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**Mina Safai**

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**California Electricity Crisis 2001**

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Autor práce: **Mina Safai**  
Vedoucí práce: **PhDr. F. Raška**

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### **Abstract**

This paper describes the Californian Electricity Crisis 2001 from the energy security perspective. The work shows that deregulation of the electricity sector in California challenged the main energy security principle - uninterrupted energy supply at affordable prices. The principle is vital for economic development and national prosperity. Disruptions or blackouts along with unprecedented high electricity prices during the Californian crisis damaged not only the economy, but increased the budget deficit and brought to bankruptcy private generators of energy supply. This damaged the policy of energy security management. The approach I take in addressing the causes of the Californian Electricity Crisis is to perform a case study; its examination from the perspective of energy security, clarification of the risks for energy security if the state authorities restructure electricity sector; and to extract lessons for future application, which should be learnt from the crisis. In order to make the mentioned approach successful I highlight the conditions in the western US electricity supply industry, which enabled the California crisis to happen. In addition, I describe the regulatory structure of the California electricity sector, and the way the deregulation plan was implemented applying comparative analysis with implemented deregulation of the English electricity sector in 1989. I concluded that deregulation of the electricity sector can pose risks to energy security if a weak policy is applied during deregulation.

In my case study, I evaluate the lessons learned from the California electricity crisis, diagnosing its causes and citing recommendations for state authorities to consider in future regulation of the electricity sector.

## Abstrakt

Tato práce pojednává o kalifornské krizi na trhu s elektřinou v roce 2001 z hlediska energetické bezpečnosti. Práce ukazuje, že deregulace trhu s elektřinou v Kalifornii vedla k narušení hlavního principu energetické bezpečnosti – nepřerušovaná dodávka energie za přijatelné ceny. Dodržování tohoto principu je nezbytnou podmínkou pro ekonomický rozvoj a národní prosperitu. Narušení či zastavení dodávek společně s vysokou cenou elektřiny během kalifornské krize nepoškodily jen ekonomiku. Tyto faktory také vedly ke zvýšení rozpočtového deficitu a přivedly k bankrotu soukromé dodavatele energií a to vedlo k narušení politiky managementu energetické bezpečnosti. Pro zkoumání příčin kalifornské krize na trhu s elektřinou v roce 2001 jsem zvolila postup případové studie. Zkoumám krizi z hlediska energetické bezpečnosti, objasňuji rizika pro energetickou bezpečnost spojená s rozhodnutím státního aparátu o restrukturalizaci energetického sektoru a analyzuji ponaučení pro budoucí rozhodování. Aby mohla být tato případová studie úspěšná, zdůrazňuji podmínky v oblasti sektoru dodávek elektřiny na západě Spojených států, které umožnily vznik takovéto krize. Dále popisuji regulační strukturu kalifornského sektoru s elektřinou a způsob jakým byla provedena jeho deregulace v komparaci s deregulací implementovanou v britském sektoru s elektřinou v roce 1989. Docházím k závěru, že deregulace sektoru s elektřinou s sebou může nést rizika pro energetickou bezpečnost, pokud jsou implementovány špatné politiky.

Z této případové studie vyvozují potřebná ponaučení získaná během kalifornské krize na trhu s elektřinou z roku 2001, objasňují příčiny této krize a doporučují některé postupy k budoucí regulaci energetického sektoru pro státní orgány.

## **Key words**

**energy security, electricity sector, deregulation – restructure, market liberalization**

## **Klíčová slova**

**Energetická bezpečnost, sektor trhu s elektřinou, deregulace – restrukturalizace, liberalizace trhu**

**Rozsah práce: 149, 872 znaků**

## **Prohlášení**

1. Prohlašuji, že jsem předkládanou práci zpracoval/a samostatně a použil/a jen uvedené prameny a literaturu.
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3. Souhlasím s tím, aby práce byla zpřístupněna pro studijní a výzkumné účely.

V Praze dne

Mina Safai

.....

## **Poděkování**

Na tomto místě bych ráda poděkovala vedoucímu své diplomové práce, PhDr. Francisovi Raškovi a PhDr. Kryštofovi Kozákovi, za jejich ochotu a úsilí, které věnovali čtení jednotlivých kapitol a za jejich připomínky, které práci obohatily. Bez jejich pomoci by tato práce ztratila na své hodnotě (ať už po stránce jazykové či po stránce obsahové). Jsem jim nesmírně vděčná za veškerou poskytnutou pomoc a podporu, kterou jsem v jistých chvílích velmi potřebovala.



**Institut mezinárodních studií**  
**Teze magisterské práce**

**Jméno:** Mina Safai

**E-mail:** safaridream09@yahoo.com

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**Vedoucí diplomního semináře:** Miloš Calda

**Vedoucí práce:** Francis Raška

**Zdůvodnění výběru tématu práce (10 řádek):**

Nowadays, energy issue is rather pressing. Over the past half century, the world's total energy consumption has increased radically. Economic growth as well as, shifting patterns of production, consumption, and trade away from solid fuels toward petroleum, gas and nuclear power strengthened significance of energy issue in U.S. From that, prospective the problem of energy security evokes the attention of scholars and scientists. Moreover, the case study, of California Electricity Crisis 2001, which is my research topic, is a good example of the energy security challenges. The collapse of the California electricity restructuring program showed the incapability of the state and federal authorities to manage with electricity and financial crisis.

**Předpokládaný cíl (10 řádek):**

The aim of the work is to conduct a holistic case study of the California Electricity Crisis of 2001; to examine the case study from the perspective of energy security, to clarify what are the risks for energy security and in what dimension did the restructuring program create risks leading to the energy crisis; to stress what lessons should be learnt from the crisis. Define the complexity of energy sector in California, including

generation, transmission and distribution. Observe how California Electricity Crisis influenced on U.S. economy. Monitor the political, regulatory and economic factors that led to California electricity crisis in 2001. Discuss three phases of crisis development and their effects on the market liberalization.

**Základní charakteristika tématu (20 řádek):**

This paper describes the Californian Electricity Crisis 2001 from the energy security perspective. The work shows that deregulation of the electricity sector in California challenged the main energy security principle - uninterrupted energy supply at affordable prices. The principle is vital for economic development and national prosperity. Disruptions or blackouts along with unprecedented high electricity prices during the Californian crisis damaged not only the economy, but increased the budget deficit and brought to bankruptcy private generators of energy supply. This damaged the policy of energy security management. The approach I take in addressing the causes of the Californian Electricity Crisis is to perform a case study; its examination from the perspective of energy security, clarification of the risks for energy security if the state authorities restructure electricity sector; and to extract lessons for future application, which should be learnt from the crisis. In order to make the mentioned approach successful I highlight the conditions in the western US electricity supply industry, which enabled the California crisis to happen. In addition, I describe the regulatory structure of the California electricity sector, and the way the deregulation plan was implemented applying comparative analysis with implemented deregulation of the English electricity sector in 1989. I concluded that deregulation of the electricity sector can pose risks to energy security if a weak policy is applied during deregulation.

In my case study I evaluate the lessons learned from the California electricity crisis, diagnosing its causes and citing recommendations for state authorities to consider in future regulation of the electricity sector.

**Předpokládaná struktura práce (15 řádek):**

The work consists of 4 parts: research design, three chapters and conclusion accompanied by lessoned learned approach to the topic and set of recommendations. The first part of the work analyzes the case study of California Electricity Crisis, characterizing tight interconnection of California electricity market with Western Interconnect system. Moreover, it highlights the motivations, which justified deregulation as market liberalization in California. In addition, it provides the reader with necessary information about federal regulatory structure on the base of which electricity sector was functioning. It also analyzes was the deregulation an opportunity or risk? The second part of the work devoted to examination of the main players of the crisis, the causes of the crisis, and two sets of the challenge: electricity challenge and financial default of private generators who filed bankruptcy. Third part of the work connects energy security issues with California case, criticizing American government in the lack of adequate attention on domestic energy issues. In conclusion, there is a list of recommendations, which could be useful for state authorities during implementation of deregulation plan of the electricity sector.

**Základní prameny a literatura (20 nejdůležitějších titulů):**

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## Content

|   |           |
|---|-----------|
| Who is who in California energy sector?.....                        | 2         |
| A Chronology of California Electricity Restructuring.....           | 3         |
| <b>Introduction</b> .....   | <b>5</b>  |
| <b>1. Research design</b>   |           |
| 1.1. Research question and its justification.....                   | 9         |
| 1.2. Working hypothesis.....  | 11        |
| 1.3. Literature review.....   | 11        |
| 1.4. Methodology.....   | 16        |
| <b>2. Deregulation of the California electricity market</b>         |           |
| 2.1. California Electricity Infrastructure before deregulation..... | 17        |
| 2.2. Deregulation as a market reform.....                           | 18        |
| 2.3. Federal Regulatory Structure.....                              | 24        |
| 2.4. Deregulation: opportunity or risk?.....                        | 27        |
| <b>3. Crisis of the California electricity sector</b>               |           |
| 3.1. Main players.....  | 28        |
| 3.2. Causes of the crisis.....                                      | 37        |
| 3.3. Two set of the problems: electricity and financial crisis..... | 43        |
| 3.4. State and Federal Policy Responses.....                        | 49        |
| <b>4. Energy security and California case</b> .....                 | <b>52</b> |
| Conclusion  |           |
| Lessons learned.....  | 60        |
| Set of recommendations.....   | 63        |
| Resume.....   | 64        |
| Bibliography.....   | 65        |
| List of annexes.....  | 70        |
| Annex.....  | 71        |

## **Who is who in California energy sector?**

### **California Independent System Operator (CAISO)**

California Independent System Operator (California ISO) is charged with managing the flow of electricity along the long-distance, high-voltage power lines that make up the bulk of California's transmission system. The not-for-profit public-benefit corporation assumed the responsibility in March 1998, when California opened its energy markets to competition and the state's investor-owned utilities turned their private transmission power lines over to the California ISO to manage.

### **California Public Utilities Commission (CPUC)**

The CPUC regulates privately owned telecommunications, electric, natural gas, water, railroad, rail transit, and passenger transportation companies. The CPUC is responsible for assuring California utility customers have safe, reliable utility service at reasonable rates, protecting utility customers from fraud, and promoting the health of California's economy.

### **Water Resources (California Department of...)**

The Department of Water Resources is handling the state's bid-purchasing of short and long term electricity for sale to the state investor-owned utility companies.

### **Federal Energy Regulatory Commission (FERC)**

FERC is an independent regulatory agency within the Department of Energy that: regulates the transmission and sale for resale of natural gas in interstate commerce; regulates the transmission of oil by pipeline in interstate commerce; regulates the transmission and wholesale sales of electricity in interstate commerce; licenses and inspects private, municipal and state hydroelectric projects; oversees related environmental matters; and administers accounting and financial reporting regulations and conducts of jurisdictional companies.

### **Utility Distribution Companies (UDCs)**

#### **Investor Owned Utilities (IOUs)**

Pacific Gas & Electric Company (PG&E), San Diego Gas & Electric Company (SDG&E), Southern California Edison (SCE)- private energy companies.

#### **Power Exchange (PX) – auction based market**

## **A CHRONOLOGY OF ELECTRICITY RESTRUCTURING IN CALIFORNIA**

**1994:** The California Public Utility Commission (CPUC) begins a formal rulemaking procedure to consider approaches to restructuring the state's electricity market. That action builds on changes in federal law and regulation that began with the Public Utilities Regulatory Policy Act of 1978 and continued with the Energy Policy Act of 1992.

**1996:** California law AB 1890 codifies various regulatory changes and initiatives by the PUC. Those changes include requiring the state's three major investor-owned utilities--Pacific Gas and Electric (PG&E), Southern California Edison (SCE), and San Diego Gas and Electric (SDG&E)--to sell half of their fossil-fuel capacity (they eventually sold all of it); transferring control of electricity transmission to a newly created nonprofit corporation, the California Independent System Operator (CAISO); creating another nonprofit corporation, the California Power Exchange (PX), to run wholesale auctions of electricity; and freezing retail electricity prices until 2002 (or such time as the utilities recover certain costs). The California state auditor reports that the western states as a whole have excess generating capacity of roughly 20 percent.

**1998:** The California PX begins operating at the end of March. Between August 1998 and March 1999, market-monitoring, surveillance, and market-analysis groups of the PX and CAISO issue reports expressing concern about the functioning of California's wholesale electricity market.

**June 1999:** The CAISO's Surveillance Committee recommends that investor-owned utilities be granted more authority to enter into long-term contracts.

**July 1999:** SDG&E recovers its stranded costs (the decline in the value of certain assets, such as generating facilities and long-term contracts with other suppliers, because of restructuring). As a result, it is allowed to charge its customers market prices for electricity.

**2000:** Growth of income in California and neighboring states--which affects the demand for electricity--accelerates. In California, total personal income, which had grown steadily since the restructuring debate began, jumps by about 9 percent from its level in 1999.

**April 2000:** The price that California's electricity generators pay for natural gas begins to climb from about \$3.50 per thousand cubic feet (reaching more than \$6 by November).

**May 2000:** The summer cooling season begins. May and June 2000 rank among the 15 hottest May-June periods of the past 100 years.

**June 2000:** Rising wholesale prices for electricity consistently exceed the frozen retail price. As a result, PG&E and SCE must sell purchased power at a loss. Customers of SDG&E, by contrast, pay the market price, which is three times higher than it was the previous summer. On June 14, PG&E interrupts service for the first time in its history, which affects 100,000 customers in San Francisco.

**August 2000:** The estimated annual prices that generators pay for pollution credits--which reflect the costs of producing electricity from fossil-fuel plants--rise to \$30 per credit (from \$10 in June). They reach \$45 per credit by December.

**September 2000:** California enacts a law rolling back and freezing retail rates for SDG&E customers at the 1996 level.

**October 2000:** The PUC permits Southern California Edison to increase its short-term borrowing authority from \$700 million to \$2 billion to pay for power in the wholesale market.

**November 2000:** PG&E and SCE file for rate increases to cover power costs they could not collect from consumers. The Federal Energy Regulatory Commission (FERC) releases a report describing how market design and flawed regulatory policies in California have contributed to high prices.

**December 2000:** The CAISO declares many Stage 3 emergencies, warning of the prospect of blackouts as electricity reserves (the amount by which available generating capacity exceeds demand) fall below 1.5 percent during periods of peak demand. The U.S. Department of Energy orders electricity generators outside California to sell to the state's wholesale market. FERC imposes "soft" price controls (limits that may be exceeded in emergency circumstances) and directs California's investor-owned utilities to negotiate long-term supply contracts and reduce their reliance on the wholesale market.

**January 2001:** The PUC approves retail rate hikes for PG&E and SCE. The CAISO orders rolling blackouts on several occasions. Emergency orders by the governor direct the state's Department of Water Resources to buy power in response to the deteriorating financial condition of the three large investor-owned utilities. The PX suspends operations.

**February 2001:** The state negotiates and signs long-term agreements to buy power. It begins implementing a strategy intended to restore the financial health of the utilities, which includes having the state purchase major transmission lines.

**March 2001:** Rolling blackouts occur statewide. FERC directs 13 power suppliers to refund \$69 million that it says they overcharged utilities in January. The PUC approves immediate increases in retail rates.



**April 2001:** PG&E declares Chapter 11 bankruptcy. Standard & Poor's downgrades California's bond rating (from AA to A-plus) because of the state's additional borrowing to address its electricity problems.

**May 2001:** California authorizes a \$13 billion bond issue to finance its purchases of electricity. The North American Electric Reliability Council warns that the state could face 260 hours of rolling blackouts during the summer.

**June 2001:** FERC announces a price-mitigation plan for all of the western states, with wholesale prices to be capped at a level reflecting the highest cost of generating electricity in California.

**July 2001:** Moderate temperatures help keep the demand for electricity lower than during the previous summer. Even though water levels in the streams used to generate hydropower are low, declining demand for electricity and falling natural gas prices combine to push wholesale electricity prices to the lowest level since the spring of 2000. Prices in the spot market fall far below the level that the state is paying for electricity under its long-term contracts. This information was copied from the Congressional Budget Office web site, Accessed May 2011, <http://www.cbo.gov/doc.cfm?index=3062&type=0>.

## INTRODUCTION

The research on the case of 2001 California Energy Crisis addresses the problem of energy security and emphasizes the key role of sustainable and affordable energy supply. An undisrupted energy supply for reasonable price is among the core cornerstones of any industry and economy. The unforeseen scenarios in the energy market of California, a leading economy within the United States, in the early 2000s are a perfect example for the statement above.

Problems of energy security are rather sensitive in the United States because of misbalanced energy markets, high prices for oil and gas resources. Those factors as imbalances, insufficient hydrocarbon extraction and power generation within the United States, including unstable political situation of supplier countries<sup>1</sup>, depleting hydrocarbon resources<sup>2</sup> and rising energy consumption are key issue in energy security.

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1. Rambler Media Group, Accessed, May 2011, <http://lenta.ru/news/2011/03/14/brent/>.

There are several challenges for the US energy security: dependence on unstable prices for hydrocarbon sources, the dependence on unstable energy supplier regions/nations<sup>3</sup> and unequal proportion in demand and supply.<sup>4</sup> It is conventional wisdom that prices of energy resources are extremely sensitive to and dependent on political developments: the more unstable, conflict prone political situation in the world, the less production and the higher the price<sup>5</sup> we can observe. One would argue that the statement is true only for crude oil and natural gas, and then there is the question, do the deficit and high prices for the oil and natural gas influence on the other sources of energy? Indisputably, the scarcity of the former leads to the demand growth of the latter, which eventually leads to price increase of the latter.

The 2001 California Electricity Crisis demonstrates the vulnerability of energy security policy, in the context of issues mentioned above. Moreover, it shows incompetence of state authorities to manage challenges of newly restructured electricity system in unprecedented conditions, which brought the system to a crisis and led to financial default of private companies who generated and distributed energy.

California is the most populous state of the U.S. with about 37 million people. It has a large economy with technology industries, most of which heavily depend on electricity consumption. In late 1990s, the state had booming economy with mounting demand on energy resources, electricity

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2. One may argue that recent advances in shale gas production put us on the optimistic side, however, despite the shale gas boom in the US, the sophisticated exploration and production process make us more cautious.
  3. For instance, according to the EIA data for 2007, except Canada which was USA largest petroleum products (18,2%) supplier including crude oil, the next 8 countries (Mexico, Saudi Arabia, Venezuela, Nigeria, Algeria, Angola, Iraq and Russia) are suppliers with instable and unpredictable regimes. Share of Mexico, Saudi Arabia, Venezuela and Nigeria in USA net imports amounted nearly 41 percents.
  4. Despite being a leading producer in the number of energy sources, USA consumption surpasses far beyond their supply. Considering only the proportion between crude oil supply and consumption, one witnesses that USA supply constitutes for 10,7% of world's total, while the overall consumption exceeds over 26% of world's total.
  5. I would like to draw your attention to the most significant case in the South Ossetia war (7-16 August 2008) that confirms my hypothesis. The Baku-Tbilisi-Ceyhan crude oil pipeline, which was built to the capital of the West and the single transportation route to deliver Azerbaijan's (and the Caspian in prospective) oil to European consumers was closed for two days during the war. BP, the main operator of the pipeline, decided to stop oil flow from 12<sup>th</sup> to 14<sup>th</sup> of August, 2008 due to security considerations. This example verified that in so-called traditional Russian sphere of influence to carry out energy projects without Russian participation is not secured from security risks. During the war, the oil price not increased by expected 10USD only because of the economic downfall in the world economy, prognoses over slip up in oil demand and relatively enough resources supplied from the Middle East and other regions.

in particular. Conversely, the price for electricity was high, which was hindering the economic prosperity. The government of California, in order to facilitate economic growth through interfering into the electricity market, decided to restructure the sector through deregulation reforms.

In 1996, the state passed legislation, which was supposed to liberalize electricity market in order to make it more competitive and to deregulate<sup>6</sup> monopoly of Investor Owned Utilities over generation, transmission and distribution of electric power.<sup>7</sup> The plan aimed at transferring much electricity generation from three Investor Owned Utilities (Pacific Gas and Electric Company, Southern California Edison and San Diego Gas and Electric) to independent utilities.<sup>8</sup> The new owners of the sold power plants became wholesalers in the market. They put up for sale power directly to municipal or cooperative utilities and sold the overload of power to private producers, thus influencing the price policy.

