Mara's Short Form

The U.S. Federal Energy Regulatory Agency's 2002 Investigation of Enron: *Information-Seeking Questions, Methods and Conclusions*

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Short Form: Prepared by Erin Greenwell for Research Purposes

Abstract

The Federal Energy Regulatory Commission (FERC) investigated Enron and other energy marketeers in 2002 for their suspected manipulation of the Californian energy market during the Californian energy crisis of 2000-2001. This paper seeks to recreate the information-seeking process that FERC might have used when searching Enron's online data archives in an effort to answer that investigation's questions. Of course, understanding this process requires also understanding the investigation itself, and the events that led up to it. Hence this paper can be treated as two separate but equal halves. The first half provides the necessary background to the story, namely a synopsis of the following: the energy industry and market in the United States generally, and in California specifically, at the time of the allegations; the 2000/2001 energy crisis in the West, and how it contributed to these allegations; Enron's role within the Californian energy market; and FERC's specific accusations against Enron. The second half of the paper examines how FERC went about finding the information for its investigation. This begins with a theoretical model of how people seek information in general, followed by a description FERC's particular information needs, data requests, answers, and conclusions in this investigation. Finally, there are several appendices with supplemental information. These provide: a table overview of FERC's questions and answers; sample queries that might have been posed of the email dataset during this investigation; some important players (scheduling coordinators) in California's energy market at the time; and general historical background on the electric and gas industries in the U.S.

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On a more personal note, a heartfelt thanks goes to the author’s housemates Dave Kuhl and Ken Shimada. They lifted her spirits when she became discouraged, and helped her brainstorm a way over the numerous roadblocks to understanding the “whole picture.” An unspoken thanks is due to the author’s brothers, who demonstrate in their daily lives the importance of “doing one’s best.” She is especially grateful to her older brother, who proved that one *can* go back to graduate school, even after one has passed the dewy-eyed age of 20-something. Finally, the author would like to thank her parents for their ongoing love and support – and for patiently waiting for her to return home once the paper was “all done.” The author has come to realize that, in reality, there is no such thing as “all done.” But they had the kindness to wait until the closest version of that was at hand. Hopefully that version will be helpful to any who read it.

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Introduction

During 2001 and 2002, California witnessed unusually high energy prices, bankrupt utility companies, rolling blackouts, and large profits by energy companies. This led to cries of foul play by many citizens and leaders, who all suspected the energy marketers[1] were making a profit at the consumers' and utilities' expense. In early 2002, the Federal Energy Regulatory Commission (FERC), which oversees the prices in jurisdictional wholesale energy markets in the U.S. to ensure that they are just and reasonable (35, p. 1), launched an investigation. It sought to discover whether any entity, to include Enron Corporation and its affiliates, had used its market position to distort electric and natural gas markets in the Western United States (35, p. 1). The investigation combed through large amounts of company data, such as memos, sales reports, correspondence, voice conversations, and emails – much of which FERC subsequently put into the public domain. In the end, FERC found Enron and several other energy companies guilty of manipulating energy prices in California. These findings led to several subsequent legal cases, many of which are still underway.

The purpose of this paper is to understand the process through which FERC might have searched Enron's online data archives to answer its investigation's questions. This process might mirror the ways that other investigative entities, such as lawyers or historians, might seek information in the digital world. The wealth of publicly accessible data in the Enron case, especially the email archives, lends itself well to this goal. Therefore, this paper seeks to reconstruct the following aspects of the Enron investigation: what FERC's original information needs were in the investigation; what specific questions were asked; and what the answers to those questions were. In the process of this research, the iterative nature of question-answering, and the need to search multiple data sources to answer questions, become evident. It should be noted, however, that the author originally focused on the Enron email archive. Hence, any specific answers that were found or supported through email evidence are highlighted in the paper. Also, since many of FERC's findings of purposeful market manipulation were limited to the electricity market, the author has focused much more on electricity than gas.

In order to understand FERC's information-seeking process, however, it is first necessary to have some background on the Californian energy story. Therefore the paper has been broken down into two halves, which have a very different "look and feel" from each other. The first half of this paper will attempt to do this by giving an overview of: the energy industry and market in the United States generally, and in California specifically, at the time of the allegations; the 2000/2001 energy crisis in the West, and how it contributed to these allegations; Enron's role within the Californian energy market; and the specific accusations levied against Enron. The second half of the paper examines

[1] An energy marketer is an independent middleman who buys and sells wholesale electricity at market prices, but who has no generation, transmission, or distribution capacity in his own right. (5, p. 7) This definition will make more sense upon reading the Physical Energy Market and Financial Energy Market sections of this paper.

how FERC went about finding the information for its investigation. This includes a theoretical model of how people seek information in general, followed by a description FERC's information needs, data requests, answers, and conclusions in this particular investigation. Finally, there are several appendices, which the reader might find helpful. Appendix A provides a table overview of these questions and answers. Appendices B and C show some examples of queries that the author imagines might have been posed of the email dataset during this investigation. Appendix D lists some important players (scheduling coordinators) in California's energy market, as will be explained later in the paper. Appendix E provides general historical background on the electric and gas industries in the U.S. There is also an index, which the reader might find helpful for locating definitions of the numerous terms and acronyms, or finding the explanations of Enron's various market strategies. The reader might find it helpful to print the index out separately, and refer to it as necessary while reading the paper.

Background

Energy is big business. In 2004, the U.S. comprised the world's largest electric market, consuming more than one quarter of world production. (5, p. 2) This consumption is fairly evenly divided amongst the residential, commercial, and industrial markets, with a small amount going to transportation and direct use. (84) Looking at solely the residential side, electricity accounted for approximately 60% of the U.S. household utility[2] market in 2002, with 30% of that coming from natural gas. (9, pp. 2-3)

With those figures in mind, it is easy to see how the energy market generally, and the electric and natural gas markets specifically, have the potential to generate great sums of money. Any successful manipulation of these markets could lead to huge profits.

But what exactly is this energy market that is being discussed here? How is this energy produced? How is it harnessed for human consumption? How is its sale or flow controlled? These questions can best be answered by examining the structure of the industrial, physical, financial, and regulatory energy market.

U.S. Energy

It is best to get a macro view of the energy industry and market in the United States, before narrowing in on California. What follows is a description of the U.S. energy scene.

Electricity Industry

[2] A utility is broadly defined as a public service. The major utility sectors are electricity, natural gas, and water. (9, p. 1) In the broader sense, utilities also include services such as sewage, telephone, and cable TV. (10, p. 1)

The electricity industry can be thought of as the physical space where electricity is actually produced and/or transmitted. It is not concerned with when, how, or where that energy is *sold* for money[3]. The electricity industry has three main phases: power generation, power transmission, and power distribution. (15, p. 61) Refer to Figure 1 below to better understand this processing sequence and the explanations:

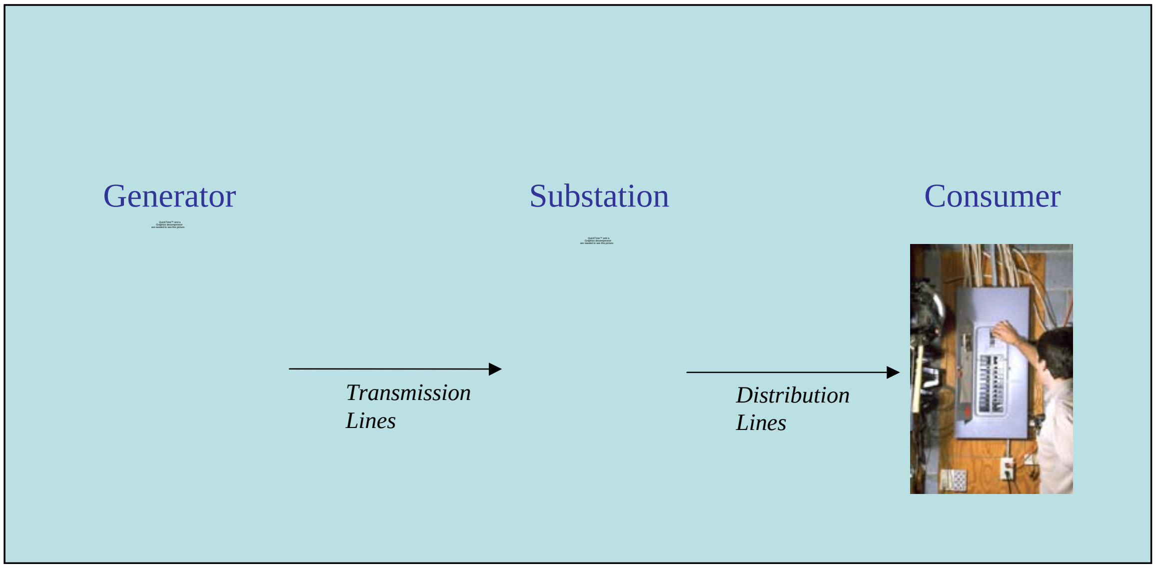

Figure 1: Electricity Industry Model

Power Generation

Electric power can be generated several ways, as is evident in Chart 1 below. The most common method is to burn non-renewable fossil fuels, such as coal, petroleum, and natural gas (6, p. 4). Each of these sources has its advantages and disadvantages. Coal is cheap (16, p. 4), and so generated the majority of the world's electricity as recently as 2004 (5, p. 2). However, it is considered fairly dirty, producing a great deal of air pollution when burned. Petroleum is popular, but worldwide reserves are dwindling (5, p. 3), and the U.S. relies more heavily on imports than national production. (84, p. 159) Natural gas claims some advantages over its fellow fossil fuels. It is generally touted as a "cleaner" solution to coal, as it emits no soot, carbon monoxide, or nitrogen oxides when burned. (5, p. 19) It also has a higher number of known but untapped reserves than petroleum. (5, p. 3) Outside of these fossil fuels, there are some "alternative" sources, such as wind, hydroelectric, and nuclear energy. These tend to be more expensive than the above, traditional methods of production. (7, p. 42.)

[3] The sales side of the equation is called the energy *market*. This will be discussed shortly.

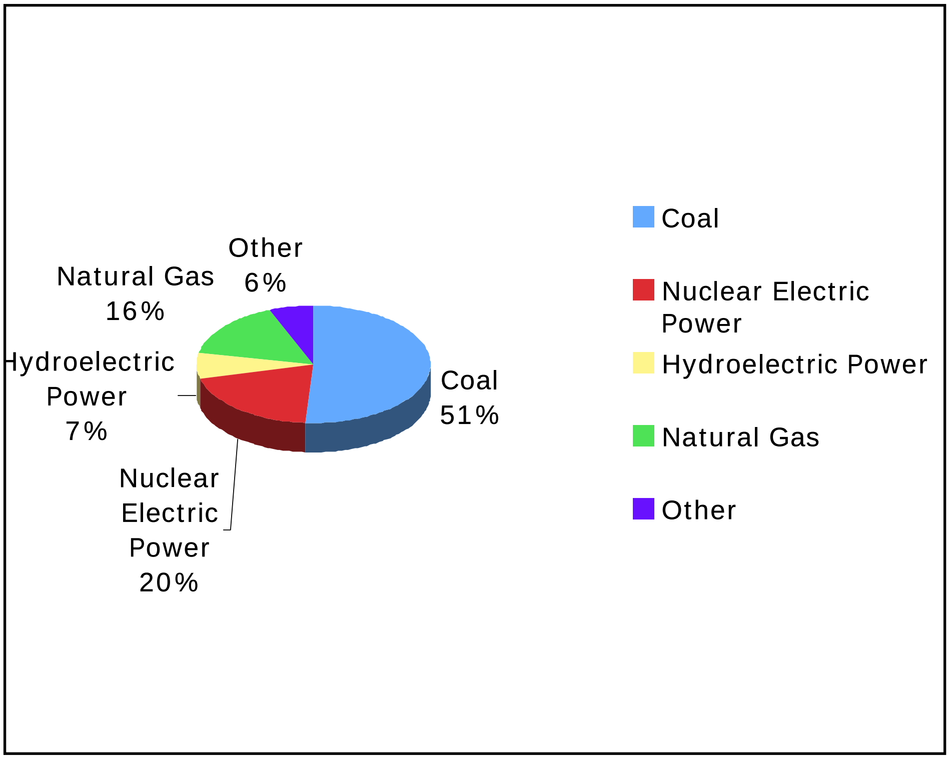

Chart 1: Major Sources of Energy in the U.S. in 2003
Source: (11)

Electricity is "produced" at a generating station. A key point to remember here is that, unlike many other commodities, electricity is not easily stored. Hence, it is important to be able to estimate in advance how much demand there will be, and to schedule electricity production accordingly. There are also ways to generate electricity at the last-minute, but these are expensive.

Having said that: There are three basic types of generating stations: base load, intermediate load, and peak-load plants. The rule is: the bigger the plant, the cheaper and more efficient its production. (16, p. 4) The base-load plants meet an area's normal minimum demand level, are usually the largest and most efficient units (6, pp. 3-4). American base-load plants are usually fed by steam turbines / coal (5, p. 2), although hydroelectric power is sometimes also used (6, pp. 3-4).[4] Intermediate-load plants handle non-peak increases in demand – i.e. they cover energy needs when demand is higher than normal, but not at its highest (peak) level. (6, p. 4) Peak-load plants cover short-term, highest-level demand. They are typically quick to start up, but they are also the least efficient stations. Gas and internal oil are the most common source of energy in peak-load plants in the U.S., although hydroelectric power is also sometimes used. (6, p. 4; 16, p. 4)

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[4] Interestingly, as of 2003, most new power plants were fueled on natural gas in the state of California. (122, p. 31) This will help the reader understand why higher natural gas prices in California during the energy crisis of 2000-2001 also fueled higher electricity prices in that state. See the section on the California Energy Crisis for more information.

Electricity is measured in watts, where one watt equals 1/746th of one horsepower. Electricity is sold in kilowatt hours (kWh), where one kWh equals the amount of electric energy required to burn ten 100-watt light bulbs for one hour. (6, p. 1)

Now, what happens to electricity once it is generated? It is routed to the customer. This is a two-step process, involving transmission and distribution.

Power Transmission

Transmission is simply the transportation of energy from its production source (the generator) over high-powered electricity lines to substations. This is generally done via overhead or underground transmission lines. (15, p. 13) See Figure 2 for a picture of a typical transmission line.

Figure 2: Transmission Line

Power Distribution

The distribution phase starts at the substation, which transforms the high-voltage power from the transmission lines to the low-voltage power appropriate for the consumer lines. It then divides and routes this energy to the “distribution” lines, which typically go underground or overhead, via the ubiquitous neighborhood electric poles, to the end customer. (15, p. 15) See Figure 3 for a picture of a typical overhead distribution line.

