produce and perhaps making electricity markets less open to competition from new suppliers.

Market Power and Wholesale Price Caps

If evidence supports the view that generators have market power, empower FERC or public utility commissions to order additional divestitures to deconcentrate the market, since the antitrust laws do not limit a firm's ability to reduce output unilaterally in order to raise price. Regulation of output could be considered, for example, through a "sick day" limit on outages, as suggested by Frank Wolak (2001).

The main controversy is over the need to cap wholesale prices to limit market power. The best case for capping wholesale power prices is if generators can unilaterally exercise significant market power or if an auction conducive to placing high bids is in place. Caps are not necessary to control collusion; agreements to fix electricity prices are already illegal under the antitrust laws. Using a cap as a kind of windfall profits tax may be appealing, but caution is warranted. However well intentioned, wholesale price caps may discourage production and encourage consumption, putting the system at greater risk and turning a price spike into an emergency blackout, unless generators are holding power off the market in order to raise prices.

In addition, expectations that wholesale price caps are only "temporary" may not be borne out. To cover costs, generators will have to earn capacity rents in peak periods; earning capacity rents implies inelastic supply. If demand is inelastic, too, generators with an otherwise small share (10% to 20%) of the market will find it profitable to withhold output in order to raise prices above the competitive level. If supracompetitive pricing warrants price caps, then caps may be around as long as there are peak periods and capacity rents in electricity and generation companies have more than trivial market shares. Unless generation capacity is unprofitably overbuilt or electricity demand becomes more responsive to price, "temporary" price caps may become permanent.

VI. Other Political Battles

Controversies over price spikes, retail electricity rates, rolling blackouts, and utility bankruptcies are not the only political battles facing policymakers and the public in deciding whether and when to restructure.

A. Marketers versus Customers

The effectiveness of restructuring will also depend on whether electricity customers believe they can get what they want from those who sell them power. Some concern follows from the experience with telecommunications. A common reaction among the public is whether electricity competition means that dinner will be interrupted by even more telemarketing calls. Perhaps more concrete have been allegations of "slamming"—switching a customer from another provider to oneself without the customer's consent—and "cramming"—billing for services that the customer did not select. Last and not least is a concern that trying to compare the price and service offerings of different providers is often daunting.

State and federal policymakers are well aware of those concerns. Some have proposed regulations that would require generators to make a uniform presentation of price and pollution data, akin to the nutritional charts on food packages. Such data may help a consumer decide which generation company best matches his or her preferences for low price and environmental protection. State regulators, individually and collectively, are considering new rules governing marketing and other business practices to prevent slamming and cramming. Regulators will also have to consider how to adapt "cut off" protections—when a consumer whose bills are overdue loses access to electricity—to an era when generators, transmission companies, and local distributors each have separate claims to the customer's account.

A more daunting policy consideration is whether consumers would rather let the government choose their power provider and regulate its rates or choose for themselves and rely on competition to set rates. Again, telecommunications offers some precedents. In a market economy, consumers presumably prefer having options, especially when competition among the possibilities leads to lower prices and better service. But a commonly heard complaint following the AT&T divestiture in 1984 was that after years of having no choice, consumers were unhappy about having to pick a long-distance company.

Policies predicated on purported dislike for having to make choices need to be implemented with care. Reducing choices in the name of customer convenience can lead to more expensive and less desirable products sold to the consumers whom such policies are intended to

benefit. We wonder how many consumers would go back to the predivestiture days of just one telephone company, and whether they would currently like a world with only one cellular telephone or Internet service provider.

Depriving consumers of options in electricity may preclude them from enjoying the potential benefits of packaged energy management services or from exercising preferences for green power. Nevertheless, consumer aversion to choice in electricity remains a phenomenon sufficiently significant to warrant the attention of regulators as they consider when and whether to open retail power markets. And, of course, choice is meaningful only when consumers have more than one supplier from which to choose.

B. High-Cost versus Low-Cost States

Opening power markets, at either the wholesale or the retail level, means that power companies in one state will find it easier to sell power in other states. The predictable outcome is that power prices will tend to become more equal across states, reducing enormous differentials in which customers in high-cost states (prederegulation California, New York) may pay double or triple the price for electricity paid in low-cost states (Washington, Kentucky). This price equalization can be a boon for electricity customers in high-cost states, but it may well lead to higher prices for the consumers—and higher profits for the companies—in low-cost states. People in low-cost states will be competing with customers in high-cost states for power; they will no longer be able to keep it for themselves.

In principle, the gains to the power companies in exporting states could be redistributed to customers in a way that makes everyone better off. In practice, redistributing these gains in an effective and efficient manner will not be easy. Taxing in-state sales will only encourage exports, making matters worse for in-state consumers. Taxing exports can restore the status quo, but in doing so, it defeats the benefits to the nation as a whole from increasing access to low-cost power sources. Taxing profits themselves would likely discourage low-cost producers from expanding their operations and reduce the national electric power bill.

