



# Policy Brief

Stanford Institute for Economic Policy Research

## What Went Wrong With California's Restructured Electricity Market?

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The blueprint for electricity industry re-structuring in California, Assembly Bill (AB) 1890, stated that it would create a “market structure that provides competitive, low cost and reliable electric service, provides assurances that electricity customers in the new market will have sufficient information and protection...” Several events during the summer of 2000 appear to directly contradict these claims. On June 14, 2000, Pacific Gas and Electricity was required to institute rolling blackouts for nearly 100,000 customers in San Francisco because of insufficient available transmission capacity to serve the extremely high demand caused by a peak temperature of 103 degrees. San Diego consumers, the first to see the end of the retail rate freeze imposed by AB 1890, experienced electricity bills for June 2000 that were more than double those in the same month in 1999. These events have caused many consumer groups and federal and state policymakers to question the wisdom of placing greater reliance on market forces to provide such an essential commodity as electricity.

Can a competitive market provide the low cost, reliable electric service promised in AB 1890? Other re-structured electricity markets around the world provide evidence that competitive markets can benefit consumers, but with a number of important qualifications. Specifically, several features of the technology of producing and distributing electricity, and the manner in which it has been priced historically, can make it difficult for a competitive electricity market to achieve these goals. The major factor causing the events of the summer of 2000 was a failure to account adequately for these unique features of the electricity industry in the California market design process.

### The Vertically-Integrated Regulated Monopoly

For almost 100 years, the dominant mode of electricity supply in the US was through a vertically-integrated geographic monopoly market structure. In exchange for this legal geographic monopoly status, the firm is required to serve all demand in its service area at a

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regulated price set to allow it the opportunity to recover all prudently incurred costs. By combining the obligation to supply all electricity demanded over a large geographic area in a single firm, larger and larger facilities with lower and lower average production costs could be constructed to meet a growing demand for electricity. This market structure also fostered the development of extensive transmission and distribution grids to deliver electricity to consumers located throughout the firm's geographic territory. This market structure yielded declining nominal electricity prices until the early 1970s, despite growth in aggregate electricity consumption that was significantly higher than the rate of growth in the level of aggregate economic activity.

The run-up in oil prices during the 1970s brought significant increases in electricity prices and a search for alternate technologies for producing electricity. During this period of uncertainty, the local geographic monopolies and their associated state regulators made many very long-lived investments that turned out to be extremely costly because of the subsequent behavior of oil prices, increased environmental concern and a slowdown in the rate of growth in electricity consumption. Few states made more costly investments in new generation facilities and long-term purchased power contracts during this period than California. By 1996, California retail electricity rates were as much as twice as high as those in neighboring states because of very costly investments approved by the California Public Utilities Commission (CPUC) over the past twenty years.

## **The Promise of Competition**

California's competitive wholesale electricity market began operation on April 1, 1998, but transmission and distribution services are still supplied by the original vertically integrated geographic monopolies at prices regulated by the California Public Utilities Commission (CPUC). To ensure non-discriminatory access of all generation unit owners and load-serving entities to the transmission grid, the California Independent System Operator (ISO) was established as non-profit corporation to operate the grid. The ISO is responsible for ensuring that sufficient electricity is available at all times and at all loca-

tions in the transmission grid to meet the geographic distribution of electricity demand. The California Power Exchange (PX) was established as an anonymous market for generation unit owners and load serving entities to trade wholesale electricity.

As part of the re-structuring process, the CPUC allowed the three large investor-owned utilities—Pacific Gas and Electric, Southern California Edison, and San Diego Gas and Electric—to recover the costs of assets rendered uneconomic by a competitive wholesale market. These outstanding obligations are often referred to as “stranded assets,” because of the belief that they could not be recovered in a competitive wholesale market. In return for stranded asset recovery, these firms agreed to sell a substantial fraction of their generation capacity to new entrants to the California market.

As a result, currently there are a number of firms competing to supply electricity into California. During the period in which the three large investor-owned utilities recover their remaining stranded assets, retail electricity prices are frozen at 10% below their 1996 levels. In early 1999, San Diego Gas and Electric completed the recovery of its stranded assets and ended the retail rate freeze for customers in its service area. During the summer of 2000, Pacific Gas and Electric and Southern California Edison each initiated a proceeding with the CPUC to end their retail rate freezes.

The impetus for re-structuring in California was the desire to avoid in the future the costly investment mistakes of the past, or if these mistakes did occur to transfer the cost to investors rather than to consumers. Competitive markets provide no guarantee that long-lived investments will receive sufficient returns to re-pay their cost, different from the case of a regulated monopoly industry. If technological change occurs that makes a mode of production obsolete, a firm employing this technology in a competitive market may not receive sufficient revenues to repay its investment costs and may be forced to exit the industry.

