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The California energy crisis☆,[1]

Luís Cabral*

Department of Economics, Stern School of Business, New York University, 44 West Fourth Street, KMC 7-82, New York, NY 10012, USA

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Abstract

When a basic commodity becomes unavailable for periods of time; when prices (wholesale prices) fluctuate on an interval that is several times greater than the average level, an average that increases by a factor of 10 or 20 over a few months; when some of the basic suppliers are on the verge of bankruptcy; then we say we are in a crisis.

This is just some of what happened in the Californian electricity industry in the past two years. In this paper, I will discuss the main events in the energy crisis; the main reasons why things got to the point where they are; and some possible solutions.

Keywords: California; Energy crisis; Regulation

1. What happened?

Following the example of the United Kingdom, the State of California decided to partially deregulate its electricity industry. The electricity value chain can be divided into three different stages: generation, transmission and distribution. While natural monopoly considerations may be relevant for transmission and distribution, the same is not true for generation. It was, therefore, decided to deregulate generation, while maintaining transmission and distribution under a system similar to the pre-existing one (rate of return regulation).

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[1] The journal will publish lectures and short papers by renowned administrators, statesmen and scholars who have influenced economic policy. This paper is one of those series of policy papers.

* Tel.: +1-212-998-0858.

E-mail address: lcabral@stern.nyu.edu (L. Cabral).

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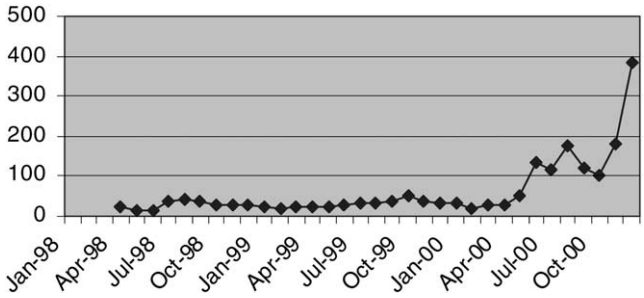

Fig. 1. California PX day-ahead prices. Average monthly average prices (7 × 24). Source: Joskow and Kahn (2001).

Two important additional measures were: (a) not to allow long-term contracts between the power generation companies and utilities (i.e. those responsible for transmission and regulation); and (b) to freeze consumer rates until the Spring of 2002. The idea behind (a) is that long-terms contracts may be anti-competitive (i.e. they may deter entry by new firms) (see Cabral, 2000). The idea behind (b) is to protect consumers during the transition period, while allowing utilities to recover "stranded" investment costs, under the assumption that competition at the generation level would lead to lower wholesale prices and better retail margins.

Unfortunately, things did not work out as expected. Instead of going down, wholesale prices increased dramatically, beginning in the Spring of 2000 (see Fig. 1). In the current situation, not only are wholesale prices high, they are also extremely volatile. Naturally, this put a lot of pressure on the utilities: selling below cost is generally not good business.

Responding to this, regulators retracted the long-term contract ban and allowed utilities to increase rates. But it was too little and too late. Mounting losses eventually led the utilities to significant financial distress. It was not a big surprise when—just days ago—PG&E filed for Chapter 11 creditor protection.

In addition to the utilities' financial viability, there is also the basic problem of supply and demand. A booming California economy and nearly frozen retail rates implied that demand grew faster than supply. The utilities' financial distress, in turn, led to additional supply problems: no sensible businessperson wants to sell on credit to a nearly bankrupt firm. The result is a classical example from Econ 1: if demand exceeds supply and price is fixed, then some form of rationing must take place. On 17 January 2001, a series of rolling blackouts were ordered statewide, a situation that continues to affect the Californian economy.

2. What went wrong?

As the above description of the main events suggests, the California energy crisis is the result of a number of factors. Spreading the blame among the different exogenous and endogenous factors is still a point of debate. However, there is relatively common agreement on the following five-point list.

1. An unexpectedly high demand, resulting from a booming Californian economy.
2. Very low retail rates. Initially, rates were frozen at their 1996 levels. Notice moreover that, in addition to being low, consumer rates are by and large time independent.[2]
3. Low level of new generation plant investment (reflecting, to a great extent, the uncertainty surrounding the industry). In an attempt to improve this, Gov. Davis has ordered, on 8 February 2001, an expedited approval process for new power plant construction, saying this would help bring 20,000 MW of new generation on line by July 2004. He also eased emissions controls on older plants. But these measures have little impact on short-run supply.
4. Increased operation costs of generation plants. Most California plants rely on natural gas. Courtesy of OPEC, natural gas prices increased dramatically in the past few years. On 27 December 2000, US natural gas futures hit a record high US$ 1010 per million Btu, about four times above year ago prices.
5. Last but certainly not least, the new wholesale electricity market structure also played an important role in the unraveling of events. Given the importance of this factor, I deal with it in a separate section.

3. The wholesale market

The wholesale market is a spot market, long-term contracts not being allowed. Power companies submit bids of the type "I am willing to supply x_i for a price p_i". Bids are aggregated in increasing order, forming a supply curve. The winning bids are determined by the intersection of supply and demand. Winning bids x_i get to sell the quantity they promise and are paid the value of the "equilibrium price", the price set by the highest winning bid. In the jargon of auction theory, this is a uniform price auction.

