THE CALIFORNIA ENERGY CRISIS

By

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I. INTRODUCTION

In the early 90's, the idea of deregulating the electricity market, in order to reduce prices, began to be developed in the public policy arena. For many scholars and think tanks, deregulation in the power industry, which allows for greater competition, thereby decreasing prices seemed particularly desirable.

Therefore in April 1994, the Federal government gave the order to all states to reform the electricity market in order to allow competition. In that sense, California, as the sixth largest economy in the world and the epicenter of the information technologies, was one of the first states to implement radical reform. A new system was created, and under this system power purchasers have so far paid much more for power than in the past. Further, the system has been more vulnerable to supply shortages than ever before, causing energy price to rise dramatically. Furthermore, the regulatory measures adopted in California are the most stringent in the nation because of the presence of a massive environmentalist lobby namely the "Sierra Club," which has strong opposition to the building of new power plants.

Today, the deregulation process seems very questionable. It might have led to an unprecedented power crisis that is occurring in California – a crisis, which, during certain periods of the day, leaves huge parts of the state in total blackout, and which might also drive some companies into bankruptcy. Therefore, it seems relevant to ask the question: How did California get into this predicament? Why has the deregulation process which most economist favor in theory become

such a fiasco? The main objective of this paper is to provide an answer to each of these questions

The paper is organized as follows. In Section 2, we sketch some of the recent historical events that explain how the industry was operating before deregulation. In Section 3, a brief account of the deregulation process is presented. The new market structure after deregulation is described in section 4. In section 5 California power crisis and the neighboring states is explain, In section 6 an economic model that helps explain the energy crisis in California is developed and finally section 7 contains some concluding remarks.

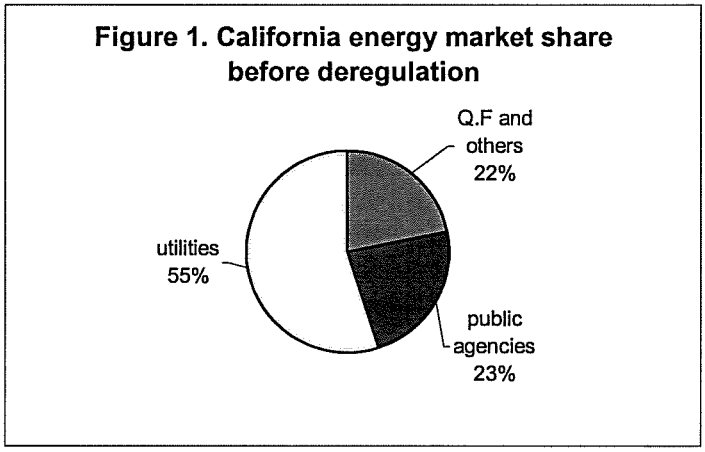
II. THE ENERGY INDUSTRY IN CALIFORNIA BEFORE DEREGULATION

In the 1980's, state energy planners and regulators attempted to balance production and consumption, through a process called Integrated Resource Planning (IRP), by building new power plants when needed, but investing in conservation and energy efficiency to minimize the need for costly new plants. By this time, nuclear power plants were built and running, and the cost of producing that power caused utility rates to rise. Late in the decade, utility rates were driven up further by higher fuel prices and policies that encouraged QFs (Qualified Facilities) that are small private companies that co-generate electricity and public agencies to build new private, power plants.

Figure 1 presents the market shares of various suppliers before the deregulation process began. According to this figure, the utilities, which are private organizations but are subject to the government regulation, had about 55% of the total market, of which the Qualified Facilities

(QF) and the public agencies represented each a little less than a quarter of the market, respectively 22% and 23%. This shows that even before deregulation, the California energy market, although highly concentrated, remained mostly private.

Figure 1



Source: California Energy Commission September 2000.

In the early 1990's, the PUC (Public Utility Commission) and past administration's mandate was to integrate energy resources. The PUC's policy increasingly emphasized competitive provisions of power. It used a bidding process to choose new power plants to meet projected demand, but little or no new capacity was actually built before that process was replaced in the mid-90's. Until 1996, five major companies, Pacific Gas and Electric, Southern California Edison, San Diego Gas and Electric, Los Angeles Department of Water and Power and Sacramento Municipal Utility District shared a government granted monopoly over California's electricity market under the condition that they guarantee increasing competition and continuing lower prices. The legislators voted to end this monopoly in 1996. Therefore it seems important to present some statistics that help describe the degree of concentration in California's power

industry and the state of its energy production in order to better understand the facts during the deregulation process.

Table 1 presents the degree of concentration in the power industry in California. According to the Table, the retail sales revenues of the top five utilities represents 90% of the utility sales for all sectors (residential, commercial, industrial and other) for a total of 18,443 millions dollars. Observe that the revenues of Southern California Edison and Pacific Gas & Electric -- the two utilities with nuclear plants -- was 14 137 millions dollars, which accounted for 76 % of the total revenue made by these top five utilities. In table 1 it can be seen that, although the deregulation process was taking place, the top five utilities were controlling almost 90% of the total retail sales market.

Table 1. Top Five Utilities Ranked by Retail Sales Revenue Within the State, 1996 (Million Dollars)

Utility	All Sectors	Residential	Commercial	Industrial	Other
A. Southern California Edison Co	7,105	2,777	2,726	1,526	76
B. Pacific Gas and Electric Co	7,032	2,891	3,138	931	72
C. Los Angeles Department of Water & Power	2,074	666	1,156	215	37
D. San Diego Gas & Electric Co	1,520	637	643	233	8
E. Sacramento Municipal Util Dist	711	338	63	304	5
Total	18,443	7,310	7,727	3,209	198
Percentage of Utility Sales	90	92	93	83	55

Source: Energy Information Administration, December 2000

Table 2 provides the generating capability by plant type for the three years 1988, 1993, and 1998. It covers the period before and after the deregulation process of the electricity market in California. According to the table, the total electrical power generating capability of utility

producers was about 44,429 MWe in 1988 and 44313 MWe in 1993. By 1998, it has declined to 30,663 Mwe, resulting in a negative growth rate of –3.6 %. The supply of utility producers, as a share of total industry supply, was 80.6 % in 1988, 81.4 % in 1993, and finally, 58.6 % in 1998. These numbers indicate that as electricity needs were increasing, generation from utility producers was decreasing at the benefit of the non-utility producers, which are entirely private. Meanwhile, the total share of non-utility producers was 19.4 % in 1988, 18.6 % in 1993, and 41.4 % in 1998. As a whole, the annual growth rate for the industry generating capability between 1988 and 1998 was - 0.5 %, due to the combined result of fewer new power plants being built and the aging of older generating facilities.

Table 2. Electric Power Industry Generating Capability by Plant Type, 1988, 1993, and 1998 (Megawatts Electric)

Plant Type	1988	1993	1998	Annual Growth Rate (%) 1988-1998	Percentage Share 1988	Percentage Share 1993	Percentage Share 1998
Total Utility	44,429	44,313	30,663	-3.6	80.6	81.4	58.6
Petroleum-fired	559	558	395	-3.4	1.0	1.0	0.8
Gas-fired	886	814	1,527	5.6	1.6	1.5	2.9
Dual-fired	23,257	23,466	9,396	-8.7	42.2	43.1	17.9
Nuclear	5,611	4,310	4,310	-2.6	10.2	7.9	8.2
Hydroelectric	12,469	13,448	13,510	0.8	22.6	24.7	25.8
Renewable	1,647	1,716	1,525	-0.8	3.0	3.2	2.9
Total Non-utility	10,705	10,109	21,686	7.3	19.4	18.6	41.4
Industry	55,134	54,422	52,349	-0.5	100.0	100.0	100.0

Source: Federal Energy Regulatory Commission, February 1999

In Table 3, the statistics on electricity generation, classified according to primary energy source, for three years 1988, 1993, and 1998 are presented. As can be seen from the table, the total electricity generation by primary energy source for the utility producers was about 125,981,157

MWh in 1988 and 125,782,063 MWh in 1993; by 1998 it became 114,926,213 MWh, which represents a decline of 0.9 % annually. Like the generation capability by plant type, the generation of electricity by primary energy source was also decreasing, but the fall in the percentage share, between 1988 and 1998, was relatively smaller. As for non-utility generation by primary energy sources which are mainly represented by small private companies that are less subject to the government regulation, the annual growth rate between 1988 and 1998 was about 3.3 %, with a percentage share rising from 29.7 % in 1988 to 39.1 % in 1998.

