The California Electricity Crisis: Lessons for the Future

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Introduction

California's experience in 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 about the deregulation of electricity. A more complete discussion appears in my forthcoming book, "The California Electricity Crisis".

California went through four stages, all of which presented the state with opportunities for good or 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.

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. 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 was not bad, but the implementation was severely flawed.

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 law 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 and these served to isolate the consumer economically from the producer of electricity. California had created at the wholesale level a volatile commodity market but had fixed sales prices for the investor-owned utilities at the retail level, a potentially untenable combination.

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 pay for all of the stranded costs they

had incurred prior to deregulation. These stranded 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 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 could not adjust to changing economic circumstances. With the sale of generating capacity, risk was 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 late as ten minutes ahead of the time the electricity was to be sold. This arrangement was apparently believed to be more than sufficient for utilities to make necessary adjustments. Utilities were 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. This created a high-risk situation for the investor-owned utilities.

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 idea behind the restructured system was to elicit new supplies of

electricity through construction of new generation plants. Engineers and economists know, however, that even if you can offer higher prices, electric generating plants cannot be pushed beyond their capacity. In the short run, rising wholesale prices in California could allow California to obtain additional electricity from western states connected to one another through the power grid. New plants can be built in California or other states, but construction takes time. The time delay between a price signal and the market response was an important part of the market dynamics.

California needed more than time for the construction of new plants, however. The state also has a difficult and time-consuming process for licensing. In addition, 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.

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

Deregulation could not bring new plants on line instantly, however. 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. Environmental groups such as the Sierra Club and the American Lung Association endorsed the construction.

A second claim 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 projections, 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 (that is, that use more natural gas per MWh 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 caused an increase in demand on an aging system of natural-gas pipelines, which was also forced to operate near to its transport capacity. Because no substantial investment had been made in newer pipeline infrastructure, the rapid increase in the demand for natural gas was constrained by the natural-gas distribution system, which increased natural gas prices dramatically. Another reason generating capacity was limited in the winter was that 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 system. Prices per megawatt hour in California, which were near $30 in April, rose significantly 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 well publicized as a California crisis, soaring wholesale price was a reality for the entire Pacific Northwest and the Southwest. Price spikes were similar, although less publicized in other states. But these other states responded differently. Figure 5 shows the wholesale prices for three different non-California locations – just north of the California-Oregon border (COB), receipt points along the Columbia River (mid-Columbia), and at the switchyard of the Palo Verde nuclear power plant, Arizona (Palo Verde) – as well as in California – originally PX prices, then prices in Northern California (NP 15) and in Southern California (SP 15). Non-California prices are shown with solid lines; California prices are shown with broken lines. In all of these areas prices are almost identical except during December 2000 when California price controls kept wholesale prices below the COB and mid-Columbia prices, and early January 2001, during which the financial risks associated with the financial crisis pushed California prices somewhat above 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, the problem was fixable, however, if the wholesale prices were allowed to serve as price signals to consumers in California, which accounted for 40% of the western electricity use. The higher retail prices would have encouraged rapid and broad-scale energy conservation, conservation that 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.

Had the State allowed retail prices to increase with wholesale prices the wholesale price increases would have been far smaller. This point is illustrated Figures 2 through 4. Figure 2 shows, using data at one-hour intervals from July 1999, the market clearing wholesale price of electricity per megawatt hour on the PX as a function of the total megawatts demanded. When demand is well below capacity, even significant changes in demand have little influence on wholesale price. 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 3 shows the supply and demand equilibrium under California's retail price control regime. With no price signals making their way to California consumers, demand is 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 by a large amount 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 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 therefore limited.

Rather than allowing prices to motivate demand reductions, California state officials continued to assert the need for broadened, stronger wholesale price controls. Price controls had been part of the 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. This soft cap did make it easier for the CAISO to acquire out-of-market electricity and allowed California to avoid a continued sequence of blackouts. But these soft caps were generally ineffectual and they encouraged gaming of the system by generators and marketers, say by exporting electricity from California and re-importing that electricity at a higher price justified by cost, consistent with prices outside California.

