

California's Electricity Woes: A Vision of the Future?



Based on a presentation by Stephen P. A. Brown,
Director of Energy Economics and Microeconomic
Policy Analysis and AVP, Research Department,
Federal Reserve Bank of Dallas

March 2001

The views expressed are those of the authors and should not be attributed to
the Federal Reserve Bank of Dallas or the Federal Reserve System.

California's Electricity Woes: A Vision of the Future?

California has long been in the vanguard of national trends. Since mid-2000, California has experienced a considerable number of problems with its electricity market, including fluctuating prices and shortages. California's electricity woes give us a reason to take pause and consider the future of U.S. electricity markets and of energy policies in general.

Electricity is an important part of the U.S. energy infrastructure—accounting for more than one-third of U.S. energy consumption (*Figure 1*). If other states experienced problems with their electricity markets similar to those in California, the effects would be felt throughout the economy.

Nearly half the states are restructuring their electricity markets, and many more are considering doing so. The eight states shown in blue have already implemented restructuring of their electricity markets (*Figure 2*). The 16 states shown in lighter blue and the District of Columbia have enacted legislation or issued regulatory orders that will restructure their electricity markets. The 18 states shown in purple are investigating the possibility of restructuring their electricity markets. Only the eight states shown in gray are not currently taking any steps toward electricity market restructuring.

Figure 1

Electricity accounts for one-third of U.S. energy consumption

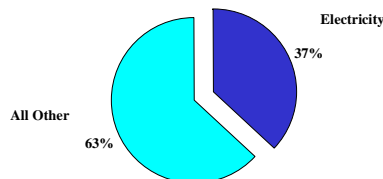


Figure 2

Many states restructuring electricity markets



The problems with the California electricity market are the result of several factors, including a poorly devised restructuring that took place nearly three years ago. As the states progress toward restructuring their electricity markets, we should ask: Are California's electricity woes a dark vision of the future or an isolated incident in a state where policymaking was not sufficiently informed by economic reality?

What is Restructuring?

It is convenient to think of the electricity industry as made up of four functions: electricity generation is simply the production of electricity; transmission is the movement of electricity over high-voltage lines from the generators to power substations located in cities, towns and rural areas throughout the country; distribution is the movement of electricity over lower voltage lines from power substations to customers; and marketing/sales is the sale of electricity to customers.

Currently, most regions of the country are served by integrated electric utilities, each of which performs all four of the functions from generating electric power to selling it. These utilities established natural monopolies in transmission and distribution—which were extended into

generation and marketing. (Transmission and distribution are considered natural monopolies because one provider is thought to be the most efficient means of production.) A utility's electric rates are subject to regulation at the state level, and in the typical process, rates are set to earn what the regulators deem to be a fair rate of return on the investment.

Restructuring consists of opening one or more segments of the current system to competition. A number of variations are possible across the 50 states and the District of Columbia. As typically envisioned by policy analysts, however, restructuring has five fundamental elements (in which some regulation is retained): 1) electricity generation is opened to competition with free entry of new power plants and private contracts, 2) transmission and distribution remain in the hands of the utilities and under regulatory control because they are viewed as natural monopolies, 3) marketing/sales to consumers is opened to competition, 4) electricity prices are free to move, and 5) a range of market instruments, including long-term contracts, spot sales and market-making activities is allowed and encouraged.

A mixture of market instruments for conducting sales of electricity is important in creating well-functioning markets. Long-term contracts distribute the risks between buyers and sellers and enable planning. Spot sales allow a response to changing market conditions.

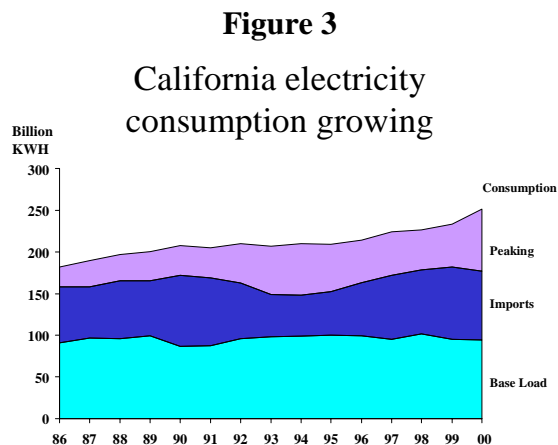
Market-making is an activity of firms, such as Enron, that act as intermediaries in the electricity market. They buy electricity under contracts of a given duration and sell it under contracts of another duration. This intermediation helps make electricity markets more efficient and restructuring more successful.