Table 3. Electric Power Industry Generation of Electricity by Primary Energy Source, 1988, 1993, and 1998 (Megawatt hours)

Fuel	1988	1993	1998	Annual Growth Rate (%) 1988-1998	Percentage Share 1988	Percentage Share 1993	Percentage Share 1998
Total Utility	125,981,157	125,782,063	114,926,213	-0.9	70.3	67.3	60.9
Petroleum	7,620,777	2,007,674	121,385	-33.9	4.2	1.1	0.1
Gas	53,892,578	46,499,103	26,385,452	-6.9	30.1	24.9	14.0
Nuclear	30,862,960	31,580,692	34,594,206	1.1	17.2	16.9	18.3
Hydroelectric	23,474,130	38,264,443	48,684,142	7.6	13.1	20.5	25.8
Renewable	10,130,711	7,430,151	5,141,028	-6.6	5.6	4.0	2.7
Total Nonutility	53,344,477	61,079,976	73,831,654	3.3	29.7	32.7	39.1
Industry	179,325,634	186,862,039	188,757,867	0.5	100.0	100.0	100.0

Source: Federal Energy Regulatory Commission, February 1999

The increasing needs in electricity by the state then had forced legislators to look at a perspective of a new market that will satisfy demand and thereby lower prices. Therefore a deregulation process was put in place, and Assembly Bill 1890 was passed unanimously in September 23 1996 and signed by then Governor Pete Wilson to establish the framework.

III. THE DEREGULATION PROCESS

In its attempt to reform the electricity market, California was inspired by the policies implemented in certain foreign countries, mainly the United Kingdom. The state adopted the same pool formula as the UK, a sort of centralized market in which producers were ordered to deliver all of their production to the pool. The pool manages the market and determines prices with respect to a supply classification procedure. Therefore the Electric Utility Industry Restructuring Act (Assembly Bill 1890), which is the legislation that the deregulation process was based upon, made the generation of electricity competitive in California, and allowed more companies to operate and sell power throughout the state.

1. Assembly Bill 1890:

Under AB 1890 California would adopt a market-based model of electrical energy generation and distribution. The law of supply and demand was to guide the price of electrical energy and provide incentives for utilities and other power providers to make their operations more efficient. When the law was fully implemented, ratepayers were to pay prices that were set by the market, not by the California Public Utilities Commission (PUC).

At the request of Investor-Owned Utilities (IOUs), Pacific Gas & Electric Company (PG&E), Southern California Edison, and San Diego Gas & Electric (SDG&E), lawmakers established a transition period during which these utilities were allowed to collect a Competition Transfer Charge (CTC) from customers, designed to pay off their investments in generation. In addition

to the CTC, Assembly Bill 1890 mandated a 10 % rate reduction and established a rate freeze, so that the collection of the CTC would be stable and predictable. The CTC and the rate freeze extend to March 2002. However, SDG&E, the smallest of the three major IOUs, had fewer costs and was able to pay them down by the spring of 2000, without any apparent reason to collect the CTC. In June 2000, SDG&E applied for and received permission from the PUC to end the rate freeze within the utility's service territory. Customers in San Diego and parts of Orange County, which is one of the largest counties in the state, would for the first time pay electricity prices established by the market.

Also under AB 1890, the state legislators forbade the utilities from signing long-term contracts at the same time, they enacted a new regulation, which ordered the utilities to sell off their gas and oil-powered plants, causing them to lose control over power production and to become dependent on the new owners of these power plants for the electricity needed to serve their customers. AB 1890 also ordered the utilities to buy electricity strictly on a daily basis. The reason behind this measure was simple: when prices tend to be low, this type of contract is a means that could be used by producers to keep prices at higher levels than the ones emanating from the market evolution. Indeed, the state government wanted the bill to be executed with the maximum transparency, thinking that, this is better than long-term contracts. However, in the end, that transparency did not work quite well. As a matter of fact, the Power Exchange (PX), which was co-administrated by members who came from different backgrounds mainly public servants as well as businessman who were appointed by the state government, had led to a new bureaucracy not quite different from the previous one. It takes weeks and months to publish statistics.

Meanwhile a price transition mechanism was put in place to freeze prices at the distribution level until the year 2002, while prices at the generation market level were liberated. This incoherent policy outcome was the end result of heavy political bargaining before the bill was implemented in 1996.

2. The restructuring plans

California was the first state in the nation to create a separate Independent System Operator (ISO) to control utility-owned transmission facilities. The state moved first and furthest in divesting the utilities of their power plants. It created an exchange, the PX, to run wholesale power auctions and shape wholesale power products in a manner similar to the future's market. The separation of the power sales function and the transmission control system function into two separate organizations is a distinguishing characteristic of the California's experiment compare to the rest of the states. The separation of these functions also complicates the operation of California's wholesale electricity market. Wholesale price caps was put in place, which limited the market's ability to drive prices up during periods of short supply. The use of this measure recognizes the potential for seller's market power or customer's inelastic demand to drive up prices. Currently, the law requires that California electric utilities, which serve the vast majority of California customers, purchase all of their power through the ISO and the PX. However, individual (usually large) customers and marketers may purchase power outside the PX by signing bilateral contracts with other marketers or generators. In this case, the ISO's centralized system still directs the flow of electricity, but prices and service conditions are established by private contracts.

Several other states have followed California in designing their electricity industries with ISO's that are regulated by the FERC, not by state or local authorities. However, California is the only state with an ISO comprised of shareholders, rather than an ISO that is a public agency. Twenty-five states have not yet restructured their electric industries, apparently awaiting the results of the experiments in California and the northeastern states.

California's restructuring plans have made a difference in its prices and supply conditions, even though it is part of a tightly interconnected grid that courses through several states in the western region. It participates in the Western Systems Coordinating Council, a voluntary organization that coordinates the activities of the control areas that make up the grid. California's ISO is the largest control area. It buys and sells enormous quantities of electricity. It dispatches power from plants and operates the California transmission system. Unlike other utilities, the ISO is neither a governmental body nor a state-regulated utility; it has no responsibility to California consumers. Indeed, it seeks to control the transmission system in several states as a regional operation.

Contrary to popular thinking, the state government did not totally deregulate the electricity pricing system, because the price at which utilities could buy electricity was deregulated, but the state government fixed the price at which utilities could sell power to consumers. Thus when the current spot price of electricity began to skyrocket, the utilities faced bankruptcy because they had to buy power from electricity producers at exorbitant prices but could only resell it at the low government-controlled retail price. The low retail price also induces an increase in Qd, which outstrips Qs and results in energy shortages. In recent months, several powerful

undercurrents in the electricity markets have collided with each other, resulting in a dramatic increase in demand and a sharp decline in generation. Skyrocketing prices and threats of rolling blackouts have heightened public interest in the power industry. Some observers cited deregulation as the cause of these problems, while others found fault with the way deregulation was handled. The legislation established the framework for the transition from a highly regulated marketplace to a less regulated market, which is expected to be more responsive to the law of supply and demand.

IV. THE NEW MARKET STRUCTURE

Before restructuring, a single utility provided each customer with generation, transmission, distribution, metering, and billing of electricity. As of March 31, 1998, the new structure allows customers in most existing electric utility service areas to choose their electricity generation suppliers. As in the UK, California broke its main power companies by imposing a strict separation between three activities: generation, transmission, and distribution.

- *Generation:* It refers to the production of electricity at power plants or other facilities. California has about 1000 generation facilities including those run by gas and oil, nuclear power, hydro, biomass, wind, solar, and cogeneration. The state is able to import an additional 8000MW (megawatts) and, of these, about 4500MW are under contract as firm supplies (1000MW serves 100,000 homes). The generation process is operated by private plant owners and sold at auctions. Power prices are set through bidding in the Power Exchange (PX) controlled by the Federal Energy Regulation Commission (FERC), and in the Power Exchange,

users buy power directly from generators, not utilities. Also, the utility owned as well as the utility purchased are controlled by the PUC (Public Utility Commission).

