

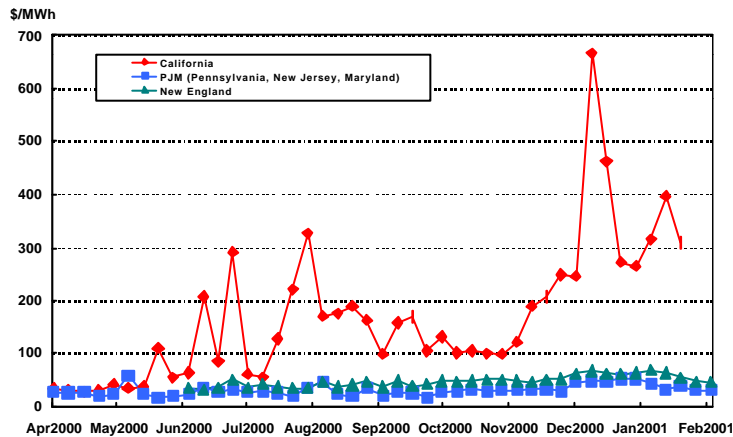
Special Research Report:
 Recent Price Spikes and Volatility in the US Energy Market
 (Part 3: Electricity Market)

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1. Introduction

In the US, the liberalization of the wholesale electricity market began by the order of Federal Energy Regulatory Commission (FERC) in 1996. However, the level of progress varies depending on each state. The state of California together with the state of Massachusetts enforced retail liberalization without delay. However, since the summer of 2000, the wholesale electricity price surged in California as the supply and demand situation became very tight due to very fierce heat, etc. (Fig. 1). In certain areas, the retail price rose also and created a major social issue. The situation got even more serious when the winter came with the two major power companies facing crisis of bankruptcy and in January 2001, rolling blackouts had to be enforced. Various analysis and evaluations have already been made on this situation both within the US and abroad, and it is revealed that a number of factors are involved¹.

Fig. 1 Comparison of Wholesale Electricity Prices in California and Northeast Regions



(Source) Prepared from respective ISO data

* Hokkaido Electric Power Co., Inc., now

¹ Refer to Junichi Ogasawara, "Karifornia-shu denryoku-kiki ni tsuite (Electricity Crisis in California)" (IEEJ homepage, updated in February 2001)

In order to investigate the situation, we interviewed related people at research institutes, industry associations and public institutions in Washington, D. C., Los Angeles and Sacramento from 4 - 10 February, 2001. This is a firsthand report on the US electricity market, especially on the electricity crisis in California and its causes based on the on-the-spot survey.

2. Insufficient Capacity of Electricity Supply

The power crisis in the state of California was triggered by the fierce heat of the summer of 2000. With the sudden increase in the demand for electricity and the limited grid capacity for transmission, the supply-demand situation in certain areas became very tight. The demand for electricity, however, has been increasing in California even before the occurrence of this situation (Fig. 2), and when their capacity to supply power becomes insufficient in peak loads, they have relied on other states in the northeastern part of the country to fill the shortage. It is also true that with the introduction of strict environmental regulations, it has become more difficult to construct power plants and has taken a longer time for construction to complete. Procedures for installing power plants are administered by the California Energy Commission, but in fact, various governmental organizations are involved to make the situation more complex, requiring a long time for getting an approval.

As shown in Fig. 3, the number of newly constructed power plants is quite limited since 1990. It is assumed that investments in 1990's were inactive due to strict environmental regulations, fewer approvals for new construction with the change of regime, and especially in the latter half of the decade, the lack of incentive for investments due to uncertainty in business environments under liberalization. Figures for 2001 and onward are based on the plans, but they now have a line of quite a few construction plans for power plants as a result of the tight supply-demand situation.

It is not easy to install new transmission lines due to environmental regulations including a scenic view. There is a limit to the capacity of system interconnecting lines with other states as well as the capacity of the main lines integrated northern and southern areas within the state. The problem in the power transmission capacity was one of the factors for the power cuts, which were enforced, only in the northwestern part; i.e., San Francisco and the surrounding area.

