Deregulation works—but not the way it was done in California.

The California Electricity Crisis: Lessons for the Future

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California's disastrous experience with electricity deregulation cast a pall on movements towards deregulation throughout the United States. Some have said that the California experience shows that deregulation cannot and does not work, which is patently untrue, as an examination of energy, price, and demand data collected before and after the California electricity crisis shows. In this paper, I will describe what happened in California and the lessons to be learned from that experience. (A more complete discussion appears in my forthcoming book, *The California Electricity Crisis* [Sweeney, 2002].)

The California saga went through four stages, all of which presented the state with opportunities to make good and bad decisions. These stages were: (1) a risky situation that became (2) a challenge that turned into (3) a crisis that rapidly turned to (4) blight. Each stage, and in fact the whole process, should be seen not as a series of random, disconnected events, but as a sequence in which choices were made at each juncture. To address problems (often created by earlier policy decisions) at each juncture, alternative actions could have been taken. Given the political and economic forces at play, one can understand the logic underlying the decisions that were made. However, these decisions often created difficulties later. If different choices had been made at each juncture, they would have led to very different and probably much better outcomes.

In 1992, the California Public Utilities Commission (CPUC) began to develop a restructuring plan, which ultimately became the basis of California Assembly Bill AB1890, passed in September 1996. Although many California legislators have since decried this action, the legislature passed the bill unanimously. In fact, the process and the final legislation were not bad, but the implementation was severely flawed. California had very good reasons for restructuring its energy supply system. First, many experts believed that the vertically integrated system in place was not operating as efficiently as it could. Second, the system had very high costs. Third, the system did not seem to provide enough incentives for investments in new generating plants.

The restructuring began with the creation of a group of wholesale markets, with the understanding that deregulation had to begin with wholesale electricity transactions. To control these new markets, the legislature created the Power Exchange (PX) and the California Independent System Operator (CAISO). Creating markets for wholesale transactions was a sensible thing to do. The markets, however, were run as two separate organizations rather than as an integrated system, creating market inefficiencies and opportunities for market manipulation. In addition, retail price controls were established, which isolated consumers economically from the producers of electricity. At the wholesale level, California had created a volatile commodity market, but it had fixed sales prices for the investor-owned utilities at the retail level, a potentially untenable combination.

Cost changes at the wholesale level could not be passed on to retail customers.

A Risky Situation

The legislature and the CPUC believed that the "competition transition charge," a charge equal to the difference between the price-controlled retail price and the volatile wholesale price, would be sufficient for utilities to recover enough funds to recoup the stranded costs they had incurred prior to deregulation. These costs were mostly based on a combination of green-power contracts and nuclear power, two power supplies that had been costly under the old system. The CPUC also ordered additional transition charges to fund the public-interest activities required of the utilities, such as a public-interest research program and demand-side energy management programs. The utilities were also required to divest themselves of most of their generating assets, and it was made financially unattractive for them not to do so. This left the utilities with little generating capacity to fall back on.

Retail price controls meant that cost changes at the wholesale level could not be passed on to retail customers, which created the initial risky situation. Because of the rigid price controls in the new system, California utilities could not adjust to changing economic circumstances. With the sale of generating capacity, the risks were increased.

Once new wholesale markets had been created, someone had to use them. In fact, the law stipulated that all utility sales and purchases had to go through the PX and the CAISO. Power was purchased up to a day in advance, with shorter-term purchases made as little as 10 minutes before the electricity was to be sold. This arrangement was apparently believed to be sufficient for utilities to make necessary adjustments. Because the utilities had been required to sell what remained of their power-generating capacity and restricted from buying back that capacity, or any other capacity, under long-term contracts, they found themselves in a high-risk situation.

The Challenge

Because the market system was set up with controlled retail prices, the risk became a challenge for California. Economists have posited that with higher prices, supplies come forward, and part of the rationale for the restructured system was to elicit new supplies of electricity through the construction of new generating plants. Engineers and economists know, however, that even with higher prices, electric generating plants cannot be pushed beyond their capacity. In the short run, rising wholesale prices in California allowed the state to purchase additional electricity from western states connected through the power grid.

Opponents of deregulation claim that the process failed because it did not bring forward new supplies of electricity. As Figure 1 shows, however, there was a rapid surge in applications and the construction of new power plants. More new plant applications were submitted in 1998 than in any of the preceding 16 years.