- *The distribution:* The system consists of the wires and related facilities that run from customer premises to the transmission network. The sites, where high voltage power is stepped down so that it can be delivered to customers and to the distribution system that interact with customers, are accountable to regulators.

- *Transmission:* It is a network in which wires run from generators and carry power throughout the state. California has about 40,000 miles of power lines that connect utilities to the national and international power grid. The transmission is run by an autonomous entity, which is accountable to a self-perpetuating board.

Table 4 presents some selective statistics in 1999 on the sale of electricity after the deregulation process, to all the sectors of the state as well as some more detailed numbers in the residential sector. The corresponding data for the nation are also provided for purpose of comparison. According to the table, the regulated and deregulated electric energy market retail sales, for all sectors of the US, were about 3,312,087,879 MWh, of which California accounted for 7%. In terms of number of customers, California accounted for 10% of that of the nation in the regulated residential market. In 1999 the retail price of 1 KWh was 10.7 cents, which placed California as the 9^{th} highest in the United States. However, the average energy price in the deregulated residential market was about 4.10 cents/KWh, which was almost equivalent to the national average price. The average monthly residential consumption of electricity was about 548 KWh, in contrast with 866 KWh for the whole nation. In terms of costs, the average

monthly residential electricity bill was $58.70, which was 17% below the national average of $70.68. Also, one can be find in Table 3 the data for planned capacity additions of California and the nation. This statistics indicate the importance of California's energy market with respect to the rest of the States, which shows undoubtedly that the crisis is the nation's problem.

Table 4. Selected California Electric Energy Statistics for 1999			
Item	California	**United States**	**Share of Total or U.S. Ranking**
Regulated & Deregulated--All Sectors			
Retail sales (megawatt hours)	234,830,879	3,312,087,081	7 %
Number of customers	13,040,890	125,945,003	10 %
Regulated & Deregulated—Residential Sector			
Retail sales (megawatt hours)	75,303,200	1,144,932,069	7 %
Number of residential customers	11,438,113	110,383,238	10 %
Regulated--Residential Sector			
Retail sales (megawatt hours)	74,490,158	1,140,761,016	7 %
Retail price (cents per kilowatt-hour) (includes *energy & delivery*)	10.71	8.16	9th highest
Number of customers	11,326,501	109,817,057	10 %
Deregulated--Residential Sector			
Retail sales (megawatt hours)	813,042	4,162,053	20 %
Average energy price (includes *energy only*) (cents per kilowatt-hour)	4.10	4.09	3rd highest
Number of customers	111,612	566,181	20 %
Other Statistics			
Monthly average residential consumption of electricity (kilowatt-hours)	548	866	37 % below national average
Average monthly residential bill	$58.70	$70.68	17 % below national average
Total existing generator capability, net summer (megawatts)	53,157	793,957	7 %
Planned capacity additions (nameplate), 2000 through 2004 (megawatts)	4,489 (31 units--all by nonutilities)	188,255 (utility & nonutility)	2 %

Source: Energy Information Administration, August 2000

1. The Demand Structure

California's population grows at a rate of 500,000 people a year, which, according to the California Independent System Operator (ISO), results in an increase of about 2 % a year in the demand for electricity. Statewide demand for electricity, however, climbed 3.4 % in 1999 and 7.1 % in 2000. In the Silicon Valley area, generally considered the engine room of the new economy, demand grew by 12 % in the year 2000, according to estimates of the Electric Power Research Institute. In past years, California used to be able to buy enough energy to accommodate peak demands. Typically, the state imports about 8,000 megawatts at peak demand. California is the tenth largest consumer of energy in the world, ranking slightly ahead of Italy, but slightly behind France. The transportation sector consumes 46 % of California energy; the industrial sector 31 %; the residential sector 13 %; and the commercial sector 10 %. The transportation sector's energy consumption determines the importance of in-state energy sources, among which petroleum accounts for 54 % of California's energy production. Natural gas and electricity contribute, respectively, 33% and 13 % of total energy use, while coal is a relatively unimportant fuel in California and accounts for less than 1 % of the state's energy consumption. In contrast to some other regions of the US and also due to climatic factors, very little petroleum is used in the residential, commercial, and industrial sectors.

Total statewide electricity consumption grew from 166,979 GWh during the 1980's to 228,038 GWh in 1990, an annual growth rate of 3.2 %. Sacramento Municipal Utility District (SMUD), Southern California Edison (SCE), and San Diego Gas and Electric (SDG&E) were high growth areas. Electricity use from 1980s to 1990s grew:

- in SMUD from 5,352 GWh to 8,358 GWh, with a growth rate of 4.6 % per year;
- in SDG&E from 9,730 GWh to 14,798 GWh, with a growth rate of 4.3 % per year;
- in SCE from 59,624 GWH to 81,673 GWh, with a growth rate of 3.2 % per year.

Growth in the Pacific Gas and Electric (PG&E) (2.7 %) and Los Angeles Department of Water and Power (LADWP) (2.2 %) areas lagged behind the other three areas and the state as a whole. Consumption growth slowed in the early 1990's, as a result of the severe economic recession that struck the state from 1990 to 1994. Southern California was hardest hit by that recession.

Table 5 presents statistics on California's electricity consumption from 1990 to 2000 in various sectors.

Table 5. California Electricity Consumption by Sector (GWh)

Year	Residential	Commercial	Industrial	Agricultural	Other	Electric Vehicles	Total Consumption
1990	67,669	74,562	51,195	20,849	13,763	0	228,038
1991	67,145	74,296	50,439	16,345	14,036	0	222,260
1992	69,227	77,929	49,926	15,483	14,423	0	226,988
1993	68,426	79,152	49,479	15,918	14,649	0	227,624
1994	69,781	78,546	49,524	16,957	15,290	0	230,097
1995	69,767	80,528	50,594	14,321	15,780	0	230,990
1996	72,166	83,366	51,758	16,898	15,415	0	239,603
1997	73,549	87,401	53,253	17,733	15,477	0	247,412
1998	75,388	87,093	51,996	14,661	15,270	0	244,409
1999	76,174	89,538	53,527	17,840	15,335	0	252,414
2000	77,564	91,771	55,020	18,054	15,462	0	257,871

Source: Energy Information Administration, December 2000

From 1980 to 1998, statewide consumption of electricity by residential customers grew annually at an average rate of 2.1%, reaching 75,389 GWh in 1998. Residential electricity use is expected to increase to 92,726 GWh in 2010, a growth rate of 1.7 % per year. Statewide consumption of

natural gas by residential customers fell from 5,840 million terms in 1980 to 5,520 million terms in 1998, a decrease of 0.3 % annually. Residential natural gas use is projected to continue falling until the year 2004 but then expected to increase until the year 2010, resulting in a decrease of 0.1 % per year to 5,511 million terms of consumption in 2010. Electricity consumption in commercial buildings accounted for 36 % of statewide electricity consumption in 1997, with the share expected to remain the same up to the year 2010. Statewide consumption of electricity by commercial buildings grew from 49,762 GWh in 1980 to 87,093 GWh in 1998, an annual growth rate of about 3.2%. Electricity consumption is expected to increase 2.0 % per year over the forecast period, reaching 109,926 GWh by 2010. In 1998, statewide consumption of natural gas by commercial buildings was 2,129 million terms. Commercial natural gas use is expected to increase by 1.4 % per year, reaching 2,460 million terms in 2010.

Electricity use in the industrial sector accounted for 21 % of the statewide energy use in 1998, and is expected to increase to 22 % by 2010. Therefore, these statistics are consistent with the fact that the State population was growing with the installation of the new technology industry, which have a particular need of electricity in order to operate.