California's Restructuring Not Prototypical

The restructuring of California's electricity markets provided for much less deregulation than is prototypical: 1) California opened its generation markets to competition, but the state did not permit the free entry of new power plants, 2) California retained regulation of transmission and distribution as is prototypical, but a public agency assumed control of some transmission lines, 3) California did not open up marketing/sales to competition, 4) California froze retail electricity prices, and 5) California banned the use of long-term market instruments and forced all power to be transacted through a daily spot market operated by a public agency. In doing so, California obviated market-making activities. In short, California has not created a transition to a free electricity market, and its restructuring should not be considered deregulation.

Growth and Seasonality in California Electricity Demand

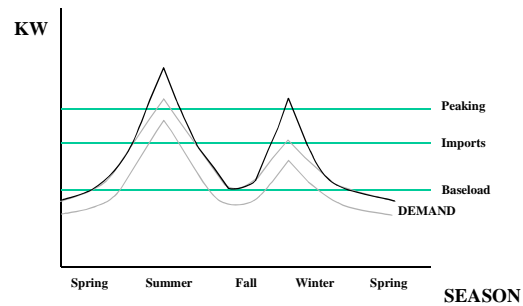
For years California's electricity consumption has grown. In 2000, it grew by a surprising 8 percent (*Figure 3*). We can think of California's electricity demand as met by three forms of supply: baseload, imports and peaking. The baseload supply of electricity is the lowest cost and is typically produced in coal-fired, nuclear, hydroelectric, and some oil-fired power plants that operate nearly continuously. Imports from baseload facilities in other states generally have intermediate costs as the result of the added transportation costs. Peak supplies of electricity are the highest cost and are typically produced in oil- and natural gas-fired power plants that operate intermittently to meet peak demands in electricity.



As its electricity consumption grew, California became more reliant on costly sources of electricity because it had not developed additional baseload capacity. The expense of operating peaking facilities rose substantially as oil and natural gas prices began rising in 1999.

Seasonality is an important aspect of California's electricity woes. As shown in Figure 4, the demand for electricity varies by season, with strongest demand in summer and the second strongest demand in winter. When demand is weak in the spring and fall, lower cost baseload facilities can provide all or most of the electricity. As demand strengthens seasonally, electricity is drawn in from other states and produced in higher cost peaking facilities.

Figure 4
California's electricity woes are seasonal



As the California economy grew, its energy demand also grew, but the ability to produce electricity in less expensive baseload plants was not expanded. The development of new electricity generation facilities in the state of California was checked for environmental reasons. Californians did not want the pollution associated with the additional electric power plants. In addition, electric utilities, fearing they would be unable to recover their costs as the state moved away from rate-based regulation, stopped trying to build new generation facilities. The imposition of price caps on retail electricity prices under the state's restructuring plan further deterred the development of new generation facilities.

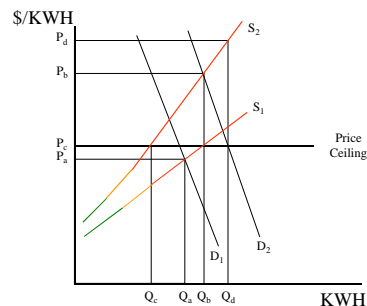
Without additions to baseload capacity or additional imports, an increase in demand increases the reliance on higher cost peaking facilities and could result in a shortage during periods of extreme demand that might be seen in summer. An increase in the strength of seasonality—as occurred last year—accentuates the problem. Moderate reductions in baseload supply and imports further increase reliance on peaking facilities and expose the state to more episodes of power shortages.

But many Californians seem surprised to be paying the higher electric rates that resulted from the policies that made electricity scarce. They did not seem to make the connection between the opposition to new power plants and the increased reliance on higher cost sources of electricity.

The California Electricity Market: An Economics 101 Perspective

Most aspects of California's electricity problems can be illustrated with a supply and demand diagram (Figure 5). First consider the market before restructuring. California's electricity supply comes from lower-cost baseload plants, intermediate cost imports, and higher-cost peaking facilities. Higher prices support production at more facilities, and therefore, more electricity is available at higher prices along the supply curve (S_1). A demand curve (D_1) shows consumers willing to purchase more electricity at lower prices. Together supply and demand establish a market-clearing price and quantity (at P_a and Q_a , respectively).

Figure 5
The California electricity market: an Economics 101 perspective



When California opened its electricity generation market to competition, policy makers hoped that competition between the owners of power plants would shift the supply curve outward, but they also imposed a price ceiling (at P_c) to maintain stable retail prices.

Rising energy prices and the reduced availability of baseload capacity and imports reduced electricity supply in California (to S_2). Costs rose the most at peaking plants that rely on natural gas. At the same time, strong economic growth and more severe weather boosted electricity demand (to D_2). These changes should have established a new market-clearing price and quantity (at P_b and Q_b , respectively).

As shown by the figure, however, the market-clearing price was higher than the price ceiling and could not be charged to the consumers. With the price ceiling in place (at P_c), consumers tried to purchase much more electricity (Q_d) than producers were willing to sell (Q_s) at the ceiling price.