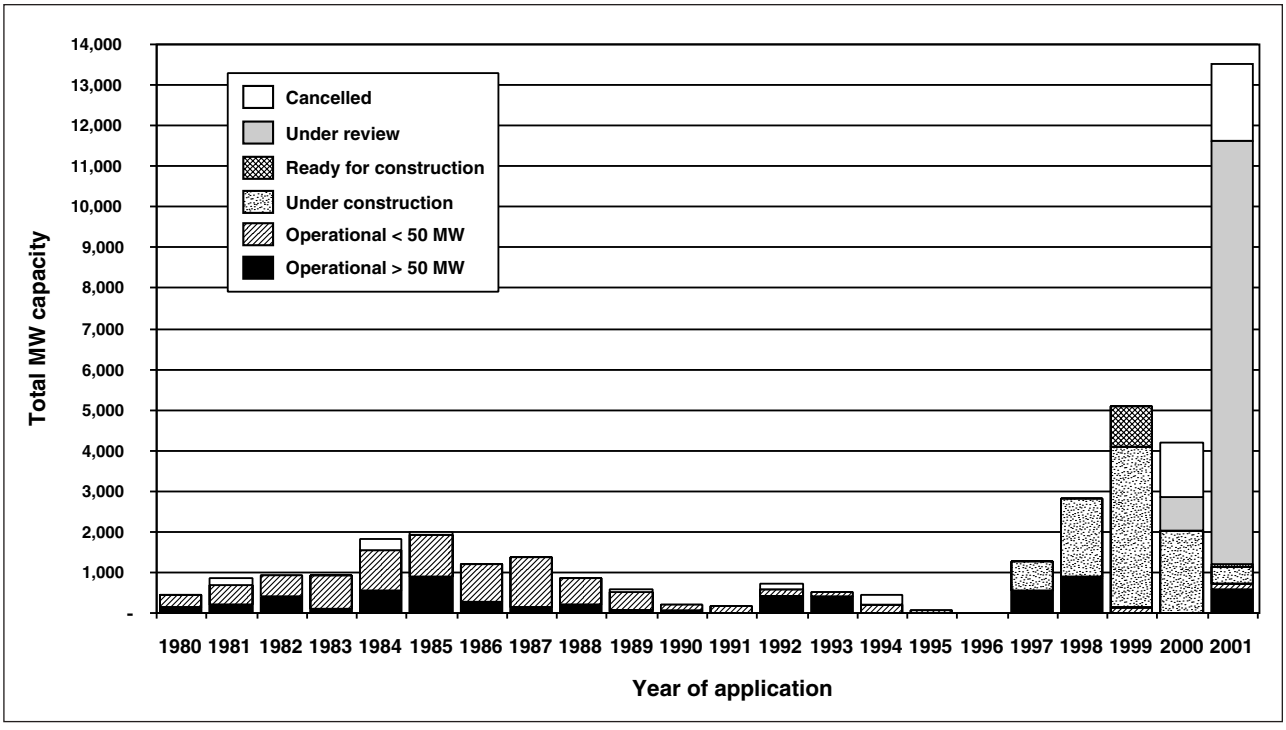

FIGURE 1 Applications for and construction of new power plants. Source: Sweeney, 2002.

And in 1999 and 2000, there were even more applications than in 1998.

New plants can be built, but construction takes time. In California's case, however, more than time was needed. The state also has a difficult and time-consuming process for licensing. Time has to be allowed for advocacy and input from affected parties, which not only delayed construction but also created uncertainties for utilities and generators as to whether they would actually realize benefits by installing new capacity. This uncertainty caused delays in the forward momentum of new generating plants.

Deregulation could not bring new plants on line instantly. Consider, for example, the Metcalf Energy Center in San Jose, which began to seek regulatory approval in 1999. Metcalf was still seeking approval until very recently, even after the major price spikes of 2001. It is ironic that CISCO Systems, Metcalf's neighbor and a member of an industry that relies on energy for communications and manufacturing, was a major opponent of construction because CISCO did not want a power plant near its manufacturing plant. Even environmental groups, such as the Sierra Club and the American Lung Association, had endorsed the construction.

A second claim of opponents of deregulation was that there was a sudden demand for electricity and that it surged in ways nobody had predicted. It is true that demand increased about 4 percent from 1999 to 2000, more than in previous years. But the demand was only slightly higher than projected and not out of the range of expectations. At the same time, however, there was a lack of rainfall in the Pacific Northwest and an increased demand for electricity in the Southwest. Thus, available imports to California were reduced by an average of more than 2,000 megawatts from 1999 to 2000.

The combination of a small delay in new plant construction, a slightly higher demand than projected, and a small reduction in imports in a system that was already operating close to the edge caused problems. Hydroelectric, nuclear generation, and newer, more efficient gas-fired facilities were already working at full capacity.