During the 2000 – 2001 period there were 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 had to buy electricity from others. The purchase price rose beyond the capped retail selling price. At this point most retailers would stop selling the product. But 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; Southern California Edison 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 California 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 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 were communicating, although both with a lag and attenuated by average cost pricing. These utilities were able to collect enough revenue to pay for the power they bought and thus these other states did not face a financial crisis.

One result of the financial crisis was that when the utilities ran out of money, they couldn't pay their suppliers of electricity. Organizations that the California governor derided as the "Texas utilities," (most of which were neither utilities nor based in Texas, several of which were public agencies from California, Oregon, or British Columbia) typically were able to face delays in payment yet still keep producing. But many small cogeneration plants, or qualifying utilities (QFs), which came into being under the Public Utility Regulatory Policies Act (PURPA), however, live a more-nearly hand-to-mouth existence. 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, which 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 in mid-January 2001. 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 assure there will not be a short-term repeat of the crisis. Figure 7 shows California's cumulative estimate of new capacity expected to come on line during the next three years. By December 2004, it is estimated that there will be 12,000 extra megawatts of new capacity. During 2000 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 electricity crisis was limited by circumstances, but the financial crisis continued.

The Blight

The California State mismanagement of the crisis resulted in financial obligations that now threaten a blight on 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 go on for up to twenty 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.

The annual rate of expenditure will be about $4 billion a year for these contracts, which will also continue until 2011. Under the governor's plan, these costs will be paid entirely by electricity consumers. Although the governor has announced he will demand renegotiation of these contracts, the renegotiations so far have primarily shortened the duration of the contracts without materially reducing their prices, while the State has given up the legal right to challenge these generators for electricity overcharges during the crisis.

In addition, the State plans to issue electricity revenue bonds to cover the State costs of past electricity purchases. If the State issues $13 billion for the bonds, the ratepayers 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 in to retail electricity prices to be charged to consumers and companies in California. This additional cost will be a strong incentive for industries to opt out of the system. These high prices create an incentive for industries to bypass California's electricity market and contract directly with generators or invest in distributed generation, generating their own electricity. If companies made such a choice, these costs would be paid by somebody else. The governor and the legislature realized it was likely that consumers would have to bear these costs. In response to the large number of such contracts being signed, California passed a law eliminating direct access. That law made it illegal for industries to enter direct contracts to buy electricity from generators, thereby bypassing the financial consequences of the State's actions during the crisis. Thus as of July 1, 2001, no new direct contracts are allowed between generators and users of electricity. California is blocking off retail competition so that it can 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 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 lead to cancellation of plants that have already been approved.

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 between 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.

A basic debate currently ongoing is the degree to which exercise of market power by generators played an important role in creating the electricity crisis. Thus the system should be examined closely to ensure that it is working competitively.

The state should allow the 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 contract structures to 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 stop saying that deregulation doesn't 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 driven entirely by political expediency.