If we stopped here, we would have a classic shortage at the price ceiling, but electric utilities have a duty to serve under the law. Consequently, California's utilities were legally obligated to supply all the electricity consumers wanted to purchase (Q_d) at the ceiling price. To do so, utilities were forced to pay a much higher price (P_d) for electricity on the open market. Because the utilities did not quite succeed in obtaining all the electricity that customers want at the ceiling price, the result was a combination of shortages and utilities paying higher prices for electricity than they can sell it for to their own customers.

By the end of 2000, California utilities were paying a wholesale spot price of about 40 cents per kilowatt hour while they were only allowed to sell it for about 10 cents per kilowatt hour to their customers (*Figure 6*). California's failure to allow retail prices to rise to reflect market conditions has had several effects. The most obvious is that it puts a financial burden on the utilities. In addition, low prices discourage the development of additional supply while encouraging customers to continue low-valued uses of electricity.

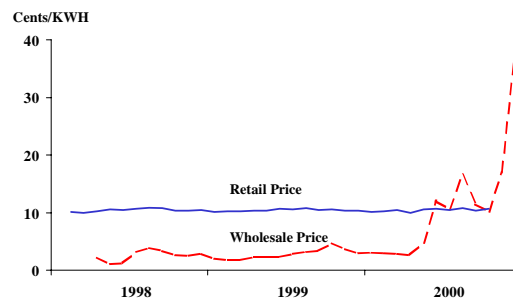
Economic Effects Are Relatively Small

Although we have heard stories about how the electricity blackouts are affecting industry, the disruptions of electric service appear to have had only a mild aggregate effect on the California economy. A few analysts have speculated that sustained disruptions of electric service that are no worse than those already experienced, would reduce California's gross state product by about 0.2 percentage points below what it would otherwise be. Taking into account California's size and the negative ripple effects to other states, we might guess that the total impact on the national economy would be to reduce gross domestic product by about 0.1 percentage points below what it would otherwise be—though some analysts have suggested the spillovers to the national economy would be smaller.

If California does not resolve its electricity problems, however, the longer term effects on the state may be significant. Unreliable electricity service could make California less attractive to business and slow the state's economic growth. Some of that growth could be displaced to other states.

Figure 6

Retail price ceilings squeeze California utilities



Successful Electricity Market Restructuring

To develop standards for evaluating the restructuring of electricity markets, we can draw upon what to appear to be the successful experiences in Pennsylvania and the United Kingdom as well as fundamental strategies suggested by analysts. These standards can be used to evaluate and suggest changes in the electricity market restructuring in California, Texas and other states.

Important elements of a successful restructuring of electricity markets seem to be sufficient generation capacity (and fuel supplies); opening power generation to competition with the free entry of new power plants and private contracts; opening marketing/sales to competition; freeing electricity prices to move with changes in market conditions; allowing a range of market instruments including long-term contracts and spot sales; and encouraging private market-making activity.

Success should not be judged by the often used political barometer of stable prices, but rather by the extent to which the market is allowed to operate freely with the minimum of disruption. With energy prices rising and environmental restraints on electricity production, higher prices will help allocate scarce electricity and clarify the costs of environmental protection.

Improving California's Electricity Markets

California has room for improvement in most areas. California entered deregulation with insufficient capacity. California has deregulated its power generation market, but it must also reduce its regulatory impediments to power plant development. It is taking some steps in that direction. California should also allow the development of additional natural gas pipelines to enhance natural gas deliverability to power plants using that fuel in the state.

California could accomplish much by opening marketing/sales to competition. California also should allow electricity prices to move freely with market conditions. Freely moving prices would encourage consumers to conserve electricity and at the same time stimulate the development of new electric power plants.

California has begun seeking electricity supply under long-term contracts, but it has interjected the state and its nonprofit electricity system operator into the process. California needs to allow a range of market instruments including long-term contracts and spot sales, as well as private market-making activities.

In the short run, these solutions are likely to raise electricity prices in California, which would reflect the scarcity of electricity in the state. But the philosophy of market determined prices would encourage the development of new power plants while higher prices would discourage consumption. In the long run, prices would fall, but probably not as low as they were prior to restructuring—unless overall energy prices also fall.

Electricity Market Restructuring in Texas

Texas is in the process of restructuring electricity markets in most areas of the state. Restructuring will be completely phased in by the end of 2001. As Texas approaches its restructuring, success seems very likely.

Texas is entering deregulation with sufficient generation capacity (and fuel supplies). It is opening electricity generation to competition with the free entry of new power plants and private contracts. Marketing/sales to consumers will be opened to competition. Electricity prices will be free to move. Texas is allowing a range of market instruments including long-term contracts and spot sales and encouraging private market-making activities.