The result was a significant increase in demand for power from older, less efficient gas-fired plants, which have much higher heat rates (i.e., they use more natural gas per megawatt hour of electricity generated). Therefore, when there were no other options, the highest cost units of energy were introduced. In addition, the spike in the use of natural gas increased the demand on an aging system of natural-gas pipelines, which was also forced to operate near its transport capacity. Because no

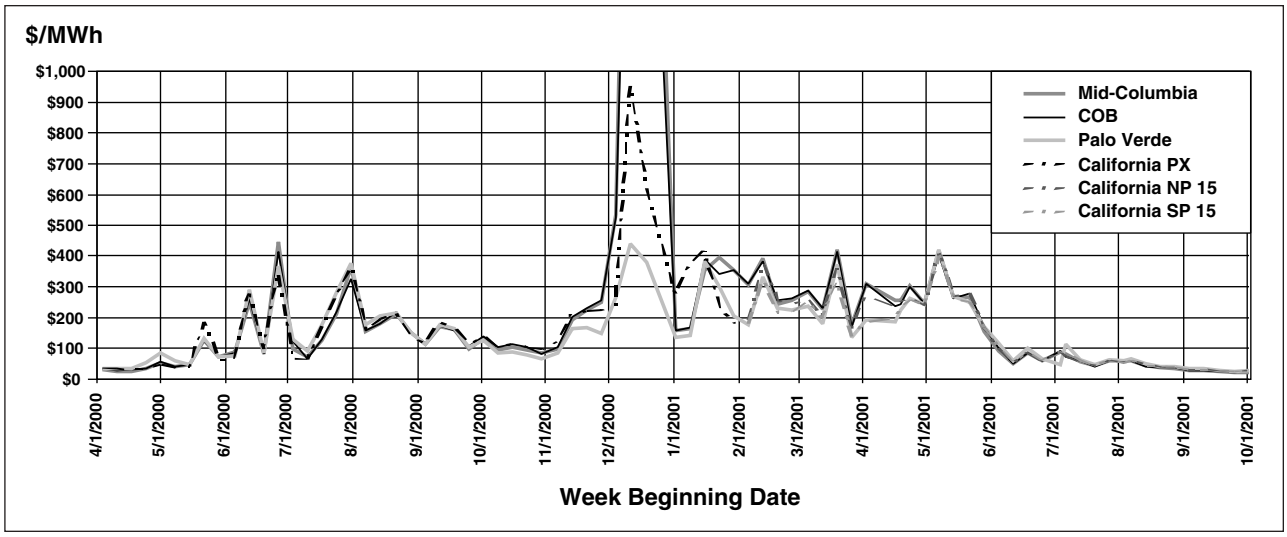

FIGURE 2 Spot power prices: average of high and low peak prices for several western markets. Source: *www.newsdata.com.*

substantial investment had been made to upgrade the pipeline infrastructure, the delivery of natural gas was constrained, which increased natural gas prices dramatically. Another reason generating capacity was limited that winter was that during the preceding summer the power-generating system had been operating at such high capacity that it was already near the breaking point. Many plants had to be shut down for repairs during the winter.

The Crisis

As of June 2000, these combined problems resulted in a serious challenge to California's energy system. Prices per megawatt hour in California, which were near $30 in April, rose to more than $100 by June 2000. By November, prices had increased to between $250 and $450. The first five months of 2001 were characterized by soaring wholesale prices, energy emergencies, and a small number of rolling blackouts. The pain was severe.

Although the electricity crisis was publicized as a California crisis, wholesale prices also soared throughout the entire Pacific Northwest and the Southwest. Similar, although less publicized, price spikes occurred in other states, but they responded differently. Figure 2 shows the wholesale prices for three non-California locations—just north of the California-Oregon border (COB), receipt points along the Columbia River (mid-Columbia), and the switchyard of the Palo Verde Nuclear Power Plant in Arizona (Palo Verde)—as well as California prices—original PX prices, prices in northern California (NP 15), and prices in southern California (SP 15). Non-California prices are shown with solid lines; California prices are shown with broken lines. As the figure shows, prices were almost identical in all of these areas except during December 2000, when California price controls kept wholesale prices below the COB and mid-Columbia prices, and early January 2001, when the financial risks associated with