Figures

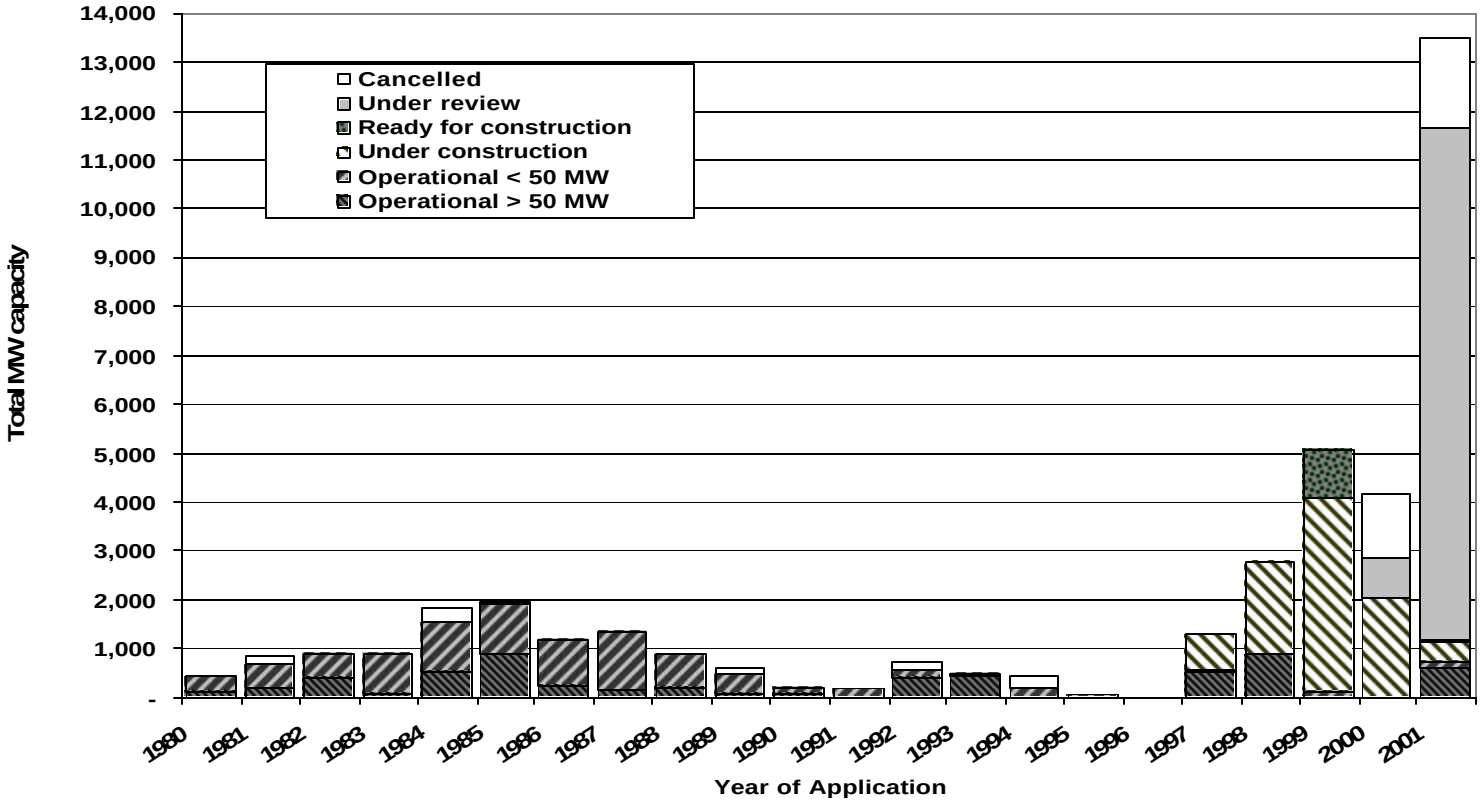


FIGURE 1 Applications for and construction of new power plants. From *The California Electricity Crisis*, by James L Sweeney, published 2002 by the Hoover Institution Press, Stanford University. Data originally from the California Energy Commission.