Figure 3: Distribution Line

Consumer

Finally, the power arrives at the consumer's location, be that a private residence or a large company. The electricity typically enters the premises through a fuse/electrical box. (15)

Gas Industry

The gas industry looks nearly the same as the electric industry picture (Figure 1), except that gas is extracted from the earth at a gas field and is routed via pipelines. It is then either routed to electric power generators and used as fuel source to produce electricity, or routed directly to industrial, residential, or commercial consumers via another pipeline system. (84, p. 217)

Electricity Market

The energy "market" is an (often virtual) place where money is exchanged for energy. In other words, it represents sales transactions. This is slightly different than the industrial side of the picture, which is merely concerned with the physical production and transportation of power. However, production and sales are two sides of the same coin. Thus, the market model can be superimposed on the industrial model, as is shown in Figures 5 and 7.

The energy market has a wholesale and a retail side. The wholesale side consists of physical and financial markets. (85, p. 4) The retail market consists of simply retail sales to the final customer, who will actually use the energy. These markets are briefly described below.

Wholesale Market

The wholesale market is comprised of the physical and financial markets. These will be examined in turn.

Physical Market

In order to visualize the energy marketplace, imagine the industrial picture (shown in Figure 1) in terms of sales. How is energy bought/sold as it passes from the generator to the transmitter to the distributor? When one looks at the picture this way, one looks at energy's "physical market," which is defined as a marketplace where energy is bought and sold for actual *delivery*. Technically speaking, the physical market consists of only the "spot" or "real-time" market, where energy is sold for immediate delivery. So it can be considered a marketplace for short-term sales[5]. However, day-ahead markets are often also classified as physical markets, as will be seen later in a discussion of California's market. (86, p. 2.) Overlaying these two markets will reconfigure Figure 1 into Figure 5 below. Here, one can see that the generation / transmission transaction, wherein a generation plant sells energy to a distribution company, equates to the "wholesale" side of the physical market. Similarly, the distribution side of the equation, where the local electric company sells that energy to the consumer, equates to the "retail" side[6].

This sales aspect of the energy flow can be mapped into the industrial picture thus:

[5] These different wordings for the same concept can be confusing. For instance, FERC's data requests often asked for information about short-term or long-term sales. FERC's final report, however, generally discussed the physical and financial markets. The law that deregulated California's electricity market, AB 1890, also addressed these as physical and financial markets.

[6] Sometimes large industrial consumers may be physically located on the retail side of this equation, but may buy their energy directly from the generator on the wholesale side of the equation. (101) The author has chosen to portray the physical model as it is in Figure 5, however, for the sake of simplicity.

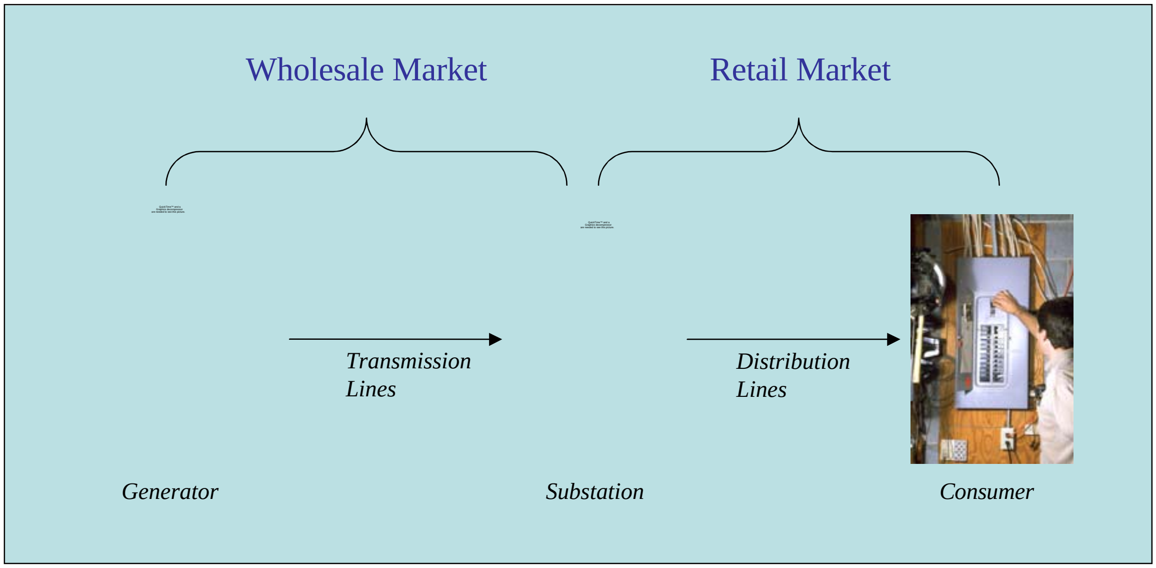


Figure 4: Electricity's Physical Market

Financial Market

A financial market allows participants to buy or sell power with no actual obligation to *deliver* the power. This is because the participants may resell their power purchases before the delivery date arrives. (101) The objective is not to provide a commodity; it is to make money, based on that commodity's value. Any power that is not delivered is paid for by a financial transfer. This is in contrast to the physical market, which requires actual delivery of power. Technically, any market that is not real-time can be considered a financial market. (86, p. 2) this would mean that the day-ahead market is a financial market. However, FERC classified the day-ahead market as part of the spot (physical) market in its investigation; therefore, this paper will do the same. Under this definition, then, the financial market includes the futures and forwards markets. These are discussed below.

Futures Market

In the futures market, traders buy and sell standardized, transferable, exchange-traded contracts that promise delivery of a commodity, bond, currency, or stock index, at a specified price, on a specified future date. In energy futures, the delivery date is usually a month after the sales date. (46, p. 2) This is because one month is the standard delivery date written into the fixed-form futures contract. (101)

Energy futures are traded at certain "hubs" around the U.S. A "hub" is a delivery point on a power grid where power can be sold and ownership can change hands. (15, p. 78) The liquid spot-trading hubs, for example, were rarely involved in the actual delivery of energy, but were capable of it. This capability was considered necessary for the hubs' hedging activity to occur. (46, pp. 1-2) There are numerous hubs where electricity could be sold in the U.S.; however, 85% of the trading is concentrated at a dozen or so locations. (91)

A futures market allows both purchasers and sellers to hedge their bets on what energy prices would do in the future, and to “protect” themselves from uncertain changes. For instance, a buyer can invest in futures to protect himself from an expected price increase, while a seller can invest to protect himself from an expected price decrease. (46, pp. 1-2) This hedging, and the resulting sense of self-protection, tends to have a stabilizing effect on most markets. Buyers are more willing to commit to future purchases, because they feel safe in their negotiated future price. Sellers are more willing to invest in large undertakings, such as constructing generation plants, because they have a guaranteed flow of future income. (15, p. 78)

Futures are run by a formal exchange and guaranteed by a clearinghouse[7]. (87) The New York Mercantile Exchange (NYMEX) (89 *and* 90) and the Chicago Board of Trade (CBOT) (15, p. 78) act as the clearinghouses (exchanges[8]) for these hubs’ futures contracts. NYMEX runs the California-Oregon Border (COB) and Palo Verde hubs, which are the hubs closest to California. (15, p. 78) The major U.S. hubs can be seen in Figure 6 below.

[7] A clearinghouse is a neutral third party that removes credit risk from the futures transactions by guaranteeing that all parties will honor their fiduciary commitments. It also oversees the operation of the market, to ensure fair and orderly transactions. For instance, it sets a daily limit, or a maximum amount that a futures price is permitted to move in one day, compared with the previous day's settlement price. This is done to protect the small speculator against the larger traders, who could conceivably distort prices over a short time period and thus cause distress liquidation. Finally, the clearinghouse is regulated by various government agencies to ensure against default. (88)

[8] A clearinghouse sounds (to the author) like the same thing as an exchange.

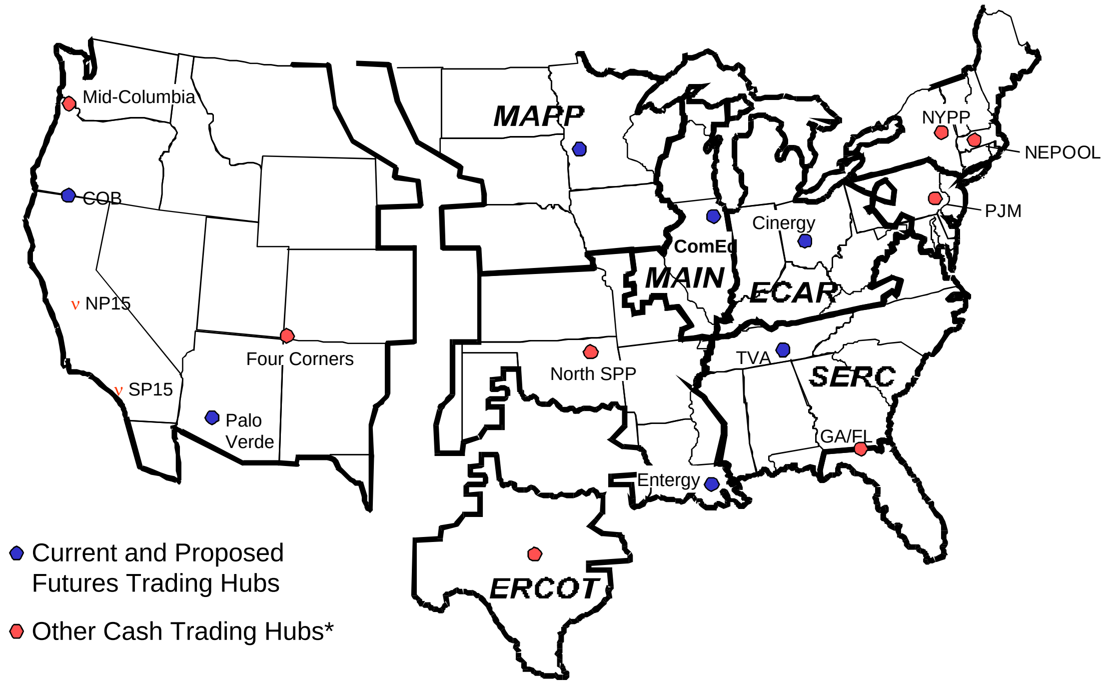


Figure 5: U.S. Futures Energy Trading Hubs
Source: (85) Note: NP15 and SP15 were Cal-ISO zones (19, p. V-7&8)

When Enron collapsed, there was a significant fall-out on the futures market. However, there were no serious or long-lasting repercussions on futures prices -- perhaps thanks to the mitigating influence of the neutral parties that ran the futures exchanges (e.g. NYMEX). (46, p. 2)

Forward Market

The energy market also has what is called a "forward market." Forwards are very similar to the futures, except that futures contracts contain standardized wording, are traded on a formal exchange, are regulated by overseeing agencies[9], and are guaranteed by clearinghouses; forwards are not. (87) Forwards use non-standardized, privately negotiated, bilateral contracts, as opposed to the futures' sales through a clearinghouse. Like futures, the forward price is the commodity's spot price plus the "cost of carry" (foregone interest, convenience yield, storage costs, and interest/dividends). Unlike futures, each forwards party bears its counterparty's credit risk. Therefore, forwards' prices typically include a premium to cover the other party's credit risk. (93) Forward

[9] The NYMEX is regulated by the Commodity Futures Trading Commission (CFTC), and has been since 1974. (92. Also 101)

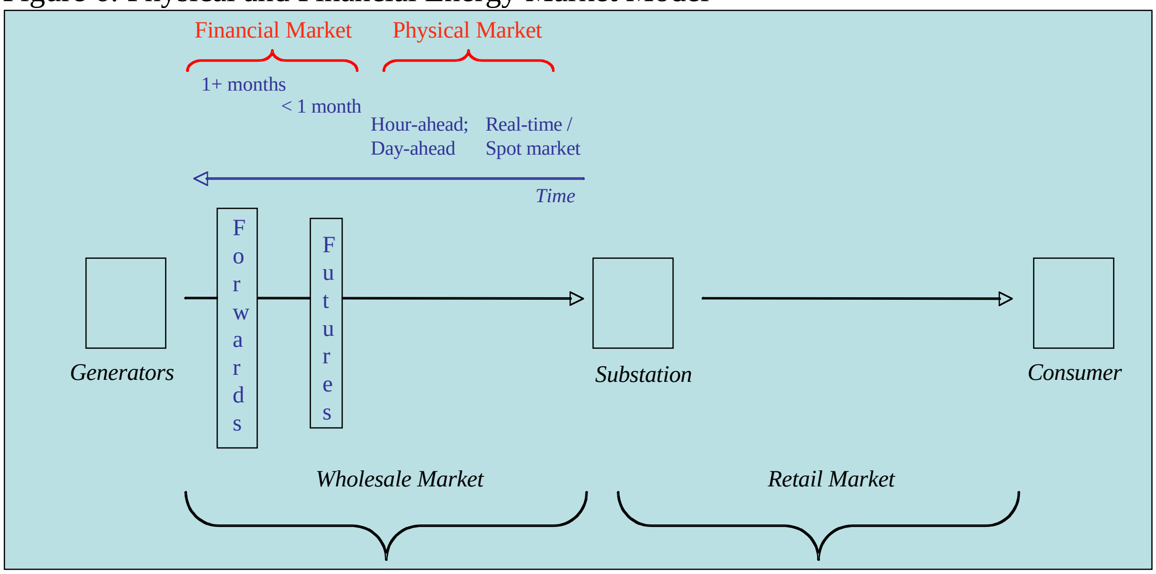
energy contracts also usually promise energy delivery farther off in the future than the futures contracts, i.e. more than one month away. (46, p. 2)

Retail Market

Finally, there is the retail market. This is where the retailer/distributor sells the energy to the final consumer. This might be a private resident, a large corporation, a public agency, etc.

Superimposing the above market onto the industrial picture yields the following physical/financial energy model:

Figure 6: Physical and Financial Energy Market Model



Gas Market

The gas market is reasonably different from the electricity market. Gas is traded at various physical and financial hubs, which are just slightly different than the electricity hubs. The author would refer the reader to the Department of Energy's Energy Information Administration (EIA) website, http://www.eia.doe.gov/, for more information.

California's Energy

With this basic understanding of how the industrial and market sides of energy work, one can now examine the Californian energy scene in particular.

California's Energy Sources

California relies on several sources of energy, such as natural gas, nuclear, hydroelectric, (107, p. 3) and thermal (7. p. 8) energy. The primary source by far, however, is natural gas, followed by hydroelectric and nuclear energy. This can be seen in Chart 2 below.