Electricity Market Restructuring in Other States

Most states progressing toward a restructuring of their electricity markets are creating freer markets than California did. Of the 24 states and the District of Columbia that have deregulated or have taken concrete steps toward deregulation, the eight states shown in green on Figure 7 seem to meet the criteria for a successful transition to a free market. The 11 states shown in yellow are entering deregulation in pretty good shape. Nine of these states have price caps but sufficient in-state generating capacity. Connecticut and Virginia do not have price caps but do import significant quantities of electricity. The three states shown in orange and the District of Columbia are in only slightly better shape than California. They import significant quantities of electricity. In addition, Maryland, Delaware and the District of Columbia have price caps, and New York has other impediments to freely functioning electricity markets.

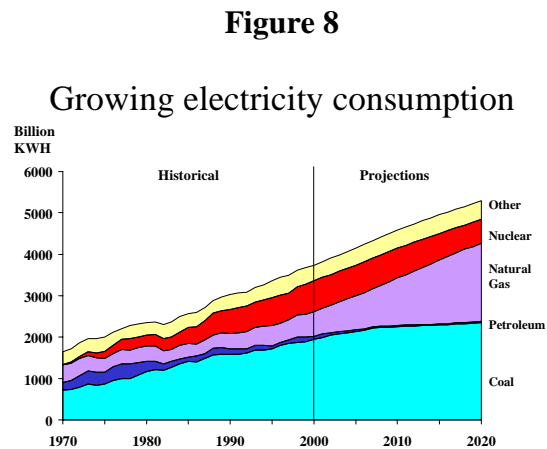


Only Oregon, shown in red along with California, seems to be freeing its electricity markets as little as California. Oregon imports significant quantities of electricity, is not allowing for entry into marketing and sales, is retaining regulated prices, and discourages market-making activities. The other 26 states, shown in gray, do not currently have concrete plans for restructuring and are in a position to learn from those who are preceding them.

A Wake Up Call?

In some sense, California's electricity woes should serve as a wake up call for thinking about the direction of U.S. electricity markets and energy policy. The U.S. Department of Energy forecasts that U.S. electricity consumption will grow by more than 30% over the next two decades, while the use of natural gas to produce electricity grows by nearly 60% (*Figure 8*). That forecast calls for a much stronger growth rate in the use of natural gas to produce electricity than occurred over the past 30 years.

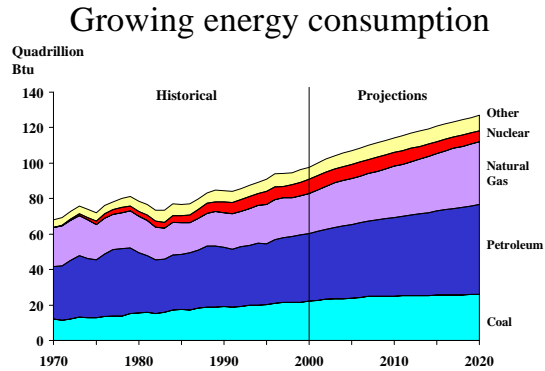
The infrastructure to produce the additional electricity and supply the additional natural gas does not currently exist. If people in other states take the same attitude toward the development of new electric power facilities and natural gas pipelines as Californians seem to have taken over the past 20 years, electricity will be relatively scarce, and either higher prices or shortages of electricity will result.



In a broader sense, we face the same issues in thinking about future economic growth and the resulting growth in energy demand. As shown in Figure 9, the U.S. Department of Energy forecasts that U.S. energy consumption will grow by more than 40% (about 1.8 percent annually) over the next 20 years while real GDP grows by 3.0% annually.

Restricting the growth of energy consumption to pursue other goals—such as a cleaner environment—will reduce economic growth. This is not to say that we should not pursue a clean environment. Rather it is to acknowledge that a clean environment has a cost. Some analysts have promoted the notion that a clean environment can be had without cost. That view helped shape the policies that created California’s electricity crisis.

Figure 9



Conclusions: Learning from California

The effective restructuring of an electricity market creates a transition to a free market, but California’s restructuring plan was far from yielding a free electricity market. California’s course corrections to date do not represent much more of a transition to a free market. Most of the states that are moving toward electricity market restructuring seem to be going much farther toward creating free markets for electricity than California has, but only eight seem to be making a complete transition to free electricity markets.

If they do not worsen, California’s electricity woes should have a small but possibly noticeable effect on economic growth. Nonetheless, California’s electricity problems remind us that economic growth is facilitated by abundant energy supplies. Limiting energy consumption in the pursuit of other goals—such as a cleaner environment—has a cost. In making policy, we should explicitly consider these costs rather than pretend they do not exist. The resulting policy will have a much sounder basis in economic reality rather than wishful thinking. And California’s woes will be wake-up call, rather than a vision of the future.