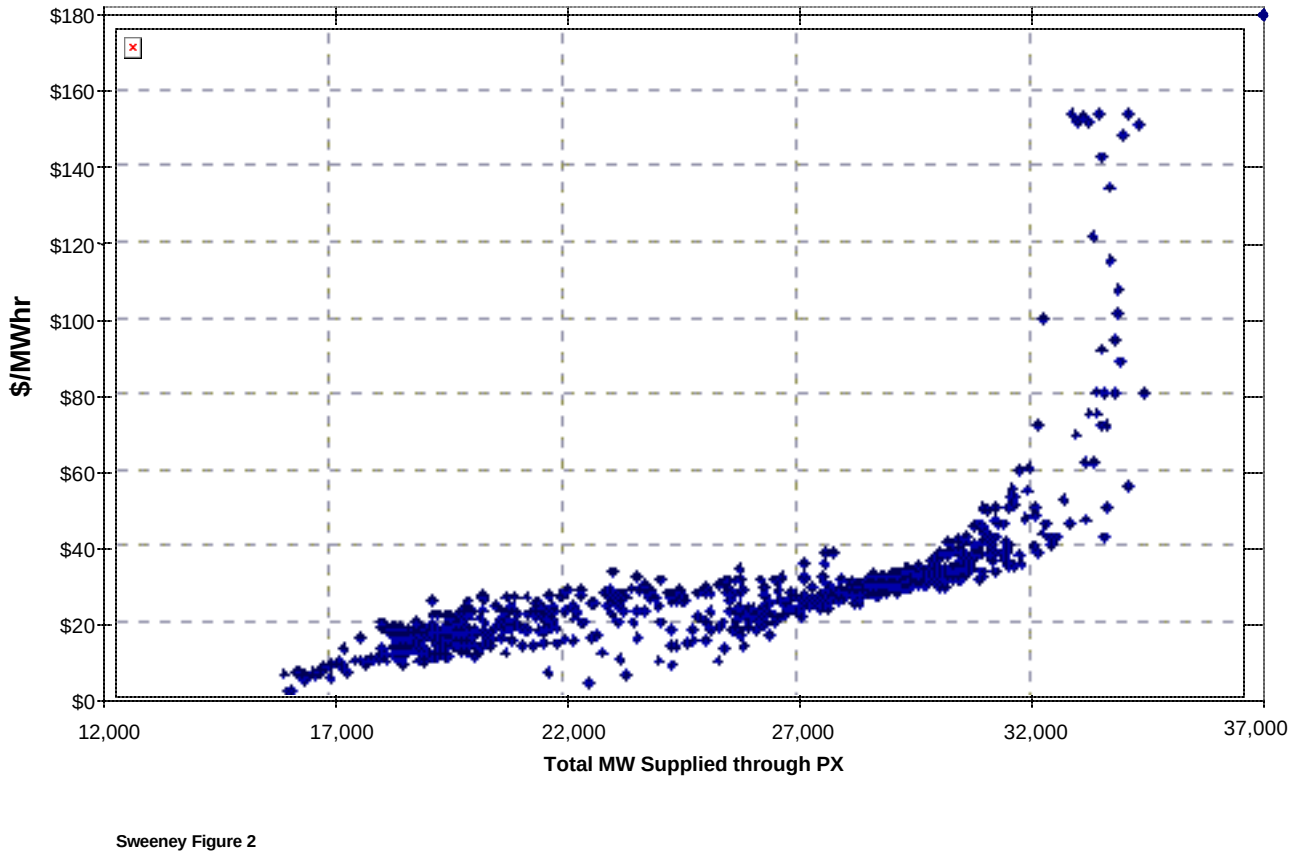


FIGURE 2 Total megawatts at one-hour intervals and prices per megawatt hour. From *The California Electricity Crisis*, by James L Sweeney, published 2002 by the Hoover Institution Press, Stanford University. Data originally from the California Energy Commission.