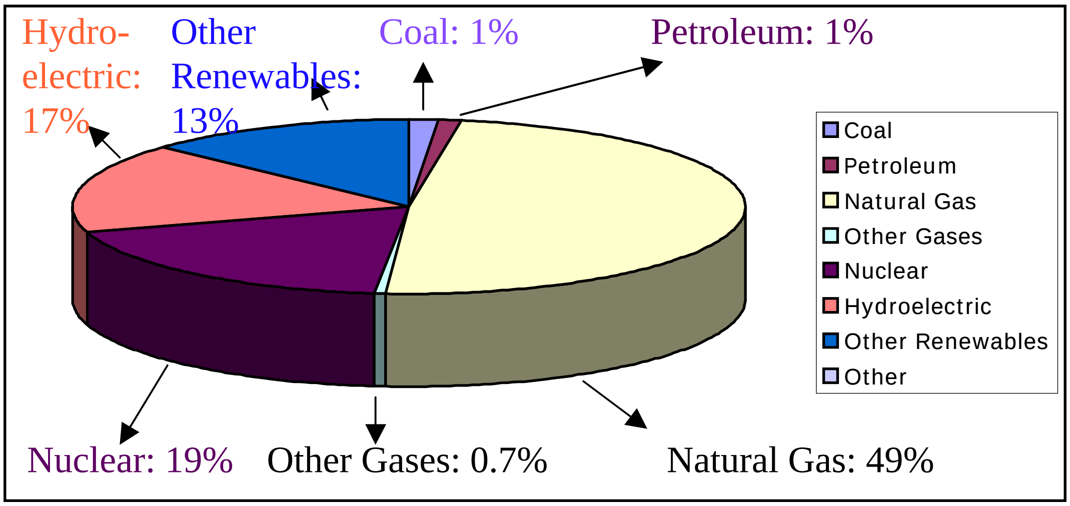


Chart 2: Sources of California's Energy Production, 2002
Source of data for this chart: (107, p. 3)

As can be seen below, this allocation of energy sources is typical for California, and was not isolated to the time period of FERC's investigation:

Energy Source	**MWh, 2002**	**Percentage of 2002 Generation**	***Percentage of 1997 Generation***	***Percentage of 1993 Generation***
Coal	2,327,809	1.3%	*1.3%*	*1.7%*
Petroleum	1,961,066	1.1%	*1.2%*	*1.9%*
Natural Gas	89,624,044	48.7%	*41.1%*	*42.6%*
Other Gases	1,240,053	.7%	*1.7%*	*1.7%*
Nuclear	34,352,340	18.6%	*17.7%*	*16.9%*
Hydroelectric	30,899,631	16.8%	*24.3%*	*21.8%*
Other Renewables	23,680,568	12.9%	*12.6%*	*13.4%*
Other	124,520	.1%	*0%*	*0%*
Total Electric Industry	**184,210,030**	**100%**	***100%***	***100%***

Table 1: Electric Power Generation by Primary Energy Source, California, 2002
Source: (107, p. 3)

California's Electricity Industry

Generation

There are numerous generation plants within the state of California, and the majority of these run on oil or gas, as can be seen in Figure 7 below. There are too many plants to name, but reader should visit the California Public Utility Commission's website at http://www.energy.ca.gov/electricity/#powerplants for a listing all plants (and substations) in the state. These are *large* Excel spreadsheets, so beware.

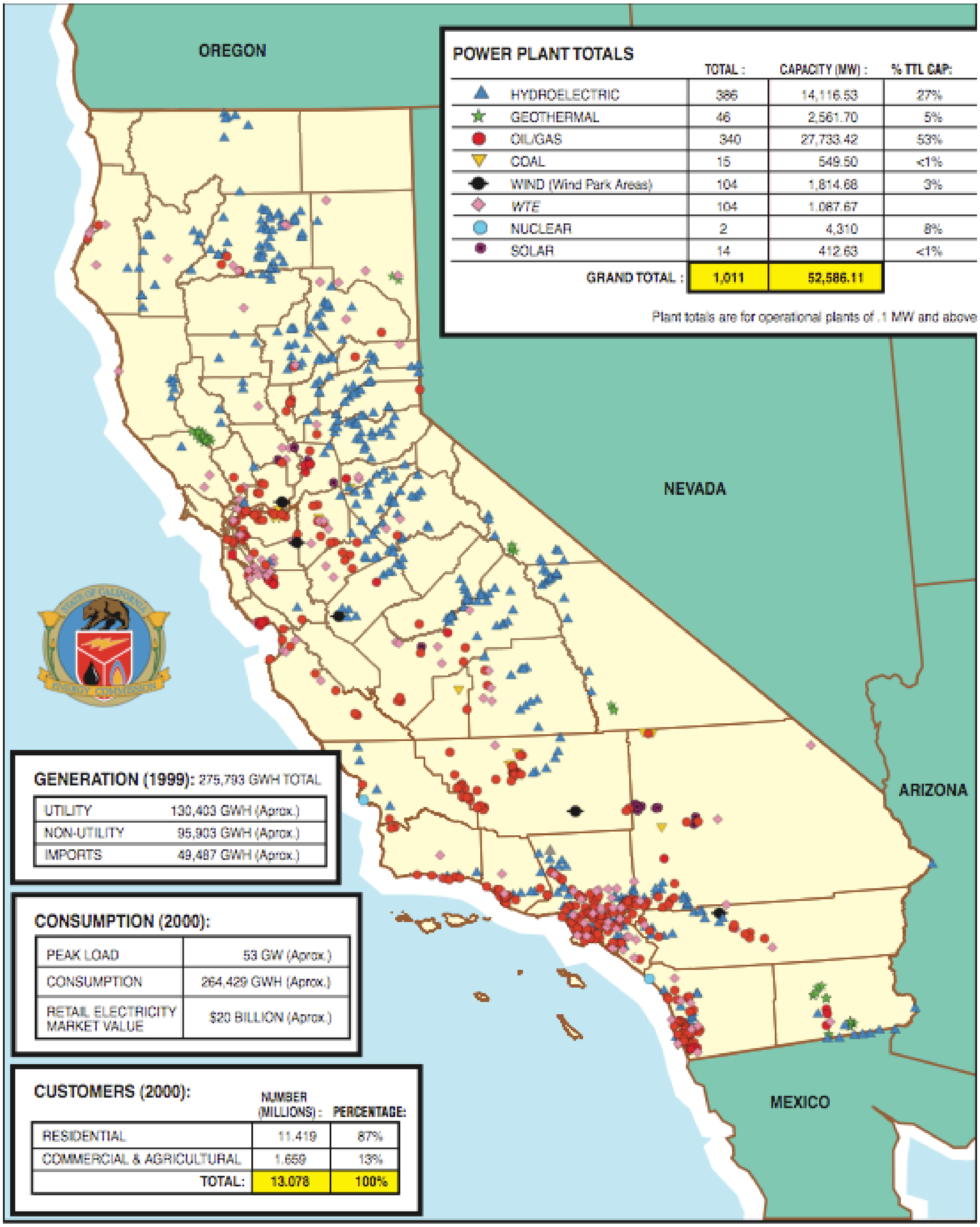


Figure 7: California’s Power Plants, 2004
Source: (123)

Transmission

Due to time constraints, the author did not research California's transmission lines in great detail. The author will note, however, that most of California's transmission lines ran North-South, with some East-West lines appearing in the southeastern part of the state. These lines appeared to have "Path" names, such as Path 15, Path 66, etc.[10] (7, p. 12[11]) A map of the various companies' transmission lines as of 2004 follows.

[10] The larger transmission lines with major congestion during California's energy crisis (2000) were Path 66, Path 15, Path 26, and Path 42. (7, p. 12) See the section on Congestion Payments for more information about congestion.

[11] This source shows the most congested paths during California's energy crisis. (7, p. 12)

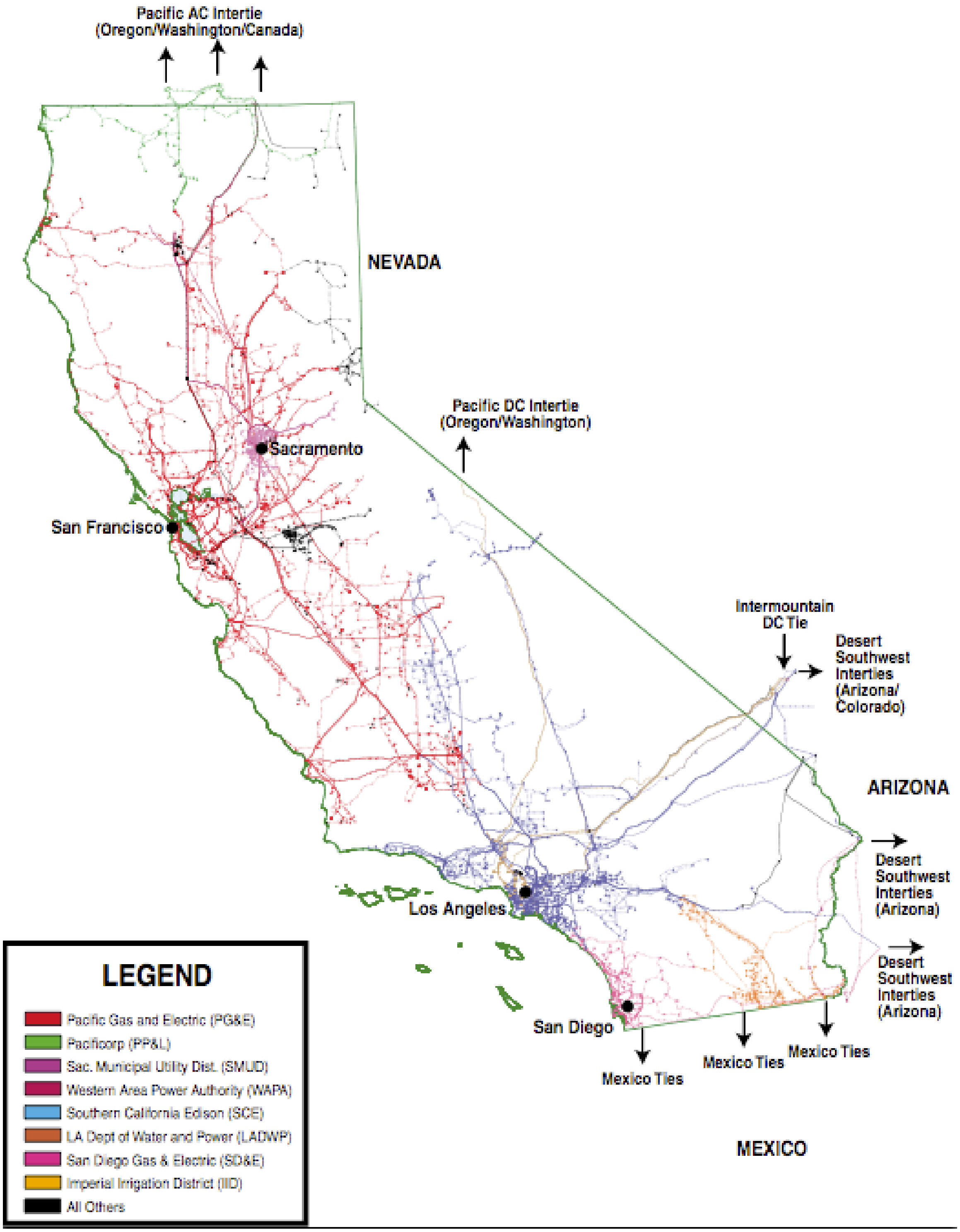


Figure 8: California's Electricity Transmission Lines as of 2004
Source: (124)

California's Electricity Market

California's electricity market was a bit complicated at the time of Enron's demise. This was largely due to the fact that California transitioned from a regulated monopoly structure to a deregulated market structure. The confusion surrounding this switch allowed Enron to manipulate the supply and price of electricity. Hence, this market will be examined in detail next.

California Before Deregulation

As with the rest of the country, California's energy market had originally been a monopoly. (See Appendix E for a history of the electricity and natural gas markets in the United States, to include their regulation and deregulation.) California had two types of monopolies[12]. One type was the privately owned (a.k.a. investor owned or independently owned or IOU) public utility, such as a municipal corporation. This company was regulated at the appropriate level, such as the municipal level. The other type was the publicly owned public utility; this was regulated by CPUC. (99)

By the 1990's, however, this structure came under pressure to change. California was suffering from electricity prices that were significantly higher than in the rest of the nation, resulting in a reduced economic competitiveness, loss of business, and prolonged recession in the state during the early and mid-1990's. (7, p. 2) Some blamed the high prices on the utilities' decision in the 1970's and 1980's to invest in expensive alternative energy sources such as nuclear, independent, and renewable energy. (7, p. 2; 16, p. 2) Seeing the advances in generation technology and (at the time) low natural gas prices, energy consumer advocates thought that California's energy costs could be reduced if energy companies were encouraged (through deregulation) to invest in these cheaper sources. (7, p. 2) The federal government had already passed numerous pieces of legislation encouraging / requiring energy markets across the nation to deregulate. (See Appendix E for more information.) Deregulation appeared, moreover, to be a low-risk option. The Western United States (including California) had a significant overcapacity in electricity at the time, so it was believed that competition could easily be introduced into the market. (7, p. 2) California state legislators jumped on the bandwagon, and advocated deregulation of California's market, in the hopes that this would be more efficient than the old monopoly structure. (99)

California's Electricity Market Deregulation: AB1890, 1996

On September 23, 1996, California Governor Pete Wilson began the deregulation of his state's electricity market by signing Assembly Bill 1890 (AB1890). (15, p. 83) The many provisions of this bill were to take effect on March 31, 1998. These changes will be evaluated here based on their effects on the industry and on the marketplace.

[12] AB 1890 appears to also refer to these former monopolies as "electrical corporations."

Changes to the Electricity Industry

Before California began its deregulation, its energy industry operated as a monopoly, just like the rest of the nation used to. This meant that the generators, transmission lines, substations, and distribution lines were all owned and run by monopolistic utility companies. One and only one monopoly would service a given geographic region, and it was responsible for meeting the energy demands of that region. Once the winds of deregulatory change began to blow, however, California completely changed this structure.

Generators

AB1890 required the utilities to sell many of their fossil fuel generating stations, loosening the utilities' hold on the vertical market. (7, p. 2) As a result, the three public utilities sold all of their gas-fired generators (7, p. 14) and most (if not all) of their oil-fired plants to other companies. (19, p. VI-16) These new owners were commonly called non-utility generation owners (NUGs) (19, p. VI-16). The chart below shows what percentage of California's generation these NUGs accounted for, and which companies owned them. Importantly, these other companies had no obligation to serve a particular territory, since they did not fit the old monopolistic "serve thy area" paradigm. That meant that they could compete for any area, in keeping with the spirit of competition. However, it also meant that they had no obligation, moral or otherwise, to meet any one area's energy needs; they only needed to make a profit to survive. (19, p. VI-16-17) As can be seen later, this profit-driven approach can lead to actions, which feed company profit, but ignore consumer needs.