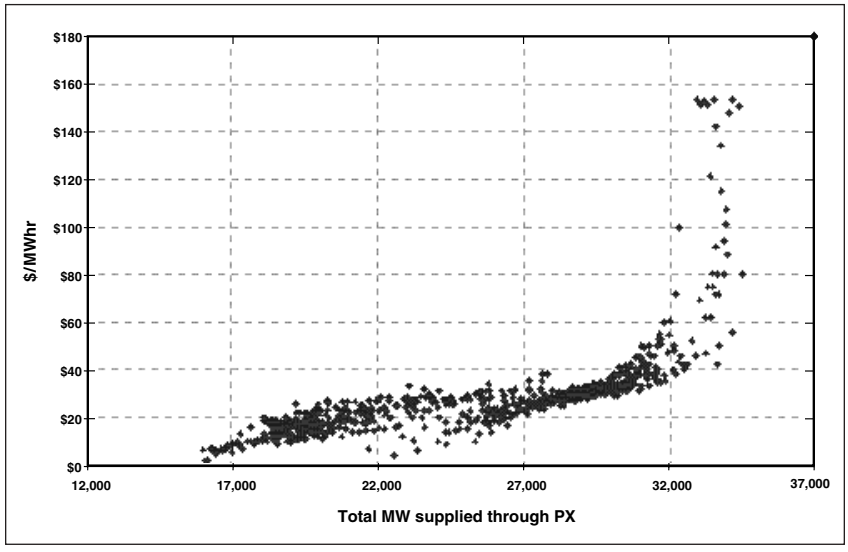

FIGURE 3 Total megawatts at one-hour intervals and prices per megawatt hour. Source: Sweeney, 2002.

the crisis pushed California prices somewhat higher than the others. The wholesale electricity price crisis affected the entire western United States through the interconnected distribution system.

As of June 2000, and perhaps as late as early 2001, if wholesale prices had been allowed to serve as price signals to consumers in California, which accounted for 40 percent of the western electricity use, the problem was still fixable. Higher retail prices would have encouraged rapid, broad-scale energy conservation, which would have been the key to placing downward pressure on the wholesale prices. But, California officials did not rise to the challenge and allow price signals to pass to the consumer, thus creating a crisis.

If the state had allowed retail prices to increase with wholesale prices, the wholesale price increases would have been much smaller. This point is illustrated Figures 3, 4, and 5. Figure 3 shows the market clearing wholesale price of electricity per megawatt hour on the PX as a function of the total megawatts demanded at one-hour intervals beginning in July 1999. When demand is well below capacity, even significant changes in demand have little influence on wholesale prices. As the figure shows, supply can be increased over a wide range without having much influence on price. Once demand exceeds capacity, however, prices rise sharply as the system puts the least efficient plants on line.

Figure 4 shows the supply and demand equilibrium under California's retail price control regime. With no price signals making their way to California consumers, demand was almost independent of wholesale prices. When wholesale prices rose, retail prices did not, and consequently, consumers were not motivated to reduce their use of electricity. Wholesale prices had to increase greatly to balance supply and demand, and that large price increase was the essence of the electricity crisis. A slightly larger increase in supply finds no equilibrium, resulting in what has been called rolling blackouts—real shortages in the system.

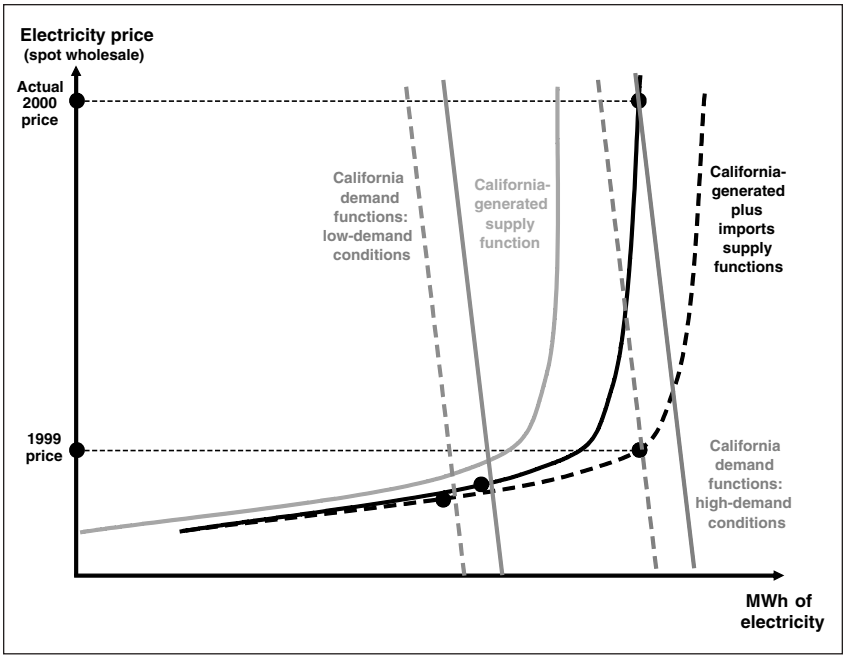

FIGURE 4 Supply and demand system with retail price controls. Source: Sweeney, 2002.