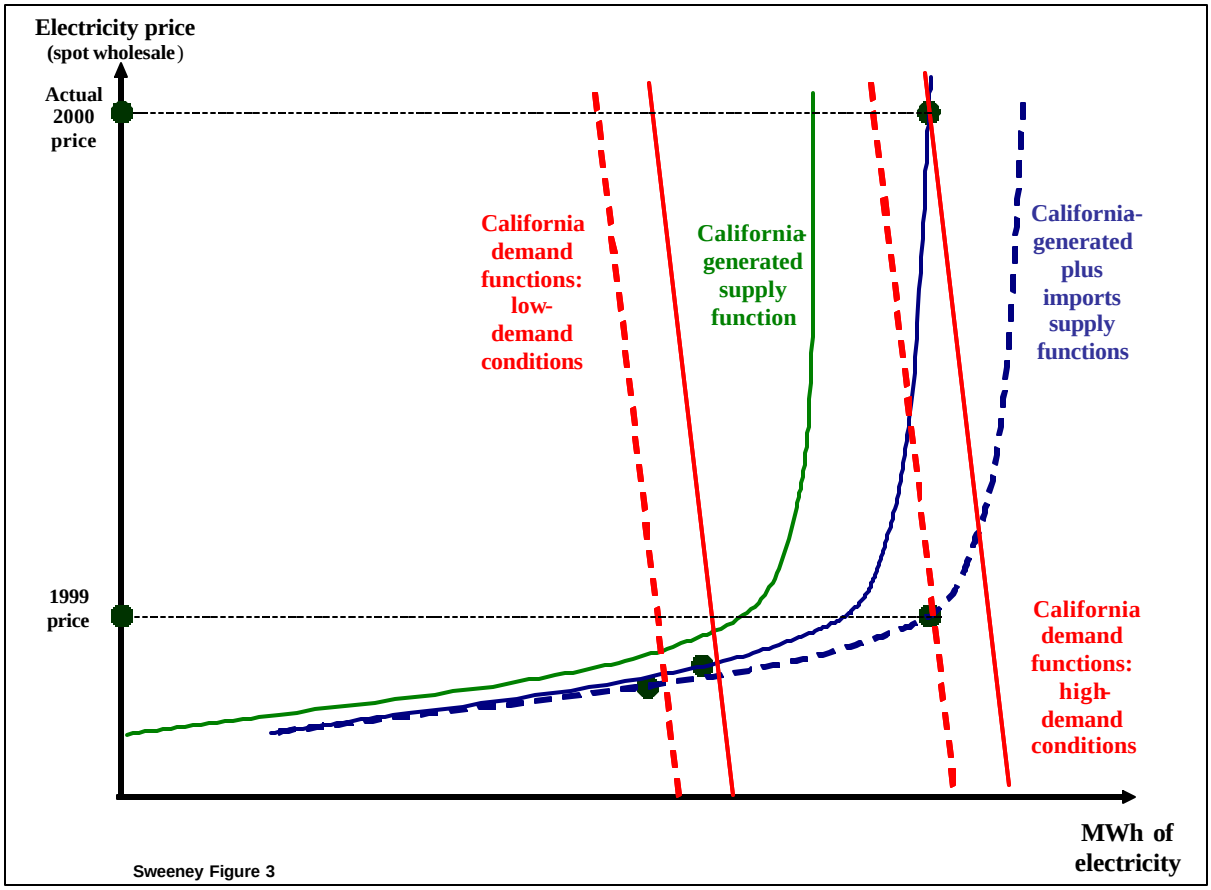


FIGURE 3 Supply and demand system with retail price controls. From *The California Electricity Crisis*, by James L Sweeney, published 2002 by the Hoover Institution Press, Stanford University.