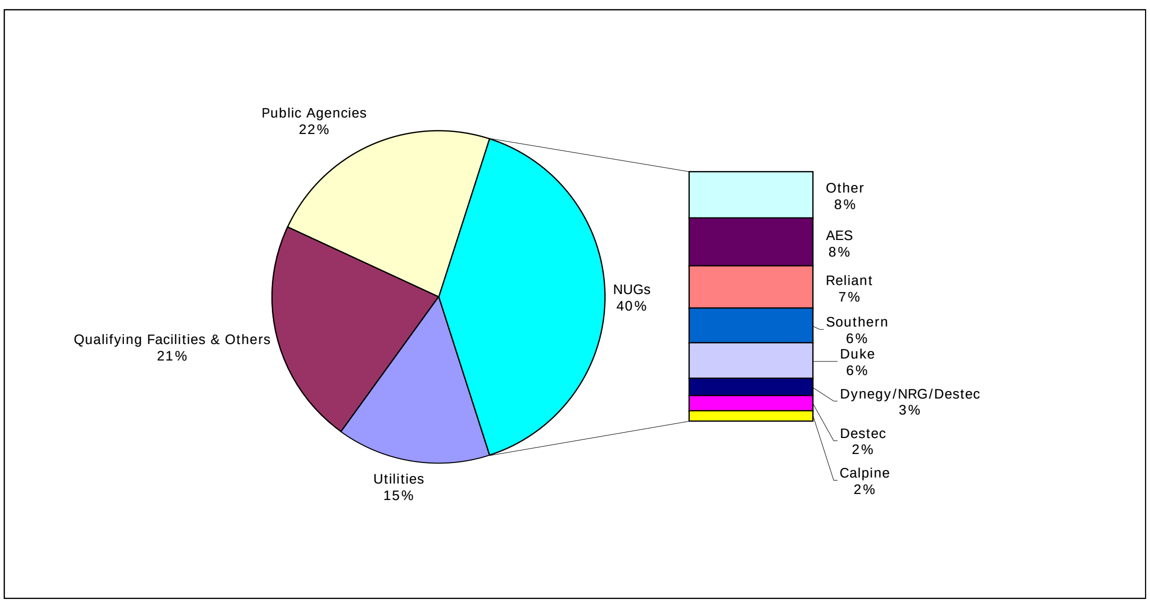


Chart 3: California's Generation Ownership after Deregulation (ca. 2000)
Source: (7, p. 16)

Transmission Lines

Although independently-operated utilities (IOU's) used to own and run their own transmission lines, AB1890 created an entity known as the Independent System Operator, or ISO, and endowed it with the responsibility of managing the state's transmission lines. The IOUs that had previously owned and run these lines still *owned* them; now, the ISO simply *ran* them. This arrangement ensured that the ISO could provide fair and impartial access to the transmission system. (15, p. 83) It also allowed the ISO to ensure that only as much power as a transmission line could handle was actually scheduled to traverse it. (95) This latter point will discussed in greater detail under "Congestion Payments."

Distribution Lines

Distribution lines remained in the hands of the old, monopolistic utility companies, and under the regulation of the CPUC. (99)

These changes are reflected in Figure 8 below.

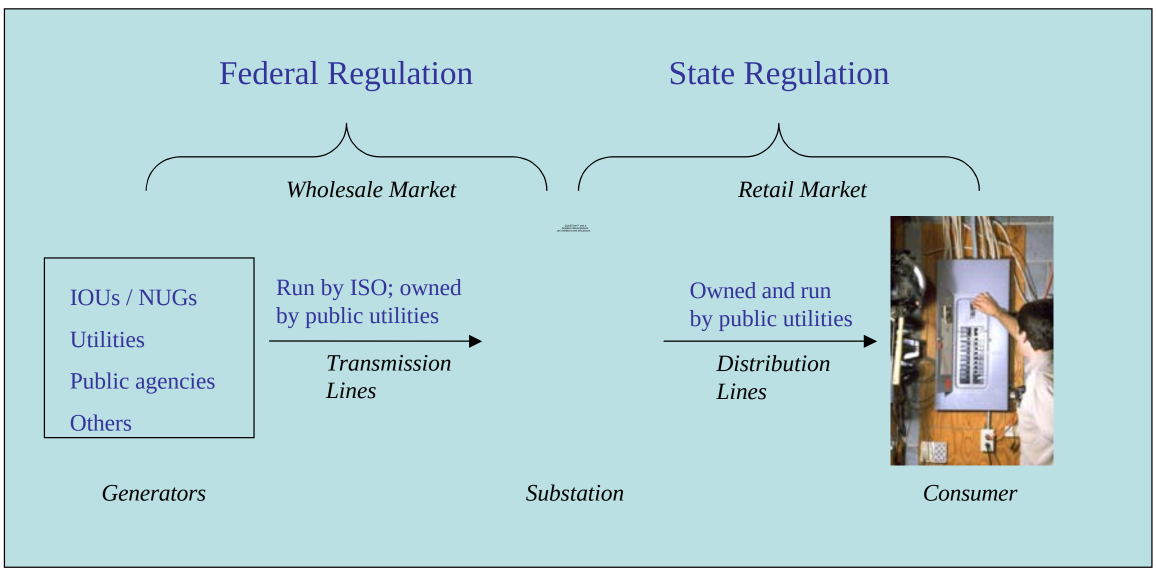


Figure 9: California's Electricity Industry Model
Source for Generator information: 7, p. 16.

Changes to the Electricity Market

AB1890 affected both the wholesale and retail sides of the electricity market. These will be discussed separately.

Wholesale Market

The reader will recall that the wholesale market encompassed the left side of Figure 8, and consisted of the *physical* and *financial* markets. Before deregulation, the monopolies owned the entire wholesale side of the equation, because it owned the entire market. After deregulation, various entities owned various parts of the physical side. The financial side remained basically untouched by deregulation, and so continued to contain the futures and forward market. The new market structure looked like Figure 9, and is described here in Figure 10.

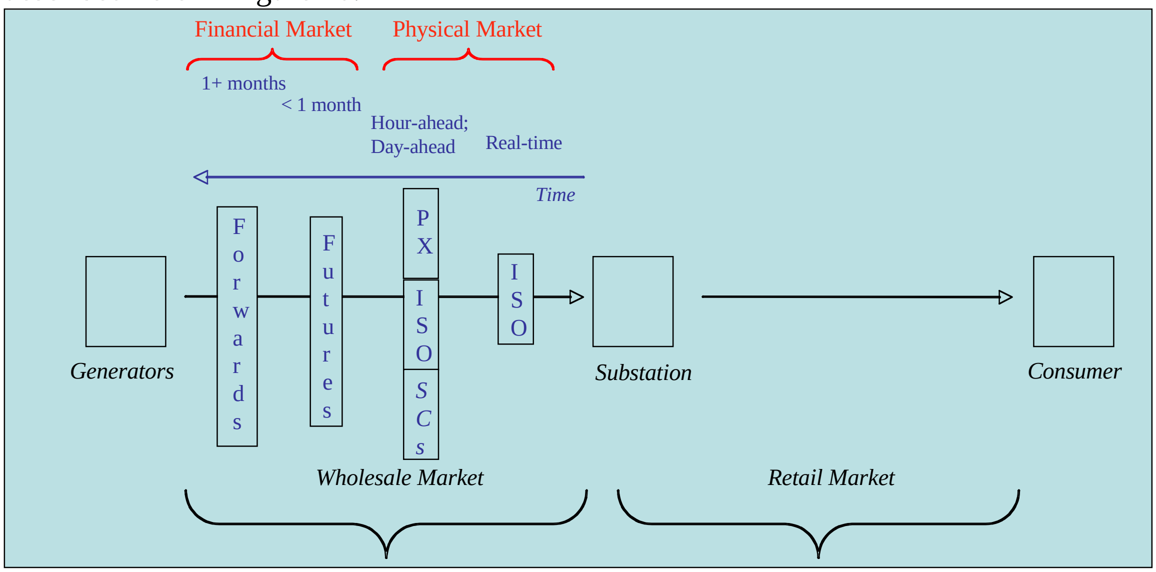


Figure 10: California's Physical and Financial Electricity Market Model

Physical Market

The reader will recall that a physical market is a marketplace where energy is bought and sold for actual delivery. Technically speaking, a physical market consists of only a real-time or "spot" market, which are real or virtual places where commodities (physical substances) are bought and sold for cash and immediate delivery. (94) AB1890 (and FERC, during its investigation) defined California's energy spot market a bit more broadly, however, to include both the real-time and near-real-time sales through the ISO and PX markets, respectively. (15, p. 77) The author has elected to use this same definition of a physical market, for the purposes of this paper.

AB1890's provisions had several repercussions for the physical market. The most important outcome stemmed from the fact that the old monopolistic utilities no longer owned the entire supply chain; now independent companies owned several generators. This meant that a new market structure needed to be established between these two entities (the generators and the retail suppliers/utilities), to allow them to sell to and buy from each other freely. No such marketplace had existed or even been necessary under the old monopolistic scheme – why would a utility need a market to buy, transmit, or distribute its own power over its own lines to its own consumers? AB1890 provided this missing structure by creating the California independent system operator (Cal-ISO) and power exchange (Cal PX). These were to run California's real-time and near-real-time markets, respectively, starting on March 31, 1998 (15, p. 83).

This new market structure also spurred the creation of other entities, such as scheduling coordinators (SCs), to help the new mechanism run smoothly. Each of these entities is discussed below.

PX

Day-Ahead and Hour-Ahead Markets

Per AB1890's set-up, the PX was a state-chartered, non-profit entity that managed California's near-real-time energy markets, namely the day-ahead and hour-ahead markets[13]. It was subject to state oversight. (99, Points 335-340; also Article 4) In the day-ahead market, the PX established the market price for energy that would actually be delivered one day later. In the hour-ahead market, the PX established the market price for energy that would actually be delivered one hour later. (15, p. 77) Operationally, this meant that the PX would accept requests (from retailers/distributors) to buy a given quantities of electricity at a given price. It would then examine requests/bids (from generators) to sell energy at a certain price. The PX would then pick the lowest sales bid until it had enough supply to meet demand. (15, p. 84) All prices were publicly available.

The PX made revenue from its transactions, and so appears to have been a self-supporting, solvent entity. (99, point 367, (a) (5) (c).) This money came from a charge it levied against all power bought/sold through it. (101)

Utilities Required to Use PX

In theory, any generator or marketer could sell on this market, not just California companies. In practice, of course, a company would buy/sell here only if the PX price were worthwhile. (101) AB1890 skewed this normal market dynamic by requiring the old monopolistic utilities[14] to buy all of their needed electricity through the PX during AB1890's 4-year transition period. This was done to increase participation and liquidity in the wholesale market. (15, pp. 83, 84; 19, p. VI-4)

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[13] The reader might ask why it was necessary to have a day-ahead and hour-ahead market. Recall that electricity cannot be readily stored. Therefore it was necessary to price and schedule energy in advance of its actual delivery.

[14] These old monopolies were California's three largest independently-operated utilities (IOUs), namely Pacific Gas & Electric (PG&E), Southern California Edison (Edison), and San Diego Gas & Electric (SDG&E). (19, p. VI-20-21).

Some claim that this forced arrangement prohibited the utilities from taking advantage of the forward/futures markets and the price-security those markets offered. (7, p. 4. Also, 13.) Others note that there were merely economic, not regulatory, disincentives for the old monopolies to participate in the financial markets. (101)

ISO

The ISO was a state-chartered, non-profit entity that was responsible for California's real-time market, ancillary services market, congestion market, (15, p. 77) and, as mentioned before, the state's transmission grid. It, too, was subject to state oversight (99, SECTION 1. (c). Also Points 335-340. Also Article 3.) ISO's costs were covered by charging entities for access to the state's transmission grid. These charges were utility-specific. (99)

Real-Time Market

In the real-time market, the ISO established the market price for energy that would be sold, bought, and delivered *right now*. Logically, this market should only have been activated if the real-time market were imbalanced – i.e. if actual demand exceeded scheduled supply, or vice-versa. If this situation arose, and if there were insufficient bids in the ISO to make up for this shortfall, the ISO had the right to purchase *out-of-state* energy for any price. This out-of-state price, however, did not affect the price paid to other (in-state) generators. (17, p. 4. 19, VI-17 is even better) This allowance led some marketers to withhold Californian energy on the PX market (thereby creating a shortage in the real-time market) and then sell out-of-state energy to California at a higher price on the ISO market. This will prove significant later, under the "Energy Export" section of the "FERC's Investigation of Enron" half of this paper.

Ancillary Market

The ISO also ran the ancillary market (15, p. 77), which was primarily responsible for holding production capacity in reserve, in case the ISO suddenly needed more energy in the real-time market. (19, p. VI-31) Note that the same generators that provide regular energy also provide this back-up energy. This means that an ancillary agreement may force a generator unit to sit idle during regular production, so it can actually deliver the reserve energy if needed. (81, pp 1-3) Sometimes this is referred to as "firm energy," because orders for firm energy include ancillary services. (3, p. 7)

Congestion Market

The ISO further ran the congestion market. Here, the ISO would pay generators money *not* to send scheduled energy along a transmission line, should the ISO suddenly discover, in real-time, that it was attempting to send more energy across a line than the line could physically carry. By way of explanation: transmission lines are usually able to carry only so much energy, and that amount varies from line to line. An overloaded transmission line can heat up, sag, and then possibly hit something (like a tree branch or the ground). When it touches something, it will transmit its energy to that object, thereby shorting the line. If the transmission system is smartly organized, this will merely cause that particular line to short, as it would be immediately cut off from the rest of the system. If the system is poorly organized, this situation could cause a blackout through an entire sector. Apparently, just such an overload/short caused California's first blackout during its "energy crisis" of 2000/2001. (101)

"Congestion" occurs when more energy is passed over a line than that line can handle. The congestion payment was the money the ISO would pay generators not to send already scheduled energy over a now-congested line. The amount of the payment was determined on a daily basis as follows. Power generators submitted voluntary bids for how much money they would require to reduce their scheduled energy output, should the ISO ask them to. The ISO then used these bids to calculate a congestion cost/price for the various transmission lines. (15, p. 75-77)

Note that this kind of congestion payment was not necessary under the old monopoly system. There, the utility simply did not send any extra energy - its own energy - over a congested line. Now that the utility/ISO no longer necessarily owned the energy it was transmitting, it needed to be ready to reimburse the generator/marketer/etc. for any scheduled but unsent energy. (15, p. 73)

Regulation of the PX and ISO

To ensure their independence from the old monopolistic utilities, AB1890 placed the PX and ISO outside of the utilities' control. (15, p. 83) The PX and ISO appeared to be now under state *and* federal control: although both were created by the California state government, and hence were beholden to state regulations, they were still subject to FERC oversight. This can be seen by the fact that FERC approved the ISO's creation in October 1997, and the fact that FERC regulated the PX. (15, p. 83) The author posits that this dual-control arrangement might have come about because the ISO and PX linked the wholesale market (which falls under federal authority) to the retail market (which falls under state authority).