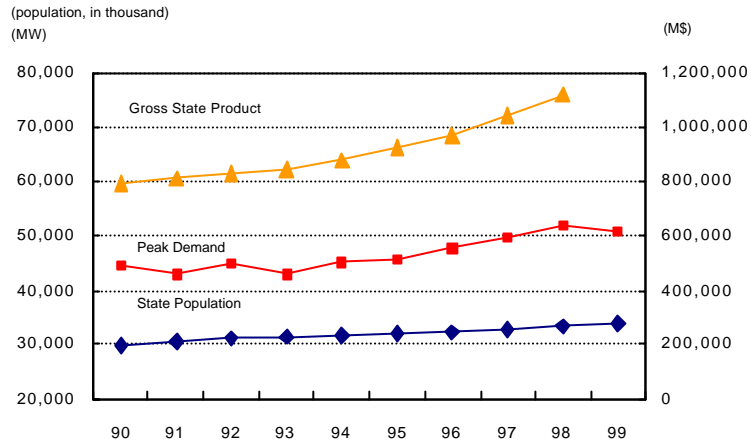
There were cases where existing power plants are suspending power transmission due to periodical inspections. Around 60% of power plants within the state are over 30 years old and needed maintenance.

At the time of sudden increase in the demand for electricity during the summer, there was a shortage of water due to intense heat, causing the hydroelectric output to decrease. As a result, fossil fuel based generation got accelerated, resulting in exceeding the NOx emission limit² and forcing power plants to suspend operation in the winter. The effect of natural phenomena such as fierce heat and water shortage is something to be expected and should be evaded by ensuring

² Each facility has its emission allocation

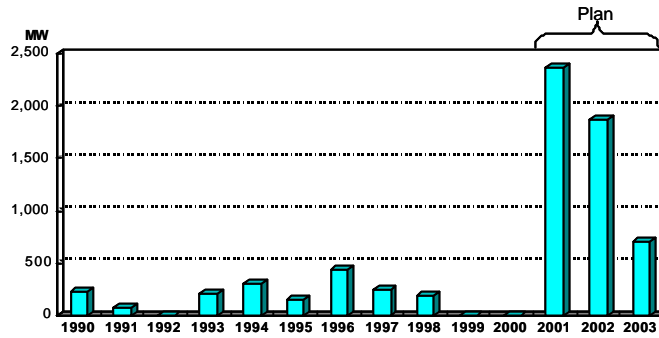
surplus supply in the first place.

Fig. 2 Economic Index and Peak Demand in California



(Source) Prepared based on California Statistical Abstract

Fig. 3 Added Generation Capacity in California 1990-2003



(Source) WSCC Load and Resource Report (1999) and PA Consulting Group data

3. Inappropriate Structure of Electricity Markets

Of the problems involving the electricity market system which have been pointed out, we would like to focus on four: namely; (1) excessive unbundling, (2) fluctuating wholesale prices and regulations on the retail price, (3) restrictions on long-term contracts and dependency on the spot market, and (4) the market structure which is vulnerable to price manipulation.

(1) Excessive unbundling

Major utilities in the state of California are three investor-owned utilities, which are Pacific Gas & Electric (PG & E), Southern California Edison (SCE), San Diego Gas & Electric (SDG & E), as well as municipally-owned utilities in Los Angeles and Sacramento. These five utilities alone

deal with approximately 85% of the total sales within the state (Table 1).

During the transitional period of competition, the three investor-owned utilities were required to separate functions (unbundling); i.e., power plant, transmission and distribution, and were forced to sell off most of their fossil fuel power plants. These were sold to non-utilities including AES, Reliant, Southern Energy, Duke, Dynegy, etc. and together they account for 40% of the total plant capacity of the state (Fig. 4). Even though the ownership of the grids will stay with the utilities, the management of the system is entrusted to the independent system operator (ISO) and the transactions via the power exchange (PX) are obligatory. This is to avoid the control of the market by the major investor-owned utilities.

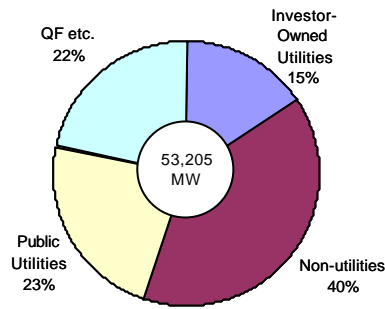
On the other hand, public utilities are not restricted by unbundling nor transactions through PX, and it is up to the judgment of each utility whether to participate in the supply system under ISO or not during the transitional period of competition until March 2002. Los Angeles Department of Water and Power, the largest public utilities, chose to continue its vertically-integrated type and as they have their own power plants, the current power crisis has been very irrelevant to them. Or rather, by selling their surplus power to ISO, they are accumulating an enormous profit out of it. While there are very stringent restrictions solely on investor-owned utilities, there are some like public utilities who are able to operate just as exactly as before the deregulation. The electricity output which are not dealt via ISO and PX accounts for roughly 25% in California as a whole.