2. The Supply Structure

As the economy of California grows, the state's energy supply becomes more and more inadequate. The state's generators no longer have surplus electricity to sell when supplies are tight. Furthermore, more than half of California's power plants are 30 years or older and prone to breakdowns. It has been at least 10 years since a power plant with a capacity larger than 1000 megawatts has been constructed. Although at least five new facilities have been approved and

scheduled to be on line with 3,600 megawatts of electricity by 2003, the growth in supply has been lagging behind the growth in demand, causing shortages.

There are three major factors behind California's inability to produce more electricity: local opposition to power plant construction; increasing environmental concerns and regulation; and barriers to entry. Worries about local opposition persist, although environmental activists have worked for decades to stop the construction of major power plants in California. As a result, California generates less power per resident than any other state. Indeed, since 1985, only minor power plants have been built, adding only 6,000 megawatts, while the needs were for at least 10,000 additional megawatts. Adding to these worries is the notoriously long process needed to gain approval for project sites from the California Energy Commission (CEC). It is not uncommon for these approvals to take two years or longer. Assembly Bill 970, a recent legislation signed by Governor Gray Davis, aims at sustaining this process. The bill requires the CEC to review and comment on the application for a proposed power plant within 100 days. In addition, if a proposed plant is scheduled to be operational by August 1, 2001 and does not represent a significant adverse effect on the environment, the CEC is to approve the proposal within four months.

Table 6 presents the statistics on electricity generation by primary sources, for utility-owned as well as non-utility producers, during the period covering 1990-1999.

Table 6. California Electrical Energy Generation, 1990 to 1999

TOTAL PRODUCTION, BY RESOURCE TYPE										
(Millions of kilowatt hours)										
	1990	1991	1992	1993	1994	1995	1996	1997	1998 [r]	1999 [p]
Total Generation:	252,355	242,343	245,535	242,026	256,719	256,367	253,621	255,080	276,412	275,792

Hydroelectric	26,092	23,244	22,373	41,595	25,626	51,665	47,883	41,400	48,757	41,617
Nuclear	36,586	37,167	38,622	36,579	38,828	36,186	39,753	37,267	41,715	40,419
Coal	21,402	23,442	32,435	22,907	25,095	17,925	25,460	27,114	34,537	36,327
Oil	4,449	523	107	2,085	1,954	489	693	143	123	55
Gas	76,082	75,828	87,032	70,715	95,025	78,378	66,711	74,341	82,052	84,703
Geothermal	16,038	15,566	16,491	15,770	15,573	14,267	13,539	11,950	12,554	13,251
Organic Waste	6,644	7,312	7,362	5,760	7,173	5,969	5,557	5,701	5,266	5,663
Wind	2,418	2,669	2,707	2,867	3,293	3,182	3,154	2,739	2,776	3,433
Solar	681	719	700	857	798	793	832	810	839	838
Other	4	0	2	0	0	0	343	896	230	0
Energy Imports	61,959	55,873	37,704	42,892	43,354	47,514	49,696	52,720	47,563	49,487
	1990	1991	1992	1993	1994	1995	1996	1997	1998 [r]	1999 [p]
Utility-owned: Total	139,309	131,866	153,350	154,639	157,589	148,936	147,163	144,799	153,791	130,403
Hydroelectric	25,612	22,728	22,033	40,440	25,024	50,089	46,660	40,122	47,326	40,582
Nuclear	36,586	37,167	38,622	36,579	38,828	36,186	39,753	37,267	41,715	40,419
Coal	17,710	20,392	28,806	20,358	22,440	16,788	22,590	24,838	31,836	32,726
Oil	4,449	523	107	2,085	1,954	489	693	143	123	55
Gas	45,262	42,353	54,338	46,738	61,474	39,448	31,856	37,048	27,699	14,995
Geothermal	9,684	8,700	9,441	8,435	7,842	5,855	5,540	5,302	5,009	1,543
Organic waste	0	0	0	0	0	65	59	71	80	73
Wind	0	0	0	1	26	13	10	6	3	7
Solar	2	3	1	3	1	3	2	2	2	3
Other	4	0	2	0	0	0	0	0	0	0

	1990	1991	1992	1993	1994	1995	1996	1997	1998 [r]	1999 [p]
Nonutility: Total	51,087	54,604	54,481	44,496	55,776	59,917	56,763	57,561	75,058	95,903
Hydroelectric	480	516	340	1,155	602	1,576	1,223	1,277	1,430	1,035
Coal	3,692	3,050	3,629	2,549	2,655	1,136	2,870	2,276	2,701	3,602
Gas	30,820	33,475	32,694	23,977	33,550	38,930	34,854	37,292	54,354	69,708
Geothermal	6,354	6,866	7,050	7,334	7,731	8,412	7,999	6,648	7,546	11,708
Organic waste	6,644	7,312	7,362	5,760	7,173	5,904	5,498	5,630	5,186	5,590
Wind	2,418	2,669	2,707	2,867	3,268	3,169	3,144	2,733	2,773	3,426
Solar	679	716	699	854	797	790	831	808	837	835
Other	0	0	0	0	0	0	343	896	230	0

[p] Preliminary.

[r] Revised.

Source: California Energy Commission, August 17, 2000

In 1990, the total electric generation in California was about 252,355 millions KWh. By 1999, it rose to 275,792 million KWh, an increase of 8.5 %. Among the various components that make up this total electric generation, hydroelectricity achieved the highest growth rate (37 %). On the other hand, the electric generation from oil dropped precipitously from 4,429 million KWh

to 55 millions KWh during this same period. As for nuclear generation, it did not grow much between 1990 and 1999, rising slightly from 36,586 million KWh to 40,419 millions KWh, a consequence of the strong opposition to the building of new power plants – in particular gas and nuclear power plants – by the environmental lobby. One also notices a decrease in the electric generation of the utilities from 139,309 millions KWh in 1990 to 130,403 millions KWh in 1999. This decline can be attributed to the drop in the number of gas power plants owned by the utilities. As for non-utility producers, their total combined generation almost doubled between 1990 and 1999, rising from 51,087 millions KWh to 95,903 millions KWh, an increase of 47 %. That can be seen as the result of the deregulation process, which had allowed small private new entrants to the market.

3. Purchases and Sales of Power under the New Structure

After March 31, 1998, all customers located in the service territories of the Investor-Owned Utilities (IOUs) -- Pacific Gas & Electric, San Diego Gas &Electric, Southern California Edison, PacifiCorp, Sierra Pacific Power, and Bear Valley Electric -- were allowed to shop for power in an open market. No longer are customers restricted to buy power from only their local utility company; they can now compare deals and pick the one that best meets their needs.

Vesting the operational control of the high voltage transmission system with the independent system operator (ISO) was designed to ensure that owners of the transmission system cannot favor their own generation facilities over competing generators in providing transmission access. The ISO has the responsibility of maintaining the reliability of the overall electricity system. It also maintains reserve generators, which can provide additional power in case a

generator owned by an electricity service provider fails to operate or cannot deliver the required amount of power. Electric service reliability will remain the same whether an individual consumer remains with the current utility or purchases power from a new energy service provider. While local distribution lines continue to be operated by the existing electric utilities, the IOU utilities are required to operate the distribution system in such a way that customers could gain direct access to any seller of electricity operating in their area.

The Power Exchange (PX) creates a pool where the information on prices is publicly available. It solicits bids from electricity buyers and offers from generators and chooses the lowest generation offer until enough electricity supply is obtained to meet requests for power. Prices on the PX change on an hourly basis, and participation in the PX is voluntary for all buyers and sellers other than the IOUs. For the four-year transition period, the IOUs will be required to offer most of their generation at the PX and buy the power they need to meet their customer's demands from the PX. In contrast, the new power generators will have the option of selling power directly to consumers. Many customers will pay for electrical power, based on the PX price, either directly through their local utility or through a private power supply contract, with terms that are set at the PX price. Thus consumers who choose to enter into private contracts for power where the terms, conditions, and prices are not public knowledge may use the public information from the PX to understand the attractiveness of supply or service offers they receive.