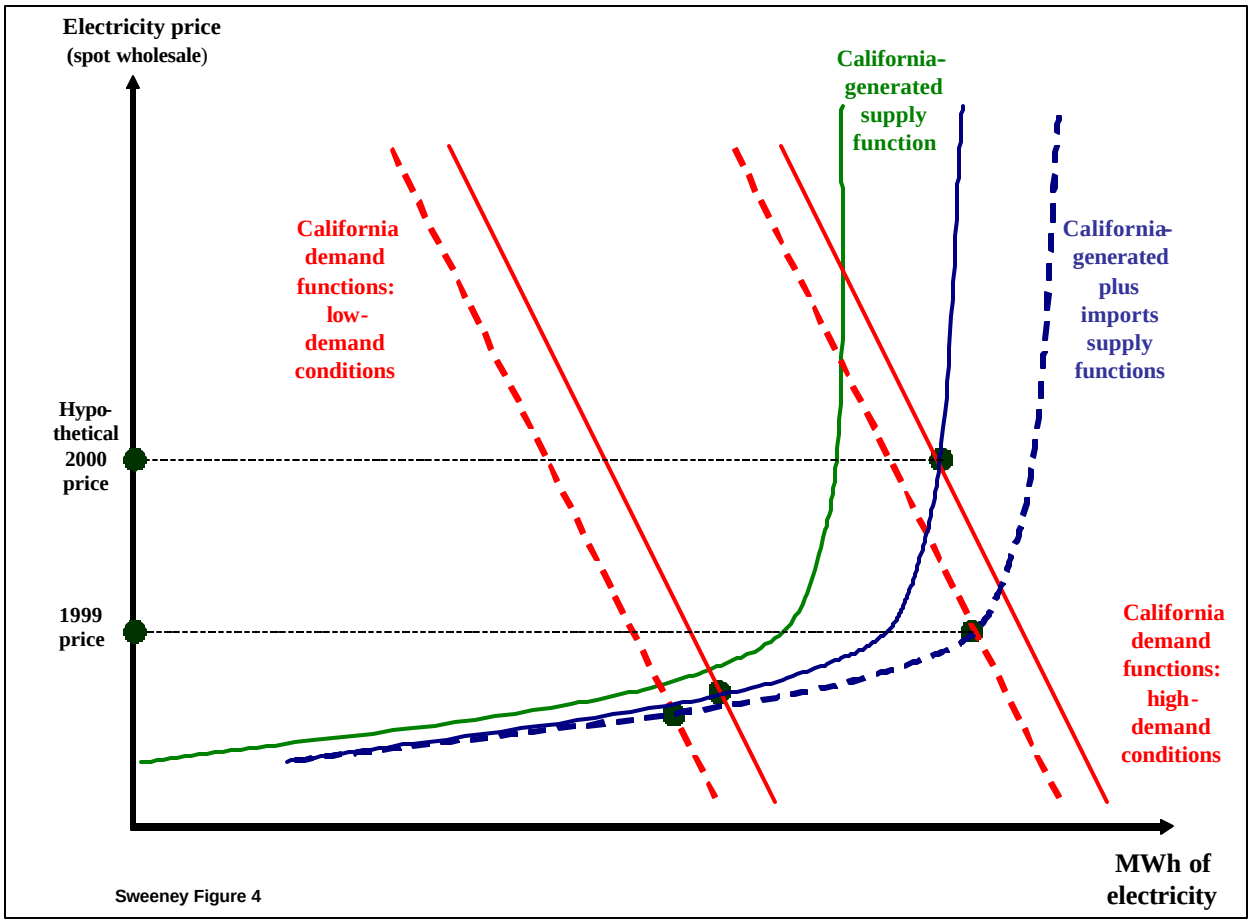