Table 1 Major Electric Utilities in the state of California (1999)

Utilities		Sales (GWh)	Revenue (\$ million)	Number of Consumers (thousand)
Investor- Owned	Pacific Gas and Electric [PG&E]	70,187 (33%)	6,786 (34%)	4,536 (35%)
	Southern California Edison [SCE]	67,207 (32%)	6,692 (34%)	4,214 (33%)
	San Diego Gas & Electric [SDG&E]	14,718 (7%)	1,415 (7%)	1,185 (9%)
	Others	1,412 (1%)	105 (1%)	106 (1%)
Public	Los Angeles Department of Water and Power [LADWP]	20,057 (9%)	2,081 (11%)	1,385 (11%)
	Sacramento Utility Municipal District [SMUD]	9,284 (4%)	722 (4%)	504 (4%)
	Others	22,583 (11%)	1,869 (9%)	956 (7%)
Others (Federal, Cooperatives)		6,533 (3%)	121 (1%)	14 (0%)
Total		211,981 (100%)	19,791 (100%)	12,900 (100%)

(Source) Prepared based on DOE EIA data

Fig. 4 Ownership of Power Plants in the state of California



(Source) Prepared based on Annual Energy Outlook 2001/EIA

(2) Change in the Wholesale Price and Regulations on the Retail Price

Even though the wholesale price has been fluctuating, a ceiling was set for the retail price in order to recover stranded cost. As procurement of power through bilateral contracts is prohibited and trading through PX is obligatory, sudden rise in the wholesale power price had a direct effect. In case of SDG & E, however, they completed the recovery of stranded costs in July 1999 and the rate freeze has been lifted³, and so the soaring wholesale power price was directly reflected in the electricity rate. With PG & E and SCE, on the other hand, the wholesale price hiked before the removal of the price control, creating a reverse situation, which resulted in the worsening of the business conditions.

(3) Disproportionate Emphasis on the Spot Market

The electricity trading markets consist of three types according to the time the deals are made; i.e., Day-Ahead (prior date) market and Hour-Ahead (current date) market both of which are run by PX and the real time market managed run by ISO. The real time market is utilized when the supply and demand plan predicts a shortage of supply in advance, and so the procured price would become higher than the price at the PX. As a ceiling price is set at the real time market, utilities purchase power at the real time market when the PX price rise. In reality, 25% of the necessary supply volume has been procured at the real time market.

The three major utilities were restricted with such risk hedging as long-term contracts, and they were therefore compelled to make a purchase at the volatile spot market. In the northeastern regions including the state of Pennsylvania, mutual trading based on long-term contracts had more importance while in California, they put disproportionate emphasis on the spot market.

(4) Suspicion of Price Manipulation

The market structure being as described in the clauses (1), (2) and (3), when the supply and demand situation becomes tight in the whole area, the situation would arise where power producers

³ Lifted in June 2000, but frozen again in September 2000

can easily execute their power to control the market. In fact, the power producers make the supply conditions stricter as the peak load time approaches and their price manipulation has been suspected. However, according to the investigation by FERC, no evidence against power producers has been obtained for their price manipulation⁴.

4. Rise in the Power Generating Cost

Apart from the issues of power supply capacity and the structure of electricity markets, there are factors which directly pushed up the power generating cost such as (1) the sudden rise in the price of natural gas which is the main fuel for thermal power generation, and (2) the appreciation of the cost of NOx emission credit⁵ levied by the environmental regulation.

The price of natural gas more than doubled from 1999 to the summer of 2000, bringing up the cost of gas-fired power generation to \$25 - 35/MWh. In November 2000, it rose up to approximately 260% compared to the same month of the previous year⁶. There is also an added fact that the construction of power plants using natural gas has increased throughout the US, which caused the price to go up. The appreciation of the fuel price happened in other states as well, but in the northeastern regions, the proportion of nuclear power supply being high, they do not seem to be so affected by the rise in fuel price, etc.

As to the price of NOx emission trading price, the emission credit which was \$2.5 - 4 per pound in 1999 went up to \$40 - 50 in the summer 2000 (in case of Los Angeles). As of January 2001, the combined generation cost of fuel and NOx credits for a natural gas-fired peaking unit is approximately \$147/MWh⁶.