The new system of buying and selling power and the rules that govern those sales and purchases are extraordinarily complex. A day in advance, participating generators offer their power on the

wholesale market auction, which is conducted by the PX and their counterpart buyers, who estimate and order the power needed to meet California's electricity demands. On the basis of hourly supply and demand bids and orders, the PX sets the price to be paid to all power sellers at the highest amount bid for that hour, even if some sellers would have sold power at a lower price. The ISO then directs the flow of electricity throughout the state. When supply purchased in the PX market is less than the state's demand for electricity, the ISO makes up the difference by purchasing enough electricity from outside the state to balance the load and meet specified reserve levels.

The Independent System Operator administers a graduated system of increasing alerts to maintain operating reserves at the buffer capacity needed at all times to keep the electric system stable and functioning. When forecasted electricity reserves for the next day fall below 7% of the level of the previous day, the ISO issues an alert, and generators are asked to increase their power offers on the market. When forecasted electricity reserves for the current day fall below 7%, the ISO issues a warning and begins buying supplies directly. When actual electricity reserves fall below 7%, the ISO issues first a Stage 1 Emergency (public appeals and other measures to increase supply and decrease demand). When actual electricity reserves fall below 5%, a Stage 2 Emergency, (interruptible customers are curtailed) is issued. Finally, when the actual electricity reserves fall below 1.5%, the ISO issues a Stage 3 Emergency, the highest level under which firm customers (including residential and commercial) are blacked out to keep the system from crashing.

The ISO purchases generation products needed to instantaneously balance the load by ramping generators up and down and that includes both the capacity to produce electricity and the actual production. There are a number of auctions for services into which generators can offer under current rules. In addition, Schedule Coordinators (SC) can adjust their schedules to enable the ISO to balance the system. The ISO has also signed long term contracts with some generators whose power is used to keep the transmission system stabilized. These contracts provide a degree of control comparable to the former utility integrated ownership. The ISO puts a lid on the top price purchasers, who will be charged for electricity in accordance with the prices approved by the FERC through the pricing process.

4. The Impact of Deregulation on the Price of Electricity

In June 1999, purchasers of California power spent over $1 billion to buy electricity, one eighth of their spending for all of 1999. The effects of these price increases on customers depend on their choice of electricity suppliers. Retail customers of Pacific Gas and Electric Company (PG&E) and Southern California Edison Company (Edison) are temporarily protected from the impact of rate spikes caused by direct exposure to high wholesale prices. For consumers in other areas, the situation changed dramatically. In August 1999, the average SDG&E residential consumer paid about $50 a month for electricity. By August 2000, the average monthly electric bill rose to $120 a month, an increase of about 150%. Power bills for commercial customers, such as restaurants and hotels, nearly tripled. The rate freeze that ended in June was quickly followed by the three hottest months in the summer and the highest wholesale energy costs that the western United States had ever seen. Unless something is done, the rising costs of electricity

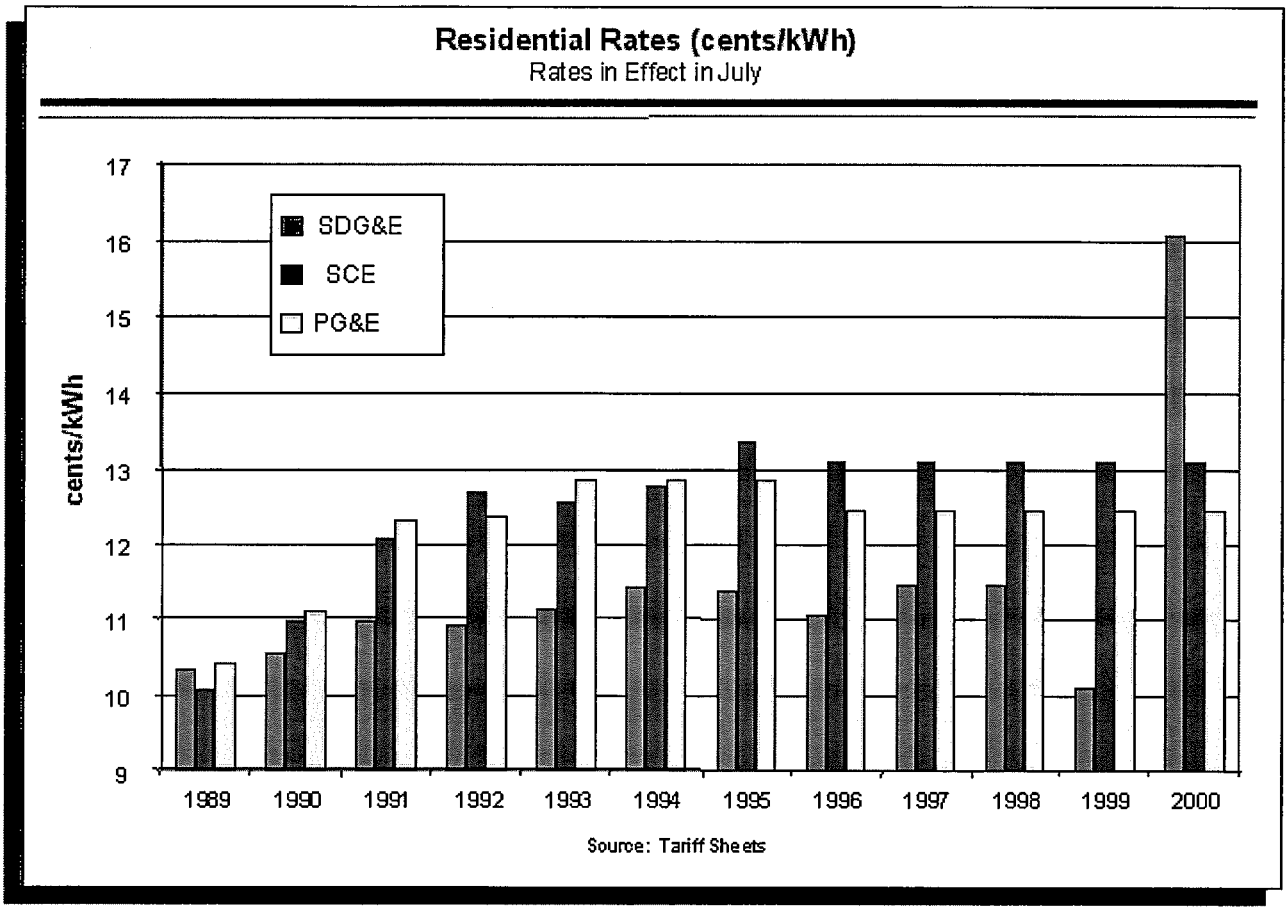
experienced in San Diego will eventually hit other California customers. Currently, SDG&E, with PUC authorization, may stabilize its retail customer's liability for these wholesale electricity costs by spreading out the high electricity payments over future periods. However, the PUC is constrained in what it can do to relieve customer's liability for these wholesale costs. This is because the FERC ordered the states to pass on to utility customers the costs of electricity that are purchased subject to their rate. For example, SDG&E's purchases from the ISO and PX are federally billed. Thus, the FERC ultimately controls how much SDG&E pays for wholesale power. Whatever SDG&E pays for wholesale power, if allowed under a federal rate, must by federal mandate be passed on to San Diego utility customers. The PUC may, however, inquire whether SDG&E's purchasing strategies are reasonable and result in reasonable rates, and it may exclude from retail rates the cost recovery deemed to have been imprudently incurred.

The San Diego price spikes imposed heavy burdens on fixed- and low-income customers. To alleviate this problem, the PUC sets a discounted rate for low-income customers by statute. Currently, the PUC requires that all utilities offer a 15% discount to low-income customers. This discount is clearly not a complete solution for customers whose bills have recently doubled. The Independent System Operator had put in place a new pricing mechanism in order to reduce prices at the consumption level. Thus what a user pays for electricity depends on how the electricity is purchased. Last summer, for example, much attention was given to the "day-ahead" market, which allows generators to withhold their energy from the market until the price climbs to incredible heights. In response to this offering practice, the ISO lowered the cap twice, eventually proposing a cap of $100 per megawatt hour. However, that cap was rejected by the

Federal Energy Regulatory Commission. Customers of municipal utilities may face higher prices unless their governing bodies have deferred rate increases. Retail customers of non-utility electricity producers, including renewable energy customers who have opted for direct access, may also have higher bills if their electricity rate is set as some percentage of the PX price. Generators may also sign either bilateral contracts or forward contracts with large users. This policy allows consumers to purchase power for more than what they would pay in low demand periods, but substantially less than they would pay during peak demand periods. The policy has the effect of dampening the volatility of the market.