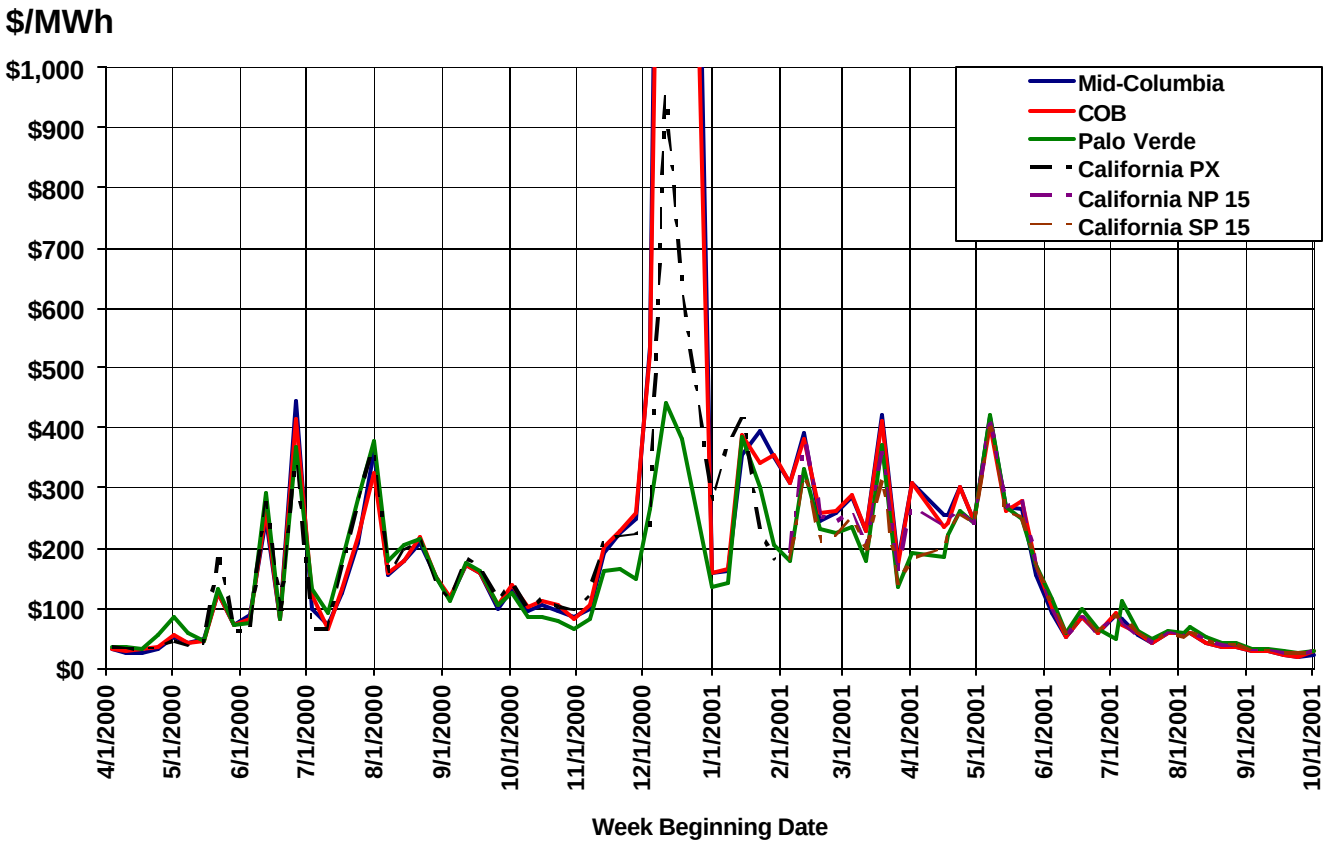