SC's

Now, how did the ISO know how much energy would traverse its transmission lines, so it could avoid congestion problems, etc.? This is where the Scheduling Coordinators (SCs) came in. The SCs were private entities that helped the ISO decide how much energy to transmit on a given day. They did this by submitting to the ISO a balanced schedule of expected demand and corresponding supply for their constituents for a given day[15]. All uses of the ISO grid, in fact, had to be scheduled through an SC. (32, p. 28. Also, 101) Their constituents were those distributors/retailers and generators whom they represented on the market, for a fee. For instance, a distributor/retailer would let an SC have access to its historical metering data, and pay the SC to estimate how much demand for electricity (aka "load") that distributor would typically need to meet during a given season, month, day, etc. (32, pp. 36, 41-46/UDC&ESP, 63, 69-70) Similarly, a generator would send its SC information about how much energy it could provide for a given time period, and it would pay the SC to sell enough of the generator's energy to meet the SC's (i.e. their distributors) known demand. (95)

There were numerous SC's in California – 108 in early 2001, to be precise. (96) (See Appendix D for a full list of the SCs that operated in California in February 2001.) The PX was the largest (19, p. VI-4) and a very powerful SC, as it ran the schedules for the three public utilities[16] (19, p. VI-20). Many generators and utilities were also SCs. (101)

The day before energy was to be delivered to customers in California, each SC would estimate how much energy (load) its constituent distributors would need that next day. The SC would also estimate how much supply (generation) would be available to meet that need. The SC would then balance these two estimates, so that the estimated supply equaled the estimated demand, and submit them together as one "schedule" to the ISO for approval. (This was done because the ISO required all SCs to submit balanced schedules. (19, p. VI-5)) The SC would also inform the ISO of which transmission grid would be used to transport the energy. (34, p. 14) The ISO would check that the schedule was balanced and that the proposed energy supply would not overload the proposed transmission lines, and would then approve or modify the schedule as needed. (95) The ISO would also establish the day-ahead congestion charge, as discussed earlier. (19, p.VI-5)

Financial Market

Deregulation had no effect on California's financial market for energy. California continued to use the national futures and forwards markets, just as it had before, and just like other states.

It is perhaps worth noting that electricity forwards were traded at the following "locations"[17] in the Western U.S.: SP15, NP15, COB, Mid-Columbia, and Palo Verde.[18] (19, p. V-8)

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[15] *Only* SCs could submit a schedule to the ISO for day-ahead sales/purchases. (101)

[16] On December 15, 2000, FERC lifted its requirement that utilities sell their generation on the California PX market. (19, p. VI-22) That PX subsequently ceased operations in January 2001. (19, p. VI-5) It is not clear to the author how the Californian energy market worked after that, or what effect this had on the California ISO or SC's.

[17] Presumably "location" means the same thing as a trading "hub" in this context.

Retail Market

One of AB1890's most important changes was that it allowed customers to choose their electricity provider, rather than being forced to use their local utility. This would supposedly provide free-market competition. This deregulation was to happen gradually, however, as retail prices were to be capped and regulated by the CPUC through 2002. (7, p. 2. Also, 15, p. 83, but this does not mention that caps were to be regulated.)

The retail price cap was a complicated matter. One fall-out of AB1890's requirement that the old utilities sell many of their generators was that the utilities needed to recoup their initial investment from when they had built and improved the state's power facilities. Californian legislators did not want the average customer to bear this burden, so they placed a cap on retail prices for customers who purchased their energy through the PX. (99, point 367 (e) (2).) This cap froze retail rates at their June 10, 1996 level, and was to last for a 4-year transition period of March 31, 1998 – March 31, 2002. (15, p. 83) Since the utilities could not recoup their "stranded costs" from their customers, AB1890 allowed them to sell rate reduction bonds[19] instead. (99)

The reader will recall that nearly half of California's electricity came from burning natural gas, and that some camps believed that the higher price in natural gas spurred the higher price in electricity during California's energy crisis. Hence, it is worthwhile to cast a brief glance at California's natural gas industry. This is done below.

California's Natural Gas Industry

For natural gas, California leans heavily on the Southwest. In 2000, 85% of California's natural gas supplies came from out-of-state, and 15% came from in-state. (108) A fuller breakdown is shown in Chart 4 below.

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[18] Presumably any these trades could be conducted on EnronOnline, which will be discussed under the section on Enron.

[19] AB 1890 defined rate reduction bonds as "bonds, notes, certificates of participation or beneficial interest, or other evidences of indebtedness or ownership, issued pursuant to an executed indenture or other agreement of a financing entity, the proceeds of which are used to provide, recover, finance, or refinance transition costs and to acquire transition property and that are secured by or payable from transition property. (99)

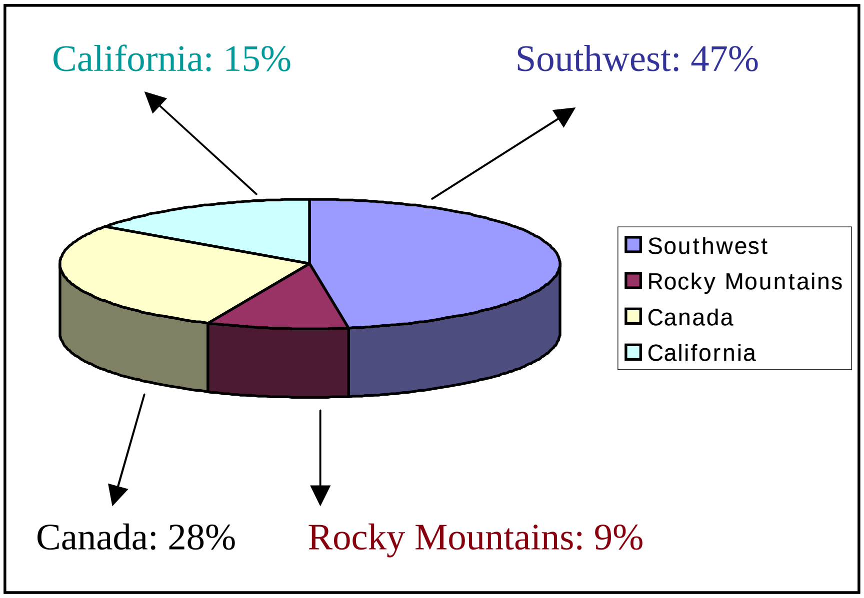

Chart 4: Sources of California's Natural Gas, ca. 2001
Source: (108)

The major interstate gas pipelines serving southern California came from the following locations and belonged to the following companies (19, p. I-13 for company names; 108 for locations):

a) Southwest (47%)
   a. El Paso Natural Gas Company
   b. Transwestern Pipeline Company
b) Rocky Mountains (9%)
   a. Kern River
c) Canada (28%)
   a. PG&E

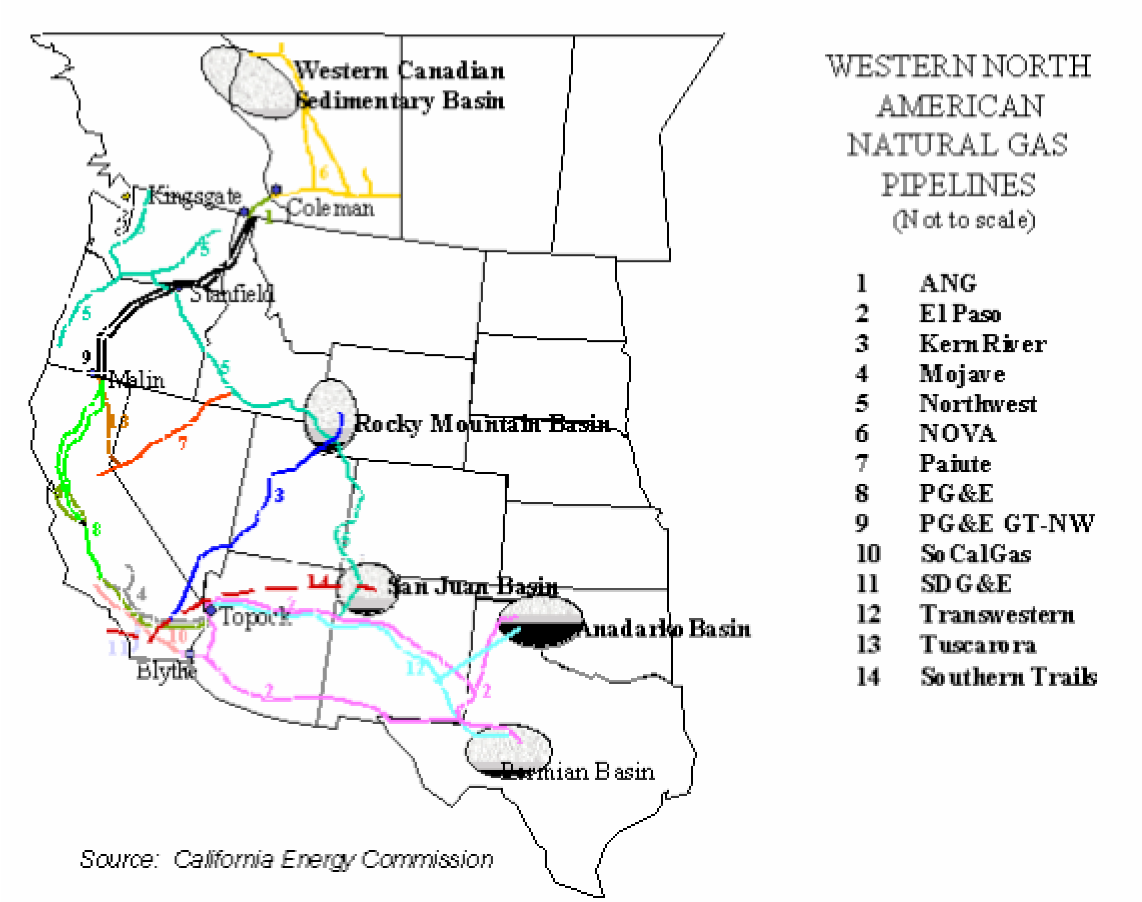

Figure 11: California's Out-of-State Gas Supplies and Interconnected Pipeline Network
Source: (108)

California has numerous gas wells, so these will not be listed in this paper. The interested reader can visit the California Energy Commission's website at http://www.energy.ca.gov/oil/statistics/producing_wells_by_county.html for a full listing.

California's Natural Gas Market

Gas did not appear to be traded on the PX or ISO, as far as the author can tell. Gas was, however, traded on EOL in the physical market (19, p. II-13).

According to FERC's Staff Report, some of the major "locations"[20] where Enron traded physical gas (day-ahead gas, specifically) in the Western U.S. were: SoCal Topock (Southern California Topock), EPNG (unknown acronym), PG&E Ctygte (probably PG&E Citygate), Opal, PGT Malin (unknown acronym), PG&E Ctygte Pool, and EPNG SoCal Ehrenberg. (19, p. II-14) Outside of the West, Enron also engaged in physical gas trades at the Henry Hub in Louisiana. (19, p. VIII-3)

[20] Probably trading "hubs" are meant here.

Also according to FERC's Staff Report, forward gas contracts were traded at the following "locations,"[21] which correspond roughly to their cousin locations for forward electricity trading:

Electricity Forward Trading Hub	Gas Forward Trading Hub
SP15	Topock
NP15	Malin
COB	Malin
Mid-Columbia	Sumas
Palo Verde	Permian

Table 2: California's Gas and Electricity Forward Trading Hubs
Source: (19, p. V-8)

The reader is referred to the California Public Utility Commission's (CPUC's) and Department of Energy's Energy Information Administration (EIA) websites for more information.

Enron

So, how did Enron fit into this picture? And what was "Enron," anyway?

Enron the Corporation

Enron was involved in many business ventures, as can be seen below. It was primarily known, however, for its gas and electric industry and energy marketing. Enron was originally founded out of three other companies in 1930, took the name of Northern Natural Gas Company, and placed its headquarters in Omaha, Nebraska. In 1986, it adopted the current name of "Enron Corporation," and consolidated its headquarters in Houston. (48, pp. 1-3) Enron conducted its business operations through its subsidiaries and affiliates, which were engaged in the following (47, p. 1-2):

- Transport of natural gas through pipelines throughout the U.S. One example would be the Transwestern Pipeline Company, an Enron affiliate that transported natural gas from West Texas, Oklahoma, New Mexico, and the San Juan Basin in New Mexico/Colorado to California. (47, p. 1-2)
- Generation, transmission, and distribution of electricity to the Northwest U.S. For example, Enron purchased Portland General Electric Company (PGE), a utility in Oregon with generation transmission, and distribution capabilities, in 1996. (47, p. 1; 48, p. 4; & 47, p. 2)
- Marketing of natural gas and electricity, and related risk management services, worldwide. (47, p. 1-2)

[21] Presumably "location" means the same thing as a trading "hub" in this instance.

- Development, acquisition, construction, and operation of power plants and pipelines worldwide. (47, p. 1-2)
- Development of intellectual network platforms. (47, p. 1-2)
- Retail sales of natural gas and electricity to the residential and commercial sectors. (47, p. 3)
- Consulting services for smaller utilities. For example, acted as several utilities' scheduling coordinator (for a fee), once deregulation made that market so complex. (19, pp. VI-37-39)
- Creation of EnronOnline for forward energy trading. (1999) (48, p. 5; 47, p. 2; 46, p. 2, 49b)

Enron's divisions (which presumably contained its subsidiaries[22]) were as follows (36, p. 3):

- Enron Networks
- EnronOnline (EOL)
- Enron North America
- Enron Power Marketing, Inc. (EPMI)
- Enron Gas Marketing
- Enron Generation
- Enron Energy Services
- Enron Broadband
- Enron Transportation Services

Enron in California

Enron was a presence in the Californian energy market by the time of the latter's deregulation in 1998. (48, p. 5) In fact, Enron Board Chairman / CEO Kenneth Lay had been a big proponent of that deregulation. (48, p. 4) By the time of its demise in 2001, Enron played four roles in the Californian energy market: as a generator, forward marketplace owner, SC, and marketer. These roles are highlighted in red in Figure 12 below.

[22] Author's observation.