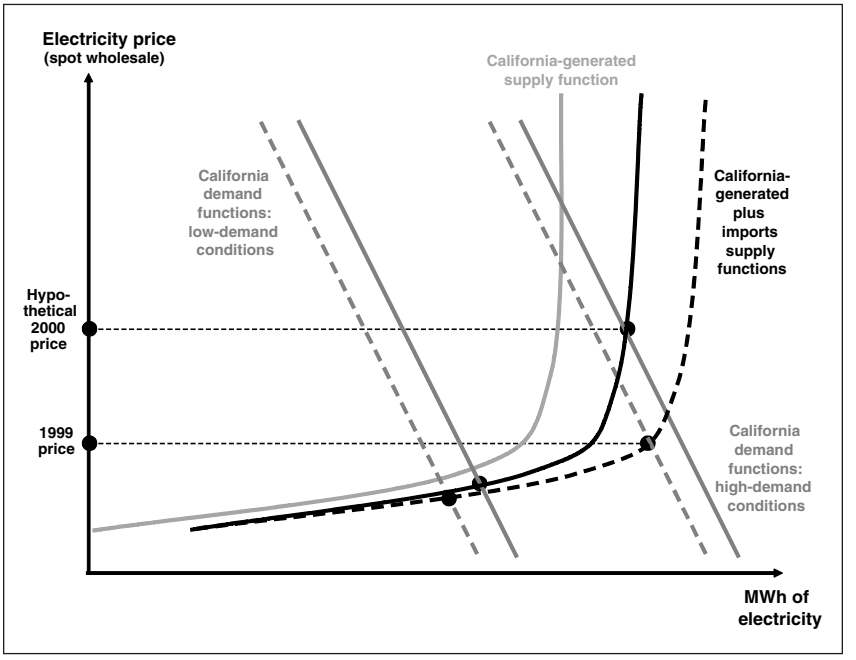

FIGURE 5 Supply and demand system with no price controls. Source: Sweeney, 2002.

Figure 5 shows a more sensible supply-demand system with no price controls and signals properly communicated between buyers and sellers. Wholesale price increases translate to retail price increases, which in turn motivate reductions in electricity demand. The net result is that wholesale price increases are limited. The time delay between the price signal and the market response was an important part of the market dynamics in California.

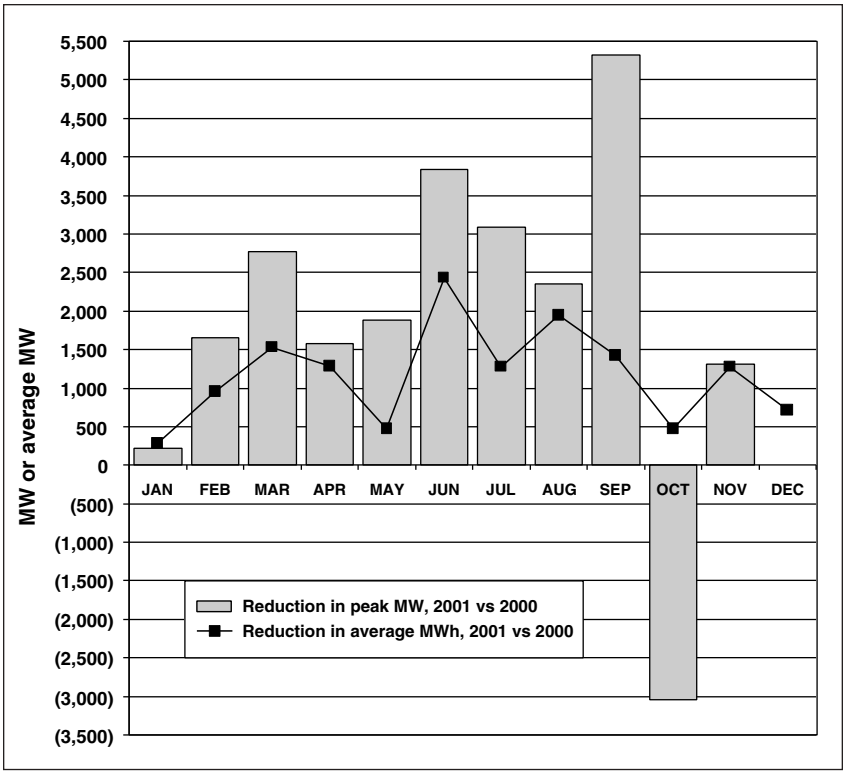

FIGURE 6 Reductions in electricity in 2001 and 2000. Source: Sweeney, 2002.