In addition, the deregulation program aimed at diversifying private companies' electricity generation; also aimed at creating the Power Exchange institution for wholesale electricity auctions; freezing of retail prices for electricity until 2002 by price caps; and provision of free consumer choice for power distributor.<sup>9</sup>

In general, the deregulated electricity system was functioning quite well until early 2000, when demand capacity prevailed over supply capability. In fact, rapid economic development in California stimulated the elevation of energy consumption; moreover, the reduction of hydropower energy in the region due to limited rainfall, created a deficit of electricity and skyrocketed prices of natural gas, which was also among main generation sources, having negative effects on price formation. These reasons were the ground for the electricity crisis and financial default of private companies. Private companies went bankrupt because of high

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6. Despite existing debate in the scholarship, in present paper the terms "deregulation" and "restructuring" are used synonymously.

7. Ramo, A., "California's Energy Crisis - The Perils of Crisis Management and a Challenge to Environmental Justice." 7 Albany L. Env. Outlook Journal, (2002) 1.

8. Joskow, Paul, "California's Electricity Crisis", *Oxford Review of Economic Policy*' (2001) Vol. 17, No. 3.

9. Grant et. al., "Three Years after the California energy Crisis: A Plan to Avoid Future Shortages", Capstone Policy Analysis, 2004.

electricity prices – on the wholesale market and low electricity prices for consumers because of low caps initiated by government. As a result, they could not gain expected economic benefits in the electricity market.

The further purpose of the research that I am going to conduct is to prove the interdependence of financial, regulatory and market factors in the 2001 California Electricity Crisis, which was not thoroughly studied in the existing literature on the issue. From this point of view, the thesis is supposed to be an important contribution to the scholarship by presenting a new vision on California Electricity Crisis 2001, which is based on the holistic approach to the causes of the crisis. The research is mainly done on the bases of three core questions: What were the objectives of the deregulation policy? What were the results of the deregulation attempt in the California? Finally, what are the reasons for unsuccessful deregulation policy and what can be recommended not to repeat the destructive experience of the crisis in the future? The single fact that world population is growing as well as their need for sources of energy explains why topics such as California electricity crisis are relevant and always catches one's attention.

Structure of the present thesis is organized in the following order: *the first chapter* is introduction where I present general initial remarks on the case of California electricity crisis and importance of the energy security; *the second chapter* is devoted to the research design of the final thesis, explains aims of the research, working hypothesis, justifies the chosen research question and analyzes literature on the California case; *the third chapter* exclusively deals with the deregulation of the California electricity market, reviews the main regulatory acts and emphasizes that deregulation measures were the key triggering factor of the electricity crisis; *the fourth chapter* studies the California electricity crisis case and highlights its roots, actors, causes and nature of the crisis in detail; *the fifth chapter* examines the issue of energy security as an integral part of national security and draws attention to the significance of California case to the American energy security; **the last chapter** is the conclusion part which highlights the main lessons learned from the electricity crisis.

## I. RESEARCH DESIGN

### *1.1. Research question and its justification*

King et. al. recommend research questions<sup>10</sup> that make contribution to the identifiable scholarly literature, not repeating what has already been studied in depth; consequently, such original work guarantees that others will also benefit from the research in the future. To this end, I specified below the structure of the thesis.

*The aim of present research is to analyze challenges for energy security through the prism of the California electricity crisis case that created unprecedented electricity blackouts and market crisis after restructuring the state's electricity system. Consequently, the **dominant research question** for the project will be: "What were the principal reasons for the California electricity crisis in 2001?"*

Any chosen research project in social sciences can be evaluated as a successful if the topic is "important" in the real world<sup>11</sup> and deals with crucial political, economic and social necessities or allows us to understand something that significantly impacts on many people's lives or to understand and predict events that might be harmful or beneficial.<sup>12</sup>

In this context, it is important to justify the significance of the chosen topic and the selected research question. First of all, the crisis occurred during the Clinton presidency, which is considered to be among several prosperity periods in American economy and the case seriously damaged the image of private business in the United States. The case remains vital in the sense that state/federal government who is supposed to guarantee energy security of the nation in fact caused the electricity crisis as a result of haphazard restructuring initiatives. If we assume that decision made on the state level can be questioned on the federal level, why didn't the Federal

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10. King G., Keohane R. and Verba S., "Designing Social Inquiry: Scientific Inference in Qualitative Research", (Princeton, NJ: Princeton University Press, 1994), p. 16.

11. Ibid. 17.

12. Shively, W. Philips (1990): *The Craft of Political Research*. 3<sup>rd</sup> ed. Englewood cliff, NJ: Prentice Hall pp.14-26).

government responded to the legislation of California even though states in the U.S. enjoy wide political freedom? The attempt also questioned the competence of Federal Energy Regulatory Commission and state authorities.

Below, I identified my main goals in present project:

1. to conduct a holistic case study of the California Electricity Crisis of 2001;
2. to examine the case study of the 2001 California Electricity Crisis from the perspective of energy security, to clarify what are the risks for energy security;
3. in what dimension did the restructuring program create risks leading to the energy crisis;
4. to stress what lessons should be learnt from the crisis.

The number of works on the topic is rather high, it is necessary to stress such authors as James L. Sweeney<sup>13</sup>, Eric Hirst<sup>14</sup>, Paul Joskow<sup>15</sup>, Peter Navarro and Shames, M.<sup>16</sup>, Taylor and Peter VanDoren<sup>17</sup>, Frank Wolak<sup>18</sup>, Jun Ishii<sup>19</sup>, Jingming Yan<sup>20</sup> and many others who contributed to the studies of California Electricity crisis 2001.

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13. Sweeney, J. L , “The California Electricity Crisis”, (Stanford: Hoover Institution Press, 2002).

14. Hirst, E., “The California Electricity Crisis: Lessons for Other States”, Edison Electric Institute Publication, 2001, Accessed January 11, 2011,  
[http://www.eei.org/whatwedo/PublicPolicyAdvocacy/StateRegulation/Documents/CALessons\\_hirst.pdf](http://www.eei.org/whatwedo/PublicPolicyAdvocacy/StateRegulation/Documents/CALessons_hirst.pdf).

15. Joskow, P. (2001) ‘California’s Electricity Crisis’, *Oxford Review of Economic Policy* Vol. 17, No. 3.

16. Navarro, P. and Shames, M. Electricity Deregulation: Lessons Learned from California; *Energy Law Journal*, Vol. 24 No.1, (2003) pp.33-64 // Navarro, P. & Shames, M. ‘Aftershocks—And Essential Lessons—From the California Electricity Debacle’, *The Electricity Journal*, (2003) Vol. 16, Iss.4, pp. 24-30.

17. Taylor, J. and Van Doren, P. , “California’s Energy Crisis: What’s Going On, Who’s to Blame, and What to Do” Cato Institute Policy Analysis Report Number 406, 2001, accessed January 22 2011,  
<http://www.cato.org/pubs/pas/pa406.pdf>.

18. Wolak, F. “Diagnosing the California Electricity Crisis”, The research Paper of the Energy Foundation & the Hewlett Foundation Toward A Sustainable Energy Future, 2003; //Wolak, F. “An empirical analysis of the impact of hedge contracts on bidding behaviour in a competitive electricity market”, *International Economic Journal*, 2000, pp. 1-40.

19. Ishii, J., “Technology Adoption and Regulatory Regimes: Gas Turbines Electricity Generators from 1980 to 2001”, *CSEM Working Papers 128*(2004).

20. Jingming Yan and Jun Ishii, “Investment under Regulatory Uncertainty: U.S. Electricity Generation Investment Since 1996”, *CSEM Working Papers 127*, 2004.

*The practical significance of the work* is the possibility of using final thesis for an advanced investigation in the field of energy security on the experience of California Electricity Crisis. The thesis aims at revealing the interdependence of public-private energy relations and proving the hypothesis that poorly designed large-scale deregulation in the energy sector can seriously undermine energy security.

## **2.2. Working hypothesis**

The data collection process for the final thesis revealed different viewpoints on the 2001 California Energy Crisis. Not surprisingly, the authors approached the issue based on their specializations and possible causes ranged from governmental failure to control the situation to environmental reasons, which restricted the usage of nuclear power stations or coal as a fuel in power generation. Thoroughly, studying the potential causes for the above crisis, I came up with my own hypothesis for the final thesis, which is that the deregulation of energy sector (especially electricity sector) can seriously challenge energy security system.

### ***Literature review***

In this sub-chapter, I will look through the existing literature on the 2001 California Electricity crisis, the rationale behind my wide selection of authors is the multi-vector approach on the causes of the crisis ranging from regulatory to environmental.

Sweeney<sup>21</sup> for example, applies a comprehensive approach to the Crisis, which is useful because of a detailed description of the restructure plan, electricity system with its components, private and public actors, retail and wholesale markets, price policy etc. His work helps us to understand the whole integrated electricity sector as well as the goals of deregulation in general. Sweeney wraps up his arguments stating that deregulation measures should not be written off from accounts due to its failure in California and he brings England as an example.

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21. Sweeney, J. L., "The California Electricity Crisis", (Stanford: Hoover Institution Press, 2002).

He argues that isolation of the supply side from the demand side as it was done in California will be disastrous.

Taylor and VanDoren<sup>22</sup> write about the threat of the crisis not only on the economic well-being of ratepayers, but on the economic well-being of the US as well. Furthermore, the result of their work reveals the argument that environmentalist are to blame for the crisis, because of limited credits of nitrogen oxide emission by energy generating plants.

Marcus and Hamrin's<sup>23</sup> work highlights the failure of California Energy Commission (CEC) to forecast accurate data on electricity demand. They mention that nobody could predict the skyrocketing prices when the cost of wholesale electricity increased by 500 % between 1999 and 2000. In 2001 wholesale spot of electricity averaged over \$ 300/ Mwh, which is ten times more than in 1998. "In their work titled: "How we got into the California energy crisis," the authors deny the arguments that the California energy crisis was originated from the environmental regulations that put a stop to power plants from functioning. Additionally, the work does not support the notion that the crisis escalated because of state's electricity restructuring legislation. They attempt to explain the origin of the failure with the interconnection of electricity and gas supplies. Accordingly, their explanation has four major elements that contributed emergence of energy crisis:

- *Insufficient generation of electricity within California*
- *Insufficient natural gas capacity: total dependence on the natural gas imports and vulnerability to unexpected price rise*
- *Unbalanced disconnection between changes in environmental regulations and changes in the electricity sector*
- *Competitive self interest in conflict with the public interest as well as market power abuses.*

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22. Taylor, J. and VanDoren, P. , "California's Energy Crisis: What's Going On, Who's to Blame, and What to Do" Cato Institute Policy Analysis Report Number 406, 2001, accessed January 22 2011, <http://www.cato.org/pubs/pas/pa406.pdf>.

23. Marcus, W. and Hamrin, J. "How we got into the California energy crisis", 2001 ,*The Coming Global Oil Crisis*, accessed January 11, 2011.

[http://www.oilcrisis.com/us/ca/How\\_We\\_Got\\_into\\_the\\_California\\_Energy\\_Crisis.pdf](http://www.oilcrisis.com/us/ca/How_We_Got_into_the_California_Energy_Crisis.pdf).



From their work, we can also outline the weak points and limitations of California's energy restructuring scheme as follows:

- There was enough supply reserve for several years
- New power plants would cost less than old ones and this new supply would be built in case it was required
- Old, dirty plants will not continue to run
- There would be robust competition in the wholesale and retail electricity market
- Consumers would have accurate information upon which to make rational decisions about how much power to use, when to use it and the options available to switch to alternative suppliers.

Through drawing the entire picture of the state's crisis, Marcus and Hamrin<sup>24</sup> argue that due to their own self-interest and rules governing the marketplace, private actors demonstrated insufficient concern for the public's interest. However, the research does not explicitly illustrate in which cases private players failed to consider the public interests. Rather, the work labels acting within the borders of self-benefit by private actors as a rational choice for them.

In contrast to Marcus and Hamrin<sup>25</sup>, most researchers (e.g. Bushnell<sup>26</sup>; Jascow<sup>27</sup>) support the statement that energy breakdown is originated from the state's de-regulation measures. As Jascow's work asserts, the downfall of the energy system was escapable, when the state government was adequate enough with sufficient measures<sup>28</sup>. Jascow rejects 'state deregulation' as a fostering factor for the crisis, but the method of implementation of new reforms was a core factor in grounding the breakdown<sup>29</sup>.

In this viewpoint, Bushnell supports Jascow's statements. Bushnell's work entitled 'California's electricity crisis: a market apart' which was published on Energy Policy is another

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24. Ibid.

25. Ibid.

26. Bushnell, J., "Looking for trouble: competition policy in the US electricity industry", In: Griffin, J., Puller, S. (Eds.), *Electricity Deregulation: Choices and Challenges*, (University of Chicago Press: Chicago, 2003).

27. Joskow, P. 'California's Electricity Crisis', *Oxford Review of Economic Policy* Vol. 17, No. 3, (2001).

28. Ibid.

29. Ibid.

valuable research on the topic.<sup>30</sup> Bushnell identifies the crisis in two contexts: economic upheaval of during the downfall period and physical scarcity of supply, which was grounded by a lack of competition that was worsened by incompatible Federal and state regulations.<sup>31</sup> Through accenting on the lack of competition among supplier, the author attempts to indicate the reason of price increase when the market got tight. Consequently, having flexibility would not lead to collapse of the utilities, which turned into blackouts. Importantly, Bushnell gives a broader view of the context through discovering the impact of the financial trends on the overall crisis.<sup>32</sup> Accordingly, supply damage was caused from the financial conditions.

One of core arguments of Bushnell is the lack of agreements or arrangements for a long term energy supply, as the market was based on day-ahead and real-time deals and transactions. Despite such vulnerable market conditions, CPUC (California Public Utilities Commission) failed to prevent real time transactions. Moreover, it attempted to discourage long committed deals through their utilities by not favoring the terms of such contracts addressing to the mechanism and calculation of the Competitive Transition Charge (CTC). Consequently, this forced utility shareholders, rather than tax payers, to bear the risk of any contracts signed by the utilities.

Frank Wolak for instance, in his working paper “*Lessons from California Electricity Crisis*” describes federal and state regulatory infrastructure of electricity supply industry in California.<sup>33</sup> He also analyses the important regulatory decisions of Federal Energy Regulatory Commission. All studies mentioned above help to clarify the roots of the crisis and stimulate further research.

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30. Bushnell, J., “Looking for trouble: competition policy in the US electricity industry”, In: Griffin, J., Puller, S. (Eds.), *Electricity Deregulation: Choices and Challenges*, (University of Chicago Press: Chicago, 2003).

31. Ibid.

32. Ibid.

34. Wolak, F. “Lessons from the California Electricity Crisis” Working paper series of the Center for the Study of Energy Markets, CSEM MP 110, 2003, accessed January 22 2011, Scientific Literature Digital Library and Search Engine,

<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.64.2429&rep=rep1&type=pdf>.

Similar to Wolak's paper, the work of Hirst prepared for Edison Electric Institute in July 2001 also presents a good analysis on important lessons<sup>34</sup>, which should be learnt as result of the crisis. He stresses the fact that transition from one industry structure to another is to be a long and complicated process. Electricity is a most flexible energy and real-time product, generation of which occurs at the same time and creates additional complexity. Moreover, Hirst speaks about the focus on the long-term benefits of competitive electricity market and admits short-term problems that can happen during the deregulation program.<sup>35</sup>

Last but not least, the works devoted to the topic varies in finding the reason why the occurred and lessons learned for the long perspective. As it was aspired and predetermined during the literature search, the collected data and literature give an additional advantage to understand the 'problematique'. The literature covers the main description of the electricity market, the electricity system with its components, the understanding of the restructuring policy (Sweeney); further gathered materials are primarily on causes of the crisis: VanDoren and Taylor fairly evaluated the affects of environmentalist approach on power generation, the work is clearly explains that the environmentalist measures did not play key role in the crisis; Marcus and Hamrin's work to the studying the crisis is one of the priceless contributions, authors conducted step by step analysis of the crisis and supported the argument of Taylor and VanDoren environmentalist approaches. Moreover, they emphasized on the financial and regulatory aspects as well. They argued that no one could predict the possible 500% price rise and therefore not a single player was ready for such an escalation. According to them, competition based restructured electricity system will have many advantages in the long run, however the energy system is fragile to rapid restructuring and logically, there would be difficulties at early stages of restructuring. Bushnell also pointed out the financial aspect of the crisis and argued that lack of long term contracts caused instability in the electricity market leading to price hikes. Wolak's work also serves as a continuation of Bushnell's absence of long term contracts argument. The literature collected via stratified sampling resulted to achieve more objective sources, which increased the reliability of the research.

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35. Hirst, E. 'The California Electricity Crisis: Lessons for Other States' Edison Electric Institute Publication, 2001, accessed January 2011, Edison Electric Institute, [http://www.eei.org/whatwedo/PublicPolicyAdvocacy/StateRegulation/Documents/CALessons\\_hirst.pdf](http://www.eei.org/whatwedo/PublicPolicyAdvocacy/StateRegulation/Documents/CALessons_hirst.pdf).

## *Methodology*

Data collection is as important as choosing the right theory to answer originally posed questions.<sup>36</sup> In order to collect data efficiently one needs also a certain degree of theory,<sup>37</sup> which determines the data collection directions. I am intending to use only already existing resources – literature, articles, statements of government officials, doctrines and reports of international organizations and energy companies. Primary resources for the thesis will be original documents, official data and statistics, laws and regulations while reflections and commentaries to the primary sources will also be a secondary resource for the research.

*Theoretical and methodological base of research* is a combination of comparative method of investigation, system analysis as well as content analysis. Such wide-ranging approach stimulates comprehensive study of energy sector and helps to understand the nature of the crisis on the basis of scientific publications and available data.

The sources of final thesis work thus are:

- Legislative Acts both at the federal and state level on energy issues, official documents.
- Published books.
- Scientific journal which are essential in analysis of the crisis
- Newspaper articles, which are extremely useful in tracking the developments during the crisis: developments covering political, financial, environmental issues.
- Statistic data of national energy corporations, international organizations, think-tanks such as Energy Information Agency, BP, CSIS and private companies in the energy sector.

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36. King G., Keohane R. and Verba S., “Designing Social Inquiry: Scientific Inference in Qualitative Research”, (Princeton, NJ: Princeton University Press, 1994), p. 13.

37. Ibid. 23.

As the title of the thesis shows, the case study is the main design for the present research. The advantages of the case study method are seen in the possibility of detailed description of the issue, which introduces the reader to the existing problem. Then, the researcher can guide the reader to more analytical issues, depending on the research question. As the “what?” research question assumes, the nature of the research will be descriptive and explanatory which also matches the goals of the research project. To reach the answer for the proposed research question, I intended to conduct step by step analysis of study variables – including main players of the crisis and main regulatory policies.

## **II. Deregulation of the California electricity market**

### ***2.1. California Electricity Infrastructure before deregulation***

Historically, California’s electricity infrastructure was linked to western states system, called Western Interconnect. Western Interconnect transmission system connected 11 western states, including Northern Mexico, Canadian provinces of British Columbia and Alberta.

In other words, California was net importer of electricity from its neighbors. That factor increased dependence of the California electricity sector on import.

Moreover, there were no investments in innovation of pipelines system for gas import. In fact, it was because of the expensive construction and inefficient investments in nuclear plants in early 1980s. Nuclear plant investments weren’t profitable, because of the risks of radioactive emissions and vulnerability to geological active faults in coast lines of California, as environmentalist argued. Anyway, in 1980s nuclear plants as “Diablo Canyon, near San Luis Obispo and San Onofre, about midway between Los Angeles and San Diego” started to operate.”<sup>38</sup>

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38. “Nuclear Energy in California,” The California Energy Commission, Accessed October 6, 2010, <http://www.energy.ca.gov/nuclear/california.html>.

In addition, reliance of hydropower export, which was the secondary source of energy, depended on rainfall and hydropower of Pacific Northwest, increased export vulnerability in the case of drought. California's private utilities practiced purchasing hydroelectric power from the Bonneville Power Administration (BPA), a federal power-marketing agency, which generated energy from the Federal Columbia River Power System.

The other factor that contributed to high electricity prices before restructuring was federal and state policy toward alternative energy or qualifying facilities (QF). According to the federal Public Utilities Regulatory Policy Act of 1978 IOUs had to buy electricity from alternative energy sources, the price of which reflected the cost of the most expensive source of electricity - nuclear power (average price was about 12.3 cents per kWh for electricity from qualifying facilities, compared with only 4.2 cents per kWh for power from other sources in 1995).<sup>39</sup>

On the state level, there was another problem- monopoly over generation, transmission and distribution, which contributed to high electricity price. High electricity prices pushed the California government to restructure the electricity system in order to create more competitive infrastructure - free market, which would provide cheaper energy supply.