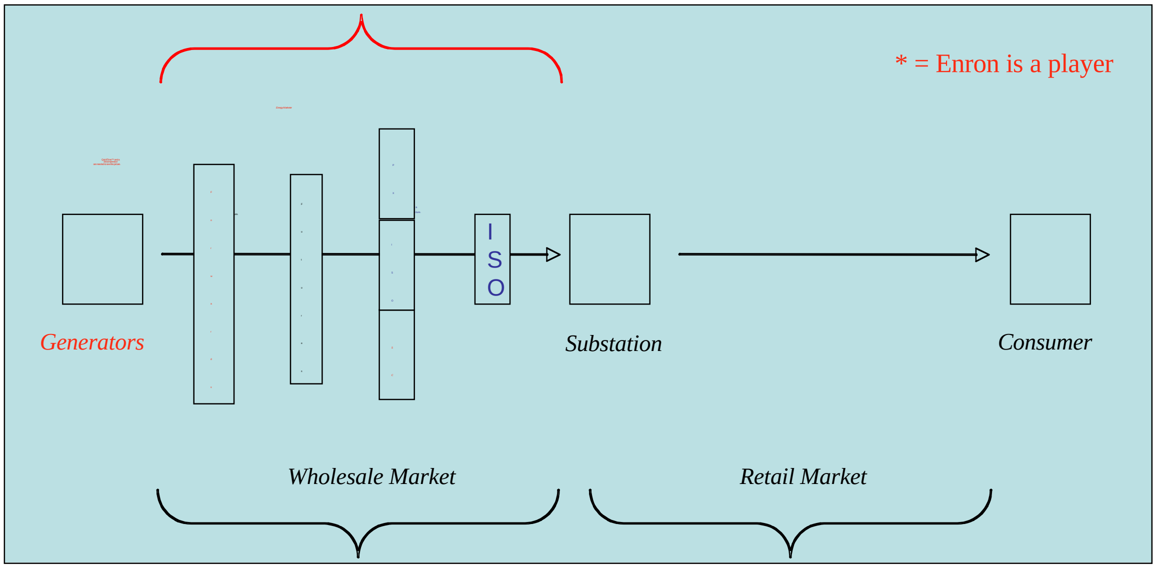

Figure 12: Enron's Role in California's Deregulated Energy Market

Enron as Generator

Enron did not own many physical assets (101), but it did own at least one generator[23] – the production plant(s) associated with Portland General Electric Company (PGE) (47, p. 2), a utility that Enron had bought in 1996. (48, p. 4) Although Portland General was located in Oregon, it gave Enron good access to the Californian market because of its transmission lines (48, p. 4).

Enron as Forward Marketplace Owner (EOL)

Enron held a powerful position in the nation-wide forward energy market - which clearly included the Californian forward market - through its founding of EnronOnline (EOL). EOL was an Internet platform that allowed online trading of gas and electric physical and forward sales[24]. EOL was actually run by Enron Networks, Inc., an Enron subsidiary.

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[23] Enron likely owned more than one generator. (101, plus personal observation) The author was able to identify only Portland General, however.

[24] EOL's role in *physical and financial, gas and electricity sales was deduced from statements in FERC's Staff Report that indicate that* many wash trades (to be defined later) occurred on EOL. These wash trades included physical and financial sales in the gas and electric markets. (19, VII-7-8) This was also deduced from FERC's reporting that Enron marketers had attempted to manipulate next-day, physical gas prices on EOL (at the Henry Hub trading center) in order to make a profit on the financial gas market. (19, IX-14, 25) Having established this, EOL's "physical market" was then more narrowly defined to mean the day-ahead market, per a conversation with an energy policy expert. (49) As far as the author can tell, EOL's physical electricity sales would not have taken place on the California PX, as the PX did not appear to use EOL (49). Rather, EOL's physical electricity sales may have encompassed sales at hubs *outside* of California. EOL was, after all, a platform used by the entire Western energy market (49). The

(36, p. 3) Before EOL, forward energy deals had been struck via telephone, fax, etc. (36, p. 3) With the growth of the Internet, however, several online trading platforms appeared. EOL was the first of these, and was introduced in 1999 (48, p. 5). It gained popularity amongst the traders because it had a simple interface and it was quick, free, and easy to use. (19, p. IX-32 & 36, p. 11 (free)) It proved to be a boon to Enron, because it reduced Enron's transaction costs, increased its traders' productivity, and decreased trade transaction times. (36, p. 12) Moreover, EOL used a one-to-many structure, which meant that Enron was party to every transaction, as either the buyer or the seller. (36, p. 3-4) Enron would post (on EOL) the price that it was willing to buy or sell energy for; counterparties would then click on that price to accept it and start a deal. This meant that Enron itself could not initiate a deal, only the counterparty would. (19, II, p. 26) Once a deal was completed, EOL did not display many of the sales details, such as final price, volume, or time of sale. This put marketers who had not been party to the transaction at an informational disadvantage, because, of course, Enron marketers had access to that data. This fact will be discussed in greater detail under Information Need 2, Data Request 3.

EOL also provided Enron with access to the out-of-state sales market. (Recall that California imported a significant amount of its energy from out-of-state (49).) One way this would happen was that the ISO would import energy from out-of-state if it could not obtain enough supply in-state during shortages in the real-time market. Since many Western U.S. energy sales were conducted on EOL (49), and since Enron ran EOL (49), this might have provided Enron with a nice information advantage in the out-of-state market[25].

Enron as SC

Enron also acted as an SC in California. (19, p. VI-23) The reader will recall that there were numerous SC's in California, so Enron was only one of many. However, Enron did represent a reasonable number of generators and distributors, and so held some power as an SC. (96)

Enron as Marketer

Finally, Enron acted as a marketer, buying and selling energy for resale or repurchase at all levels (physical and financial) of the wholesale market. In this capacity, as in its SC capacity, Enron never physically took control of the energy; it merely bought and sold it on others' behalf. (101) Although Enron's marketers did not belong to any *one* of Enron's subsidiaries (101), Enron Power Marketing, Inc. (EPMI) does appear to have

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author chose not to draw EOL on the physical side of the energy market diagrams in this paper, however, in an effort to keep the reader's attention focused on internal Californian sales, and also to keep the market model simple.

[25] Author's observation.

acted as one of the company's main marketing arms (19, VI-39). EPMI claimed customers such as El Paso Electric, Valley Electric, Glendale, and Enron Energy Services[26]. (19, pp. VI-39-40) Other possible marketing entities were Enron Energy Services, Inc. and Enron Energy Marketing Corporation. These three marketing companies all appear to have conducted short-term and long-term market services for Enron. This is based on the fact that Enron submitted information for all three of these subsidiaries in its reply to FERC's data request 2 (DR2). (DR2 asked Enron to submit information about its short-term and long-term sales. Enron replied with data from these three subsidiaries.) (38, pp. 1-2, plus personal analysis.)

Enron would sometimes use its power as an SC to facilitate its work as a marketer. (19, p. VI-38) This commingling of duties made it difficult, however, for the author to tell when Enron was acting as an SC and when it was acting as a spot-market marketer[27]. It also made it unclear as to whether Enron's short-term marketing subsidiaries (e.g. EPMI, above) also acted as SCs, in a dual-role. This problem surfaces, for instance, when reading descriptions of the Enron Services Handbook - Enron's guidelines for business practices. According to the Handbook, Enron would build up its "clientele" slowly. Initially, it would typically charge its customers a fee for providing its "consulting services." For example, Enron might charge a customer a certain price per MWh for scheduling energy with the PX. (This sounds like Enron is acting as an SC.) As this relationship matured, Enron would shift its charges from a fee-based structure to an equity-based structure when "marketing" wholesale power. (This sounds like Enron is acting as a marketer.) Here, both Enron and its customer would share the profits from marketing energy. In most instances, Enron used a 50%-50% profit split for its energy marketing services, and a 25%-75% split for the sale of ancillary services (where Enron received 25% of the profit, and the partner received 75%). (19, p. VI-37-38) Regardless of its role, it is easy to see how Enron would benefit from manipulating the PX and ancillary markets to make a profit, if it stood to gain a percentage of the profit made thereby, rather than receiving a simple, flat fee.

What Went Wrong with California's Energy Market?

Now the reader has a complete picture of the Californian energy market during deregulation, and of Enron's role therein. This deregulated structure worked well enough in California for the first two years of deregulation. Wholesale electric prices dropped by nearly 50%. (7, p. 3) (Note: This may in line with CPUC's goal (and practical guarantee) to reduce retail prices by at least 10% by mid-2002. (99) Then something happened in 2000 that turned California's energy world on end, and that drew state and federal regulators' attention to the questionable dealings of power marketers such as Enron. This event was the California energy crisis. Let us examine that now.

[26] The reader should note that Valley Electric and Glendale appear in some of the emails that FERC cited as evidence of Enron's manipulation of the spot market.
[27] Indeed, the difference between an SC and a marketer can be confusing. Some main differences are that a marketer can be an SC, but does not need to be. Also, SCs could buy/sell only on the physical market; marketers could buy/sell on either the physical or the financial markets. (101)

The California Energy Crisis, 2000-2001

In 2000, the energy market went amok in the western United States. (78, p. 7) It seemed to hit California particularly hard, where average wholesale electric prices quadrupled (7, p. 3) and natural gas prices increased six-fold. (7, p. 18) The "safe" cushion of 15% additional generating capacity that most Western states were advised to keep[28] fell to 3.5% in California in the summer of 2000 and 6.8% that winter. (7, p. 4) Rolling blackouts became common throughout the state. The largest utilities declared bankruptcy. (1) The crisis became official when the ISO declared a Stage-2 emergency[29] on May 22, 2000. The crisis did not end until July 3, 2001. (14, p. 1, 2)

So what happened? Many people accused the new power marketers of manipulating the newly deregulated market to their own profit, and to the people's detriment. (11, p. 6) This accusation leads to the topic of the second half of this paper. However, there were other factors at play. These will be mentioned first, to keep the story balanced. Plus, some of these factors' existence allowed Enron to engage in the nefarious practices it was accused of.

Depending upon whose story one chooses to listen to, some of the events that led to California's energy crisis of 2000/2001 had nothing to do with Enron. Some sources point to a simple case of increased demand and reduced supply, complicated by an inefficient financial energy market that could not handle the situation. Other sources accuse Enron of wrongdoing. Let us examine the former faction first.

Increased Demand

On the demand side, the summer / fall of 1999 and the spring / summer of 2000 were unseasonably hot, leading more customers to turn on their air conditioners. This obviously led to a higher demand for electricity to feed those air conditioners. (2, p. 1; 7, p. 8 for summer 2000) Per the laws of simple economics, higher demand leads to higher prices.

Reduced Supply

[28] States are advised to keep a cushion of additional generating capacity, because electricity cannot be stored. Before deregulation, this cushion was at 26% in California; in 2000, it slipped to 3.5% and 6.8%. (7, p 4)
[29] The California ISO issued Stage-1/2/3 Emergency warnings when the state's stand-by generation capacity fell below an acceptable level. Stage 3 was the worst level, and was a sign that the ISO might order blackouts to keep the situation under control. (17, p. 4)

On the supply side, the two greatest sources of wholesale energy, gas and hydroelectricity, were greatly reduced in 2000. Again, simple economics stipulates that lower supply leads to higher prices. What exactly lead to this reduced supply? Several things.

The Western U.S. experienced high temperatures during the summer of 2000. This led to a drought, which reduced the water level at many of the rivers which generate hydroelectricity in the Pacific Northwest. Since California's hydroelectric energy came predominantly from the Northwest, this significantly reduced California's hydro supply. Estimates of this drop vary from 14% (19, p. I-10) to 28% (7, p. 8), when comparing supply levels from 1999 to 2000. Although the drought's effect on California's hydroelectric supply is widely accepted, some argue that it does not explain the contemporaneously high energy costs. For example, the Pacific Northwest (and the Columbia River specifically) suffered from a more severe drought in 1994, yet Californian electric prices did not rise as dramatically then as in 2000/2001[30]. So the true effect of the drought is difficult to gauge.

To offset this shortfall in hydroelectric energy, gas plants attempted to produce more energy. This ironically tended to drive gas prices up. (108) At the same time, as luck would have it, both the nation and California experienced a shortage of natural gas. California's shortage appeared to be more acute, however. As noted earlier, short supply leads to higher prices. Nationwide, gas prices increased three-fold; in California, gas prices increased six-fold. (7, p. 18) One possible reason for California's extreme shortage was an August 2002 rupture at one of the main gas pipelines into southern California, namely the El Paso Natural Gas Company's (El Paso's) pipeline in southeast New Mexico. (19, p. I-13) Since natural gas fuels many electricity plants, this would have had an obvious effect on electric prices as well.[31] (19, p. I-13) On the other hand, there have been accusations that the El Paso Company, which owned one of the major gas pipelines into southern California, engaged in anticompetitive activities, thus driving prices up. There is also evidence that California had extra capacity along other pipelines, and so should not have experienced a shortage. (108) The reader can see why FERC suspected a manipulation of the gas market as well as the electricity market, based on these observations.

Some thermal plants also tried to fill in the gap left by the Northwest's lower hydroelectric output. As part of this effort, many thermal plants deferred their normal spring maintenance in 2000. As the drought continued through the summer, however, the plants continued to delay maintenance, until they simply started breaking down. This, then, led to a decrease in thermal production. (7, p. 8-10)

Some cite the lack of construction of new generation plants as a third problem, such that the increased demand of 2000/2001 hit a soft supply. One reason for this was that

[30] This is used as an argument that gas and electric prices were being manipulated instead. (14, p. 2 and 10-15)
[31] However, that outage lasted only two weeks, so it is difficult to gauge its true effect. (19, p. I-13)

California had stringent regulations on the building of new power plants, which tended to discourage new construction. Case in point: there were at least 11 regulatory bodies (7, pp. 53-54), and their rules were continually changing (7, p. 14). Such roadblocks lead to unusually long waiting periods for permits to construct new power facilities. For instance, the average permit time was 20 months in California, but only 7 months in Texas. (7, pp. 14-16) This situation led to the dubbing of many fond acronyms in California, such as "NIMBY" (not in my backyard), "BANANAS" (build absolutely nothing anywhere near anyone), and "NOPE" (not on planet earth). (7, p. 53)

Some claim that this lack of new production helped ensure that there were insufficient resources to produce the extra energy needed during the crisis. (1, p. 1) Others dispute that, noting that 1) the existing generators were not working at capacity during the crisis, and 2) the cited reason for this low generation, namely that the plants were old, was not valid. (52, pp. 2-4, 9/18/02, 14, p. 16-17)

Effect on the Utilities

Someone had to feel the pinch here. Looking at the diagram below, one can clearly see that the increased demand and reduced supply hit the middleman (the utility companies) squarely between the eyes. The middleman had to pay more to buy gas in the wholesale market, due to energy shortages. At the time, the wholesale market had no price caps, as it had been stable for years. In 1999, one year before the energy crisis, the average price was $32/MWh. (79) By June 2000[32], however, the price of energy on the PX market had skyrocketed to $1,099/MWh. (78, p. 1) To pay these higher purchasing costs, the middleman needed to charge higher prices to his customers in the retail market. However, AB1890 had put a four-year price cap of $55/MWh on the retail market[33]. (79) So those prices could not move. The utility company middleman had to recoup his losses. Since he couldn't do this by adjusting his retail prices, he did it by reducing retail service. (7, p. 1) Hence the rolling brownouts and blackouts of the time. Even that was not enough, though, in the end; several utilities simply declared bankruptcy. (7, p. 1)

Price Caps

Obviously, a state cannot see its citizens go without electricity. Therefore, the state of California stepped in to help the utilities out. California imposed a series of peak-hour price caps on the wholesale ISO market during the summer of 2000. (See Figure 13 below.) These ranged from $750/MWh in June to $500/MWh in July to $250/MWh in August. Note that these caps applied only to in-state ISO purchases – not to out-of-state ISO purchases. (7, p 14, 18) Theoretically, this should have helped the utilities out. In