A competitive market provides strong incentives for least-cost production. However, in a competitive market all firms have a common interest in setting higher output prices. If a

firm that is small relative to the market unilaterally sets a higher price, it loses sales to competitors that do not match this price increase. In virtually all markets, consumers reduce their demand for the product if its price rises.

Economists say that a firm possesses market power if it has the ability to raise significantly the price it charges and profit from this price increase. If the combination of the likely increased sales by competitors and reduced purchases by consumers render any significant unilateral price increase by the firm unprofitable, then the firm is said not to possess significant market power. A market where no firm possesses significant market power is the goal of the electricity industry re-structuring process.

### **The Prospects for a Competitive Electricity Market**

Unfortunately, the nature of electricity production, how it is priced to retail customers and initial conditions in the industry in many states considering re-structuring make this an extremely difficult task. First, electricity is extremely costly to store. As a result, the supply and demand for electricity must be balanced at every node in the transmission grid at every instant in time. Second, electricity must be delivered through a transmission grid shared by all producers and consumers of electricity. Particularly on very high demand days, this creates the possibility that there is sufficient energy to meet statewide demand, but insufficient available transmission capacity to serve specific geographic areas. Third, electricity production is subject to severe capacity constraints—each generation facility has a maximum capacity and new construction takes many months after the necessary environmental approvals have been obtained.

When demand is a sizable fraction of the available capacity, all firms know that any attempt to raise market prices will be met with only limited increases in supply from their competitors. During these load conditions, there is very little competition constraining the exercise of market power because all firms are sure that a significant fraction of their capacity will be necessary to serve demand.

These opportunities to exercise market power are enhanced by the way that electricity has been historically priced to final

consumers. Few residential and small business customers actually pay a retail price that fluctuates with the hourly wholesale price. Historically, these consumers purchased electricity according to a fixed price schedule that does not adjust to wholesale market conditions. This retail price schedule provides little incentives for customers to reduce their demand during hours with high wholesale prices.

Even if residential consumers paid a retail price that varied with the hourly wholesale price, which was the pricing mechanism faced by the citizens of San Diego during June 2000, they would have little incentive to reduce their demand during hours with high wholesale prices. Most residential consumers have meters that are read once a month, so their total monthly charge for wholesale energy must be computed by multiplying their total monthly consumption by a weighted average of all hourly wholesale energy prices for that month. This weighted average price is computed using a load shape that the retailer believes is representative of that customer class. Although these customers have an incentive to reduce their demand during months with high average wholesale prices, they have no additional incentive to reduce their demand during the hours when wholesale prices are high. Their monthly electricity bill is reduced by the same amount by consuming 1 kwh less during an hour with a wholesale electricity price of 75 cents/kwh (the wholesale price cap during June 2000), as it is from consuming 1 kwh less during an hour with a wholesale price of 0 cents/kwh. These limited incentives for price-responsive final demand made the California wholesale electricity markets even more susceptible to the exercise of market power during the summer of 2000.

The current condition of regional transmission networks in most parts of the US also enhances the ability of firms to exercise market power. Transmission networks throughout the US were optimized to serve the geographic distribution of demand under the vertically integrated monopoly regime. Under the former regime, if a transmission constraint occurred, the monopoly electricity supplier could run a very expensive local generation facility that it owned in order to meet local load. This enabled the vertically-integrated utility to serve its load with a less extensive transmission network than would be needed in a competitive regime.

Under the competitive regime, a market process is used to determine which generation units are allowed to produce. However, there are still times when the only way to serve local demand is by operating a high-cost facility located in that area. That facility is now owned by a profit-maximizing firm that knows its output is required to serve load during that hour. This firm has a very strong incentive to bid very high prices to supply energy at these times. Unless the transmission capacity into this area is increased, there will be no effective competition to discipline the attempts of the local generation unit owner to exercise market power during these hours.

### **How Competitive Markets Can Benefit Consumers**

In spite of its susceptibility to the exercise of market power, a competitive electricity market can benefit consumers. There is no guarantee competition will yield lower retail prices than those under the former vertically-integrated, geographic monopoly regime. For this to occur, the market must be designed with the primary goal to protect consumers against the exercise of market power. Without these safeguards in place, market outcomes such as those that occurred this past summer in California can happen in virtually any competitive electricity market.