## ***2.2. Deregulation as a market reform***

According to Electricity Report in 1994, the California Energy Commission unanimously supported the restructuring plan of the state's electricity sector from a system of regulated monopolies to a competitive market. Competitive market supposed to transform monopoly over electricity generation into a free market, and to transfer control of monopoly over transmission lines to a central coordinating body that would grant nondiscriminatory access to all sellers and buyers.

That restructuring plan supposed to be applied to state's private, investor-owned utilities (IOUs) and publicly-owned utilities (POUs). Private utilities had a legal monopoly called a "franchise

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39. Congressional Budget Office, Accessed May 2011, <http://www.cbo.gov/doc.cfm?index=3062&type=0>.

in their service areas.”<sup>40</sup> There were 3 big IOUs, which owned franchises in three areas of California state: Pacific Gas and Electric Company (PG&E) in Northern and Central California, Southern California Edison (SCE) in Coastal, Central, and Southern California, and San Diego Gas and Electric (SDG&E) in San Diego.

Moreover, there were small investor-owned utilities, electric co-ops, and municipal utility systems as well, (Los Angeles Department of Water and Power, and the Sacramento Municipal Utility District).

The monopoly franchise comprised generation process, which meant production of power in power plants or purchase of it from other generators, transmission, carriage of the electricity power from power plants via high-voltage transmission lines to load centers, and distribution, deliver of the electricity power to customers at reduced voltages, through small stations and delivery lines..

Granted, monopolies mandated IOUs to serve customers in their franchise areas under rates, set by the California Public Utilities Commission and Federal Energy Regulatory Commission, which set rates for wholesale power sales and high-voltage transmission. The rates covered operating costs and returns on invested capital (cost of service plus changing price of electricity due to market conditions).<sup>41</sup> The profits were used for paying dividends of utility stockholders and interest rates of utility bondholders, and were not used for investments in structural innovations.

“This particular industrial organization –utilities operating as monopolies – had been justified for many decades by the increasing-returns-to-scale nature of electricity generation, transmission, and distribution”, which argues that the increase of the size of individual firms reduces the average cost of the product.<sup>42</sup> However, the electricity price in California was rather high. See the map below.

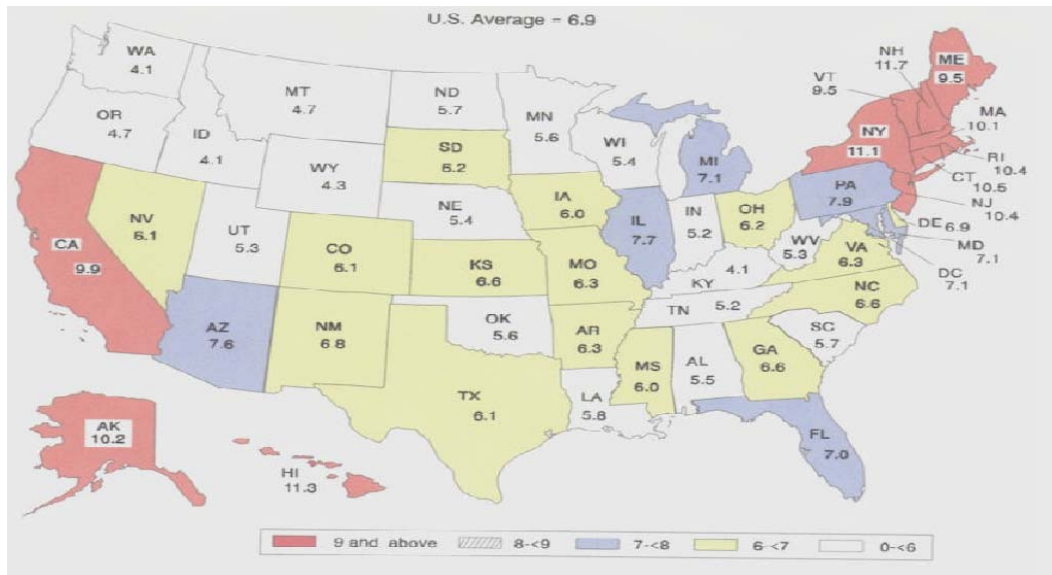
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40. California Government Energy Archive, Accessed February 2011, <http://energyarchive.ca.gov/ER96/FINALER96.PDF>.

41. Ibid.

42. Ibid.

Figure: Prices per Mwh-National Comparison<sup>43</sup>



As the electricity prices continued to rise in the early 1990s, bigger energy consumers started to voice their dissatisfaction with the evolving situation. Objections were directed to the state’s three main investor owned utilities – Southern California Edison (Edison), Pacific Gas and Electric (PG&E) and San Diego Gas and Electric (SD G&E) on the one hand and to lawmakers in all instances. The main goal of the big consumers was to reach a proper regulation and the creation of a more efficient electricity system in California.

This led to countless debates on the regulation and restructuring of electricity markets in the state. The U-turn in the reforms was the California Public Utility Commissions report about the possible ways for restructuring the electricity systems dated back to December 1995, which served as a fundamental document for the Assembly Bill 1890 (*The Electric Utility Industry Restructuring Act*) which was passed by California State Assembly and signed by Governor Pete Wilson on September 23, 1996. Surprisingly, the Assembly Bill 1890 was unanimously approved by the state legislature.

The Electric Utility Industry Restructuring Act considered the following changes from the 1<sup>st</sup> of April, 1998 in order to restructure deteriorated conditions of the electricity system:

43. California Government Energy Commission, Accessed, April, <http://www.energy.ca.gov/maps/>.



The state's three main investor owned utilities – Southern California Edison (Edison), Pacific Gas and Electric (PG&E) and San Diego Gas and Electric (SDG&E) (3 IOU hereafter) have to sell off most of their power generating capacity to the 3<sup>rd</sup> party. This step was taken towards avoiding manipulation in the wholesale market by vertically integrated companies in order to separate generation, transmission and distribution of energy.

## **Generation**

The generation process supposed to operate under free-market principles, where any operators of a power plant could sell power to the customer. Sellers and buyers could participate in a coordinated market, using the prices set by daily bids of the Power Exchange (PX). The PX served as Scheduling Coordinator in support of most market players.

Generators and customers involved in the Power Exchange submitted bids for the price at which they were ready, to sell and buy power. Customers could, in the case of demand bids, specify the price at which they probably would not buy electricity or reduce their power consumption. “If there would be enough supply to meet demand, the bid of the most expensive generator necessary to meet demand will set the market-clearing price (MCP), which will then be paid by all buyers to all generators. When supply is inadequate to meet demand, the MCP will be set by the lowest demand bid necessary to curtail a customer's energy use and thus restore the balance between supply and demand.”<sup>44</sup> So, the Power Exchange operated in California's spot market and identified the state's supply and demand in wholesale power markets on an hourly base. Moreover, the customers who have not signed binding agreements with any of the three IOUs were able to buy energy from PX on spot prices.

PX was a “nonprofit corporation, created to run wholesale electricity auctions, where the utilities were required to buy all of their power that was not coming from their own plants or from preexisting contracts (primarily with qualifying facilities).”<sup>45</sup> Participation in auctions limited IOU's from having long-term contracts with independent power producers because, until 1999, the PX did not sell such contracts.

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44. California Government Archive, Accessed February 2011, <http://energyarchive.ca.gov/ER96/FINALER96.PDF>.

45. Congressional Budget Office, Accessed January 2011, <http://www.cbo.gov/doc.cfm?index=3062&type=0>.

## **Transmission**

Three IOUs have to give the control but not ownership of their transmission lines to the newly formed Independent System Operator (ISO) later called CAISO who will be responsible for scheduling transmission through the grid, preventing domination by bigger actors.

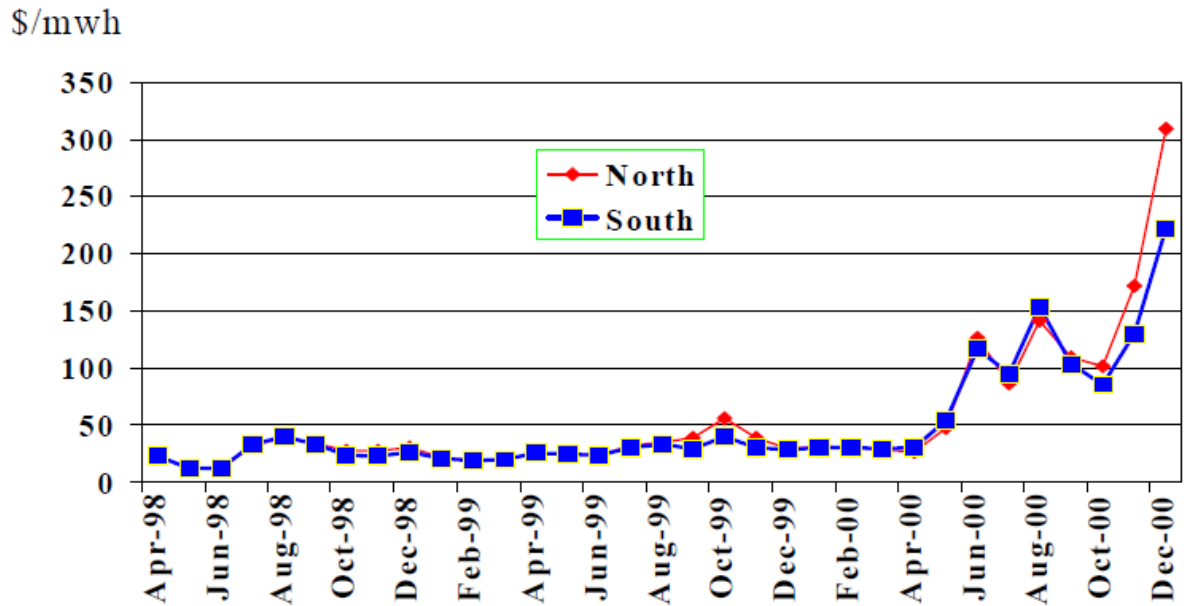
Consequently, the California ISO and PX were two central bodies in the California markets - granting the means throughout which electricity was sold and bought, taking guarantee for market players, and resolving accounts as Scheduling Coordinators.

**Distribution** would not change much; IOUs would still own and operate their local distribution system as a monopoly, while distribution rates would be regulated by the CPUC.

1. The retail customers achieved considerable price advantage. Retail customers who did not have alternative power supplier were granted a privileged right to buy electricity 10% below the regulated rates for the next four years.
2. The retail customers also obtained a right to select power supplier within the service territories of Edison, PG&E and SDG&E.

As a result of deregulation, Edison, PG&E and SDG&E had to sell off a part of their assets to Dynegy, Duke, AES-Williams, Thermo Ecotek, Reliant and Southern by 1999. The taken measures helped to stabilize the electricity market during 1998 and 1999: the behaviour of the wholesale market remained stable and most importantly, during the period the responsible institutions managed to keep transmission routes not overloaded, which helped the stabilization of the market. The stable economic situation and the success of the “deregulation” policies continued by April 2000 as the price for the electricity stayed below \$40mwh on the wholesale market. The gap between retail and wholesale prices facilitated the three IOUs to rebuild their pre-deregulation status and generate profits.

Figure: Average monthly wholesale power prices in California<sup>46</sup>



In addition, AB 1890 establishes rate caps for IOU customers, dividing them into two categories: caps “for industrial and large commercial (20 kW or more of maximum peak demand) customers, rates must be capped at their June 1996 levels. For residential and small commercial customers, rates must be reduced by 10 percent below their June 1996 levels, starting January 1, 1998.”<sup>47</sup> Both of those rate caps expected to last until March 31, 2002 and AB 1890 had authorized to finance the initial 10 percent reduction.

The market operated daily where the PX carried out a bid energy auction for the next day and agreed with the ISO, schedule based on the results of the auction. PX was required to submit balanced schedules, which meant demand equalled to supply.

46. Stuebi, R. (2001) ‘California Energy Crisis: Causes and Consequences’, *Next Wave Energy*.

47. California Energy Archive, Accessed February 2011, <http://energyarchive.ca.gov/ER96/FINALER96.PDF>.

### 2.3. *Federal Regulatory Structure*

The regulatory framework of the California energy market has its roots back to the 19<sup>th</sup> century – the United States Constitution. According to the US Constitution, the United States Congress has the power: “...to regulate Commerce with foreign Nations, and among the several States, and with the Indian Tribes.” (Article I: Section 8)<sup>48</sup>The second major document that regulates power generation and related issues inside the United States is the US Code (Title 16: chapter 12 – Federal Regulation and Development of Power). For the most part, the electricity industry is regulated by several federal laws:

- **Federal Water Power Act of 1920**, in which the United States Congress defined the first rules, limitations and rights to use navigable rivers for the purpose of generating hydroelectric power.
- **Federal Power Act of 1935** remains the fundamental legislation stipulating Federal Energy Regulation Commission’s duties. This federal legislation delineates the federal regulations for electricity transactions among the US states. By adopting the Federal Power Act the government formed a new body, (FERC) an independent agency within the Department of Energy. The importance of the new regulatory agency can be assessed through mentioning that the five members of it are directly appointed by the US President and need to be approved by the Senate. The wholesale of the hydroelectric power and its interstate transmission fell under authority of the newly created structure. The FERC was responsible for delivering electricity to consumers at reasonable, non-discriminatory and just prices. Summing up, “FERC regulates the transmission and sale for resale of natural gas in interstate commerce; regulates the transmission of oil by pipeline in interstate commerce; regulates the transmission and wholesale sales of electricity in interstate commerce; licenses and inspects private, municipal and state hydroelectric projects; oversees related environmental matters; and administers

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48. Article 1 - The Legislative Branch, Section 8 - Powers of Congress.

accounting and financial reporting regulations and conducts of jurisdictional companies.”<sup>49</sup>

FERC was a crucial body because it was empowered to design national markets vs. state vertical integration not only in California but in all states as well. The difficulties the FERC faced during the transitional period of restructure were to find a unilateral approach in average pricing of energy because different states had various resource planning, market rules, and reserve margins. It was complicated in the frame of net importing system.<sup>50</sup> It was also state vs. federal authority in the leadership of domestic market.

- **National Environmental Policy Act of 1969** (NEPA) was one of the most important legislative documents in the US that changed prior rules and influenced costs for the energy industry. As it was outlined in the beginning of the NEPA, federal government sought the following goals from the Act:

*“ .....fulfil the responsibilities of each generation as trustee of the environment for succeeding generations;*

- *assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings;*
- *attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;*
- *preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity, and variety of individual choice;*
- *achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities;*

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49. The California Energy Commission, Accessed, April 2011, <http://www.energy.ca.gov/newsroom/links.html#stateagencies>.

50. Harvard Kennedy School, Accessed, May 2011, [http://www.hks.harvard.edu/hepg/Standard\\_Mkt\\_dsgn/Welch\\_Market.support.open.letter%208-18-03.pdf](http://www.hks.harvard.edu/hepg/Standard_Mkt_dsgn/Welch_Market.support.open.letter%208-18-03.pdf).

- *enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources....”*

The National Environmental Policy Act of 1969 became a real headache for the energy industry, introducing environmental restrictions especially for emissions. These measures led to price increases in electricity generation, transmission and consequently also consumption. The process of getting licenses for the construction of the new energy facilities became more difficult because of the additional procedures on the evaluation of the potential impacts of the planned object for the environment. The coal based energy generators were affected the most from the restrictions enforced in the new legislation.

- **Public Utilities Regulatory Policies Act of 1978 (PURPA)** was a legislation directed towards technological innovations in electricity generation and aimed at reducing the dependence of power plants on fossil fuels. The PUPRA also made it easier for smaller power generating companies to enter the wholesale market.<sup>51</sup>
- **Electric Consumers Protection Act of 1986** (100 Stat. 1243) has not only widened the rights of consumers but also accentuated the environmental issues pointing out the need to preserve water resources and wild life in them.
- **Clean Air Act Amendment of 1990** sharpened the restrictions of emissions and introduced emission allowances which are also known as pollution credits.
- **Energy Policy Act of 1992 (EPACT)** was the logical continuation of the Public Utility Regulatory Policies Act (PURAPA) of 1978. PURPA promoted the development of small-scale renewable sources of energy for electricity generation, mentioned earlier as QF in order to reduce dependence on premium fuel (oil and gas). Moreover, PUPRA stressed the importance of QF as a nonutility who could be introduced in the free market as a competitive power generator against a monopoly of 3 IOUs. EPACT had broader coverage than PURPA in air pollution aspect.

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51. State of California. California Public Utilities Commission. California’s Electric Service Industry: Perspectives on the Past, Strategies for the Future.

Those mentioned above acts were quite important because they created basic regulatory structure for energy resources such as hydropower, gas, coal and alternative power in California. Moreover, such act as EPACT initiated development of QF, which contributed to high electricity price in California. This issue was discussed in chapter 3.

#### ***2. 4. Deregulation: opportunity or risk?***

Above all, we should emphasize that California electricity crisis was a regulatory crisis rather than a financial crisis. And in order to assess this aspect, one should be familiar how federal and state regulatory infrastructure operates in the electricity supply industry. The Federal Energy Regulatory commission could not timely and wisely estimate the events of 2000 and 2001 and could not respond in due order. The Federal Power Act of 1935 outlines the main obligations and responsibilities of the FERC.

The fact that the Assembly Bill 1890 was unanimously approved by the California legislature was puzzling when analyzing the crisis. It is difficult to explain how a Californian legislative body, passed it unanimously, as it suggests that all members were sure about the prospective success of the deregulation reform. Perhaps, the ultimate goal of such legislative initiative was to reduce electricity price for consumers who were paying twice as much as their counterparts in neighbouring states.

If we seek an answer to our question “Was deregulation an opportunity or risk for the California energy market?” One can assume that the California legislative body responded positively, pointing out the potential perspectives of the deregulation towards market liberalization. They believed that state is able to successfully intervene into the electricity wholesale and retail market and by employing the FERC tool to control three giant players - Edison, PG&E and SDG&E. The conventional wisdom that increased competition in the market brings better quality of supplied goods and services as well as decreases the price for them. Thus, influencing the policy makers while passing the Assembly Bill of 1890. However,

first of all, in the present case the above mentioned economic principles did not work because the market was not totally regulated or deregulated. The state put restrictions on the price on the retail market and the IOU's were simply forced to sell the power for lower prices than they bought it in wholesale markets. Here is the first contradiction to the market rules – the market is an institution which is based on profit, nobody carries out business just for the sake of consumers and against his or her economic stability and profitability.

### **III. Crisis of the California electricity sector**

#### ***3.1 Main players***

The California energy market remains to be one of the biggest in the United States and the 2008 statistic points out that California produces 12.8% of the U.S. gross domestic product (\$1.8 trillion out of \$14.44 trillion).<sup>52</sup> The population of the state also accounts roughly for 12% of the overall U.S. population<sup>53</sup>. In the early 2000s, according to California Power Exchange the customer spending per annum equaled approximately 23 billion US Dollars while the annual electricity consumption was about 246 billion kWh<sup>54</sup>. These statistics show that California is among the largest power grid operators in the world.<sup>55</sup> The California electricity market importing about 20% of it<sup>56</sup> depending on imports from North-Western states such as Oregon and Washington<sup>57</sup>, which make the electricity market vulnerable. Despite the import

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52. The California Energy Almanac, Accessed, February 2011, <http://energyalmanac.ca.gov/overview/index.html>.

53. Reddy, Amulya, “California Energy Crisis and Its Lessons for Power Sector Reform in India”, Economic and Political Weekly, Vol. 36, No. 18, 2001.

54. Ibid.

55. Stuebi, Richard: “California Energy Crisis: Causes and Consequences”. Nextwave Energy. February 2001 page 1.

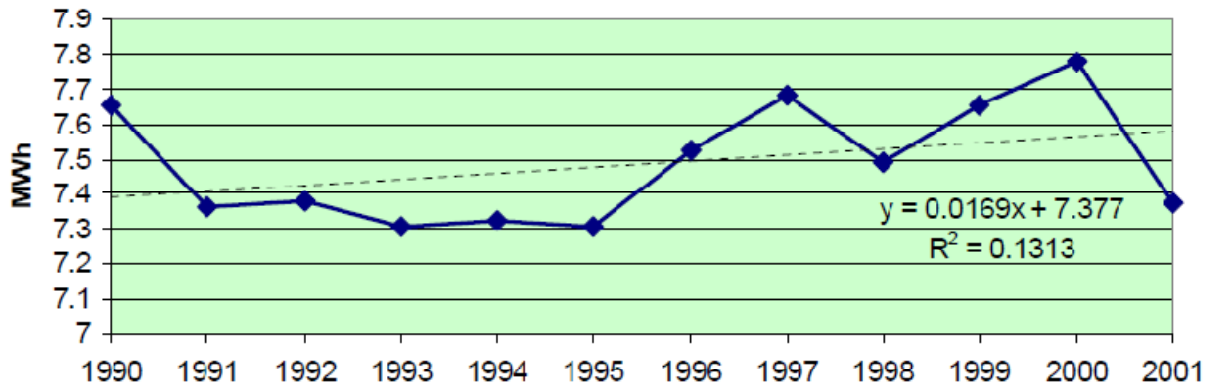
56. Blumstein, et. al. “The history of electricity restructuring in California”, Journal of Industry Competition and Trade, 2, (2002)pp. 9–38.