The graph in Figure 2 shows the residential rates charged by three major companies -- SDG&E, SCE, and PG&E -- in July of each of the years covering the period 1989-2000. As it can be seen from the graph, the residential prices remain almost constant during the 90's resulting, from the rate freeze that was impose upon them by the government, but they started rising in the late 90's. After the deregulation process, the residential rates for SCE rose to 13.5 cents/KWh, and they remained unchanged until 2000, while the prices for PG & E declined from 12.8cents/KWh, in 1995, to 12.4 cents/KWh, in 2000. Furthermore, it is important to notice that between 1995 and 2000 SDG&E's residential rates increased by almost 50 %, rising from 11.4 cents/KWh to 16.1 cents/KWh because SDG&E was no longer subject to a retail price freeze, its customers' electric bills more than doubled, as the chart below illustrates. The portion of retail customers' bills that goes to pay for electricity increased almost 300% (from roughly 5 cents to 15 cents). As a result, SDG&E's total rates for last year are twice the national average for residential consumers.

Figure 2



Source: California Energy Commission, September 2000

V. CALIFORNIA POWER CRISIS AND THE NEIGHBORING STATES

California generates 75 % of the electricity it consumes; the rest is imported from the Southwest (14 %) and the Northwest (11 %). The state's utilities were able to cover their needs in peak demand periods by buying additional energy from generators in neighboring states. Many of these generators produced more electricity than needed in their service territories. California offered a convenient market for these generators to unload their surplus power. However, regional energy demand has grown at a rate greater than regional energy supply. Furthermore,

accompanying the increases in regional demand is a decrease in the amount of electricity generated, both in California and in the neighboring states. The western states outside of California are becoming concerned that California may try to alleviate its own problem by taking power from them. The federal Department of Energy has ordered outside generators to sell power to California at artificially low rates. Under this mandate, power companies in the neighboring states must then buy some supplies on the spot market at higher prices to replace supplies lost to California. However, shoring up California's dysfunctional markets in this manner may drain cash from ratepayers of neighboring states. The western states are becoming very concerned that this mandated power sharing might impact the willingness and ability of investors to construct new plants that are needed elsewhere in the west. Indeed, some companies from Arizona have not been immune from the wholesale price disruption in California. For example, Citizen Communication, an Arizonian company, purchases virtually all its power in the wholesale market to serve certain areas. Citizen collects revenues from customers to pay these costs through rates set by the Corporation Commission. From May to September 2000, Citizen reported that it has incurred a deficit in excess of 59 million dollars from the power supplies purchased on the spot market. It has submitted to the Corporation Commission a plan to recover the deficit through increased rates over time.

Furthermore, heat waves in the Southwest strained supplies in that region. Utilities, which used to have a surplus of electricity, competed with California for extra capacity to make up for their own shortfalls. Meanwhile, the Pacific Northwest was hit by drought in the summer of 2000, which reduced hydroelectric generation in British Columbia, Oregon, and Washington.

Therefore, those states may not be able to sell power to California for the upcoming year. The following table presents some statistics on energy imports of California between 1990 and 1999.

Table 7. California Energy Imports, 1990 to 1999

(Millions of kilowatt hours)

	1990	1991	1992	1993	1994	1995	1996	1997	1998 [r]	1999 [p]
Energy Imports: Total	61,959	55,873	37,704	42,892	43,354	47,514	49,696	52,720	47,563	49,487
Pacific Northwest	31,665	28,819	19,600	15,466	15,315	19,890	29,529	25,204	19,428	26,051
Southwest	30,294	27,054	18,104	27,426	28,040	27,624	20,167	27,517	28,135	23,436

[p] Preliminary.

[r] Revised.

Source: California Energy Commission, August 17, 2000

According to this table, California was importing about the same amount of KWh from the Pacific Northwest and the Southwest in the early 1990. By 1993, its importation from the Southwest states was 27,426 Million of KWh, a number that represented about two thirds of its total imports. In 1999, more than half of its total imports was coming from the Northwest. On the other hand, we can see from these figures that, since deregulation process, California's electricity import from the Pacific Northwest as well as the Southwest remained almost constant, although it is expected to increase for these coming years.

VI. ECONOMIC THEORY AND THE CALIFORNIA ENERGY CRISIS

In this section, we present an economic model that helps to explain the energy crisis in California.

After a power plant has been built, it can produce electricity up to its capacity. The costs involved in producing electricity are variable costs and consist mainly of the costs of fuels. For a large hydroelectric power plant, variable costs are low if enough water has been stored behind the dam, although the initial costs involved in building the dam and installing the turbines are heavy. For a nuclear power plant, the cost of building the plant runs into billions of dollars. However, the variable costs of nuclear fuels are rather modest. Power plants run by coal, gas or oil are less expensive to build; the fuels needed to operate these power plants, on the other hand are more costly.

In meeting the demand for electricity, power plants are put into operation in the order of increasing marginal costs. If all the power plants are running at full capacity and demand is still not completely satisfied, energy imports are then necessary. In the drastic case when the energy generated within the territory and the energy imports are not sufficient to meet demand, power supply to some customers must be cut off.

To formulate a model of electricity supply in California after deregulation, let m be the number of power plants – owned by the utilities as well as non-utility producers – in this state before the process of deregulation began. For each $i = 1, \ldots, m$, let c_i be the marginal cost, assumed to be constant, of the i^{th} power plant. Without any loss of generality, we shall assume that $0 < c_1 < c_2 < \ldots < c_m$, i.e., the power plants are ordered according to their marginal costs, with the ones having lower marginal costs coming before the ones with higher marginal costs. Let $I_0 \subset \{1, \ldots, m\}$ and $J_0 \subset \{1, \ldots, m\}$ denote, respectively the set of power plants owned by the utilities and the non-utility producers before deregulation. Clearly, $I_0 \cup J_0 = \{1, \ldots, m\}$ and $I_0 \cap J_0 = \varnothing$. After deregulation, the utilities were forced to sell off their oil and gas power plants; the set of power

plants owned by the utilities after deregulation is denoted by I_1, a proper subset of I_0. If we let J_1 denote the set of power plants owned by non-utility producers, then $J_1 = \{1, ..., m\}/ I_1$. Clearly, J_0 is a proper subset of J_1.

We shall now construct the industry supply of electricity. To this end, first recall that according to the rule of deregulation the utilities must offer all of the electricity they produce on the PX in competition with numerous other producers. Therefore, the electricity supply in California – both inside and outside of the PX – can be considered as competitive. Now let p be the price per KWh. If $p < c_1$, then no power plant is able to cover the variable costs. In this case, the industry supply will be zero. If $p = c_1$, then the power plant with the lowest marginal cost will be operating, and its production can vary from zero up to its capacity, say q_1^{max}. For $c_1 < p < c_2$, the only power plant in operation is the first power plant, and its output is q_1^{max}. When p reaches c_2, the second power plant is also brought into production, and its output varies between 0 and q_2^{max}, where q_2^{max} is the capacity of the power plant. For $c_2 < p < c_3$, only the first two