Fig. 2 shows (approximately) the actual marginal cost curve for California producers. As can be seen, the curve is essentially flat up to approximately 10 GW, and then it rises very steeply. This a common pattern in electricity supply. One the one hand, we have the so-called base plants with low operating cost but high set-up/shut down cost. Complementing these during periods of peak demand, we have a second set of plants with lower set-up/shut down costs but higher operating costs. The information in Fig. 2 is well known by all firms.[3]

The problem with this situation is that it provides significant incentives for "infra-marginal" plants to withhold supply and, thus, increase market price. Consider a plant whose operating cost is such that it is positioned around the 5 MWh portion of the supply curve. If the demand is given by D_H, then a supply cut of ΔQ effectively shifts the supply curve to the left as indicated in Fig. 2. Although this implies a revenue loss corresponding to the output cut, if the demand curve is given by D_H and each plant bids its marginal cost, then equilibrium price increases from P_0 to P_1, an increase ΔP which may more than compensate for the output cut. Notice that this capacity withholding effect only works if demand is high. If demand were D_L instead, then the same ΔQ as above would hardly have any effect on equilibrium price.

[2] Large industrial users have paid time-dependent rates for some time.
[3] Obviously, there may be maintenance and unexpected shutdowns that reduce capacity temporarily.

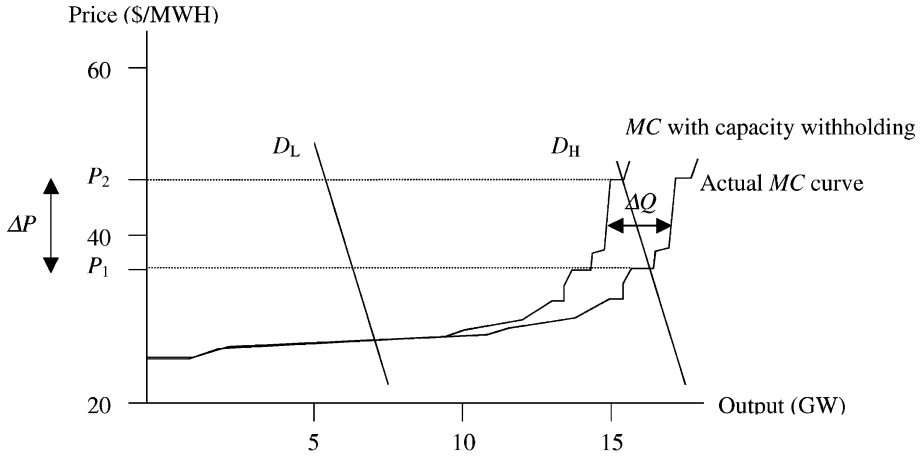

Fig. 2. Marginal cost curve of instate fossil units. Source: Borenstein et al. (2000).

In the above calculations, I have assumed that each plant bids its marginal cost; but even that is an optimistic assumption. If a given firm owns both a low-cost and a high-cost plant, as is frequently the case, then it has great incentives to set high bids for the high-cost plant. In fact, there is a good chance this will be the marginal plant, in which case gains will accrue not only for the high-cost plant but also for the low-cost one.

These considerations are not just theoretical possibilities. Empirical evidence provides ample support. See Joskow and Kahn (2001) on strategic capacity withholding in California and Catherine Wolfram (1998) on strategic high bidding in England and Wales. Also, Borenstein et al. (2000) show that price-cost margins in California are higher when demand is higher, a fact that is consistent with the capacity withholding story.

The above notwithstanding, one must be careful before assigning strategic market power motives to the decision of withholding supply. Considering the financial situation that utilities have gotten into, withholding supply may be optimal even absent market power considerations.

4. Some possible solutions

The California energy crisis is a problem of supply and demand mismatch. One important part of the solution is to increase supply, both at the generation and at the transmission and distribution levels.

But increasing supply is not sufficient. Important measures will need to be taken to make the wholesale market more competitive. Some economists proposed a price cap on wholesale prices. I am not sure this is the right solution; in fact, it defeats the purpose of deregulation in the first place.

Switching from a uniform price auction to a discriminatory auction is one possibility. It is naïve to say that discriminatory auctions are better for consumers because each utility is

paid what they bid, not the highest winning bid. It is naïve because, under a discriminatory auction, firms submit higher bids than under a uniform price auction, so there is a trade-off, the result of which is not trivial. However, the analysis in the previous sections suggests that much of the market power created by strategic capacity withholding and marginal plant overbidding would be reduced by a switch to a discriminatory auction.

Last but not least, the mismatch between supply and demand will only be solved when retail prices are made more flexible. This is a politically "expensive" measure, but one that cannot be avoided.

Specifically, there are two dimensions to price flexibility. The first one is price levels. In order to avoid quantity rationing (blackouts) prices need to increase to the point that balances supply and demand. No one likes to pay higher prices, but I am sure most Californians would be willing to pay "fair" increases for the "luxury" of not being subject to blackouts.

The second dimension of price flexibility is time-of-day pricing. Common for commercial users, this is still the exception for residential customers. In addition to the political cost, time-of-day pricing is also expensive to implement: it would require the installation of a "smart" meter in each home. But the benefits would also be enormous. An indication of the potential benefits is the significant time-of-day price variability in the wholesale market. Considering the relative flexibility of some of the consumer uses of electricity (e.g. running a washing machine), it seems extremely inefficient to have consumers optimize their decisions based on a fixed rate, when in fact the marginal cost of power may change by several orders of magnitude between different times of the day.

5. Conclusion

It must be acknowledged that not everything went well with the California experience of deregulating the electricity industry. In fact, it may be argued that everything went wrong. However, as policymakers contemplate the way forward, it is important not to make the mistake of "throwing the baby out with the bathwater". The California crisis resulted from a combination of exogenous and endogenous factors, some temporary, some structural. However, the basic idea of creating competition at the level of power generation is a valid one and one that should be maintained in the future.

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