FIGURE 4 Supply and demand system with no price controls. From *The California Electricity Crisis*, by James L Sweeney, published 2002 by the Hoover Institution Press, Stanford University.



Sweeney Figure 5

FIGURE 5 Spot Power Prices: Average of High and Low Peak Prices, Various Western Markets. Data from *Western Price Survey*, published by Energy NewsData Corporation, www.newsdata.com.

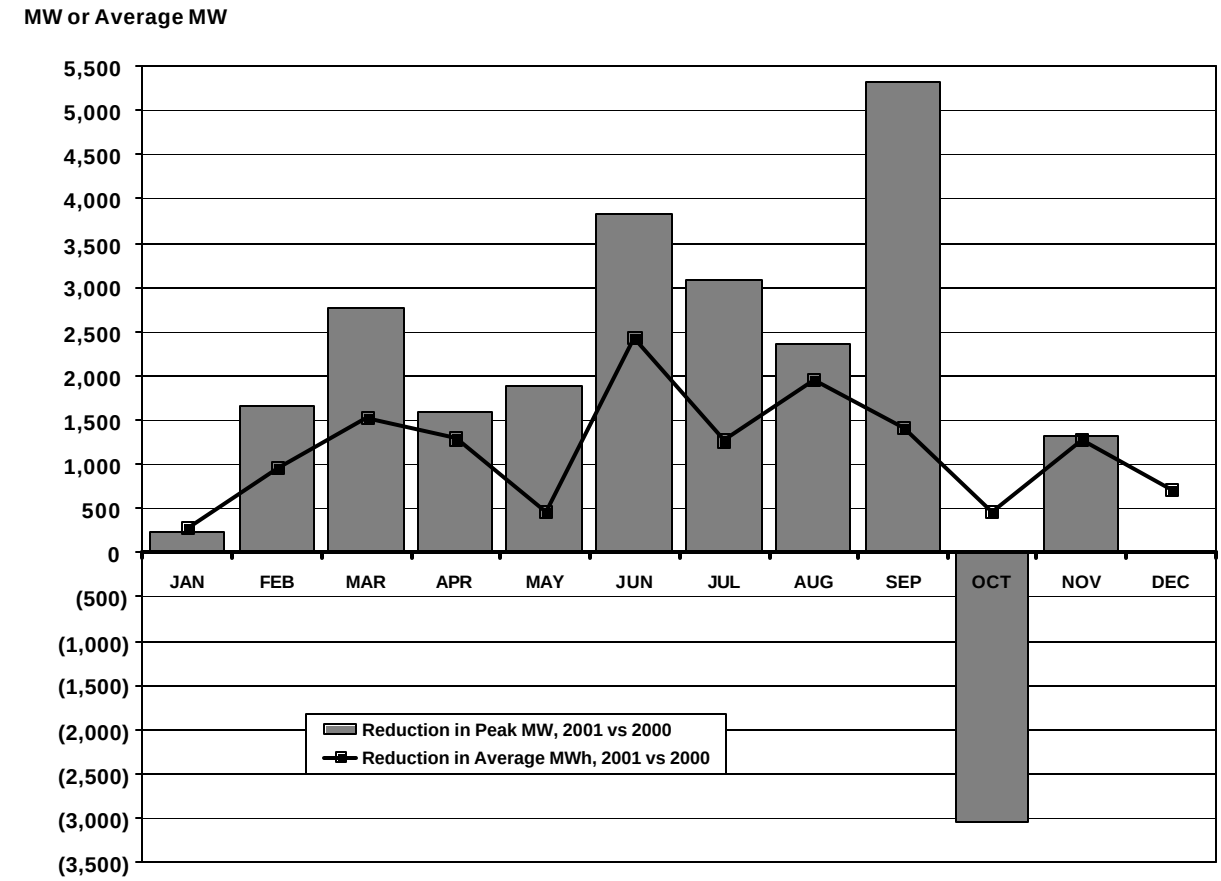


FIGURE 6 Reductions in electricity in 2001 and 2000. From *The California Electricity Crisis*, by James L Sweeney, published 2002 by the Hoover Institution Press, Stanford University. Data originally from the California Energy Commission.

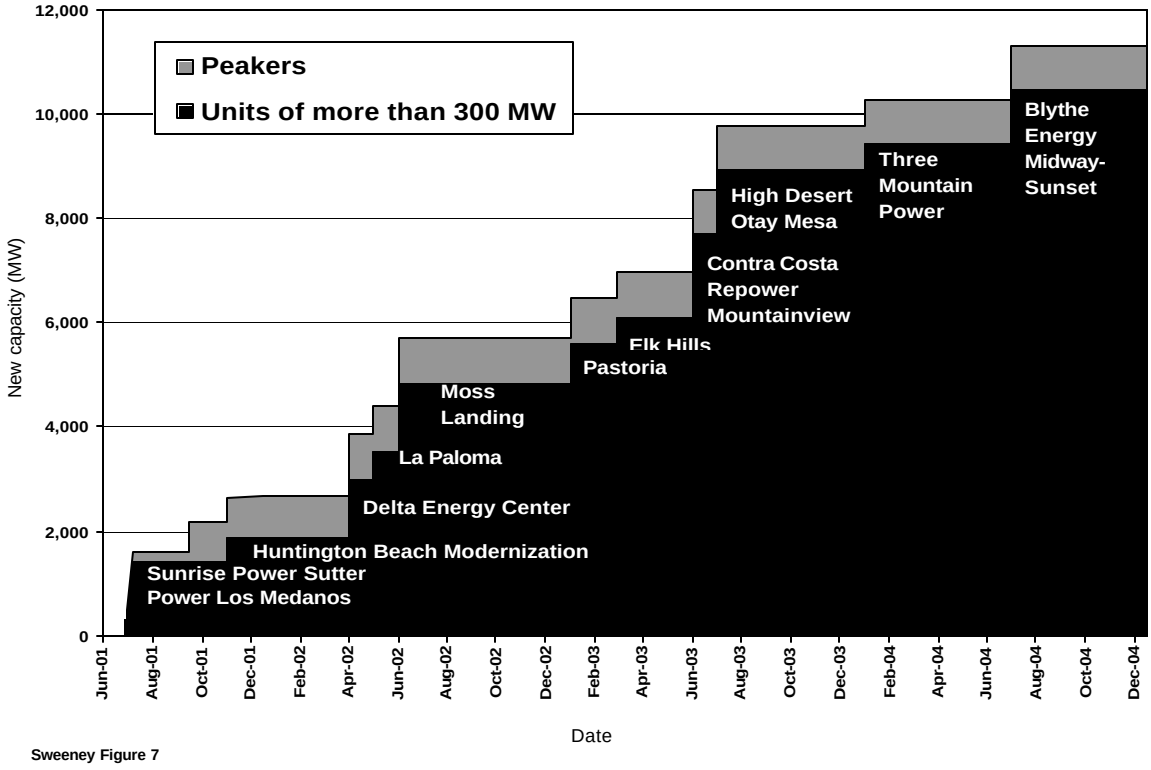


FIGURE 7 Cumulative estimate of new capacity. From *The California Electricity Crisis*, by James L Sweeney, published 2002 by the Hoover Institution Press, Stanford University. Data originally from the California Energy Commission.