[32] This was the PX day-ahead price on NP15 on June 28, 2000. (78 p. 1)

[33] This had been done in the belief that the wholesale prices would not rise above their traditionally stable price of less than $50/MWh. So retail prices could reasonably be capped at $55/MWh. (79)

practice, however (and as will be seen later), these price caps had the unintended effect of driving energy sales during peak hours to the out-of-state market, where there was no price cap. (17, p. 4)

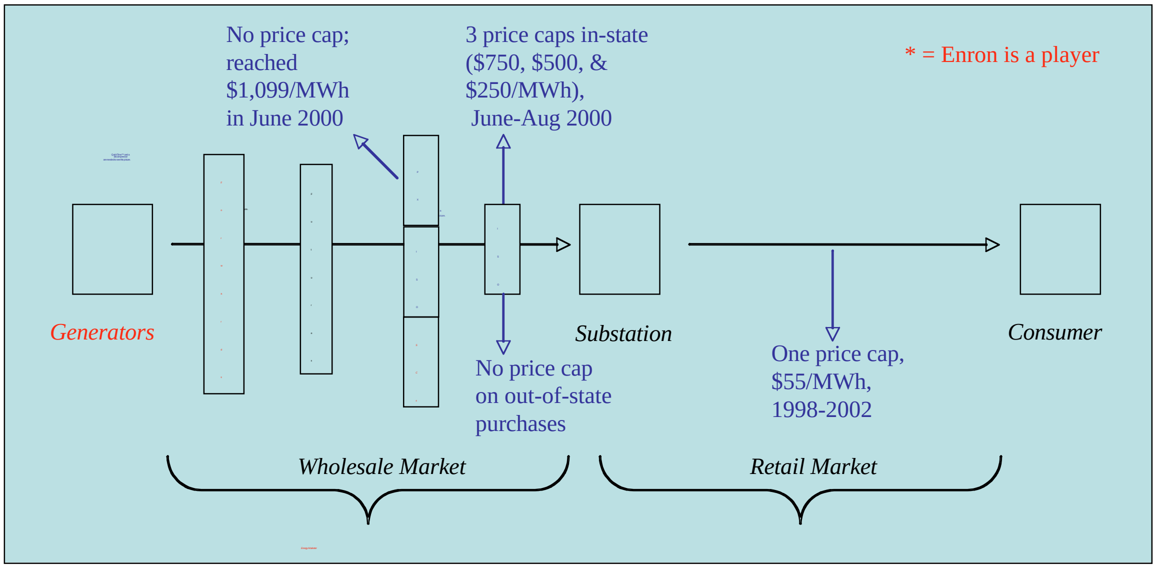

Figure 13: California's Price Caps

In conclusion, one can see that many factors were at work in 2000/2001 that wreaked havoc in the Californian energy market. It was an unstable market, with many loopholes for any marketer to take advantage of. Enron was but one marketer who recognized this opportunity.

Enron's Demise and Investigation, 2001

Enron was a marketer in this confusing, loophole-filled market in California. And it was highly successful. At its height, Enron was the largest power trader in the United States (46, p. 2), and was touted by many as one of the most successful enterprises in the U.S. (100, p. 229)

So, given all this success, what happened? Enron had posted tremendous earnings for years on end. Then suddenly, in 2001, Enron announced huge losses. (48, p. 6) Evidently, Enron had been losing money in its non-energy endeavors, and those losses had finally overtaken Enron's tremendous profits in the energy market. (97, 100, pp. 337-343, 48, p. 5) Shortly thereafter, Enron announced that it had been misstating its earnings since 1997. In December of 2001, Enron filed for bankruptcy. (48, p. 6) And then the dirt flew. Arthur Anderson, Enron's accounting firm, admitted to destroying potentially incriminating documents about Enron's operations. Rumors circulated that Enron had given large donations/contributions to George W. Bush's presidential campaign and also to Attorney General John Ashcroft, to secure its interests in powerful public policy-making circles. Finally, as Enron's stock crashed to worthless levels, Enron's employees saw their stock-only retirement programs wither away – while the Enron executives had already sold their stock before the crash and kept their profits. (48, p. 6) According to some, the company even encouraged its employees to hold on to their stocks, while the executives sold their own holdings. (100, pp. 353-353 & 366-367)

All this occurred at the same time as California's energy crisis. People saw the huge profits Enron was making in the energy market (despite Enron's bankruptcy from other endeavors), and compared that with the soaring energy prices and frequent shortages that existed in California. That did not sit well with many. Moreover, Enron made statements to the effect that it had benefited from the Californian energy crisis, (63, p. 1) which did not endear it to the public, or to the utilities that had declared bankruptcy.

So, the complaints and investigations began. The U.S. House and Senate held hearings about the impact of Enron's collapse on such issues as the energy, investment, and financial markets. (31, pp. CRS-12 & 13; 46) The California Public Utilities Commission (CPUC) investigated state generators to see if they had withheld supply. (52, p. 2-3) And numerous entities called for FERC to investigate Enron's role in the West's energy market.

FERC was a logical investigator to call upon, since it has a statutory obligation to ensure that the prices in jurisdictional wholesale energy markets in the U.S. are just and reasonable. (35, p. 1) FERC is an independent regulatory agency that administers laws and regulations related to: the sale of natural gas and oil by pipeline companies engaged in interstate commerce; interstate electric transmission rates and wholesale sales of electricity; licensing and inspection of non-federal hydroelectric power projects; and oversight of related environmental matters. (109) Moreover, FERC had already, in the summer of 2000, investigated the causes of the spring 2000 energy crisis in California[34]. (4, p. 89) So, FERC was the logical intermediary to turn to.

Who turned to FERC? Several utilities complained that the dysfunctions in the Californian spot markets had led to unjust and unreasonable long-term contracts in the bilateral markets of California, Nevada, and Washington, and requested that FERC modify those contracts. (19, p. V-2) California Senator Maria Cantwell requested that FERC investigate Enron's trading activities in the forward and long-term firm power markets, especially as far as EOL was involved. (72, p. 1) Senator Barbara Boxer requested that FERC investigate Enron's potential manipulation of prices in California's newly deregulated market, as well as all long-term contracts between the state and electric generators. (74, p. 1) Senator Dianne Feinstein asked FERC to investigate how much of the gas trading market Enron controlled through EOL, and whether Enron's share of the natural gas trading market distorted electric prices in California. (76, p. 1) Senator Gordon Smith asked FERC to examine the relationship between Enron and its wholly-owned subsidiary, Portland General Electric (PGE), as well as whether Enron

[34] Although FERC concluded at the time that the power sellers had the potential to manipulate the energy market, it found no evidence of any individual company had actually engaged in such abuse at the time. (4, p. 89)

forced PGE to purchase excessive amounts of spot power, especially at manipulated, overly high prices. (73, p. 1)

After FERC had begun its investigation, others chimed in. Governor Gray Davis requested that FERC broaden its investigation into any market manipulation by sellers and traders in California. (61, p. 2) Senator Feinstein asked FERC to investigate reports that California generators had not produced all their available power - thus inducing many of California's blackouts (52, p. 2). Feinstein also wanted FERC to investigate the wash trading to which several companies had, by now, admitted (57, p. 1). Finally, Feinstein asked Attorney General John Ashcroft to conduct a criminal investigation into whether any federal fraud statutes or other laws had been violated. (13, p. 4. Also, (79) for the date of Feinstein's request (May 6, 2002).)

FERC therefore began a staff investigation, entitled the "Fact-Finding Investigation of Potential Manipulation of Electric and Natural Gas Prices," on February 13, 2002, assigned it the docket number of PA02-2-000 on February 26[35]. (71, p. 1) FERC was, moreover, charged with reporting its findings to Congress. (42, p. 3) FERC did publish an Initial, Interim, and final (Staff) Report[36]. Much of this paper's findings are based on the final (Staff) Report.

It is worth noting that several other companies were also investigated for market manipulation. El Paso Corporation, Reliant Energy, Duke Energy, Dynegy, and others were accused of creating artificial shortages in 2001, which led to high energy prices. (6, p. 11) In the public's mind, however, Enron stood out above the rest.

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[35] FERC assigns a docket number to all its investigations; the nomenclature depends upon the topic. "PA" refers to non-financial audits by the Chief Accountant into electric, natural gas, oil, hydro, and general energy matters. Many related investigations were assigned "ER" docket numbers; ER refers to investigation into electric rate filings. (111)

[36] The Initial Report was published in August 2002. 19, p. II-9) The Interim Report was also published in August 2002. (4, p. 29) The Staff Report was published in March 2003. (19, p. 1)

FERC's Investigation of Enron

The first half of this paper set the stage, so that the reader can understand the underpinnings of FERC's investigation of Enron after the Californian Energy Crisis of 2000/2001. Now, the second half of the paper will attempt to recreate FERC's investigation, including the steps FERC went through in the process. Hopefully this will give the reader a feel for the iterative, multi-source nature of FERC's information-seeking approach specifically, and of investigative information-seeking methods generally. The author will touch on general information-seeking models, to see how FERC's investigation fits into these. First, however, some comments should be made about the author's methodology when researching the FERC case.

FERC's General Conclusions about DR3's Replies: Electricity

FERC found that all the activities listed in the 2000 memos violated the Californian ISO and PX market regulations known as the Market Monitoring and Information Protocol (MMIP[37]). (The ISO and PX MMIPs are very similar, and will henceforth be jointly referred to as the MMIP.) The MMIP's work plan dictates how the ISO/PX should monitor their markets in order to prevent any abuses of power by participating entities, and any actions that would undermine the ISO/PX's efficient functioning. (19, p. VI-6) The MMIP outlined two specific "practices subject to scrutiny" that were applicable to the practices outlined in the Enron memos. First, there was "gaming," which was taking unfair advantage of 1) the rules and procedures set forth in the ISO/PX Tariffs, or 2) the constraints of transmission lines during periods of substantial congestion. Gaming may include taking advantage of other conditions that might affect the availability of transmission and generation capacity. This included such things as loop flow, facility outages, hydropower output level, seasonal limits on out-of-state energy imports, or any other action that would make the markets susceptible to price manipulation or inefficient operation. (33, pp. 37-38)

Second, there was "anomalous market behavior," which was behavior that either 1) deviated significantly from what would exist in a competitive market, or 2) led to unusual or unexplained market outcomes. (19, pp. VI-7-8) Examples would be withholding generation capacity, unexplained or unusual redeclarations of generator availability, unusual trades, pricing and availability patterns that are inconsistent with actual supply and demand, and unusual imports or exports to other markets or exchanges. (33, p. 38)

The ISO/PX could impose sanctions or penalties on any entity that violated the MMIP, and/or refer that entity to FERC for misconduct. (19, p. VI-9) FERC could then enforce

[37] Acronym expansion is from source (80).

the "tariff[38]" (19, p. VI-9), ask the accused party to remit unjust profits to its customers (19, p. VI-10), and/or revoke the guilty party's market-based rate authorization and blanket certificate authority[39] (19, pp. VI-43-44).

FERC found that all the activities listed in the 2000 memos violated the MMIP, in that they indicated both anomalous market behavior and gaming of the energy market. (19, p. VI-12) Staff also found that other marketers were either guilty of using some of the same schemes, or at least of being aware of Enron's activities.

Scheduling False Demand

Enron, presumably acting in its role as an SC, could misrepresent its energy demand to the ISO, and alter its supply accordingly. Enron's trading memos revealed that Enron and other marketers did indeed do this, and that their choice of strategy depended on the price of energy in California.

Inc'ing / Fat Boy

One strategy for scheduling false demand was called "Inc'ing" or "Fat Boy." Here, if the California energy price (on the PX market) were high, Enron would schedule and sell more energy there than was needed. This practice was even outlined in the Enron Services Handbook. (19, p. VI-40) This was a tricky game, because Enron (as an SC) needed to submit a balanced schedule to the ISO. So Enron could overschedule supply only if it also overstated demand (load). (14, p. 20) However, Enron had an ace up its sleeve. It knew that most of the independently-owned utilities (IOUs) – which *had* to buy their needed energy on the PX market - would underestimate the demand in their day-ahead schedules, if the PX price were above the ISO price that day. (19, p, VI-21) Then the IOU's would simply wait and buy their needed energy the next day on the ISO real-time market, at the expected lower price. (19, p. VI-21) Thus, the IOUs' underscheduling offset Enron's overscheduling.

It should be noted that the PX-ISO price differential evidently changed over time. Per simple economic theory, increased demand leads to increased price. So the IOUs' strategy eventually had the (perhaps unintended) effect of increasing demand on the ISO market and decreasing demand on the PX market, and thereby eventually driving the ISO price up higher than the PX price. (19, p. VI-22&23) This trend apparently reversed itself again, when the ISO set price caps on the ISO market during the summer of 2000.

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[38] The tariff sounds like the market rules, or MMIP.

[39] It is unclear what this means, exactly. It sounds like the PX/ISO might have had the right to expel the guilty party from their markets. Since the ISO and PX were the only energy spot markets in California (101), that threat would have some weight.

The lowest ISO price cap that summer was $250/MWh[40]; the PX price, on the other hand, skyrocketed to $1,099/MWh on June 28, 2000. (78, p. 1)

In any case, Enron and other energy marketers[41] were aware of the IOUs' underscheduling scheme, and built that into their marketing models. (3, p. 2; 43, p. 2) Enron would then pay attention to the market, and artificially overstate its schedule's demand/supply if the California ((PX)) prices were high. (19, p. VI-40) They wagered their artificial load would get used in the end: when market needs hit real-time, the ISO would realize that it needed more supply than it had scheduled (due to the IOU's understated demand), and Enron would then have the opportunity to sell its overstated supply. (19, p. VI-20-24) In doing so, Enron would receive a higher price (an "inc" price) for this energy, because the ISO would have asked for it at the last minute. (3, p. 1-3) (This higher price still had to be below the ISO price cap during the summer of 2000, of course, unless the energy came from out-of-state. See Export/Re-import for an explanation of that strategy.)

Conclusion: FERC decided that Fat Boy involved 1) the deliberate submission of false information, and 2) violated the MMIP anti-gaming provision by taking unfair advantage of the ISO's rules and making that market inefficient. (19, p. VI-24)

Dec'ing / Thin Man

This strategy was the reverse of Fat Boy. Here, Enron SC would *understate* load on the schedule it submitted to the ISO. (19, p. VI-40) According to the Enron Services Handbook, Enron SC would use this strategy when California ((PX)) prices were low. (9, p. VI-40) Generally, Thin Man was used as a way to understate California demand, so the SC could sell the excess supply outside of the state, for a higher price. (19, p. VI-16)

Conclusion: FERC made no specific statement about Thin Man in its Staff Report. However, FERC found the IOUs to be guilty of violating the ISO and PX MMIPs when the IOUs submitted understated demand information to the ISO. This was considered gaming the market. (19, p. VI-25) Surely the same argument would apply to Enron marketers engaging in Thin Man.