57. Reddy, Amulya, “California Energy Crisis and Its Lessons for Power Sector Reform in India”, Economic and Political Weekly, Vol. 36, No. 18, 2001.



dependence remains within United States borders, the difficulties in transition and growing economy of neighboring electricity suppliers creates a room for uncertainties in stable supply.

Figure: Per Capita Power Consumption in California<sup>58</sup>



Primary reason for electricity imports from neighboring states, even from distant states like New Mexico and Wyoming, was the cheap power.<sup>59</sup> Most of the western electricity producers used coal<sup>60</sup> to generate power, which duly decreased the cost of generated power.<sup>61</sup> Moreover, the abundant hydro resources<sup>62</sup> of North-West were also important factor in generating cheaper hydropower.

In 1990s, according to the Energy Commission Source, natural gas had prevailing percentage in energy generation comprising 57, 2%, hydro power 12.9%, nuclear power 12.2%, coal 5.4%, alternative power as geothermal power 4.9%, wind power 3.8%, biomass power 2.6%, oil 0.7% and solar 0.3%.

58. Source: Grant et. al., “Three Years after the California energy Crisis: A Plan to Avoid Future Shortages”, Capstone Policy Analysis, 2004.

59. Metz, Daryl et. al. “California Energy Commission: Net Power System Report” ,CEC-200-2008-00, 2008, accessed February 2 2011, <http://www.energy.ca.gov/2008publications/CEC-200-2008-002/CEC-200-2008-002.PDF>.

60. Approximately 45% of total generated electricity in the United States come from coal based power plants.

61. Metz, Daryl et. al. “California Energy Commission: Net Power System Report” ,CEC-200-2008-00, 2008, accessed February 2 2011, <http://www.energy.ca.gov/2008publications/CEC-200-2008-002/CEC-200-2008-002.PDF>.

62. In the North-West, the dominant source of energy, especially the renewable energy, is the hydropower. The U.S relies on hydropower about 7%, while the North-West region case shows ten times higher dependence, 71%. (Stork:2003).

As we see from data above, coal had just 5.4%, because the legislature of California set limits for air pollution and the utilization of coal in the industry,<sup>63</sup> particularly in electricity generation due to Clean Air Act Amendment of 1990. Sanctions were fines and loss of Federal highway construction funds.

As a result, the ecological factor in California's electricity system made the state use neither coal in generation of electricity nor import it from outside. Therefore, California imported electricity from neighboring states where burning coal for industrial purposes were not so severely restricted.<sup>64</sup> Consequently, the state had to buy up to the quarter of its energy needs from the South-West and the North-West.<sup>65</sup>

In studying California case, one should also consider the transmitting capacity for the imported electricity. Two existing lines from Northwest and Southwest cover in total approximately 15% of California peak energy demand, which amounts about 51000 Mw<sup>66</sup>.

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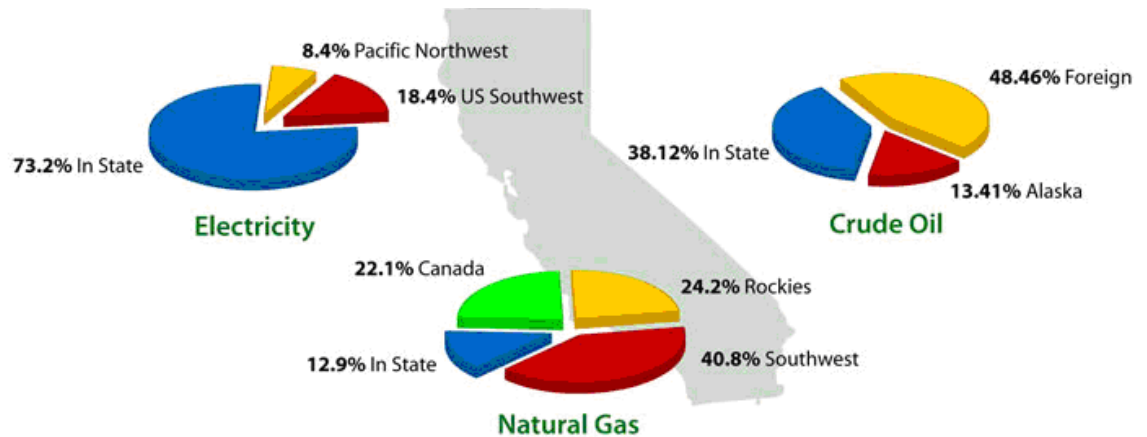
63. Metz, Daryl et. al. "California Energy Commission: Net Power System Report" ,CEC-200-2008-00, 2008, accessed February 2 2011, <http://www.energy.ca.gov/2008publications/CEC-200-2008-002/CEC-200-2008-002.PDF>.

64. Ritter, John, "California planning green power revolution" , USA Today, July 6 2005, accessed February 12 2011, <http://www.usatoday.com/educate/environmental/LIPA5.pdf>.

63. Metz, Daryl et. al. "California Energy Commission: Net Power System Report" ,CEC-200-2008-00, 2008, accessed February 2 2011, <http://www.energy.ca.gov/2008publications/CEC-200-2008-002/CEC-200-2008-002.PDF>.

66. Stuebi, Richard: "California Energy Crisis: Causes and Consequences". Next wave Energy. February 2001. pp 3-4.

Figure: California's Energy Sources<sup>67</sup>:



**Electricity (2008)**  
Note: Preliminary Numbers

|             |       |
|-------------|-------|
| Natural Gas | 46.5% |
| Nuclear     | 14.9% |
| Large Hydro | 9.6%  |
| Coal*       | 15.5% |
| Renewable   | 13.5% |

**Natural Gas (2007)**

|           |       |
|-----------|-------|
| In State  | 12.9% |
| Canada    | 22.1% |
| Rockies   | 24.2% |
| Southwest | 40.8% |

**Crude Oil (2008)**

|          |        |
|----------|--------|
| In State | 38.12% |
| Alaska   | 13.41% |
| Foreign  | 48.46% |

If we take into account the high rate of consumption and difficulties in transmission of electricity from other states to California, we understand why the electricity price in the state is about 30-40% higher than national average. Actually, to build up new transmission lines was rather expensive and complicated because of locals who were against new transmission lines. We remember that in 1980s California invested too much assets in nuclear plants, which were

67. Source: CEC, "California's Major Sources of Energy", accessed 11 February 2011, [http://energyalmanac.ca.gov/overview/energy\\_sources.html](http://energyalmanac.ca.gov/overview/energy_sources.html).

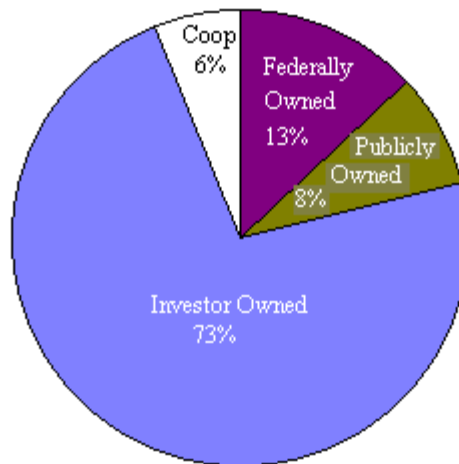
economically unprofitable. Therefore, to build up transmission line and connect it with Western Interconnect was complicated.

As the crisis occurred due to several factors and involved diverse participants, it is useful to highlight the main players of the crisis in brief.

- a) **‘Big Three’:** The major three energy utilities had direct impacts on development of the event, as these three investor owned utilities (IOU) were the main energy suppliers in California, with slightly more than 70% of market share<sup>68, 69, 70</sup>:

### Ownership of Electric Transmission 1978

Source: Energy Information Administration



1. **PG&E Corporation/Pacific Gas & Electric Co.** PG&E Corp was one of the biggest energy producers and service suppliers across North America, with about \$21 billion in revenues.<sup>71</sup> The owner of one of the largest gas and electric utilities runs operations in 21 American states, with 30 power plants

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68. McNamara, W., “The California energy crisis: lessons for a deregulating industry”, (Oklahoma: Penwell, 2002).

69. Duane, T., “Regulation’s Rationale: Learning from the California Energy Crisis”, Yale Journal on Regulation, 2002, pp. 471-540.

70. Joskow, P. “California’s Electricity Crisis”, Oxford Review of Economic Policy’ Vol. 17, No. 3, 2001.

71. Mabey, Ralph & Malone, Patrick “Chapter 11 Reorganization of Utility Companies”, Energy Law Journal, 22, 2001.

in operation and generating capacity of 7, 000MW. This San Francisco based energy utility was also a major carrier of Canadian natural gas to the US. Annually PG&E delivered energy services to 13 mln people across California, and hold 4.5 mln electricity and 3.7 mln natural gas customer accounts.<sup>72</sup> In April 2001, PG&E announced its bankruptcy due to the gigantic debts it carried which originated from the ongoing sky-high costs of wholesale electric power. The company was incapable to pass the price increases to its customers owing to a retail rate freeze in the state.<sup>73</sup>

2. **Edison International/Southern California International:** Rosemead, California based international electric power generator and distributor, with a generation portfolio of about 28,000 MW.<sup>74</sup>The company was developed and financed by Edison family, which runs operations in nine countries and 4 regions in the US.
  
3. **Sempra Energy/ San Diego Gas & Electric Sempra Energy:** was a leading energy service provider globally, which strengthened its already strong position in the global energy market with the acquisition of Pacific Enterprises and Enova Corporation in 1998.<sup>75</sup> The company launched a new road in its corporate development through offering innovative and efficient energy solutions. With its eight subsidiary companies, Sempra Energy was a Fortune 500 company. One of its subsidiary San Diego Gas & Electric

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72. McNamara, W., “The California energy crisis: lessons for a deregulating industry”, (Oklahoma: Penwell, 2002).

73. Joskow, P. “California’s Electricity Crisis”, Oxford Review of Economic Policy’ Vol. 17, No. 3, 2001.

74. Weinstein, S. and Hall, D. “The California Electricity Crisis - overview and international lessons”, Public Services International Research Unit’s Research Paper, (2001).

75. Reiss, Peter and White, Matthew, “Demand and Pricing in Electricity Markets: Evidence from San Diego During California's Energy Crisis”, the Research Paper of the National Bureau of Economic Research, 2003, accessed 12 February 2011, <http://www.nber.org/papers/w9986>.

engaged in electricity service in California since 1881 and annually provided service to 3 mln people in the state.<sup>76</sup>

**b) The California Independent System Operators (ISO later CAISO):**

California Independent System Operator was nonprofit corporation, created in 1998. It managed with the flow of electricity via the long-distance, high-voltage power lines of transmission system.<sup>77</sup> The California ISO controlled the reliable delivery of electricity and equal access of local utilities to the energy grid.

California ISO managed to purchase and sell electricity on behalf of the scheduling coordinators. In other words, CAISO coordinated the transmission system formerly operated by the discussed above ‘big three’ in the state. That fact made the CAISO the second largest energy network controller.<sup>78</sup> The California ISO was also a main planner of transmission and enhancement of the grids.<sup>79</sup>

**c) California Power Exchange (PX):**

The California Power Exchange (PX) generated prices of the electricity in California based on supply-demand trends.<sup>80</sup> The California PX was in operation from April 1998 until early 2001. This independent body set the prices of the electricity on the day-ahead and hour-ahead bases according to the calculations of biddings from whole-sellers.<sup>81</sup> The PX was shut down in January 2001 because its two largest customers, Pacific Gas and Electric and Southern California Edison, were not able to pay for power they bought through the PX. Sellers feared to

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76. McNamara, W., “The California energy crisis: lessons for a deregulating industry”, (Oklahoma: Penwell, 2002).

77. ISO, “Who is ISO?” accessed 21, January 2011, California Independent System Operator, <http://www.caiso.com/docs/2005/08/18/200508181043065591.html>.

78. McNamara, W., “The California energy crisis: lessons for a deregulating industry”, (Oklahoma: Penwell, 2002).

79. ISO, “Who is ISO?” accessed 21, January 2011, California Independent System Operator, <http://www.caiso.com/docs/2005/08/18/200508181043065591.html>.

80. Kahn et. al., “Pricing in the California Power Exchange Electricity Market: Should California Switch from Uniform Pricing to Pay-as-Bid Pricing?” Blue Ribbon Panel Report, accessed February 12 2011, <http://www.cramton.umd.edu/papers2000-2004/kahn-cramton-porter-tabors-blue-ribbon-panel-report-to-calpx.pdf>.

81. Watts, Price “Heresy? The Case Against Deregulation of Electricity Generation”, The Electricity Journal, Volume 14, Issue 4, May 2001, Pages 19-24.

offer electricity in PX auctions for not being paid. In result, the state agency, the department of Water Resources became the major electricity buyer under the plan of Gov. Gray Davis.<sup>82</sup>

**d) California Energy Commission (CEC):**

The CEC was the main body in California responsible for energy policy and planning, making sure that reliable and affordable energy supply was available.<sup>83</sup> The CEC had five major pillars of the operation;<sup>84</sup>

- Storing the energy data history and calculating the future energy demand within the state
- Granting licenses to power plants
- Encouraging energy efficiency by appliance and building standards
- Promoting renewable energy and building up new energy technologies
- Taking measures and planning for the energy emergency cases

The CEC function also included promoting the research in energy sciences, protecting public interests, through enhancing research on the energy technology, market support, promoting renewable energy technologies and sources, and such related tasks.<sup>85</sup> The CEC included five commissioners coming from the specific background and they were appointed by the state governor and approved by the Senate of the state.<sup>86</sup>

**e) California Public Utilities Commission (CPUC):**

The CPUC was a regulator of independently owned electric power, natural gas, telecommunications, water, rail road transit, and passenger transportation enterprises.<sup>87</sup> The CPUC also aimed to protect utility clients from fraud, to ensure utility clients taking safe and reliable service. In order to carry out such goals, the CPUC established regulation standards for

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82. Joskow, P. "California's Electricity Crisis", Oxford Review of Economic Policy' Vol. 17, No. 3, 2001.

83 McNamara, W., "The California energy crisis: lessons for a deregulating industry", (Oklahoma: Penwell, 2002).

84. CEC "About CEC", accessed January 11 2011, Energy Council of Canada, <http://www.energy.ca.gov/commission/index.html>.

85. Ibid.

86. Ibid.

87. CPUC "CPUC Information" accessed January 11 2011, <http://www.cpuc.ca.gov/PUC/#info>.

utilities on service, safety of utility and rate charges. The CPUC was a watchdog of safety of utility and transportation, and monopolistic behavior of utilities.<sup>88</sup> A wide range of activities of the CPUC also involves in defending the interests of customers, prosecute unlawful marketing and billing actions, realizing energy efficient programs, applying low rates for disabled customers, approval of restructuring or merger cases of utilities, environmental protection campaigns, and such related roles. Further, this unit can also get involved in federal proceedings related to price rates or energy service issues. The governor of the state appoints commissioners of this San Francisco based body for a six year term.<sup>89</sup>

**f) California Governors Pete Wilson and Gray Davis:**

As they are among key contributors to the escalation of the processes leading to the crisis, it is worth to include them as well. Republican Governor Pete Wilson and Democratic Governor Joseph Graham Davis were elected as the 36<sup>th</sup> and 37<sup>th</sup> governors of California in 1990 and 1998. Their role in the crisis is discussed throughout the work in chapters below.<sup>90</sup>

**g) The Federal Energy Regulatory Commission (FERC):**

As was mentioned before the FERC was an independent controlling body within the Department of Energy, which was established under the Department of Energy Organization act.<sup>91</sup> The FERC got its legal authority from the Federal Power Act of 1935, the Natural Gas Policy Act of 1978, the Public Utility Regulatory Policies Act of 1978, and the Energy Policy Act of 1992.<sup>92</sup> That institution was a regulator of the transmission and sale of natural gas for resale in interstate commerce, the transmission of oil by pipeline in interstate trade, and the transmission and wholesale of electricity in interstate trade.<sup>93</sup> Further, the FERC granted licenses and looked over private, municipal, and state hydroelectric projects, monitored environmental matters linked to natural gas, oil, electricity and hydrocarbon projects, was a

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88. McNamara, W., “The California energy crisis: lessons for a deregulating industry”, (Oklahoma: Penwell, 2002).

89. CPUC “CPUC Information” accessed January 11 2011, <http://www.cpuc.ca.gov/PUC/#info>.

90. McNamara, W., “The California energy crisis: lessons for a deregulating industry”, (Oklahoma: Penwell, 2002).

91. FERC, “What FERC does” accessed January 11 2011, <http://www.ferc.gov/about/ferc-does.asp>.

92. Joskow, P. “California’s Electricity Crisis”, Oxford Review of Economic Policy’ Vol. 17, No. 3, 2001.

93. FERC, “What FERC does” accessed January 11 2011, <http://www.ferc.gov/about/ferc-does.asp>.



main approving body for the construction of interstate pipeline projects, governed accounting and financial reporting regulations and conduct of jurisdiction companies.<sup>94</sup>The FERC consists of five commissioners, appointed by the President of the US for five year terms.

### *3.2. Causes of the crisis*

In March 1998, California's \$23 billion electricity market was opened for competition where about 200 marketing companies registered in order to resell wholesale electricity to residential and business consumers.<sup>95</sup>There was a 10% rate reduction for customers all of existing utilities. The utilities both as private as public started to bid for electricity with the average wholesale price - \$19.73 per megawatt-hour (MWh) in compare with \$24 per MWh fixed price before deregulation.<sup>96</sup>

However, in May 2000, prices started rising on the wholesale market (\$500 per MWh). In response, the California Independent System Operator (CAISO) imposed price caps, limiting fluctuation level of wholesale price for generators (from \$250 up to \$750 per MWh). In order to avoid those caps many generators started to sell their power out of the state, therefore reducing supply for in state-customers. In result, wholesale prices rose to almost \$ 1,400 per MWh in the western part of the US.

It would be too simple to believe that the deregulation plan was the only contributor to crisis. In this part of the research, the fundamental reasons for the electricity crisis will be discussed in detail.

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94. Ibid.

95. National Museum of American History, accessed February 2011, <http://americanhistory.si.edu/powering/past/h7main2.htm>, For bulk purchases, the MWh unit is used. For smaller purchases, the kilowatt-hour or kWh is the more familiar unit, such that 1,000 kWh equals 1 MWh. The bulk rate of \$19.73 per MWh translates to 1.973 cents per kWh.

96. Ibid.

1. The initial reason for the electricity crisis was too little locally generated energy.<sup>97</sup> During the 1990s, especially after the first steps of deregulation in 1996, the power generation inside California declined regularly.<sup>98</sup> There were no new power generators built, because it was expensive as it was mentioned before in the work and rather cheaper to import electricity generated in neighboring states which had less restricted measure for industries wasting emissions, and less anti-industrialization protests by “Greens”.<sup>99</sup> Historically, in 1970s, there were Environmental Protection Agency Emissions Trading programs, which provided mechanisms for fulfillment of the U.S. Clean Air Act air emissions standards. It set up a cap-and-trade system for power plant sulfur dioxide emissions. Due to mentioned above environmental concerns some of the power generators stopped functioning.<sup>100</sup> The quotas on air pollution were and still are one of the strictest in the whole United States.<sup>101</sup>

2. Consequently, the California’s power generation potential slowly shifted to Northwestern and Southwestern territories.<sup>102</sup> Figure: California Generation Capacity

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97. Ford, Andrew “Waiting for the boom: : a simulation study of power plant construction in California”, Volume 29, Issue 11, September 2001, Pages 847-869.