Rather than allowing prices to motivate reductions in demand, California state officials continued to assert the need for stronger wholesale price controls, which had been part of CAISO from its inception in 1998. These price controls were managed and controlled by the state. But, in December 2000, under orders of the Federal Energy Regulatory Commission (FERC), purchase price controls were replaced by a "soft cap" on wholesale markets. Under the "soft cap," bids higher than the cap could be accepted but had to be cost-justified. The FERC ordered the soft price cap to limit price changes while allowing cost-based price increases above the wholesale price-controlled levels. Thus, the soft cap did make it easier for CAISO to acquire out-of-market electricity and enabled California to avoid continuous rolling blackouts. But soft caps were generally ineffectual, and they encouraged gaming of the system by generators and marketers, for example, by exporting electricity from California and reimporting it at a higher price, consistent with prices outside California.

In fact, California experienced two crises—an electrical supply crisis and a financial crisis—creating a feedback loop that made matters worse. Inadequate supplies led directly to high wholesale prices, but California created the financial crisis for itself. With retail price controls, high wholesale prices, and utilities that had already sold off most of their generating assets, the utilities were forced to buy electricity from others. When the purchase price rose beyond the capped retail selling price, the point at which most retailers would stop selling the product, electric utilities were not allowed to stop under California's regulatory management.

The net result was that the financial assets and the borrowing power of the big electric utilities, PG&E and Southern California Edison (SCE), were completely drained and destroyed. With their monetary resources depleted, the utilities were no longer credit worthy, and generators would not sell them electricity. At that point, the state stepped in and took over as the sole buyer of electricity for the utilities. Unfortunately, state budgets are not unlimited; so the dual financial and electricity crises continued. Ultimately PG&E declared bankruptcy; SCE was on the verge of bankruptcy but eventually negotiated a settlement with the CPUC. PG&E remains in bankruptcy court; PG&E and the CPUC have proposed diametrically opposed plans for PG&E to emerge from bankruptcy.

California's financial crisis was the result of the state government's mismanagement of the electricity crisis. Most utilities in other states operate under a combination of long-term, medium-term, and short-term contracts to optimize their purchases. This is an appropriate financial arrangement for the electricity market because prices may spike, as happened in 2001. The CPUC however, did not allow long-term contracts. Therefore, the average cost to investor-owned utilities in California

rose far more than the average cost to California municipal utilities or utilities in other states. More important, when the cost went up in other states, retail prices followed. Price signals in those states were communicating, although with a lag and attenuated by average cost pricing. Nevertheless, these utilities were able to collect enough revenue to pay for the power they bought and thus avoid a financial crisis.

One result of the financial crisis in California was that when the utilities ran out of money, they couldn't pay their electricity suppliers. Organizations that the California governor derided as "Texas utilities" (most of which were not utilities and were not based in Texas and several of which were public agencies from California, Oregon, and British Columbia) were able to keep producing despite delays in payment. But many small cogeneration plants, or qualifying utilities (QFs), which came into being under the Public Utility Regulatory Policies Act (PURPA), operate in a nearly hand-to-mouth way. When they were not paid, they were forced to shut down. In short, the initial supply crisis led to a financial crisis that led to a further reduction in supply that, in turn, led to higher prices.

Once the investor-owned utilities ran out of money and the PX was shut down, the state took over the purchase of electricity on behalf of the utilities. The financial crisis of the utilities then became a state financial crisis. Through August 31, 2001, the state had paid $10 billion for electricity, which was sold back to the utilities at the regulated price for about $3 billion. Thus, the state lost about $7 billion from the state budget. The "good news" was that California had a budget surplus of $8 billion, so the purchase "only" decimated the surplus.

Thus, the problem in California was not electricity deregulation; it was price regulation at the retail level and rigid regulation prohibiting long-term contracts at the wholesale level. It was an issue of gross mismanagement by the California governor and the CPUC.