The most important protection for consumers during the initial stages of a competitive market is mandatory forward contracts at regulated prices sold by owners of generation facilities to electricity retailers. These forward contracts should cover a large fraction of the expected annual output of each generation unit for at least two years. This allows time for new generation entry and lessens the opportunities for the existing unit owners to exercise market power in the spot market when the contracts expire. These contracts can run for a longer duration, but the quantity sold should decline significantly after the first two years. With significant forward contract cover at a regulated price, electricity retailers are protected from spot market price risk for a large fraction of their sales to final consumers. This allows a state's Public Utilities Commission (PUC) to set a fixed retail price that must be offered by electricity retailers to all residential and small business customers.

Electricity retailers are not precluded from offering other pricing plans, but the availability of this fixed-price plan protects consumers and small business customers from spot market price risk during the initial stages of the competitive wholesale market. Retailers can offer more flexible pricing plans so consumers will voluntarily take on more spot price risk. Large industrial and commercial customers do not need to be covered by this fixed retail rate because they have long had the financial clout and sophistication to protect themselves in a competitive electricity market.

The next step to protect consumers from the exercise of spot market power is to develop a competitive retail electricity market as rapidly as possible. This will stimulate the development of price-responsive demand programs and other creative ways for consumers to elect to become more active participants in the forward and spot markets. Without an active demand-side, many of the potential benefits of competition will be lost. An active demand-side market does not require that all consumers proactively alter their hourly demands in response to hourly wholesale prices. Programs that automatically shut off electric hot water heaters or cycle air conditioners or refrigerators on high load days can provide significant price-responsive demand to the wholesale market.

Firms in a competitive market have strong incentives to provide the full diversity of products that consumers demand. Unrestricted entry of retailers and active competition among them to attract price-responsive residential and small business customers will maximize the likelihood that all forms of price-responsive final demand will develop. The fixed retail rate will protect consumers who do not want to switch to one of the new pricing plans. As the competitive retail market develops, there will be less need for the state's PUC to set a fixed retail rate because competition among retailers to attract customers will provide the firms with strong incentives to acquire their wholesale energy at least cost. If a retailer agrees to sell electricity to a consumer at a fixed price, then it will have a very strong incentive to make the forward market purchases necessary to hedge this price risk. If the customer is willing to share some of the burden of managing the wholesale market price risk, the retailer can offer a variable price retail rate that yields the opportunity for the customer to pay a lower average price for electricity than the fixed price contract.

The way to protect consumers is to implement market rule changes in a manner that favors consumers. One lesson to emerge from all electricity industry re-structuring processes in the US and around the world is that it is impossible to get all of market rules right from the start.

Market participants—generation unit owners, electricity retailers and energy traders will play an important role in the market re-design process because their financial interests are directly impacted. The management of the independent system operator of the transmission grid will also demand to play an important role because these decisions impact how they operate the transmission grid. Unfortunately, none of these entities have a very strong financial incentive to lower wholesale energy prices in order to benefit consumers. Clearly, generation unit owners prefer high to low prices, and they all have a common interest in using the market re-design process to pursue these interests. Electricity retailers also have little interest in low wholesale electricity prices, unless they face the prospect of losing customers to other retailers who managed to procure wholesale energy at lower prices. Finally, the primary concern of the management of the ISO is maintaining grid reliability.

Although all consumers would like the lowest wholesale electricity prices consistent with financial viability of the industry, in most market re-design processes the interests of consumers receive a relatively small weight. However, this weighting scheme fails to recognize the goal of industry re-structuring. It is not to allow generation unit owners or electricity retailers to make higher profits than they did under the former regulated-monopoly regime. These firms should be able to do so only if they are able to reduce significantly total electricity generation costs relative to those in the regulated regime. Neither is the goal to make the task of operating the transmission grid easier. The jobs of the engineers operating the bulk transmission grid should only be made easier if, at the same time, the engineers are able to reduce the cost of operating the transmission grid relative to the former vertically-integrated regulated regime.

The goal of industry re-structuring is to lower the cost of retail electricity. The market re-design process should focus on this goal and only allow generators and the engineers operating the

transmission grid to have the opportunity to earn higher profits or make their jobs easier if they are able to operate in a more cost-efficient manner. ■

## About the author



**F**rank A. Wolak received his Ph.D. and S.M. from Harvard University. He is a Professor of Economics at Stanford University, and the Chairman of the Market Surveillance Committee of the California Independent System Operator for the state's electricity supply industry. He is a visiting scholar at University of California Energy Institute and a Research Associate of the National Bureau of Economic Research (NBER). Wolak is also an associate editor of the *Journal of Industrial Economics* and *Journal of Econometrics*.

Professor Wolak's fields of specialization are industrial organization and econometric theory. His recent work studies methods for introducing competition into formerly regulated infrastructure industries—telecommunications, electricity, water delivery and postal delivery services—and on assessing the impacts of these competition policies on consumer and producer welfare.

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