5. Measures against the Power Crisis

Both federal and the state governments are pressed with the measures against the electricity crisis in the state of California, and they are proposing emergency measures as well as improvements to market systems in order to solve the shortage of the electricity supply and to prevent bankruptcies of utilities. (Table 2)

In order to increase the power supply capacity, there are plans to build new power plants (Table 3). To accelerate the construction, they are rewarded with financial incentives and are going through a rush job to complete as soon as possible before schedule. The California Energy Committee has targets for the summer of 2001 for the supply side as well as for the demand side as shown in Table 4, but in reality, it does not seem sufficient to fill the capacity needed to cover the shortage.

⁴ FERC realizes that 13 generators in California sold electricity at high cost and asks them to repay some of revenues to utilities or to present materials for justifying high costs.

⁵ Power producers must purchase emission trading credits from other facilities to offset emission allocation

⁶ EPSA(Electric Power Supply Association)data

Table 2 Government's Major Countermeasures against the Power Crisis in California

Government	Date	Measures
Federal	1-Nov-2000	· FERC proposed rescue measures
	15-Dec-2000	<Final proposals by FERC> · Abolished obligation to trade power through PX · Concluded bilateral long-term contract (\$74/MWh) · Placing a limit to the volume procured in the real time market (5% or less) · Both PX and ISO setting the price cap (\$150/MWh) (soft capping) · Establishing a regulation committee
	13-Dec-2000	· DOE Secretary ordered power generating companies in the neighboring states to lend power to California in order to solve power shortage within the state (until 07/02/2001)
	19-Jan-2001	· Instructed gas supplying companies both inside and outside the state to supply natural gas to cope with the rolling blackouts on 17 and 18 January
	16-Feb-2001	· President Bush requested federal institutions to quicken the review of new power generating plans in California
State	28-Jun-2000	· ISO lowered the price cap of the wholesale electricity price from \$750/MWh to
	1-Aug-2000	· ISO lowered the price cap of the wholesale electricity price from \$500/MWh to
	7-Sep-2000	· SDG & E set the price cap for customer electricity rates
	16-Sep-2000	· Approval for SCE to make procurement through bilateral contract
	4-Jan-2001	· PUC approved PG & E and SCE to raise electricity rate by 7 - 15 %
	19-Jan-2001	· Electricity Procurement Bill came into force to allow each state to procure and resell electricity (a limited time law to become ineffective after 15 February)
	21-Jan-2001	· Avoided power cuts by re-operating some redundant power plants in the state
	23-Jan-2001	· Department of Water Resources started a bid of a long-term power contract on the internet web-site
	24-Jan-2001	· 39 operators participated in the bid
	31-Jan-2001	· PX suspended operation
	1-Feb-2001	· The State Assembly approved Emergency Measures Bill · The State government issued a state bond of \$10 billion maximum, and the fund raised would be used by Department of Water Resources to conclude a long-term contract with power generating operators to procure and transmit power · Approximately \$500 million is invested from the general account to purchase power to be used for the time being until the issuance of state bonds
	16-Feb-2001	· The state governor announced a plan to throw in public fund to solve power crisis (Grids networks of three companies within the state are to be bought and directly operated by the state.) · Approved power companies to issue bonds with the future income as a security

(Source) Made up by IEEJ based on various data

Table 3 Power Plants being under Construction in California (as of 16/01/2001)

Power Plants	Ownership	Primary Fuel	Output (MW)	Expect to be On-line	Start of Construction	Approval
Los Mendanos	Calpine	Natural gas	500	Jul-2001	Sep-1999	Aug-1999
Sutter Power	Calpine	Natural gas	500	Jul-2001	Jul-1999	Apr-1999
Sunrise	Edison Mission Energy	Natural gas	320	Aug-2001	Dec-2000	Dec-2000
La Paloma	PG&E Generating	Natural gas	1,048	Nov-2001	Jan-2000	Oct-1999
Planned Total Capacity in 2001			2,368			
Moss Landing	Duke Energy	Natural gas	1,060	Jun-2002	Oct-2000	Oct-2000
Delta Energy	Calpine & Bechtel	Natural gas	880	Jul-2002	Apr-2000	Feb-2000
Planned Total Capacity in 2002			1,940			
High Desert	Constellation & Inland Energy	Natural gas	720	Jan-2003	May-2001	May-2000
Elk Hills	Sempra & Occidental	Natural gas	500	Mar-2003	Mar-2001	Dec-2000
Pastoria	Enron	Natural gas	750	Jun-2003	Jun-2001	Dec-2000
Planned Total Capacity in 2003			1,970			
Grand Total			6,278			