98. Brown, R. and Koomey, J. ‘Electricity Use in California: Past Trends and Present Usage Patterns’, *Energy Policy*, (2003) pp. 849-864

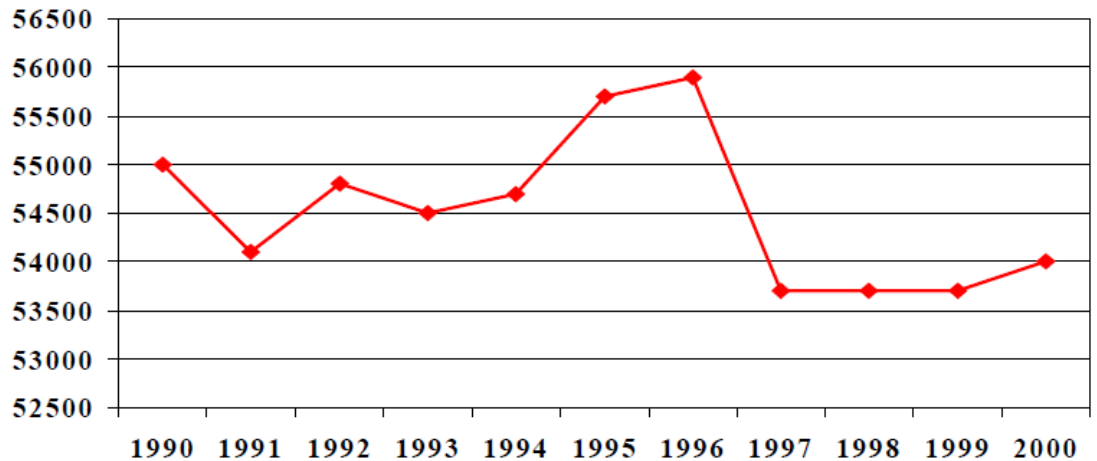
99. Kahn et. al., “Pricing in the California Power Exchange Electricity Market: Should California Switch from Uniform Pricing to Pay-as-Bid Pricing?” Blue Ribbon Panel Report, accessed February 12 2011, <http://www.cramton.umd.edu/papers2000-2004/kahn-cramton-porter-tabors-blue-ribbon-panel-report-to-calpx.pdf>.

100. Ibid.

101. Ibid.

102. Ford, Andrew “Waiting for the boom: a simulation study of power plant construction in California”, Volume 29, Issue 11, September 2001, Pages 847-869.

## Megawatts



Source: Cambridge Energy Research Associates

3. In the late 1990s about 1/5 of existing power plants in California were not being utilized and consequently, the possible twenty percent of energy demand were not being produced.<sup>103</sup> The reason for the outages in power plants were numerous: a) power generators close to coastal areas had to stop their functioning due to strong storms in early 2001;<sup>104</sup> b) natural gas based power plants were also being repaired and were not ready after a long, hot summer in 2000 and droughts when people consumed more energy than usual;<sup>105</sup> c) the extreme draughts caused less available water sources for hydro power stations and these installations were not operating

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103. Ibid.

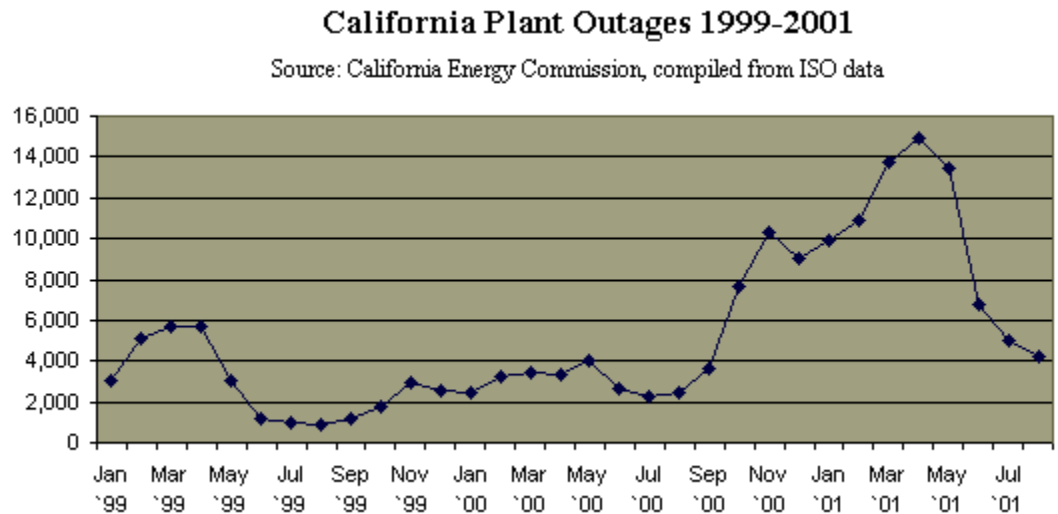
104. If we look at the Pacific hurricane season in 2000-2001, we see much modest economic damage than years, but the storms seriously affected the working regime of power generation plants on coastal areas. In fact, during 22.05.2000-08.11.2000 California witnessed total of 19 strong storms (Carlotta was the strongest with the speed about 250 kilometres per hour) with an economic loss of 14 million US Dollars (for example, about 1.5 billion USD in 1998). From 25.05.2001 to 03.11.2001, there were of total 15 stronger storms (Juliette, 230 km/h) which caused an economic damage of about 400 million USD to the Californians.

105. During the summer (June-August) of 2000, many parts of the United States experienced an intensifying drought and heat wave. Severe drought and heat, especially in the South, killed approximately 140 people. Damages were estimated at \$4 billion. States in the inter-mountain West were especially hard hit, with hot and persistently dry conditions giving rise to the worst wildfire season in the past 50 years. December 1999 was one of the driest in the California records; the annual snowfall averaged only about 20 percent of the annual precipitation.

at full capacity;<sup>106</sup> d) some nuclear power plants were also stopped due to refueling.<sup>107</sup>

“Historically, between 1000 and 6000 MW average daily generating capacity would normally be off- line in a month. However in the period between October 2000 and May 2001, a monthly average of 12,000 MW generating capacity was off- line, reaching a peak out of 15,000 MW in April 2001.”<sup>108</sup>

Figure below shows these data.



106. Besant-Jones, J. & Tenenbaum, B. (2001) ‘The California Power Crisis: Lessons for Developing Countries’, World Bank Group: Energy and Mining Sector Board Paper Series, no.1

107. Kahn et. al., “Pricing in the California Power Exchange Electricity Market: Should California Switch from Uniform Pricing to Pay-as-Bid Pricing?” Blue Ribbon Panel Report, accessed February 12 2011, <http://www.cramton.umd.edu/papers2000-2004/kahn-cramton-porter-tabors-blue-ribbon-panel-report-to-calpx.pdf>.

108. Stanford University, accessed February 2011, <http://www.stanford.edu/~jsweeney/paper/California%20Electricity%20Crisis.pdf>, p. 200.

The combination or lack of production in every type of the power plants caused considerable loss in local electricity generation.<sup>109</sup>

4. Natural gas dominated in electricity generation in California. 60.7% of California's electric power generating capacity came from natural gas fueled power plants.<sup>110</sup> For instance, in the case of the whole United States, this indicator equals about 23%. California was and is too reliant on natural gas imports for running most of its power plants. California imported gas from Mexico and Canada.

The explosion in natural gas pipeline in New Mexico dated back to December 2000<sup>111</sup> was another serious blow for the electricity market in the state. Moreover, California was suffering from price hikes for the natural gas. The natural gas price almost doubled between June 1999 and June 2000: from \$2.50 mmBtu to \$5mmBtu.<sup>112</sup> In addition to supplier related reasons, there was another factor – consumer demand.<sup>113</sup>

During the period from 1997 till 2000, the consumption of electricity in California continued to grow slowly. Per capita electricity use grew modestly

“Figure 7, below, shows the net result. From 1990 to 2000, use of electricity increased from 26,000 MW average consumption rate to just above 30,000 MW, a growth of 16% over ten years, or 1.4% per year. faster from the 1997 through 2000 period, increasing by almost 2,000 MW during the three years, or an average growth rate of 2.3% per year average. From 1999 to

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109. Borenstein, Severin, “The Trouble With Electricity Markets: Understanding California's Restructuring Disaster”, *The Journal of Economic Perspectives*, Volume 16, Number 1, 1 January 2002 , pp. 191-211(21).

110. Kahn et. al., “Pricing in the California Power Exchange Electricity Market: Should California Switch from Uniform Pricing to Pay-as-Bid Pricing?” Blue Ribbon Panel Report, accessed February 12 2011, <http://www.cramton.umd.edu/papers2000-2004/kahn-cramton-porter-tabors-blue-ribbon-panel-report-to-calpx.pdf>.

111. A 30 inch diameter Transmission pipeline 1103, owned and operated by El Paso Natural Gas, exploded on August 19, 2000 and lead to casualties from civic population near Carlsbad, New Mexico. The cause of the failure was defined extreme internal corrosion of the pipeline. El Paso's pipeline system had the capacity of 3.29 billion cubic feet of natural gas a day to Southern California. Astonishingly, California imports and 80 percent of the natural gas it consumes.

112. Ardiyok, Sahin “California Energy Crisis and Critics of Turkish Electricity Deregulation Process”, *International Journal of Business Management and Economics*, Vol.1, No.2, 2005, pp.45-70.

113. Ibid.

2000, average consumption increased slightly more than 1,000 MW, almost 4%. Peak loads were growing at roughly the same rates.”<sup>114</sup>

Extreme weather changes in the summer and winter periods were among crucial reasons for the increase in electricity consumption.

1. Irrationally fixed price for retail consumers by the state government at below 10 cents/kwh even when the wholesale prices skyrocketed up to 50 cents/kwh worsened the situation.<sup>115</sup> Despite the shortages and blackouts, the population did not cooperate with suppliers, not reducing the demand even though they knew that IOUs were paying about four times as much money for the consumed energy than customers did. Surprisingly, the states response during the crisis did not appeal for citizens to reduce usage of home gadgets to help the government with the crisis.
2. California’s electricity suppliers who have been reliable over several decades, had to cut their energy export to California due to several reasons. Drought brought more economic losses to Northwestern states that are specialized in hydro power. Supplies from neighboring states fell by 3800Mw.<sup>116</sup> Moreover, in the late 1990s all neighboring states were also experiencing economic boom, which also required extra usage of power to hold that tempo of growth.
3. One can surely blame power generators for intentionally raising the electricity price, which lead to the deterioration of the crisis.<sup>117</sup> Many bigger companies that

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114. Stanford University, accessed February 2011, <http://www.stanford.edu/~jsweeney/paper/California%20Electricity%20Crisis.pdf>.

115. Borenstein, Severin, “The Trouble With Electricity Markets: Understanding California's Restructuring Disaster”, *The Journal of Economic Perspectives*, Volume 16, Number 1, 1 January 2002, pp. 191-211(21).

116. Stuebi, R. ‘California Energy Crisis: Causes and Consequences’, (2001) *Next Wave Energy*, accessed January 22, 2011, <http://www.nextwave-energy.com/pdf/CalEnergyCrisis.pdf>.

117. Borenstein, Severin, “The Trouble With Electricity Markets: Understanding California's Restructuring Disaster”, *The Journal of Economic Perspectives*, Volume 16, Number 1, 1 January 2002 , pp. 191-211(21).

grew due to the deregulation measures – Enron, Dynergy, Duke, Southern, Thermo Ecothek etc., utilized the supply-demand uncertainties to increase their revenues.<sup>118</sup> For instance, according to FERC investigation, Enron (Energy Corporation based in Houston) was accused in market fraud. FERC documents described the fraud as “megawatt laundering.”<sup>119</sup> Enron bought electricity power in California at lower capped prices and resold it out of the state, and then bought it back in order to resell it to California at a huge markup.<sup>120</sup>

The three IOUs had to buy power through Power Exchange in spot prices and to deliver in fixed prices.<sup>121</sup> This condition became fatal for them as spot prices started growing while deliver price stayed the same.<sup>122</sup>

The skyrocketing prices destabilized the wholesale market. The IOUs were delaying payments for power in PX auctions, having great financial losses.<sup>123</sup> Moreover, this financial situation of the IOUs made smaller generators cautious, unwilling to participate in California wholesale markets, deteriorating the whole market.

### 3.3. *Two sets of problems: electricity and financial crisis*

The California CPUC made three decisions, which were crucial to California's restructured electricity markets;

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118. Watts, Price “Heresy? The Case Against Deregulation”.

119. New York Times, accessed February 2011, [http://www.nytimes.com/2011/04/10/business/10gret.html?pagewanted=2&\\_r=1&sq=enron%20vs.%20california%20crisis&st=cse&scp=7](http://www.nytimes.com/2011/04/10/business/10gret.html?pagewanted=2&_r=1&sq=enron%20vs.%20california%20crisis&st=cse&scp=7).

120. Ibid.

121. Kahn et. al., “Pricing in the California Power Exchange Electricity Market: Should California Switch from Uniform Pricing to Pay-as-Bid Pricing?” Blue Ribbon Panel Report, accessed February 12 2011, <http://www.cramton.umd.edu/papers2000-2004/kahn-cramton-porter-tabors-blue-ribbon-panel-report-to-calpx.pdf>.

122. Ardiyok, Sahin “California Energy Crisis and Critics of Turkish Electricity Deregulation Process”, International Journal of Business Management and Economics, Vol.1, No.2, 2005, pp.45-70.

123. Ibid.

1. requirement that the IOUs separate their own generation from their distribution/retailing businesses;
2. the order to the IOUs to divest generating assets;
3. prohibition of the IOUs to participate in any mitigation, such as contracts or financial forward markets (contracts for future delivery).<sup>124</sup> "Had California's three utility distribution companies (UDCs) signed forward financial contracts equal to their expected net demand for energy and ancillary services during each hour of the months of May and June of 2000, average prices in the PX and ISO markets during these months would have been significantly lower. Even if the June 2000 price spikes had still occurred, the UDCs would have been largely insulated from this spot market price volatility, because of their forward hedges."<sup>125</sup> UDCs were independent utilities to which IOU granted their distribution assets.

The forward contracts or hedges directed to reduce electricity price due to the protection of having paid for the electricity in the forward contracts.

One of the problems of deregulation in California was the timeframe during which the restructure was made. California restructured its electricity sector during 11 months, including IOU assets diversification, setting up the power exchange, the CAISO, and setting up retail competition.<sup>126</sup> In other words, it was a short time to establish and implement sophisticated market rules, provision of software and communications systems, for setting auctions. There was no transition period to test how the systems would work and whether it was efficient. Furthermore, the establishment of the PX and CAISO was done independently without market participants who had market experience.

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124. Harvard, Kennedy School, accessed February, 2011, <http://www.hks.harvard.edu/fs/whogan/mschedg1017.pdf>.

125. Ibid.

126. The free library, accessed January, 2011,

<http://www.thefreelibrary.com/What+works+and+what+does+not+in+restructuring+electricity+markets%3A...-a090702241>.



In 1998, the California opened PX, which operated day-ahead auctions, conducted on an hourly basis. Participants of the auction were IOUs and newly created independent utilities. The other participated on a voluntary basis. The power exchange was organized as a uniform-price auction. That is, “the most expensive (last) bid accepted set the price for the entire market. The logic of this structure was that it would mimic the marginal cost structure of the entire system, with price being determined by the price of the "marginal" bidder, who presumably would not bid until the price was bid up to its marginal cost.”<sup>127</sup>

The controversial aspects of California's restructuring plan was that the CPUC didn't approved long-term contracts between generators and the Utility Distribution Companies' retailers as it was in England. Long-term contracts were banned in order to help ensure a competitive wholesale market by forcing sales into the new PX and CAISO auctions. The CPUC feared that if long-term contracts would be allowed, IOUs maintain some degree of vertical control over independent producers.

In addition, the CAISO supposed to buy power on an emergency basis if demand would exceed the supply on the day-ahead markets. CAISO required buying emergency power regardless of price in order to escape outages. That factor pushed generators to withdraw their power from the normal day-ahead market to emergency CAISO market in order to sell power at higher price.

## **Regulation**

In the United States, federal and state governments shared regulation. State authorities regulated distribution and retail supply while federal regulators had jurisdiction over transmission and the national electricity market. Remarkably, only the IOUs were under regulation, because public owned utilities such as the Tennessee Valley Authority and the Bonneville Power Authority, municipal utilities such as the Los Angeles Department of Water

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127. Ibid.

and Power and the Sacramento Municipal Utility District were not regulated by state or federal authority. In fact, FERC was responsible for regulating all private wholesale rates and for enforcing access to the transmission system.

In England and Wales for instance, unlike the United States there was just national regulation, not separated on national and sub-national regulatory powers, that simplified coordination of the system. In California, it was state vs. federal regulation and struggle for market leadership.

### **Ownership**

In California IOUs sold most of their generating capacity to Independent Public Participators. Hydro and nuclear generation was distributed to IOUs' companies, which were administratively separated. In that case, England and Wales created five generation companies with ability of long-term contracts between generators and retailers. However, in California IOUs were not able to make such contracts. Long-term contracts were needed for price stability.

The AB 1890 created the possibility of retail competition by allowing free entry for new retail sales companies, it also fixed retail rates for the UDCs, as described above. Thus, when wholesale spot market prices soared, new entrants in the retail market had to compete with entrenched incumbents who had legislatively-imposed prices.

In England and Wales, the Office of Gas and Electricity Markets was responsible for assuring that competition is healthy and that rates are appropriate. However, conventional rate-of-return regulation for the distributors was rejected in England and Wales for several reasons. It was too expensive, and required a large bureaucratic structure.

### **Retail Pricing**

An element of California's legislatively fixed retail price was how the IOUs would recover the costs of their "stranded costs" in a competitive electricity market.<sup>128</sup> Before restructure CPUC

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128. California Government Energy Archive, accessed January 2011, <http://energyarchive.ca.gov/ER96/FINALER96.PDF>.

worked out ratemaking policy, which helped IOUs to recover their capital investments, invested in plants for initial construction, then and additional capital investments over time. After the restructure those stranded cost were included in fixed retail prices until 2002 when capital investment supposed to be completely repaid. That factor explained why the retail prices were fixed.

The retail rate was fixed according to the rate of June 10, 1996 and the market-based wholesale price plus distribution costs. The intent was that as wholesale prices decline, growing revenues from the competition transition charge would compensate IOUs for their stranded costs.<sup>129</sup> Retail rates were to remain frozen until March 31, 2002 or until the stranded assets were paid off.

The more important problem was that restructuring plan didn't create a provision for the case when wholesale prices increased as it was in 2000. The discrepancy between fixed retail prices and rapidly escalating wholesale prices drove PG&E to bankruptcy. California's allowed wholesale prices to vary freely while retail prices were fixed. If retail prices reflected the wholesale prices on an average monthly basis they would have reduced California's demand, thereby helping to relieve capacity shortages and upward pressure on wholesale price.

Moreover, since SCE and PC&E were not creditworthy, generators were no longer willing to sell electricity to them through the power exchange. The consequent reduction in supply caused spot wholesale market prices to soar even further in excess of retail prices.

### **Capacity Expansion**

In California, the environmental permitting process complicated creation of new power plants because of local opponents and environmentalists who blocked or delayed building of new capacity. In result, it was cheaper to expand generation capacity to neighboring state than to build it in California.

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129. Congressional Budget Office, accessed February 2011, <http://www.cbo.gov/doc.cfm?index=3062&type=0>.

Supply and pricing policy in California were the most important issues to be analyzed. In England, “the uniform-price auction system has apparently been subject to the exercise of market power rather than being a price-equals-marginal-cost solution.”<sup>130</sup> Moreover, California, forcing a policy of a competitive market violated basic free market rules such as risk mitigation tools - contracts of various durations.

### **Transmission**

In California the transmission system was interconnected with generation and distribution. It was complex system, because it consisted of wholesale market-making, mentioned above and dispatch of electricity via the network.

In conclusion, we should stress that for a federal system as in the US, coordination in policies and responsibilities of national and sub-national governments is essential. The inability of the California PUC and FERC to work on a common deteriorated the whole situation.

In fact, the prices of electricity power started to rise in the second half of the 2000 and the average price per Mwh leveled at 100 US dollars. For the North it did not come as surprise, the price growth in the October 1999 had already signaled it. The \$100 per Mwh was the brighter side of the story; in fact, the electricity price reached \$500 Mwh in the resort market in January 2001. Regulators were not able to control the situation and the prices went up faster than measures by regulators. This created an urgent situation that was just the beginning of the crisis.

The backbone of the electricity crisis was the “regulated” wholesale and retail price for the three biggest investor owned utilities. Edison and PG&E were forced to trade for negative profit – they had to buy power in the wholesale above \$100 Mwh and re-sell it to customers in retail price of below \$100mwh. The IOUs started losing in such irrational trade millions of dollars a day and “by early 2001 the outstanding obligations from the IOUs were estimated

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130. Stuebi, R. (2001) ‘California Energy Crisis: Causes and Consequences’, *Next Wave Energy* p.10.

around \$12 billion.”<sup>131</sup> Another triggering non-human factor for the electricity crisis was the extreme heat in the summer that made Californians use extra energy to mitigate the heat.