As of June 2001, the seven-month California electricity crisis was over; wholesale prices had fallen to less than $50/MWh, demand had dropped, new generating plants were coming on line, and more new plants were in the pipeline. Figure 6 shows a drastic reduction in electricity use, some of which can be attributed to price increases at the retail level and some to demand-side management or other energy conservation programs. New generating plants have now come on line in California, although after the crisis was over. This new construction should ensure that the crisis will not recur in the near future. Figure 7 shows California's cumulative estimate of new capacity expected to come on line in the next three years. By December 2004, it is estimated that there will be 12,000 extra megawatts of new capacity. In 2002 alone, there will be 5,000 new megawatts. As a result of the new production coming into the system, there will be continuous downward pressure on prices.

The Blight

The electricity crisis was limited by circumstances, but the financial crisis continued. The mismanagement of the crisis resulted in financial obligations that now threaten to blight the California electricity system and its economy. Although the state experienced a short-term electricity crisis, the California governor made a decision to adopt long-term electricity purchase contracts to address the short-term problem. But under these long-term contracts, the state promised to pay prices roughly twice as high as the expected market prices. The total contractual production delivered as of January 2001, was 3,400 megawatts. But the contracts call for additional supply, peaking in January 2004 at 8,000 megawatts and continuing at that level until 2011. Some contracts go on for up to 20 years. The new contracts, which were signed early in 2001, were intended to deal with an energy crisis that was arguably already over by the time the first electricity was scheduled to be delivered. If all costs are added in, electricity prices will be about $100/MWh until January 2003; thereafter, they will drop to about $71/MWh. These prices will extend at least until 2011.

Mismanagement of the crisis left California with financial obligations that threaten to blight the state's economy.

The annual rate of expenditure will be about $4 billion a year for these contracts, which will also continue until 2011. Under the plan, these costs will be paid entirely by electricity consumers. The governor demanded that the contracts be renegotiated, but so far the renegotiations have primarily shortened the