(Source) Prepared based on California Energy Commission data

Table 4 Measures for Summer 2001

Supply	<ul style="list-style-type: none"> • 1,308 MW (summer dependable output) of new power plants to be on-line by July 2001 • 240 MW (summer dependable output) of new renewable energy projects • Up to 1,200 MW of new peaking capacity contracted with ISO (non-jurisdictional projects <50 MW), subject to approval by countries and local air districts, to be on-line by mid-June 2001
Demand	<ul style="list-style-type: none"> • Utility and State funded conservation programs expected to reduce demand by 269 MW • Voluntary Load Curtailment (State of California: 180MW, California Grocers: 100MW, Federal Agencies, Countries and Cities: 120MW) • ISO Summer Demand Relief Program - 500MW target

(Source) Data by California Energy Commission

6. Conclusion

Even though this interview was conducted at their emergency period of Stage 3 and our visits were rather limited, we were able to have comprehensive discussions on the power crisis. We can obtain information and reports on the current situation of the power crisis in California in Japan through newspapers, magazines and internet, but the actual on-the-spot opinions we found in common among the specialists over there are as follows.

Added to the special situation of the state of California including the shortage of facilities to generate and transmit power and the unsatisfactory deregulation system by the state government (restriction on power transactions, etc.), the main causes for the power crisis include environmental regulations, effect of natural phenomena such as fierce heat and shortage of water, and the sudden rise in the price of natural gas which is the fuel for power generation. Such situations are peculiar to California and they seem to think that power crisis would not happen in other states. However, there are such issues as the capacity of the power supply and the methods of power trades, which cannot be made light of as problems peculiar to California.

In the market where demand exceeds supply, it is a matter of course that the price would rise. In the power market, which is liberalized, the price fluctuates by the balance of demand and supply, which is natural in the market mechanism. In order to check the price rise, liberalization should be enforced in the environment where sufficient supply capacity is secured. The biggest problem in the case of California is that, instead of deregulation, they were taxing further regulations including a direction to sell off power plants, compulsory power transactions through PX, and retail price capping, etc. Price manipulation by some power producers and brokers cannot be denied, but not enough evidence has been found so far. It is necessary to study and build up a structure where such price manipulation is not possible.

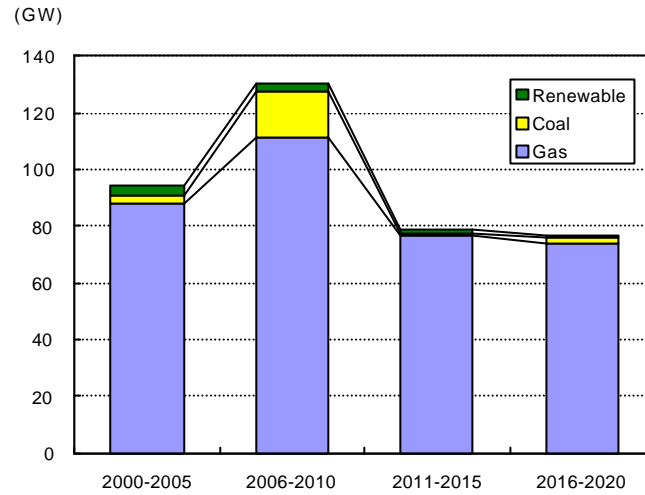
Environmental regulation is a difficult task. Proceeding with construction of power plants at the cost of environment can be done, but it is essential to give thorough considerations to environment as well as economy.

A variety of measures have been taken to tackle power crisis in California, but it is difficult to solve the issue of insufficient power supply capacity as a fundamental problem in a short period. Many specialists foresee recurrence of the power crisis in the coming summer of 2001.

We should also watch out for the effect on the natural gas market. As power generation using natural gas is expected to increase not only in California but throughout the US (Fig. 5), the demand for fuel is also expected to rise, possibly causing the natural gas price to soar.

The problem is not yet solved. It is essential to continue studying the situation in detail.

Fig. 5 Prospect of new power plants to be constructed in US



(Source) Made up by IEEJ based on Annual Energy Outlook 2001 / EIA

< Interviewed Organizations >

- California Energy Commission [CEC]
- Los Angeles Department of Water and Power [LADWP]
- Electric Power Supply Association [EPSA]
- PA Consulting Group
- Reason Public Policy Institute [RPPI]
- Pacific Research Institute for Public Policy [PRI]