The Federal Energy Regulatory Commission after appeal by IOUs created on December 15, 2000 created a fixed soft cap of \$150mwh to mitigate high prices for wholesale electricity. That attempt just deteriorated the situation because wholesale price became fixed and retail as well, while real prices rose dramatically.

Consequently, Edison and PG&E were at the brink of bankruptcy and their bonds and rating by financial agencies continued going down. The beginning of the next year was even more pessimistic for customers, emergency situation was observed in 36 days of the first 45 days of 2001. The state declared three states of emergency.

### ***3.4. State and Federal Policy Responses***

The core issue in the development of events during the energy crisis period was linked with the lack of immediate and effective governmental responses to the deterioration of electricity market. Moreover, regulatory bodies failed to have a unified view over the appropriate regulatory measures against rising wholesale electricity prices at the end of 2000 and the first half of 2001. Referring to the Federal Act of 1935, the state of California claimed that high electricity prices at the wholesale market are unreasonable and in this respect, it would be illegal for consumers to pay high rates.

In August 2000, when the electricity market deteriorated FERC started to examine problems of wholesale electricity markets in California and Western regions of the US.

In fact, “federal policy implemented through FERC was more limited than State policy because FERC had no jurisdiction over retail market operations, electricity consumers, plant sitting, or

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131. Ibid.

utility electricity purchases. It did have primary authority over wholesale markets, although it had allowed California institutions to take the lead in designing the wholesale markets within the State.”<sup>132</sup>

In November 2000, FERC issued the staff report and a market order suggesting remedies for California wholesale electric markets. In order to implement those remedies FERC took leadership and the control of market design from California institutions. Remarkably, Governor Davis and California political leaders were against that shift in control. As a result, FERC decision-making was rather slow and lengthy.

FERC implemented wholesale price controls, in the form of bid caps, at first in California and later in Western region. The policy of price control was implemented in the frame of two Orders November 1<sup>st</sup> and December 15<sup>th</sup>. The 1<sup>st</sup> Order provided a three-week period during which various proposals could be discussed. The December 15<sup>th</sup> Order dealt with directing the remedies. In these Orders, FERC drew the conclusion, that the wholesale prices were not “just and reasonable” identifying problems of market design as fundamental problem “the existing market structure and market rules, in conjunction with an imbalance of supply and demand in California, have caused and, until remedied, will continue to have the potential to cause, unjust and unreasonable rates for short-term energy during certain time periods.”<sup>133</sup>

In fact, the FERC proposed a few short, medium and long term changes in the California energy market. The FERC’s attempt was to shrink the spot market. To achieve this, the FERC requested the utilities to self-plan their existing capacity against their selling demand, purchasing only their net short in the PX & ISO. The hard \$250 cap was replaced with a soft \$150 cap – for buyers in the PX and a \$100/MWh was imposed under scheduling penalty in order to achieve more long-term committed trade deals rather than the real time transactions.

The FERC goals were to cut the over-reliance on the spot markets for wholesale electricity and remove the requirement that the investor-owned utilities buy and sell all power on the PX or CAISO. Those changes, allowed utilities to join bilateral markets and forward markets, not just spot markets. IOUs were allowed to use the electricity they had generated without selling the

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132. Stanford University, accessed February 2011, <http://www.stanford.edu/~jsweeney/paper/California%20Electricity%20Crisis.pdf>, p 259.

133. Ibid. 261

electricity and buying it back. For implementation of that order, it was necessary for CPUC to remove the requirements it had set on the utilities. FERC stressed, without the CPUC cooperation, the Order would be ineffectual:

*“We cannot emphasize enough that the California Commission must act decisively and immediately to eliminate the requirement for the IOUs to buy the balance of their load from the PX. This is the most serious flaw in the market design created by AB1890 and the California Commission's implementing orders. .... In addition, the California Commission move quickly to provide the IOUs with approval of their forward purchases. The specter of after-the- fact disallowance for transactions other than PX purchases have certainly chilled the decision making process and continues to subject California's ratepayers to the volatility of spot prices.”*<sup>134</sup>

Moreover, FERC pushed utilities to complete scheduling of load and generation with CAISO (former ISO) ahead of time, than in real time transactions. It was made in order to move electricity transactions away from the real time market. “FERC required all California market participants to pre-schedule all resources and loads with CAISO and imposed a large penalty on all real time energy transactions greater than 5 percent of the prescheduled amount.”<sup>135</sup>

In the first half of 2001, the state of California concluded several forward contracts worth \$45 billion, for the future energy supply for 10 years.

It is very essential to view the impact of this price mitigation plan on the spot market results. The FERC's plan applied only towards the real time market sales of the California ISO, which made up 5 % of the energy sales share during the 2001 period. The remaining sales of energy were made on the long-term future contract base. Further, the prices for incremental energy averaged between \$70/MWh- \$50/MWh during the second half of 2001, while the west wide cap stipulated by FERC was around \$91/MWh. Moreover, the Market Analysis reports of the ISO indicate that the real time prices were gradually getting lower from this period because of increasingly growing forward contracts. Additionally it is worth pointing out that the energy

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134. Federal Regulatory Commission, accessed April 2011, <http://www.ferc.gov/industries/electric/industry/wec/chron/rev-print.asp>.

135. Stanford University, accessed February 2011, <http://www.stanford.edu/~jsweeney/paper/California%20Electricity%20Crisis.pdf>. P 265

demand trends of the entire state were lower by 5 % during the year of 2001 comparing to the year of 2000.

The FERC's price mitigation plan had a very restricted influence on the mid-term and real time transaction comparing to the influence of the long term contracts achieved during the winter period of December 2001. However, this plan had considerable effect on the behavior of market players in the California energy market.

The increasing shutdowns were real threat to Northern California. The attempt of the Department of Water Resource tried to help Edison and PG&E by buying power on behalf of them by introducing 10 billion US dollars in bonds was not enough to cope with the crisis. Moreover, the DWR entered \$42 billion long-term power contracts, clashing with the CPUC, because it demanded authority over rates fixed by CPUC. The DWR wanted to be sure that it could cover the contract costs and the bond issue to repay the state general fund for earlier electricity purchases.<sup>136</sup> In August 2001, CPUC finally granted authority to the DWR to set retail electricity.

#### **IV. Energy security and California case**

Historically, the tradition of great attention to the energy security takes its roots from the mid of XX century, when the school of political realism started to dominate in international relations. One of the founders of classic school of political realism was Hans Morgenthau who emphasized the role of natural resources for American nations. In his well-known book "Politics Among Nations: Struggle for Power and Peace" (2006) he mentioned, that natural resources are of very high importance for each nation both in war and peace period. Calculating the strength and power of the nation, Morgenthau put natural resources, especially oil and natural gas, in one of the top positions.<sup>137</sup> He claimed that nations have wars over

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136. Public Policy Institute of California, accessed February 2011, [http://www.ppic.org/content/pubs/report/r\\_103cwr.pdf](http://www.ppic.org/content/pubs/report/r_103cwr.pdf).

137. According to Hans Morgenthau, nation's geography, natural resources, industrial capacity, military preparedness, population, national character, national morale, the quality of diplomacy and the quality of



resources not only to guarantee their own supply but also to control these resources and to prevent rival, competing nations from getting to them.<sup>138</sup> Morgenthau considered maintaining the balance of power through controlling the rival country's access to energy resources. Many representatives of the realism school in the United States are baking an active foreign policy to guarantee the import of energy resources.

Moreover, American hegemony in the world relies on the nation's military power, which depends on energy resources. Since the switch of the British and the US navies from coal to oil in the early 20<sup>th</sup> century, the linkage between military and hydrocarbon resources has strengthened.<sup>139</sup> The most of the military conflicts in the 20<sup>th</sup> century can also be characterized due to rivalry related to scarce resources.<sup>140</sup> From that point of view, energy security is an important issue in American policy making.

Specifying research topic on energy security through California electricity crisis, it is necessary to stress the missing chain between state and national perception of energy security.

The California electricity crisis got so much attention in the United States because it showed that the US could have in-state energy security challenges as a side effect of male policy regulation by federal and state authorities. By stressing the energy security issue, one should understand that energy is a crucial factor of economic development. The lack of energy supply could halt industries to produce their goods, which means losses of millions \$ supposed to be pumped in economic growth. Moreover, California electricity crisis highlights domestic mismanagement with energy supply, which is mostly produced in the US states except imports from Alberta and Mexico. That factor makes the topic rather interesting, reducing its scale from global energy security challenges to a national one. American government highlights constantly

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government are key factors to determine its national power. See for details Morgenthau, Hans. (2006): *Politics among Nations*. 122-163 pp.

138. Ibid. p.128.

139. Yergin, Daniel "Ensuring Energy Security: Old Questions, New Answers", *Foreign Affairs*, Vol 85, No 2, 2006.

140. Klare, Michael T. "Resource Wars: The New Landscape of Global Conflict" Metropolitan Books; 1st edition 2001.

energy security issues through different reports, media coverage etc., urging to stabilize regions, exporting energy resources to the US, while violating domestic energy issues as sustainability and affordability of energy supply on national ground. Remarkably, in the California case the involvement of Enron Corporation and its frauds as was disclosed later caused the public criticism of G.W. Bush administration. Media might have fuelled that case but the rationale behind overwhelming concerns was California energy security vs. profit of big corporation lobbying its interests through American authorities.

In order to identify the public attention to the energy security in the last decade I reviewed the State of the Union documents from 2001 to 2011.<sup>141</sup> Not surprisingly, each year the Presidents paid particular attention to energy issues. Both President George W. Bush and President Barack Obama pointed out the key role of energy security for the prosperity of the nation and emphasized that the United States' government should focus on reducing the American reliance on foreign energy resources.

*“...As we meet tonight, many citizens are struggling with the high cost of energy. We have a serious energy problem that demands a national energy policy. (Applause.) The West is confronting a major energy shortage that has resulted in high prices and uncertainty. I've asked federal agencies to work with California officials to help speed construction of new energy sources, and I have direct Vice President Cheney, Commerce Secretary Evans, Energy Secretary Abraham and other senior members in my administration to develop a national energy policy. (Applause.)*

*...Our energy demand outstrips our supply. We can produce more energy at home while protecting our environment, and we must. (Applause.) We can produce more electricity to meet demand, and we must. (Applause.) We can promote alternative energy sources and conservation, and we*

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141. In 2001, there were two speeches by the George W. Bush. The terrorist attacks on September 11, 2001 brought the necessity for unplanned State of the Union by the President Bush. In my analyses, I did not cover this document since the speech was not addressed within traditional framework.

*must. (Applause.) America must become more energy-independent, and we will...”*

(George W. Bush: February 27, 2001<sup>142</sup>)

This excerpt is taken from the 1<sup>st</sup> State of the Union Address of the President Bush who faced the California electricity crisis in the first year of his Presidency. His next seven annual speeches only reiterated the urgency of energy security as a cornerstone of United States economic growth and stability:

*“...Good jobs also depend on reliable and affordable energy. This Congress must act to encourage conservation, promote technology, build infrastructure, and it must act to increase energy production at home so America is less dependent on foreign oil. (2002)*

*... Our third goal is to promote energy independence for our country, while dramatically improving the environment. I have sent you a comprehensive energy plan to promote energy efficiency and conservation, to develop cleaner technology, and to produce more energy at home. (2003)*

*...Consumers and businesses need reliable supplies of energy to make our economy run. So I urge you to pass legislation to modernize our electricity system, promote conservation and make America less dependent on foreign sources of (2004)*

*...To keep our economy growing, we also need reliable supplies of affordable, environmentally responsible energy. Nearly four years ago, I submitted a comprehensive energy strategy that encourages conservation, alternative sources, a modernized electricity grid, and more production here at home -- including safe, clean nuclear energy. Four years of debate*

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142. Free eBooks by project Gutenberg, accessed February 2011,  
<http://www.gutenberg.org/cache/epub/5050/pg5050.html>.

*is enough: I urge Congress to pass legislation that makes America more secure and less dependent on foreign energy. (2005)*

*...Keeping America competitive requires affordable energy. And here we have a serious problem: America is addicted to oil, which is often imported from unstable parts of the world. The best way to break this addiction is through technology. Since 2001, we have spent nearly \$10 billion to develop cleaner, cheaper, and more reliable alternative energy sources -- and we are on the threshold of incredible advances. So tonight, I announce the Advanced Energy Initiative -- a 22-percent increase in clean-energy research -- at the Department of Energy, to push for breakthroughs in two vital areas. To change how we power our homes and offices, we will invest more in zero-emission coal-fired plants, revolutionary solar and wind technologies, and clean, safe nuclear energy. (2006)*

*... Extending hope and opportunity depends on a stable supply of energy that keeps America's economy running and America's environment clean. For too long our nation has been dependent on foreign oil. And this dependence leaves us more vulnerable to hostile regimes, and to terrorists -- who could cause huge disruptions of oil shipments, and raise the price of oil, and do great harm to our economy. (2007)*

*... To build a future of energy security, we must trust in the creative genius of American researchers and entrepreneurs and empower them to pioneer a new generation of clean energy technology. Our security, our prosperity, and our environment all require reducing our dependence on oil. (2008)”*

What is important to conclude from this rhetoric is that; the California crisis caused the reassessment of energy security policy in the US by American government. It was the unique case, which provoked great concern on the policy making process in energy field.

If we look through the priorities made by the government under President Obama, we notice the shift toward environmental issue (clean energy) and reduction of overseas dependence of energy security. Example:

*... We know the country that harnesses the power of clean, renewable energy will lead the 21st century. And yet, it is China that has launched the largest effort in history to make their economy energy efficient. We invented solar technology, but we've fallen behind countries like Germany and Japan in producing it. New plug-in hybrids roll off our assembly lines, but they will run on batteries made in Korea.*

*... we will double this nation's supply of renewable energy in the next three years.*

*...to support that innovation, we will invest fifteen billion dollars a year to develop technologies like wind power and solar power; advanced bio-fuels, clean coal, and more fuel-efficient cars and trucks built right here in America. (2009)*

*...But to create more of these clean energy jobs, we need more production, more efficiency, more incentives. And that means building a new generation of safe, clean nuclear power plants in this country. It means making tough decisions about opening new offshore areas for oil and gas development. It means continued investment in advanced bio-fuels and clean coal technologies. And, yes, it means passing a comprehensive energy and climate bill with incentives that will finally make clean energy the profitable kind of energy in America. (2010)*

*... Now, clean energy breakthroughs will only translate into clean energy jobs if businesses know there will be a market for what they're selling. So*

*tonight, I challenge you to join me in setting a new goal: By 2035, 80 percent of America's electricity will come from clean energy sources. Some folks want wind and solar. Others want nuclear, clean coal and natural gas. To meet this goal, we will need them all -- and I urge Democrats and Republicans to work together to make it happen. (2011)"*

It is undeniable that clean energy is costly; it requires big investments on research. From the perspective of the California case, alternative energy could replace conventional resources in the future, but not in the near future. Even with the attempt of that replacement average price will be rather high, because as we know from the work - costly generation assets must be repaid through stranded costs which reflect the average cost of energy. Coming back to the hypothesis I highlighted in the work, it is necessary to conclude that deregulation of energy sector, especially electricity infrastructure can challenge energy security in the case if deregulation plan and its realization have not worked out carefully. State government as well as federal authorities should apply multilateral approaches while deregulating electricity sector. By saying multiply approaches, I mean complex processes which take into consideration some specific features of California's electricity market. Such features are: vertically integrated systems, net importing conditions, in-state generation capacity and market design through which energy is sold. If one of the mentioned above features is disregarded California economy will burden severe economic losses. The economic losses could be bankruptcies of energy generators, state budget deficits and economic stagnation if the producing industries will stop working. Moreover, authorities can lose public credit, failing to manage the energy crisis. In other words deregulation is potentially dangerous if it's not done properly.

In conclusion to the chapter it is important to highlight that California electricity crisis was the important case, which spurred the American government to pay great attention to in-state energy regulation policy.

## Conclusion

### *Lessons learned*

It is useful to do a comprehensive analysis of the California Electricity Crisis through a lessons learned approach. One of the first and the most important lessons learned from the California electricity crisis was not to criticize government attempts to create competitive electricity market through restructure, but analyze why it was not effective. The problem was not in restructuring itself, but in the measures applied.

There was inadequate time spent on creation of the restructuring plan and its application. 11 months was not enough to check how the whole system would be functioning in the frame of PX, CAISO.

First lesson learnt for adequate generation

The adequate generation measure, first of all supposed sufficient supply of electricity. The old system had “strict reserve margin requirements on regulated utilities,” those margins were too costly.<sup>143</sup> In a new system, government cut the margins, but didn’t provide efficient mechanisms regulating supply and demand balance. That was one of the troubling matters when California faced supply shortage caused by hydropower supply reduction. Another problem was the fact that both old and new systems had obvious generation capacity risk. The risk related with decisions on how much new generation capacity to build and with what costs of operating the existing capacity. Such uncertainties caused severe fluctuations of wholesale prices and later led to financial crisis.

Theoretically, if all commercial generators kept enough reserve capacity it would guarantee low marginal generation costs and consequently low wholesale prices. Nevertheless, most generators would hardly earn sufficient financial return on the capacity

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144. Peter Navarro, “The Future of Electricity Deregulation: Lessons Learnt From the California Crisis,” 38, accessed March 10, 2010, [http://works.bepress.com/cgi/viewcontent.cgi?article=1008&context=peter\\_navarro](http://works.bepress.com/cgi/viewcontent.cgi?article=1008&context=peter_navarro).



to justify their investments. No investments would mean gradual reduction of the reserve capacity. Cutback of reserve capacity would bring an average price increase.

Second, keeping supply and demand in balance would stimulate investors to construct generating plants. The balance also would ensure undisrupted energy supply.

Third was to improve infrastructure adequacy, which comprised effective functioning of transmission lines and gas pipelines. In fact, good infrastructure would provide flexible and efficient generation loads under changing generation, demand, and transmission conditions. It was necessary to build new transmission resources or upgrade functioning grids. Such a system should cut generations and transmissions costs while expanding capacity. Free transmission infrastructure is as important as reserve margins or supply-demand balance. The government should find an effective approach of regulation, which balances the interests of environmentalists and private utilities, regarding constructing of new transmission infrastructure.

Fourth was to connect the wholesale and retail markets. Connection was crucially important because wholesale markets signaled price changes to retail markets, easing price spikes to retail customers who reduced or increased electricity demand due to prices. That would help to discourage generators from artificial price elevation as it was during the period when several California generating plants closed for so called maintenance works.

Fifth was to maintain retail competition, in order to escape bankruptcy of IOUs, by means of long-term contracts and caps based policy. The bankruptcy of Pacific Gas and Electric was a result of CPUC's rejection to raise price caps. The price caps were too low to cover standard costs of utilities. Anyway, if the government would apply the caps, they should be short-term and high enough to cover operating costs and avoid generators from shutting down supply.

If we compare the methods of crisis regulation in California and England, we see that England increased the spot price or made long-term and medium-term contracts, which saved the generators from bankruptcy. In California IOU tried to secure themselves from

severe price increase through long-term contracts, but such contracts were prohibited by FERC.

Sixth was to examine market risk when initiating regulated frames.

Risk management was a key principle of effective competition, because it balanced generating units and financial assets in short -and long-term contracts. For example, permission of independent retail providers and customers to participate in the electricity market would give them the opportunity to work out their own risk management strategy.

Seventh, market design within three sectors showed that they should not operate independently, because bulk-power of the electricity system was tightly interconnected and correlated with production and consumption. The new system artificially separated three sectors. That increased transaction costs of three sectors and worsened operation and planning processes of the system for capital investments because of the separation within the system.

Moreover, market monitoring problems, showed that from the beginning of restructure (in March 1998) PX and CAISO had problems with market power regulation. The rules set by auction showed that neither the PX nor CAISO were responsible in monitoring different suppliers in the market and had no power to compel generators to supply power during shortages. It was necessary to create a body with appropriate market rules and an ability to enforce sufficient supply at all times.

Finally, a tight connection of the gas and electricity market should be acknowledged. The natural gas and electricity market have to be viewed as a system. The simultaneous existence of a free electricity market and monopolized gas pipelines would lead to an unfair price policy. It not be difficult for Gas Corporations to manipulate gas prices to their own advantage. A good example of this occurred in 2001, when the El Paso Corporation manipulated gas prices, which exacerbated the energy shortage. These are the main lessons learned from California electricity crisis. In conclusion, it is necessary to stress the fact that deregulation can threaten energy security if poor strategy is applied.

### *Set of recommendations*

Acknowledged mistakes made in restructuring the Californian electricity market. Below are measures which could strengthen California's energy security in the future.