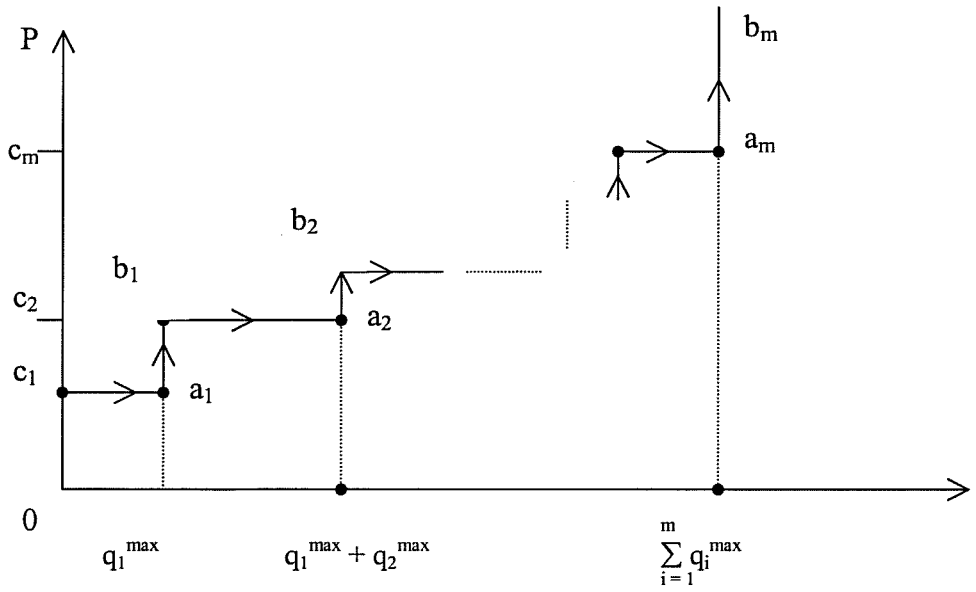


Figure 3. – The Industry Supply Curve after Deregulation

power plants are in operation, and their combined production is $q_1^{max} + q_2^{max}$. Continuing in this manner, we obtain a rising step function, which represents the industry supply curve depicted as $0c_1a_1b_1a_2b_2 \ldots a_m b_m$ in Figure 4. Observe that when $p \geq c_m$, the industry supply stops rising and becomes inelastically vertical at the industry output level of $\sum_{i=1}^{m} q_i^{max}$, the industry generating capacity.

If we superimpose California's electricity demand curve on the industry supply curve, then the intersection of these two curves represent the autarkic equilibrium of this state's electricity market. This autarkic equilibrium is depicted in Figure 5, as point *e*, where the industry supply curve *s* crosses the market demand *d*. As illustrated in this figure, the price per KWh is sufficiently high to induce the most inefficient producers into the market.

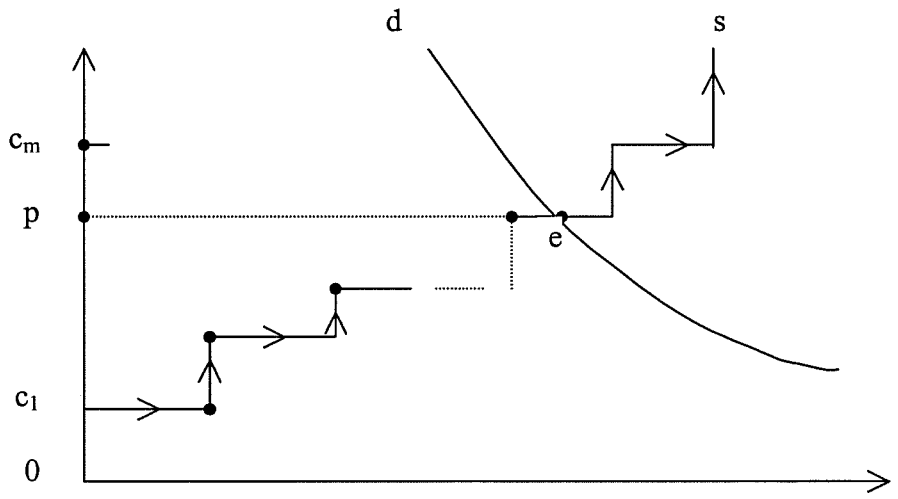


Figure 4. – The Autarkic Equilibrium in the Electricity Market of California

Let us now open the electricity market of California to competition from the neighboring states. If we lump all the neighboring states together, then a figure like Figure 5 can also be used to

depict the autarkic equilibrium in these states. In Figure 6, we depict the equilibrium in the small world consisting of California and the neighboring states.

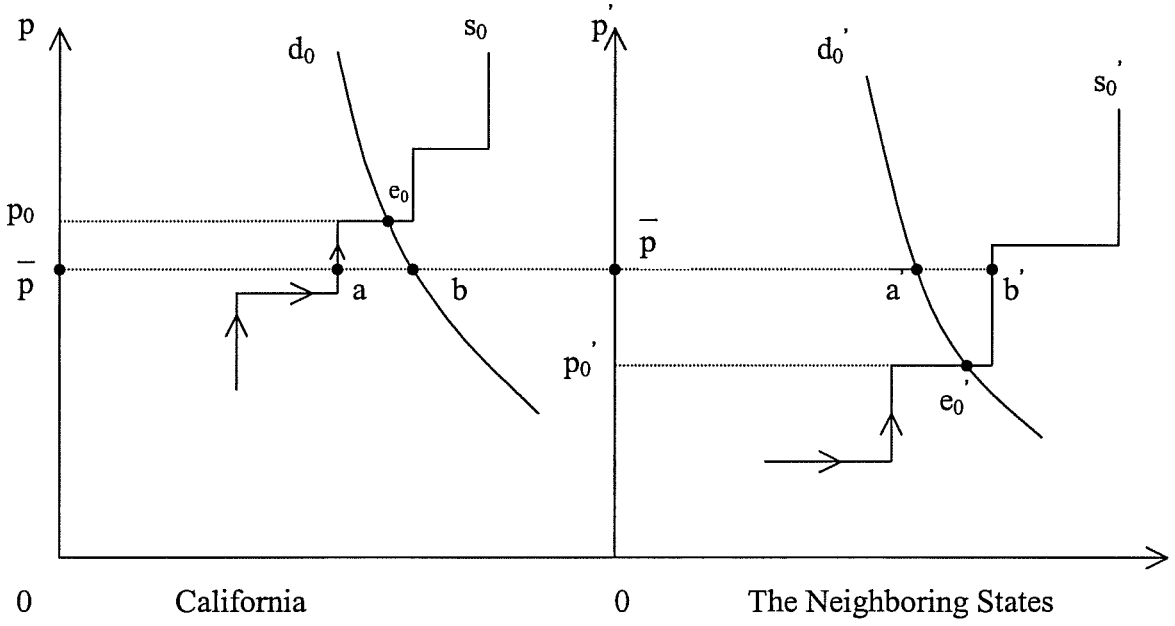


Figure 5. – The Equilibrium Price of Electricity when California and the Neighboring States Open their Electricity Markets to Competition.

In Figure 6, the autarkic equilibrium in California and the Neighboring States are denoted by e_0 and e'_0 respectively. When the electricity markets in California and in the neighboring states are open to competition, the equilibrium price of electricity is $\bar{p}$, with $\bar{p}'_0 < \bar{p} < p_0$. In California, the industry supply is $\bar{p}a_0$ and the demand is $\bar{p}b$. The shortfall in supply is covered by $a'b'$, the energy imports from the neighboring states. In the neighboring states, the total supply is $\bar{p}b'$ which is greater than the demand $\bar{p}a'$; the electricity surplus, namely $a'b'$, is sold to California.

We have now assembled enough theoretical machinery to explain the energy crisis in California. Suppose now that Figure 6 depicts the equilibrium between California and her neighboring

states – as far as electricity is concerned – immediately after deregulation. Also, suppose that the price per KWh is frozen at $\bar{p}$ both in California and in the neighboring states.

Now suppose that due to economic growth, the demand in electricity for California shifts outward to d_1. In spite of the small additions to capacity, California's electricity supply shifts leftward to s_1 due to the aging of its power plants. Similar forces are at work in the neighboring states : the demand curve shifts outward from d'_0 to d'_1 while the supply curve shifts leftward from s'_0 to s'_1.