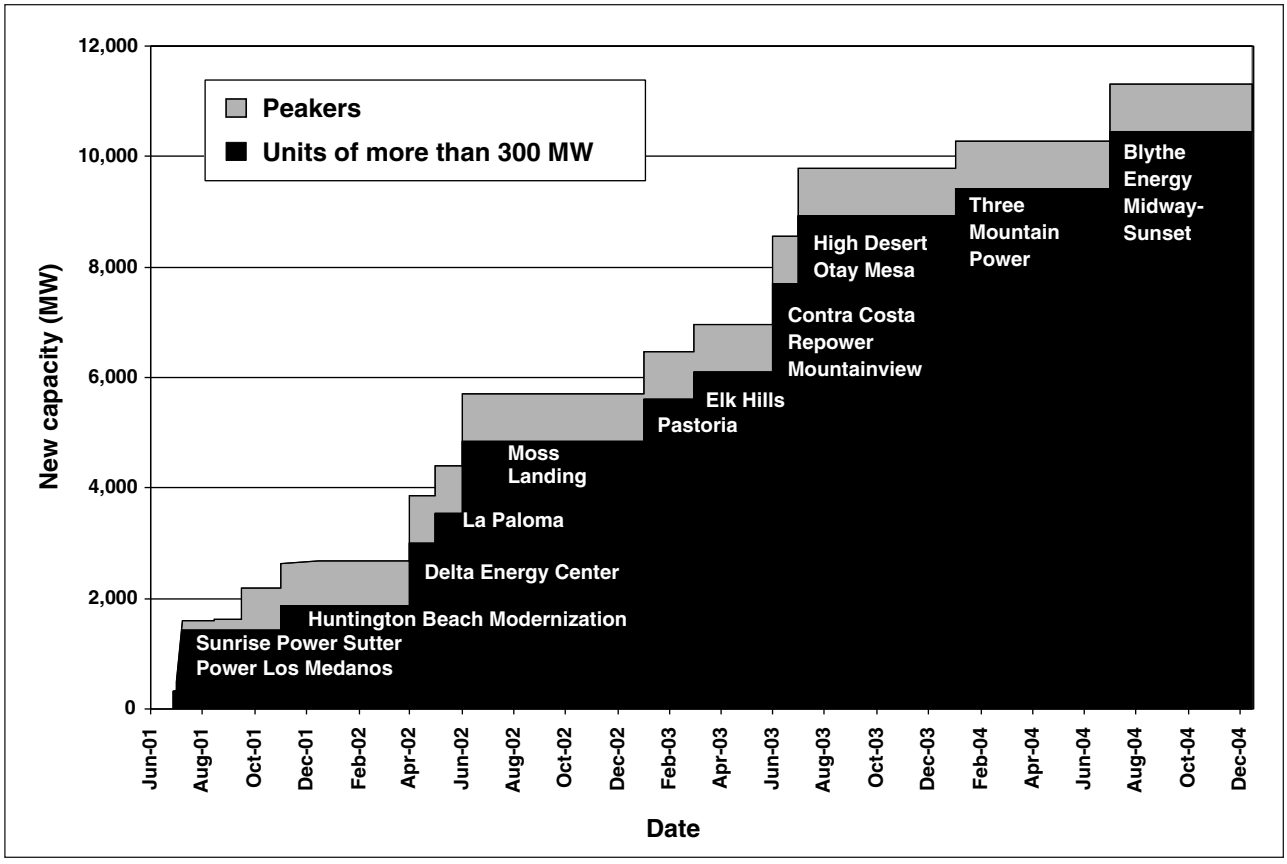

FIGURE 7 Cumulative estimate of new capacity. Source: Sweeney, 2002.

duration of the contracts without materially reducing the costs; in addition, the state has given up the legal right to challenge the generators for overcharging during the crisis.

The state plans to issue electricity revenue bonds to cover the costs of past electricity purchases. If the state issues $13 billion for the bonds, the rate payers would be charged an estimated cost of $1.2 billion per year paid over 15 years to repay this financial obligation. The bond payments and the payments for the long-term contracts would be added to retail electricity prices to be charged to consumers and companies in California. This additional cost creates a strong incentive for industries to bypass California's electricity market and contract directly with generators or invest in distributed generation and generate their own electricity. If companies made such a choice, the costs would be paid by somebody else. When the governor and the legislature realized that consumers were likely to have to bear these costs, California passed a law eliminating direct access, which made it illegal for industries to enter into direct contracts to buy electricity from generators thereby bypassing the financial consequences of the crisis. Thus, as of July 1, 2001, no new direct contracts are allowed between generators and users of electricity. In other words, California is blocking off retail competition to pay for its long-term contracts and state revenue bonds.

The Future

Despite the mistakes that have been made, some things can be done to improve California's prospects for the future. California should encourage private-sector investment and the development of new generating capacity to decrease the risk of shortfalls in supply. The system will also require better risk management because, in this integrated system, investments in transmission facilities and generating facilities will affect the rest of the system. The crisis is over for now, but there is a potential for future crises, particularly if state actions chill the climate for new construction and plants that have already been approved decide not to proceed.

The problems with the electrical infrastructure and the natural-gas pipeline and storage system must be addressed. Ideally, the electrical infrastructure of the

western states could be interconnected with the infrastructure of the eastern states. This would have allowed California to export some of its problems, but a benefit/cost analysis may show that this solution is too expensive. California should carefully reassess its transmission infrastructure, including the infrastructure connecting northern and southern California.

Retail prices should reflect wholesale prices, either on average or through real-time pricing. This would give consumers incentives to respond by reducing their demand for electricity. The role of market power by generators in creating the electricity crisis is being debated. The system should be examined closely to ensure that it is working competitively.

The state should allow utilities to enter a broad range of contractual structures. An industry that works with a nonstorable commodity like electricity, which must be sold upon production, needs to have contract structures that manage risk. Ultimately, the system should be much less dependent on political decision making.

Lessons Learned

We can learn two major lessons from California's experience. First, we should not conclude that deregulation does not work and that it should be avoided in the rest of the country. Pennsylvania is a fine example of successful deregulation. In other parts of the world, deregulation also works well. England had some problems initially, but deregulation is working well now. New Zealand, Australia, and Chile are far ahead of the United States. The issue is not that deregulation does not work but that it should not be done the California way. In fact, deregulation can work very, very well.

Second, isolation of the supply side of the market from the demand side breeds disaster. Appropriate risk management and analysis are essential. Ultimately, any major restructuring of a system, whether it is a company, the military, or the electricity system, is bound to have problems in the beginning. The system must be monitored, and management must be flexible and quick enough to respond appropriately. Governors and legislatures need to act courageously and wisely and not solely for political expediency.

Reference

Sweeney, J.L. 2002. *The California Electricity Crisis*. Stanford, Calif.: Hoover Institution Press.

SUMMER 2001 ISSUE 144 RESOURCES FOR THE FUTURE R E S E A R C H T H AT M A K E S A D I F F E R E N C E FEATURES 8 Drawing Lessons from the California Power Crisis Timothy Brennan Opening statewide electricity markets, a topic usually interesting to only a few policy aficionados, has become a. major story because of the California power crisis. High prices, rolling blackouts, bankrupt utilities, bailouts, and allegations of anticompetitive conduct should provide lessons that other states can use. 13 Redesigning Food Safety 17 Finding