- The state should promote investments from private sectors and come up with a plan to build new power generators to reduce deficits in electricity supply.
- In the light of growing environmental concerns, and aging of existing power generation plants, the state should come up with a thorough approach that satisfies environmentalists, industry and investors.
- Increase the reliability of infrastructure of electricity and natural gas transmission and storage should be chief concern of state officials.
- Another solution to the California energy security threats is that the state could enhance the relations and strengthen the infrastructure with Eastern states. This measure would allow a mutually beneficial relationship with cooperating states.

California must increase the share of renewable energy in the overall consumption, since the sunny and windy California climate conditions provide opportunities for solar and wind energy generation viable. However the main concern remains, which is to attract investment to the above sectors and influence public opinion on the advantages of renewable energy types. Moreover, the state should encourage consumers to be more efficient in energy consumption and reducing the use of stand by modes of different electric devices. Recently in California, developers have incorporated energy saving technologies in construction of office and other buildings. California also produces cars using alternative energy such as electricity.

## Resumé

Kalifornská krize na trhu s elektřinou z roku 2001 ukázala zranitelnost energetického sektoru z hlediska principu nepřerušovaných dodávek energií za přijatelné ceny. Navíc také ukázala neschopnost státních orgánů zvládat problémy spojené s nově restrukturalizovaným energetickým sektorem v neznámých podmínkách. Tato neschopnost přivedla celý systém ke krizi a přivedla bankrot soukromých společností, které obstarávaly výrobu a dodávky elektřiny.

Deregulační program byl zpočátku zaměřen na diverzifikaci výroby elektřiny soukromými subjekty. Dále sledoval vytvoření Energetické burzy pro velkoobchodní dražby elektřiny a zmrazení koncových cen elektřiny do roku 2012 pomocí cenových stropů. Také měl zavést svobodu spotřebitelů zvolit si svého dodavatele elektřiny.

Deregulovaný trh s elektřinou obecně fungoval docela dobře až do počátku roku 2000, kdy objem poptávky přesáhl možnosti dodavatelů. Rychlý ekonomický rozvoj v Kalifornii ve skutečnosti zvyšoval spotřebu elektrické energie. Navíc snížení dodávek energií z hydroelektráren kvůli nedostatku srážek vedlo k nedostatku elektřiny a způsobilo rapidní zvýšení cen zemního plynu, který tvořil jeden z hlavních energetických zdrojů, což s sebou neslo negativní důsledky pro cenovou tvorbu na trhu. Tyto příčiny nakonec způsobily elektrickou krizi a přivedly bankrot soukromých společností. Soukromé společnosti zbankrotovaly díky extrémně vysokým cenám elektřiny pro velkoodběratele a nízkým cenám pro spotřebitele, které byly nastaveny vládními cenovými stropy. Soukromé subjekty tak kvůli těmto rozdílům nemohly generovat předpokládané zisky na trhu s elektřinou.

Výzkum je veden po ose tří hlavních otázek: Jaké byly cíle deregulační politiky? Jaké byly důsledky této deregulace a jak se projeví v oblasti energetické bezpečnosti? Jaké kroky mohou být doporučeny, aby se v budoucnu zabránilo takovéto krizi?

Práce je strukturována následovně. Nejprve uvádím použité zkratky a obsah, aby se čtenář snadněji zorientoval. Následuje úvod s obecnými poznámkami ke kalifornské elektrické krizi a s vysvětlením důležitosti energetické bezpečnosti. **První kapitola** vysvětluje metodologický přístup, definuje cíle výzkumu, hypotézy a výzkumné otázky. První kapitola také obsahuje rešerši literatury k danému tématu. **Druhá kapitola** zkoumá deregulaci kalifornského trhu s elektřinou, osvětluje hlavní deregulační kroky a zdůrazňuje, že deregulační opatření byla hlavním spouštěcím mechanismem pro elektrickou krizi. **Třetí kapitola** studuje kalifornskou krizi na trhu s elektřinou a ukazuje její kořeny, příčiny a aktéry a zkoumá detailně její povahu. **Čtvrtá kapitola** ukazuje energetickou bezpečnost jako integrální součást národní bezpečnosti a ukazuje na vztah kalifornské krize s americkou energetickou bezpečností. **Poslední kapitola** je závěrečnou částí, která vyvozuje hlavní poučení získaná z kalifornské krize společně se soustavou doporučení, která by v budoucnu mohla posílit kalifornskou energetickou bezpečnost.

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### **List of annexes**

1. Table 1 CA's major electric transmission lines
2. Table 2 Electric generation facilities and projects
3. Table 3 CA Natural gas pipelines
4. Table 4 CA natural gas pipelines and storage facilities
5. Table 5 Vertically Integrated electricity sector.
6. Table 6 Hydroelectric Production
7. Table 7 Natural Gas Resource Areas and Pipelines
8. Table 8 California Electric Utility Service Area
9. Table 9 Who sells to whom in California's electricity market
10. Table 10 Electricity – Generating capacity in the Western States, 1995-1999
11. Table 11 Net electricity generation from hydropower and natural gas in 11 Western States, first nine months of 1999 and 2000
12. Table 12 Average prices that utilities paid for electricity in the California power exchange day-ahead auction, April 1998 through December 2000
13. Table 13. Cost of Electric Deregulation to California and Taxpayers
14. Table 14 Selected Activities and Responsibilities of Energy-Related Agencies

**Annex: Table 1 CA's major electric transition lines**

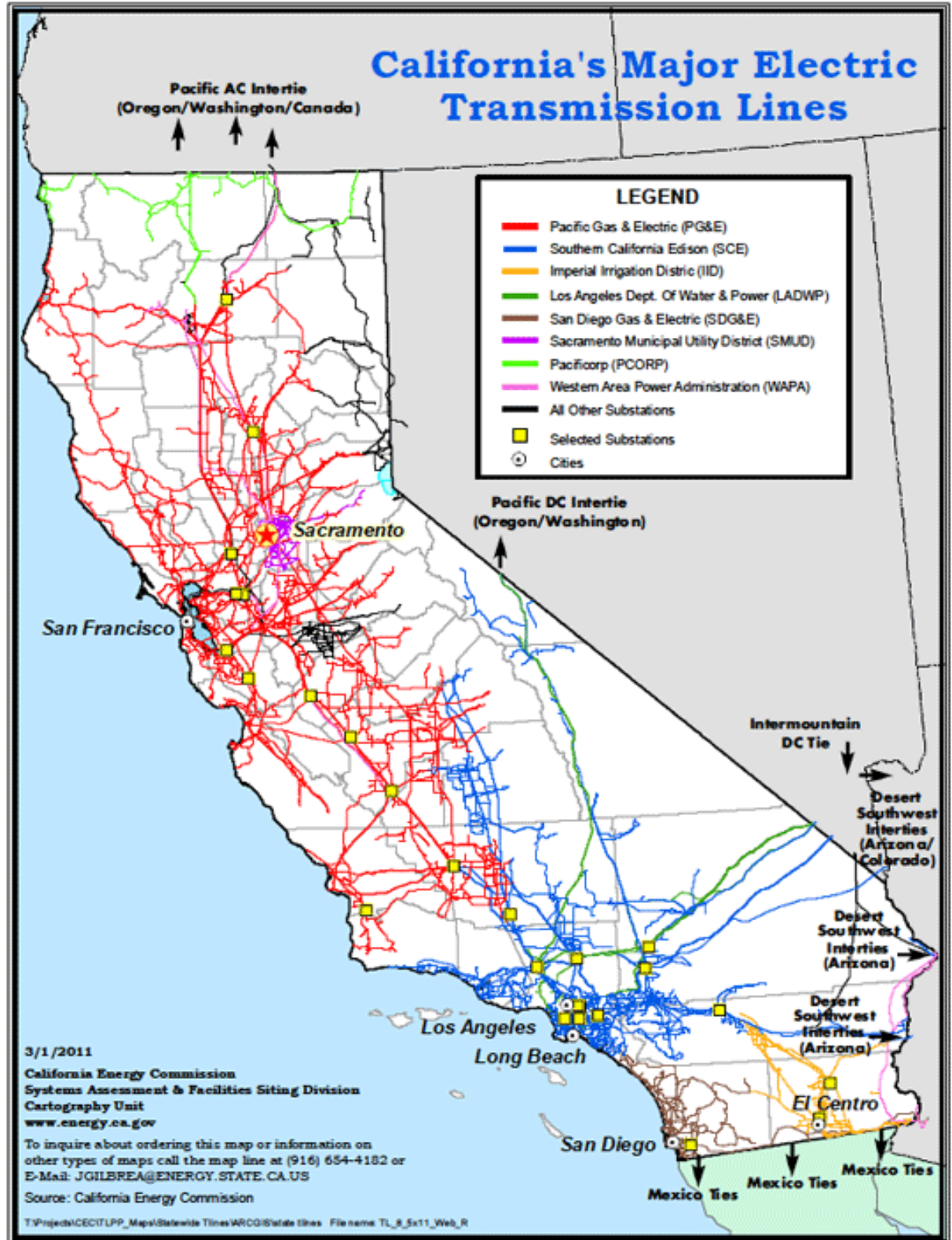
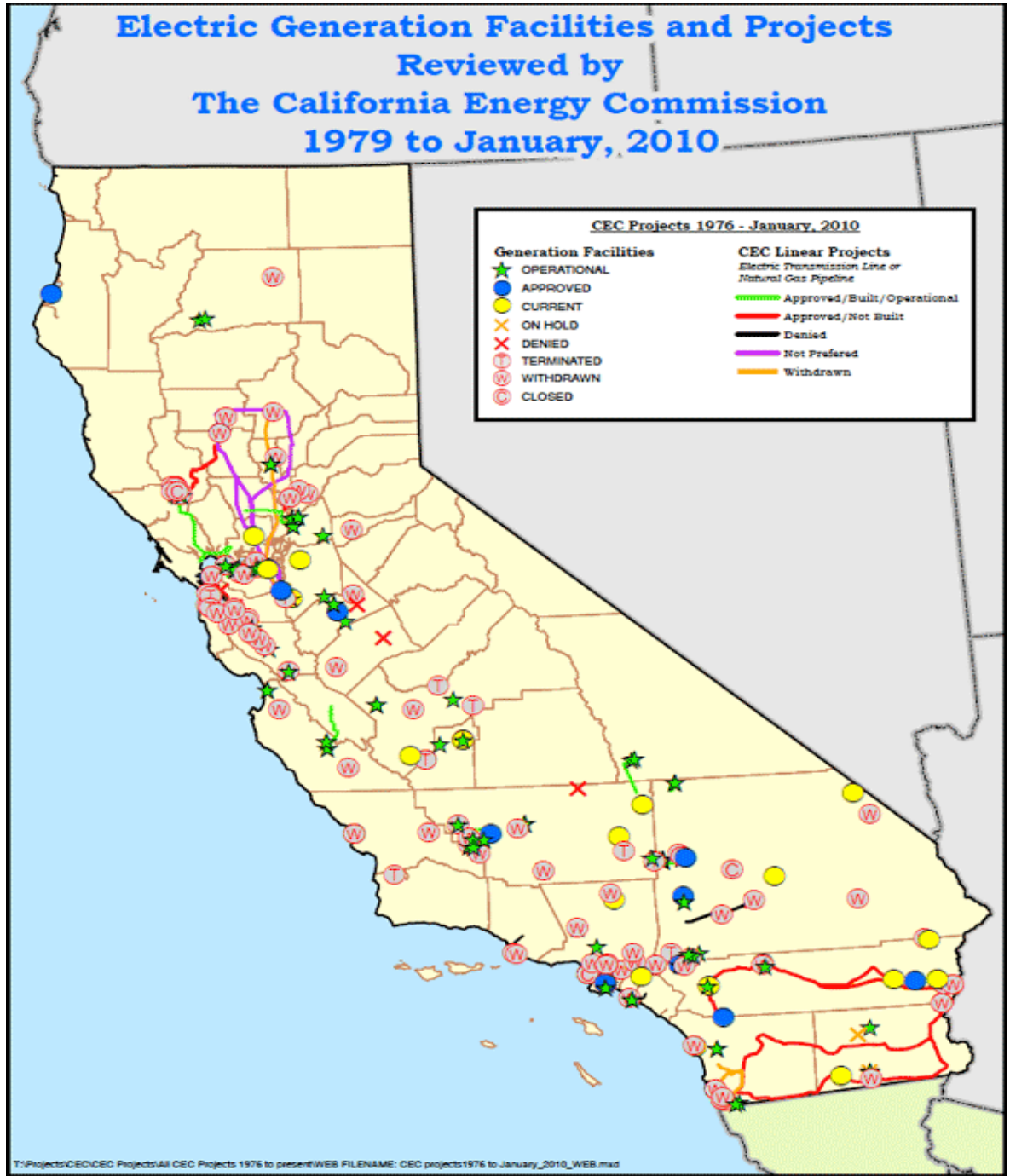
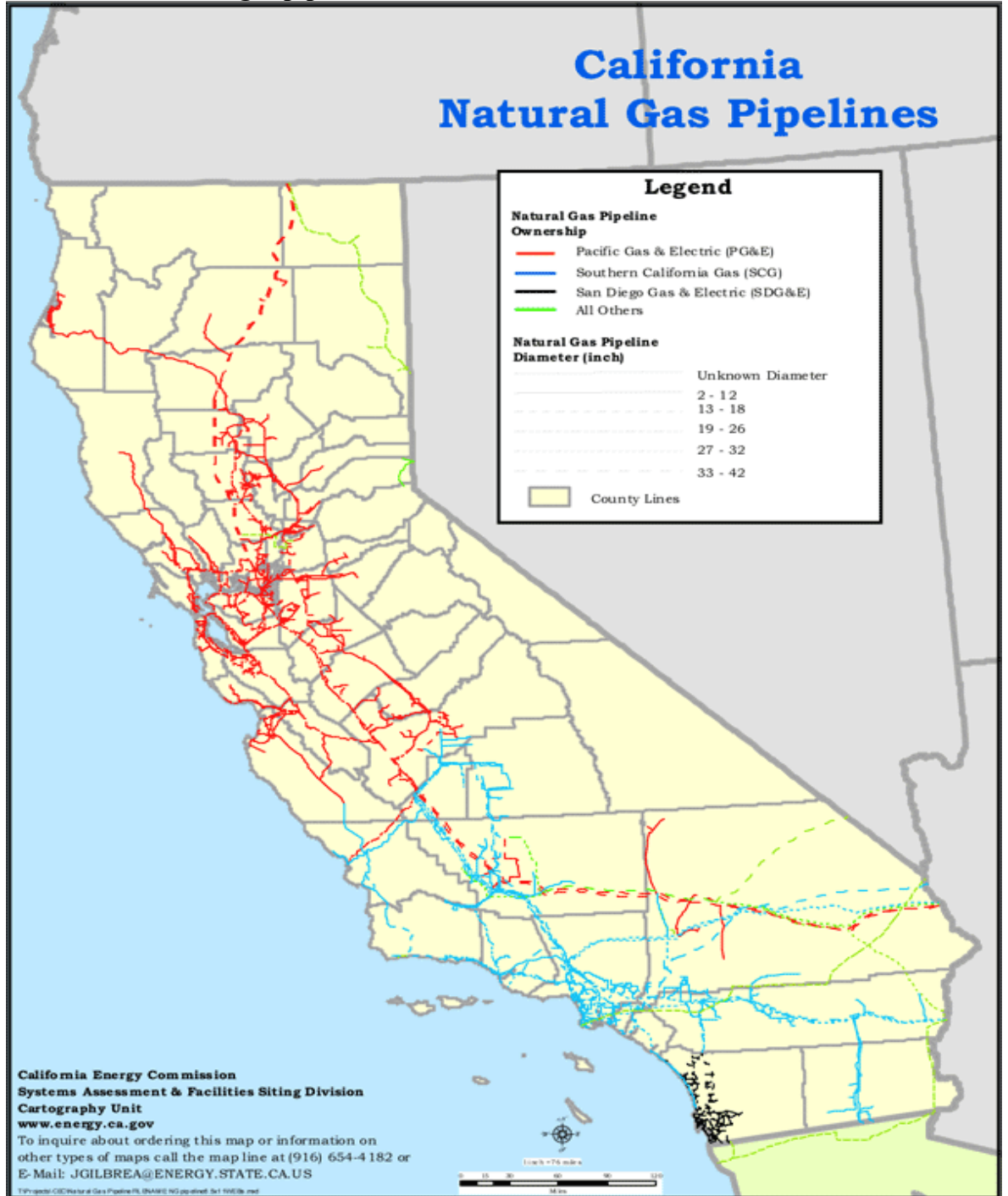


Table 2 Electric generation facilities and project

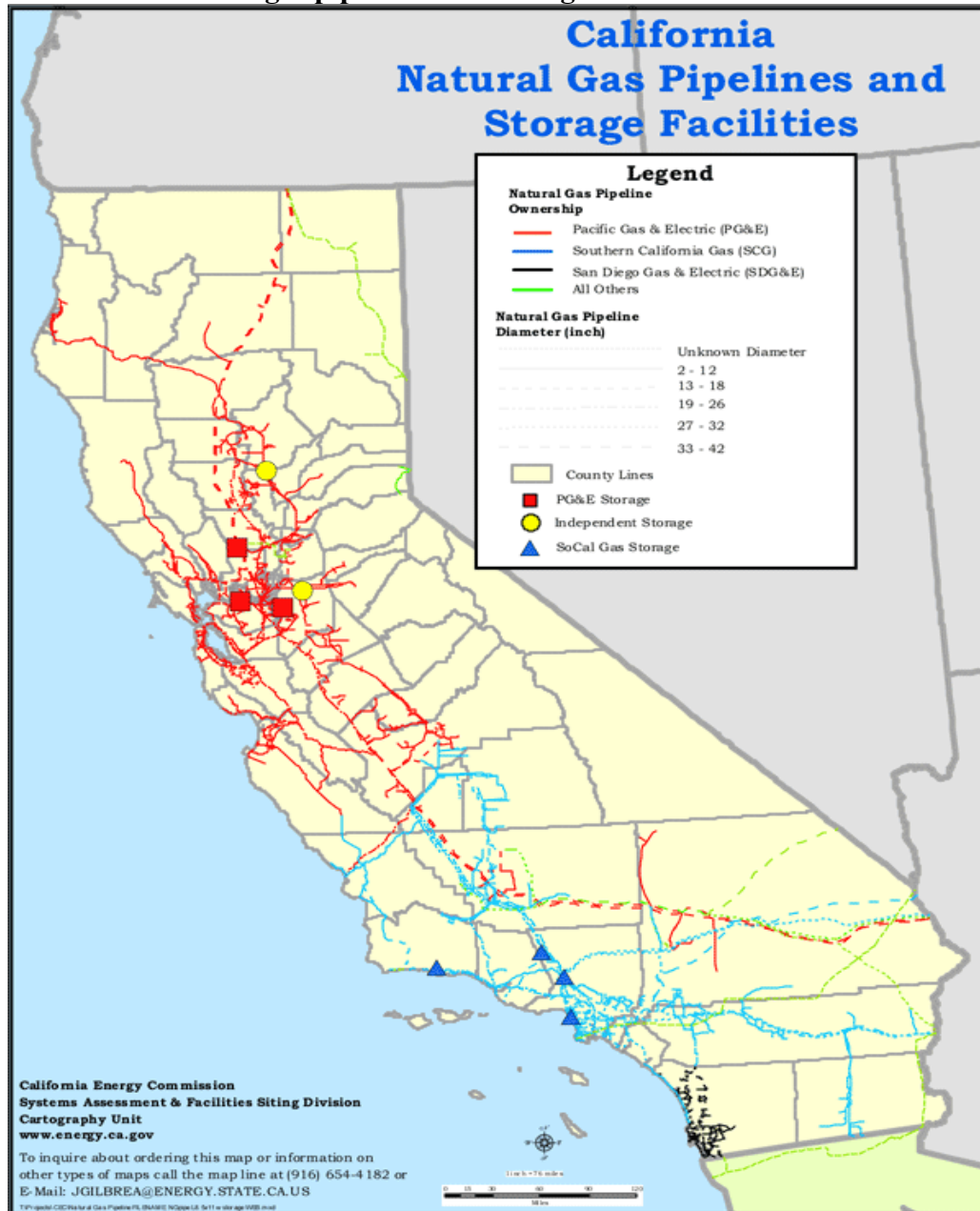


**Table 3 CA Natural gas pipelines**



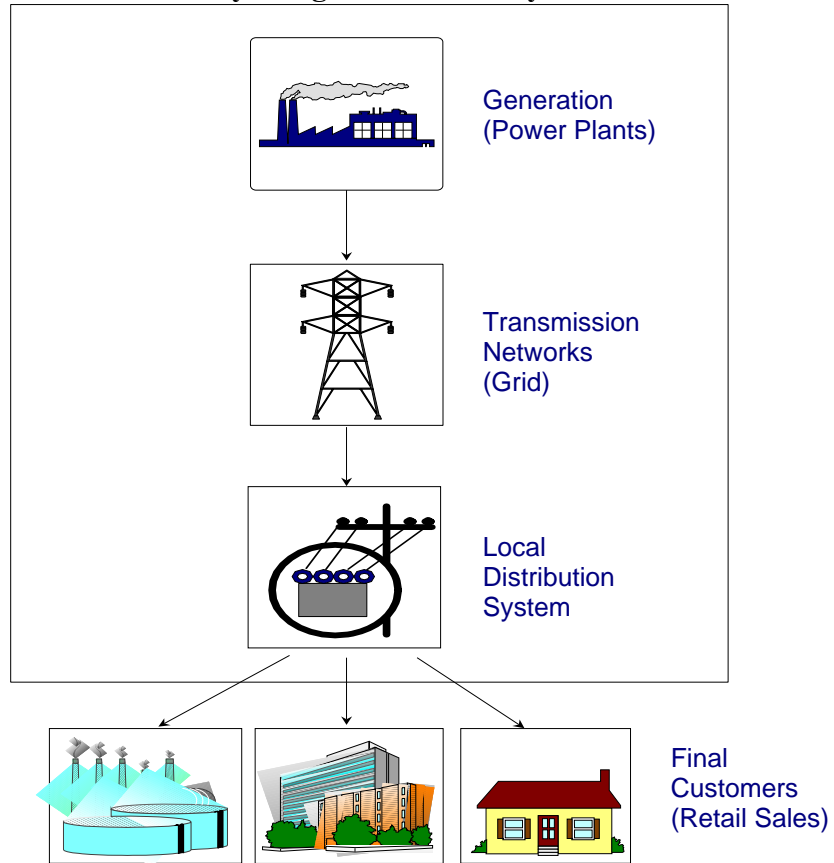
[www.energy.ca.gov](http://www.energy.ca.gov)