At the frozen price $\bar{p}$, the quantity demanded in electricity by California's residents has risen to $\bar{p}b_1$ while the quantity supplied from the state's power plants has shrunk to $\bar{p}a_1$.The shortfall in supply is now a_1b_1. In the neighboring states, the energy surplus has been reduced to $a'_1\ b'_1$. Even with $a'_1\ b'_1$ as the energy imports, the state's electricity supply cannot adequately meet demand. If market forces are free to adjust demand and supply in California, the price per KWh will rise to incredible heights. However, with the price per KWh frozen at $\bar{p}$, it is impossible to meet the demand for electricity by California's residents. Because the utilities are obliged to serve California's residents and can only charge their customers the price $\bar{p}$, they must buy part of the shortfall on the PX. However, buying more electricity on the PX will bid up the price to induce more inefficient producers into the market. Thus to satisfy part of the shortfall the utilities will bid up the price per KWh, say to $p_1 = c_m$. The total quantity supplied by the instate producers is then $\bar{p}\alpha_1$. If the FERC orders the neighboring state to sell the surplus energy at price $\bar{p}$, then the California's utilities can import the amount $a'_1\ b'_1$ at price $\bar{p}$. However, the shortfall is still $\alpha_1 b_1 - a'_1\ b'_1$.

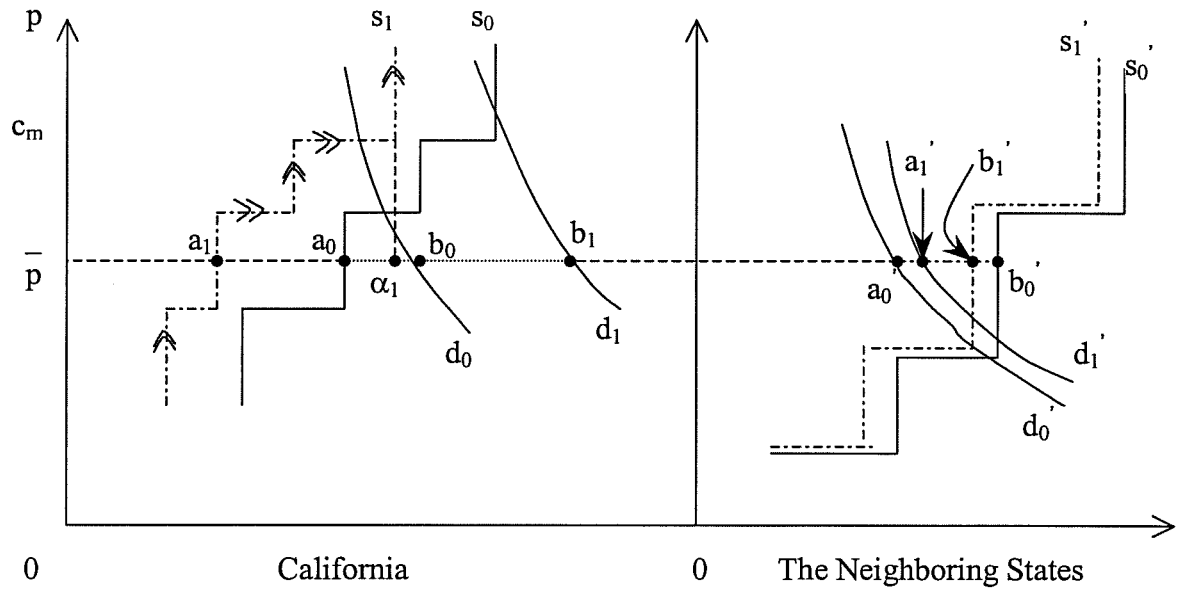


Figure 6. – The California Energy Crisis

The losses suffered by the utilities can be computed as follows. First, the total cost of operating their own power plants is $\sum_{i \in I_1} c_i q_i^{max}$. Second, the cost of the energy import is $\bar{p}(a'_1 b'_1)$. Third, the amount of electricity that he utilities buy on the PX is $\sum_{j \in J_1} q_j^{max}$. Hence, the total cost incurred by the utilities in providing the part of the needs in electricity of California's residents is

$$\sum_{i \in I_1} c_i q_i^{max} + \bar{p}(a'_1 b'_1) + p_1 (\sum_{j \in J_1} q_j^{max}).$$

However, the total revenues received from the customers are simply :

$$\bar{p}(\bar{p}\ \alpha_1 + a'_1 b'_1) = \bar{p}\ (\sum_{i=1}^{m} q_i^{max} + a'_1 b'_1)$$

The net losses suffered by the utilities are then given by :

$$\bar{p}\,(\sum_{i=1}^{m} q_i^{max} + a'_1 b'_1) - \sum_{i \in I_1} c_i q_i^{max} - \bar{p}(d'_1 b'_1) - p_1 \sum_{j \in J_1} q_j^{max}$$

$$= \bar{p} \sum_{i=1} q_i^{max} - \sum_{i \in I_1} c_i q_i^{max} - p_1 \sum_{j \in J_1} q_j^{max} << 0$$

If p_1 is high and if $\sum_{j \in J_1} q_j^{max}$, the total supplies of the non-utility producers account for a high proportion of California's electricity supply, then the preceding losses will be enormous. Indeed, this is the predicament of the utilities in California, as a result of the so-called electricity deregulation.

VII. CONCLUSION

Despite the solution put in place by California's legislators and the Federal Government, the state's electricity supplies have not yet kept pace with its economic growth. As power plants aged, California's economy grew and policy makers retreated from aggressive efforts to promote energy efficiency and investments in renewable power resources to meet demand. Therefore, the supply shortage results partly from the lack of investment in power plants, regulatory uncertainty, and a strong environmentalist opposition to building new power plants. Indeed, the California Environmental Quality Act (CEQA) and the federal Clean Air Act are two of the principal laws that ensure public health safety and environmental quality when power plants are constructed and operated. These laws focus on the environmental impacts of California's power choices. Failure to conduct adequate environmental review can result in CEQA litigation by citizens or local government agencies, and these lawsuits can delay, change, or eliminate a power plant project.

The policy incoherence between State level and the Federal authorities affects California's ability to produce more electricity. Although the federal government oversees the ISO and the PX, federal regulators pursue national interests, not necessarily those of Californians. For example, the FERC does not incorporate California's strong environmental values into its decision-making. The FERC's oversight of the ISO and PX is limited in practice partly because it does not follow a comprehensive model or set of policies. Instead, the FERC generally regulates the ISO and PX by approving or denying some proposals. California is one among 50 different systems, as a practical matter, the FERC probably cannot provide close supervision of the complex industry structures and the hundreds of utilities in 50 states, half of which have

created new structures that rely increasingly on federal action. In addition, a lack of transparency in the system prevents the market from functioning properly. Indeed, as private entities, the ISO and PX are not fully subject to state laws governing business. Furthermore, these boards conduct some of their business privately in executive sessions and then assert that they are not required to report the decisions taken at of these deliberations. These circumstances show that the electric system governance is not working for the benefit of California consumers at this time.

Therefore, it is important for actors in California's electricity market to review the system, by allowing more transparency and encouraging renewable energy, which is more likely to meet environmental standards. In the past year, about 250 non-profit utilities, which use mostly wind or solar energy, have emerged in California, and they are receiving tax credit from governments. The price cap is not the solution because when they are properly functioning, electricity markets involve producers and consumers voluntarily selling and buying at mutually acceptable prices. Electricity is essential to the public welfare. Protecting the public interest requires that electricity be delivered at an acceptable price, which can also come from the interaction between supply and demand. In that sense policy makers in California, as well as at the federal level, should set a specific and clear deregulation rule with a minimum government involvement in order to allow for a new market structure that would encourage competition and prevent an economic breakdown in California, which might then spread throughout North America.

GLOSSARY

The Independent System Operator (ISO):

It is a new organization created to increase reliability and provide new power producers equal opportunity and ability to deliver their supplies. The IOUs (Investor Owned Utilities) retain ownership of their transmission facilities, but are required to transfer operational control of the facilities to the Independent System Operator (ISO). The ISO is responsible for maintaining the integrity of the electrical grid in California.

The Power Exchange (PX):

Another important element of the restructured market is the newly created Power Exchange (PX). The PX will operate like a commodities market where power producers will compete to sell their electricity generation in response to bids submitted by buyers.

The Competition Transition Charge (CTC):

The new electricity restructuring legislation provides an accelerated recovery of the IOU investments through a Competition Transition Charge (CTC). The CTC for investor-owned utilities varies by utility.

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