VII. The Central Problem: Reliability versus Competition

Reforming regulation, controlling market power, securing environmental benefits, and avoiding a repeat of the California crisis are all major challenges facing policymakers. Most of the problems in California and elsewhere are among those we know how to solve or prevent. Antitrust laws, with additional deconcentration policies if necessary, can deal with market

power. Mistakes in the design of residual regulation and centralized auctions can be avoided. The most difficult items in the list (those dealing with supply-and-demand imbalances) will be with us, perhaps more intensely, even if retail regulation continues.

In many cases, to be sure, implementing the best policy requires getting adequate data and balancing political interests, neither of which is easy. And markets can take time to adjust, especially when the ultimate benefits depend on the construction of large capital projects, such as new generators and expanded transmission lines. But these are the kinds of problems we as a society have studied and addressed over many decades, in numerous contexts.

More challenging is how to address the deeper, longer-term uncertainties in bringing competition to electricity markets. These uncertainties come not from the similarities of electricity to earlier deregulated services, but from its differences. As noted in our introduction, electricity is unique because of the confluence of three characteristics:

- *Crucial role in the economy.* Electricity is important not merely because the United States spends about 3% of its gross domestic product on power. A better measure of its importance may be to imagine how the rest of the economy and society at large depend on it. To take but one example, the defining adjective of the growth of the Internet as a business and communications tool is not "silicon" or "digital" or "software," but "electronic," as in "electronic commerce."
- *Technically exacting.* Many industries are crucial to the nation's welfare. A short list includes food, health care, housing, telecommunications, and transportation. But keeping supplies and demands in constantly perfect balance is not a pressing concern in most of these industries. Excessive production may lead to some waste and costs in maintaining inventories. Too little production can lead to inconvenience—waiting for the next train, going to another grocer, getting a busy signal—and in some cases consumers can store a product to cushion the effects of any future shortages. But imbalances in most industries are more a nuisance than a potential catastrophe.
- *Interrelatedness.* If electricity were "only" critical and technically exacting, it would not present a potential crisis. If a supplier could not do a good job matching its supplies with its loads, it would be less able to attract future customers. The supplier could also offer warranties to insure its customers against losses resulting from power failures. Consumers could then choose among power suppliers on the basis of their reputations for reliability and warranties in case of outages. However, because electricity suppliers and users are all on the same grid, failure of one firm means

failure for all. Consequently, consumers cannot protect themselves by picking the right supplier, and suppliers cannot ensure reliability merely by guaranteeing that they can cover demands from their own customers.

Those three factors—being crucial, technically exacting, and interrelated—combine to distinguish electricity from other commodities. Together, they will make reliability of the power system a continuing matter of public policy, even after we determine how best to deal with market power, air pollution, and other potential failures of electricity markets.

Consequently, some degree of coordination— through explicit cooperation, regulatory and legal incentives, or centralized management—is necessary to ensure that one supplier's imbalance does not bring down the entire system. Thanks in part to coordination among regulated monopoly utilities, power failures in the United States have almost always been local, as when lightning hits a utility pole or local substation. Wide-area failures, such as the New York City and Northeast blackout in 1965 or the western U.S. problems in 1996, are exceptional. Will this record continue as utilities compete in each other's markets? If competing firms cooperate to manage reliability, can fixed prices, reduced output, and divided markets be far behind?

We might promote reliability by using regulatory reserve requirements and liability penalties to hold individual generators responsible for system-wide losses incurred when they fail to meet the demands of their customers. Such rules may be ineffective if a generation company declares bankruptcy instead of covering losses due to breakdowns. The time it typically takes the legal system to resolve liability disputes could be inadequate for electricity, where supply and demand must be kept equal without interruption.

If the need to ensure reliability requires central planning, the compatibility question becomes whether the role of that planner—a regional reliability council, RTO, ISO, distribution utility, or regulator of any or all of these entities—will leave sufficient scope for competition to be meaningful. If the central coordinator can limit its activity to relatively small and occasional purchases of ancillary services, the rest of the generation and marketing sectors will likely remain large enough to make competition worthwhile. On the other hand, operators of transmission systems and distribution grids have become involved in imposing reliability requirements and mandating the provision of ancillary services necessary to keep the grid operating. In some cases, this leads them to become involved in the management of markets themselves, sometimes proscribing the independent contracting between buyers and sellers that drives most other businesses. The more the planner has to extend its reach into managing

transactions, purchasing electricity, and owning generation, the narrower the scope of competition.

Whether we can reap the benefits of competition while retaining the coordination necessary to maintain system reliability remains the toughest test restructuring has to pass. Only experience can tell us whether there will be enough of a market left over to have been worth opening, after putting into place all the institutions, regulations, and procedures necessary to ensure reliability.

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