Table 4 CA natural gas pipelines and storage facilities



[www.energy.ca.gov](http://www.energy.ca.gov)

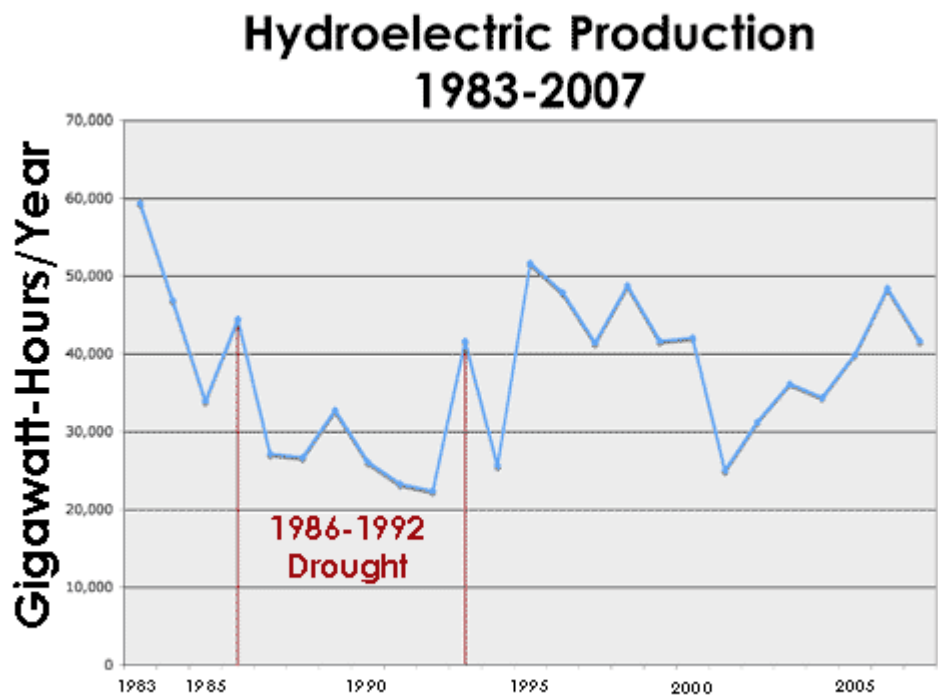
**Table 5 Vertically Integrated electricity sector.**



[www.docstoc.com](http://www.docstoc.com)

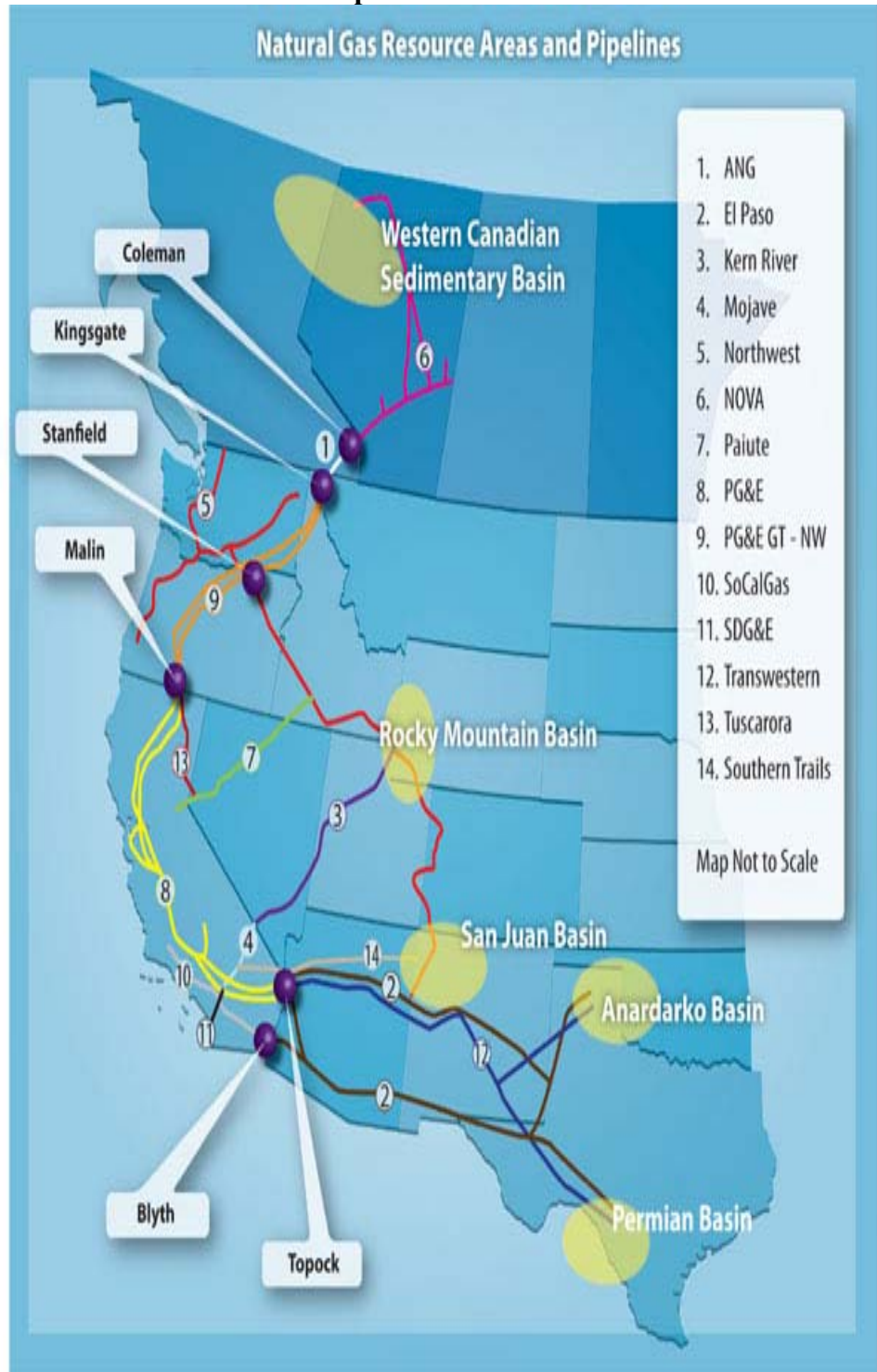


Table 6 Hydroelectric Production



[www.energyalmanac.ca.gov](http://www.energyalmanac.ca.gov)

**Table 7 Natural Gas Resource Areas and Pipelines**

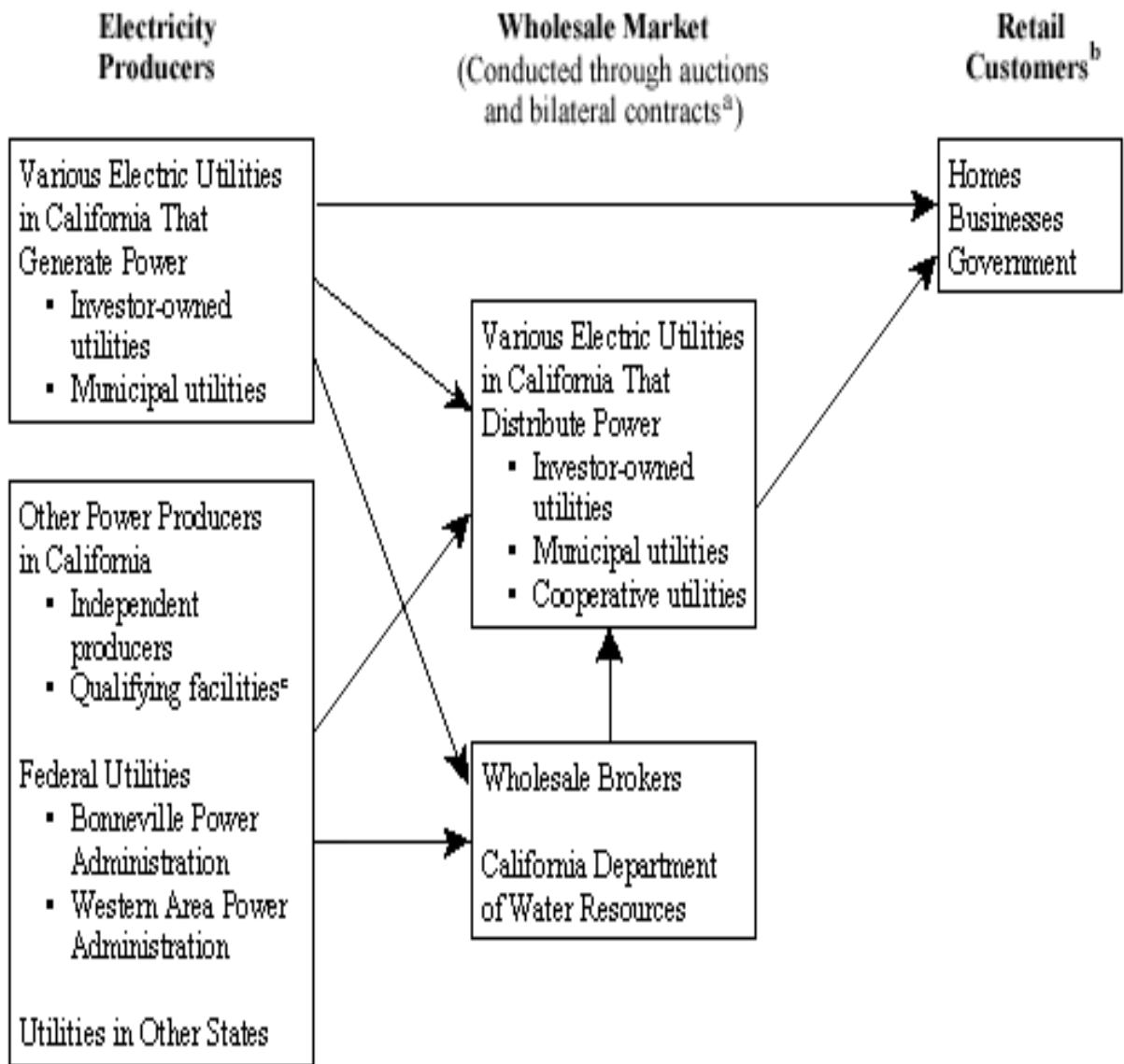


[www.energyalmanac.ca.gov](http://www.energyalmanac.ca.gov)

Table 8 California Electric Utility Service Area



**Table 9 WHO SELLS TO WHOM IN CALIFORNIA'S ELECTRICITY MARKET**



SOURCE: Congressional Budget Office.

- a. The California Independent System Operator conducts wholesale auctions of electricity. In addition, the California Power Exchange conducted such auctions until it was shut down in January 2001.
- b. California's restructuring plan allowed customers to buy electricity directly from independent producers and brokers, but virtually all customers stayed with their traditional utility supplier as long as the freeze on prices remained in effect.
- c. Producers who use renewable energy sources or cogeneration (waste heat from industrial processes)

Table 10

**ELECTRICITY-GENERATING CAPACITY IN THE WESTERN STATES, 1995-1999 (In megawatts)**

|                                     | 1995          | 1996          | 1997          | 1998          | 1999          |
|-------------------------------------|---------------|---------------|---------------|---------------|---------------|
| Electric Utilities (WSCC)           | 129,751       | 131,292       | 129,232       | 116,159       | 107,832       |
| Nonutilities (Mountain and Pacific) | <u>16,617</u> | <u>17,408</u> | <u>16,985</u> | <u>29,672</u> | <u>40,096</u> |
| Total                               | 146,368       | 148,700       | 146,217       | 145,831       | 147,928       |

SOURCE: Energy Information Administration, *Electric Power Annual 1999*, vol. 2, DOE/EIA-0348(99)/2 (October 2000), Tables 34 and 53.

NOTE: WSCC is the Western Systems Coordinating Council region (excluding Canada and Mexico) of the North American Electric Reliability Council. Nonutilities are independent electricity producers as well as some small producers (known as qualifying facilities) that use renewable energy sources or cogeneration to produce electricity. Mountain and Pacific are regions of the Census Bureau; figures for those regions include small amounts of generating capacity in Hawaii and Alaska.

**Table 11**

**NET ELECTRICITY GENERATION FROM HYDROPOWER AND NATURAL GAS IN 11 WESTERN STATES, FIRST NINE MONTHS OF 1999 AND 2000 (In millions of kilowatt hours)**

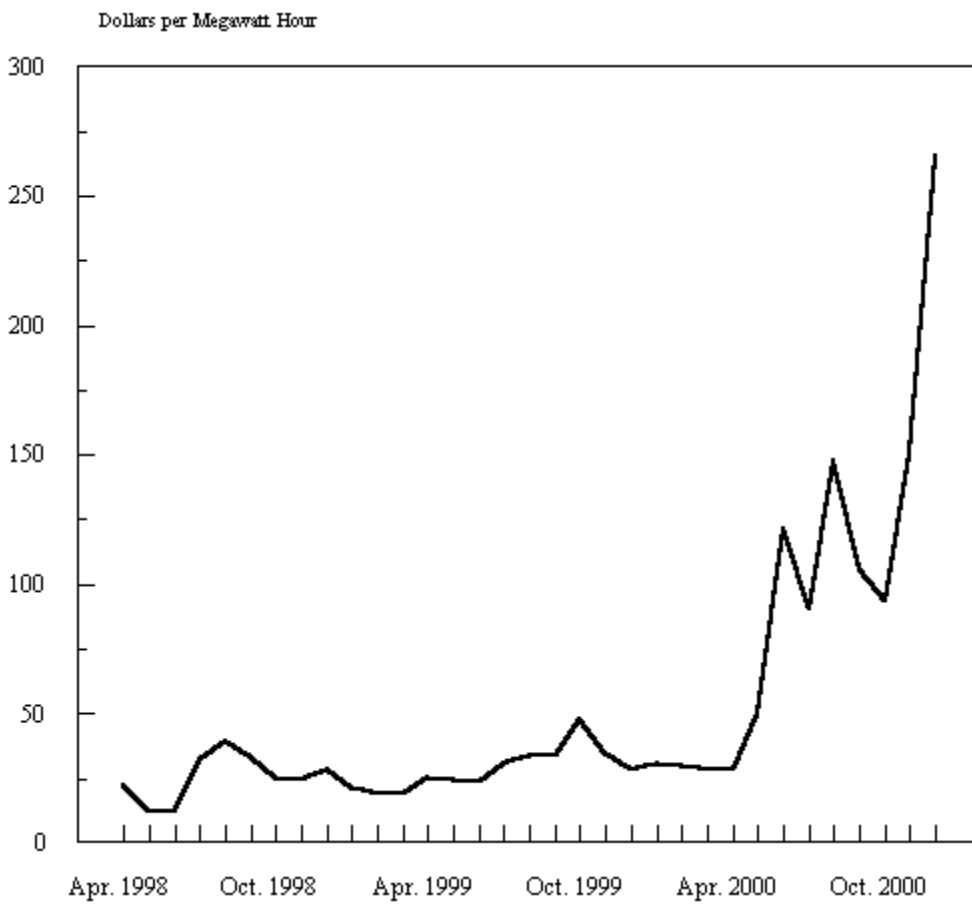
|                    | Hydropower   |              | Natural Gas   |                |
|--------------------|--------------|--------------|---------------|----------------|
|                    | 1999         | 2000         | 1999          | 2000           |
| Electric Utilities | 154,020      | 126,955      | 29,846        | 35,995         |
| Nonutilities       | <u>3,130</u> | <u>5,231</u> | <u>69,365</u> | <u>102,510</u> |
| Total              | 157,150      | 132,186      | 99,211        | 138,505        |

SOURCE: Energy Information Administration, *Electric Power Monthly*, DOE/EIA-0226(2001/01) (January 2001), Tables 10 and 65.

NOTE: Nonutilities are independent electricity producers as well as some small producers (known as qualifying facilities) that use renewable energy sources or cogeneration to produce electricity.

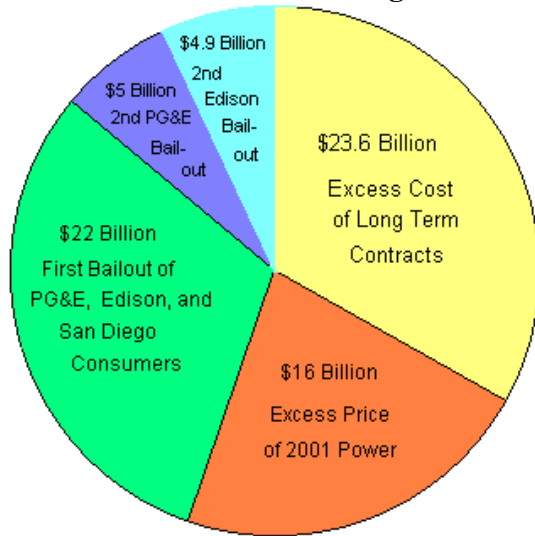
**Table 12**

**AVERAGE PRICES THAT UTILITIES PAID FOR ELECTRICITY IN THE CALIFORNIA POWER EXCHANGE'S DAY-AHEAD AUCTIONS, APRIL 1998 THROUGH DECEMBER 2000**



SOURCE: Congressional Budget Office based on data for the northern and southern regions from the California Energy Commission (available at [www.energy.ca.gov/electricity/wepr/monthly\\_day\\_ahead\\_prices.html](http://www.energy.ca.gov/electricity/wepr/monthly_day_ahead_prices.html)).

**Table 13 Cost of Electric Deregulation to California and Taxpayers**



**Cost of Electric Deregulation to California Consumers and Taxpayers**  
**\$71 Billion**  
Source: Foundation for Taxpayer and Consumer Rights



**Table 14**

**Selected Activities and Responsibilities of Energy-Related Agencies**

| FUNCTION  | CPUC | CEC | CPA | DWR | ISO | EOB | FERC |
|---|------|-----|-----|-----|-----|-----|------|
| Rate regulating                                     | X    |     |     |     |     |     | X    |
| Promoting energy conservation<br>and efficiency     | X    | X   | X   |     |     |     |      |
| Forecasting electricity demand                      | X    | X   |     | X   | X   |     |      |
| Promoting renewable resources                       |      | X   | X   | X   |     |     |      |
| Licensing generators                                |      | X   |     |     |     |     |      |
| Conducting integrated resource<br>planning          | X    | X   | X   |     |     |     |      |
| Monitoring the electricity<br>market                | X    |     |     |     |     | X   | X    |
| Monitoring/planning system<br>reliability           | X    |     |     |     | X   | X   |      |
| Planning electricity<br>transmission infrastructure | X    | X   | X   |     | X   | X   | X    |
| Planning natural gas<br>infrastructure              | X    | X   | X   |     |     |     | X    |
| Representing the state at<br>FERC                   | X    |     |     | X   |     | X   |      |

Source: Grant et. al., 2004