Export/Re-import Strategies

[40] The first cap was at $750/MWh in June; the second cap was at $500/MWh in July; the third cap was at $250/MWh in August. (78, p. 1)

[41] Enron specifically stated in one of its memos that other companies also overstated demand (inc), and that Enron itself had inc'ed for other companies *while acting as their SC*. (3, p. 2) Enron named two companies, with no native Californian load, for whom it had inc'ed: Powerex and Puget Sound Energy (PSE). (3, p. 2)

Energy Export

Under this strategy, Enron would sell electricity to entities outside of California for more than it could sell the electricity inside California. This worked as follows. First, Enron (presumably in its role as an SC) would understate the expected demand/load for power in the PX day-ahead market if the California price were low. (This was the Thin Man strategy mentioned earlier.) (9, p. VI-40) In this way, Enron would not have to sell so much energy on the PX market, if it offered a lower sales price than was expected on the ISO market (19, pp. VI-22-23) or in out-of-state markets. Then Enron would export a corresponding amount of energy outside of the state for a higher price. (19, p. VI-15&160) (The reader will remember that California had price caps on its PX and ISO markets, but other states did not. Therefore California energy marketers and generators could make money by avoiding the PX and ISO, and selling their energy outside of the state.) The difference in these two prices could be as much as $250/MWh on the PX vs. $1200/MWh on an outside market[42]. (3, p.3)

Conclusion: FERC likely had a hard time drawing a conclusion about this. Legally, neither FERC, the PX, nor the ISO forbade Californian energy companies from exporting energy out-of-state. (19, p. VI-15) However, FERC held that energy export, along with all the other activities outlined in the 2000 Enron memoranda, violated the MMIP by creating anomalous market behavior and by gaming the market. (19, p. VI-12)

Energy Re-import: Ricochet / Megawatt Laundering

Ricochet (aka Megawatt Laundering) operated very similarly to the above energy-export practice. Here, company A would buy energy on the PX day-ahead market. Then it would sell (export) that energy to company B for a fee. Then, if the ISO needed extra power in the real-time market, company B would sell that energy to the ISO, hopefully for a profit. Note that this involves some risk-taking, as the PX price is not *guaranteed* to be lower than the ISO price. (19, pp. VI-17&18) However, if company B were located outside of California, then money could almost certainly be made, as out-of-state prices were not capped in the ISO market. (13, p. 3) This presumably required coordination and profit-sharing arrangements between companies A and B.

Conclusion: FERC held that energy re-import, along with all the other activities outlined in the 2000 Enron memoranda, violated the MMIP by creating anomalous market behavior and by gaming the market. (19, p. VI-12) The author would argue that this also clearly increased the short-term price of energy on the wholesale market.

Forced Congestion Payments

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[42] The particular outside market used in this example was known as “Mid-C.” (3, p. 3)

The reader will recall that the ISO was responsible for checking its SCs' schedules to make sure they did not overload any transmission lines. (95) However, this procedure did not always work, as transmission lines sometimes did end up being "congested," or having too much energy passed over them in real-time[43]. When that happened, the ISO would pay a "congestion payment" to the transmitting company/companies to either stop sending the energy, or to send it in the opposite direction (a.k.a. schedule a counterflow). (13, p. 3) This was a tidy sum of money (e.g. $750/MWh), so that it was sometimes profitable to get this congestion payment even it meant selling power at a loss. (3, p. 3) There were many different ways to make money from congestion payments, as will be outlined shortly.

Conclusion: FERC found that all of the congestion schemes outlined in Enron's memos violated the MMIP by creating anomalous market behavior and by gaming the market. (19, p. VI-30)

Scheduling Energy to Collect Congestion Charge II (CCC-II)

This refers to Enron's strategy of scheduling a counterflow for energy that it did not actually have available. The ISO would then notice that no energy had actually been passed, and would charge Enron for the amount of energy it had promised (as a counterflow) but not delivered. However, there was a loophole: the ISO would still pay Enron a congestion payment for having agreed to provide the counterflow to start with. This scam was profitable if the congestion payment were sufficiently higher than whatever the ISO charged for non-delivery (20, p. 6). Some equate that non-delivery charge to the ((ISO's)) price cap. (3, p. 7) So, if the ISO price cap were $250/MWh, and the congestion payment were $750/MWh, Enron could earn $500/MWh by using this scheme.

Conclusion: FERC issued no specific opinion about the Collect Congestion Charge II scheme (CCC-II). Perhaps FERC lumped CCC-II together with all the congestion schemes listed in the 2000 Enron memos, all of which FERC found to be in violation of the MMIP. (19, p. VI-30) Or perhaps FERC lumped the CCC-II under the Forced Congestion Payment or Death Star practices, both of which resemble CCC-II. In that case, CCC-II would violate the same MMIP rules as those specific practices.

Death Star

[43] It may seem strange that the ISO would not recognize that an SC had submitted a schedule which placed more electricity on a transmission line than that line could handle. However, according to one energy company (Powerex), the ISO's congestion management software had a flaw that prevented it from recognizing that a tie was out of service. (19, p. VI-27) The larger transmission lines with major congestion during California's energy crisis (2000) were Path 66, Path 15, Path 26, and Path 42. (7, p. 12) See the section on California's Electricity Industry for more information about California's transmission paths.

In Death Star, Enron scheduled a counterflow transmission to get congestion payments, but would never send the energy. For example, Enron would schedule a counterflow to an out-of-state location. Enron would then purchase that same energy back from the other location, but route it back home via out-of-state or some other non-ISO-controlled transmission line. This rerouting prevented the ISO from realizing what was going on. In actuality, all that energy was merely scheduled, never sent. So Enron collected the congestion payment, but never physically moved any energy. (3, p. 4) Clearly, Enron could not do this alone; it needed the participation of other entities, especially those that owned non-ISO lines. (19, p. VI-27)

One such indication of others' participation was an email sent to Enron's Portland shift. This discusses a congestion relief scheme known as "red congo," wherein Enron, the city of Redding, California, and Pacificorp West work together to move energy along North-South lines, and along Redding's non-ISO transmission lines.[44]

Conclusion: As with the other congestion schemes, FERC found that this practice violated the MMIP by creating anomalous market behavior and by gaming the market.

Load Shift

Here, Enron would start with a balanced schedule for a transmission line – typically a line to which it had primary transmission usage rights, or Firm Transition Rights. Before submitting this schedule to the ISO for the day-ahead market, Enron would rearrange it so that the load was overstated in one direction/flow (e.g. North-South), and understated in another (e.g. South-North). The schedule would still be balanced, just not accurate. Then, when it came time to actually transmit that energy in the real-time (ISO) market, the ISO would realize that the line was congested in one direction, and would pay Enron the congestion fee either not to send it or to counterflow it.

Ironically, Load Shift did not actually work too well for Enron. This is because the three major IOUs tended to underschedule load in their ISO schedules - thus nullifying Enron's strategy of overstating load in its schedules. (19, p. VI-14)

Conclusion: FERC found Load Shift to be in violation of the MMIP for gaming the market. Enron took unfair advantage of the ISO tariffs, to the detriment of the efficiency of the ISO / PX markets. It furthermore took undue advantage of transmission constraints during great congestion. (19, p. VI-15) The author would posit that Load Shift also served to increase the short-term wholesale energy prices that FERC was investigating in IN1, as someone must bear the cost of all the added fees and payments. In describing Load Shift in Enron's December 8, 2000 memo, the researcher even admits: "Our concern here is that, by knowingly increasing the congestion costs, Enron is effectively increasing the costs to all market participants in the real-time market." (3, p. 5)

[44] The Staff Report provided no date for this email.

Wheel Out

In a wheel-out, Enron would schedule energy transmission over an intertie[45] that was "completely constrained" (i.e. had zero capacity) or was out of service. If the ISO did not catch this poor scheduling in advance, it would pay Enron a congestion payment in real-time *not* to transmit energy over that intertie. So, once again, Enron would be paid *not* to send energy. (19, p. VI-26)

FERC also found evidence of this activity in at least one email. This will be discussed under DR7.

Conclusion: Staff found Wheel Out, along with the other congestion practices, to violate the MMIP by creating anomalous market behavior and by gaming the market.

Ancillary Services

Ancillary services, according to FERC, is a series of services that are "necessary to support the transmission of energy from generation sources to the consumers and to maintain reliable operations of the transmission system." (82, p. 2) The purpose is to cover those instances when the actual energy conditions do not correspond to the expected conditions. (82, pp. 2-3) This primarily equates to the holding of reserve energy resources which can be booted up anywhere from immediately to within an hour; however, it can also include the resources needed to maintain a certain voltage level on a transmission system. (82, p. 3) It is worth noting that ancillary energy reserves are provided by the same generators as the regular electricity supply. However, since electricity cannot be stored efficiently, ancillary services provide the reliability guarantee that is needed for an energy market to work. (82, p. 1) In California, the ISO[46] specifies which entity will provide which ancillary services, and when. (82, p. 4) This reserve energy is also referred to as "firm" energy." (83, p. 2) The ancillary-service schemes that Enron used were known as "Get Shorty" and "selling non-firm energy as firm energy."

[45] By examining various online energy dictionaries and FERC's website, the author believes that an intertie is the same thing as an interconnection. If this is true, then an intertie is a connection point between two transmission systems, between two systems that serve different geographic areas (such as California and the Pacific Northwest), or between two energy supply chains. They might be located where a generating facility meets transmission facilities, where high-voltage energy transmission corridors cross, or where a utility's distribution facilities connect with the transmission grid. (114)

[46] The source of this information actually referred to this entity as the TSO/transmission system operator. (82) However, the TSO appears to be an umbrella term that contains/includes the concept of the Californian ISO. This deduction is based on the source's description of a TSO's duties, which look identical to the Californian ISO's duties.

Get Shorty

Here, Enron traders would sell to the ISO ancillary services at a relatively high price in the day-ahead market. Then they would cancel that in the real-time market, and purchase the energy from another company, at a lower price, in the real-time market. (3, p. 6) In and of itself, this was a legal activity, per the MMIP. (19, p. VI-31) However, Enron traders would also do this when they did not have the ancillary services covered (on standby) to start with. This means that they lied about possessing the ancillary services when they sold them to the ISO in the day-ahead market. (19, p. VI-31) In fact, one of Enron's internal memos basically admitted that Enron was purposefully lying in order to get the ancillary payments: "The ISO tariff requires that schedules and bids for ancillary services identify the specific generating unit or system unit … As a consequence, in order to short[47] the ancillary services, it is necessary to submit false information that purports to identify the source of the ancillary services." (3, p. 6)

FERC found further evidence of this practice in several Enron emails. One indicated Enron's plans to place ancillary bids in the day-ahead market without having the necessary resources.[48] Others indicated Enron's collusion with other companies to make this strategy work.[49]

Conclusion: FERC found this practice to be unethical, because it involved lying to the ISO about having ancillary services to sell. (19, p. VI-31) FERC also found this to violate the MMIP's anti-gaming rules. (19, p. VI-34)

Selling Non-Firm Energy as Firm Energy

Here, Enron would sell non-firm (non-reserve) energy, but claim that it was firm. So, the ISO would rely on it as firm energy, whereas it was not actually firm. It is worth noting that Enron implicated other companies in this activity, stating in one of its memos that: "Everyone does this." (3, p. 7)

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[47] In typical marketing parlance, to "short" is to buy a commodity at a low price, with the expectation that one can sell it later at a higher price. (101) Similarly, to take a "short position" is to post more sales than purchases. (19, p. VIII-4) It is unclear if that is what is meant here.

[48] January 11, 2000, email from an Enron employee to Portland shift, stating that Enron will take a more aggressive strategy in this area.

[49] A June 5, 2000 email described some ancillary money made with the City of Glendale, Colorado River Commission, Valley Electric Association, and El Paso Electric Company in May. (19, p. VI-32) A November 5, 1999 email to the Portland shift shows the problems that were created by some data-entry error about profit-sharing deals with Redding and EPE. (19, p. VI-33) A December 24, 1999 email suggested giving extra money to Washington Water Power Company if Enron made a profit from scheduling WWPC's ancillary services in the California market. This was also referred to as the "Big Foot Deal." (19, p. VI-38)

Conclusion: FERC found that this practice, along with all the other practiced outlined in Enron's memos, violated the MMIP's anomalous market behavior and anti-gaming provisions. (19, p. VI-12)

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Appendix D: Scheduling Coordinators

This is a list of the Scheduling Coordinators in California as of February 15, 2002.

Note: The source of this information (the California ISO) did not know which generators or distributors these SCs represented. The ISO recommended contacting an individual SC to find out which companies it represented. The author did not attempt to do this.

El Paso Merchant Energy
Enron Energy Services
Enron Power Marketing, Inc.
Entergy Koch Energy Trading (aka: Axia and Koch Energy Trading, Inc.)
Exelon Generation Company, LLC
FPL Energy Power Marketing, Inc.
Hafslund Energy Trading
Idaho Power Company
Illinova Energy Partners, Inc.
J Aron & Company
L.A. Dept. of Water & Power
Lassen MUD
LG & E Energy
Merchant Energy Group MEGA-
Merrill Lynch
Metropolitan Water District
Midway Sunset Cogeneration Company
MIECO,Inc.
Mirant Americas Energy Marketing, LP
Modesto Irrigation District
Morgan Stanley Capital Group
Mountain View Power Partners, LLC
Nevada Power
Northern California Power Agency
Occidential Power Services, Inc.
PacificCorp
PG&E
PG&E - PTO
PG&E - Transmission Svcs.
PG&E - UEPM
Pilot Power Group, Inc.
Portland General Electric
Power Resource Managers
Powerex
PPM Energy, Inc.
PP&L Montana, L.L.C.
Public Service Company of Colorado (Xcel Energy)

Public Service of New Mexico
Puget Sound Energy
Quiet, LLC
Redding Electricity Utility
Reliant Energy Services
Roseville Electric
Sacramento Municipal Utilities District
Salt River Project
San Diego Gas & Electric Merchant
San Diego Gas & Electric-PTO
Sempra Energy Solutions
Sempra Energy Trading
Sierra Pacific Power
Southern California Edison
Southern California Edison-PTO
Strategic Energy Ltd.
TECO Energy Source, Inc.
Tractebel Energy Marketing Inc.
TransAlta Energy Marketing California- Inc.
TransCanada
Trans Electric
Tucson Electric Power
Turlock Irrigation District
TXU Energy Trading Company, LP
UBS AG
Viasyn, Inc.
Williams Power Company, Inc.
Western Area Lower Colorado
Western Area Power Administration (WAPA)

Table 5: California Scheduling Coordinators (SCs) in February 2002.
Source: (96)

Appendix E: History of the Gas and Electricity Markets

This is a brief history of the gas and electric markets in the United States.

Gas Market History

Although the gas market existed before the electric market, it is generally considered a secondary source of energy, and so will be discussed more briefly.

According to the history annals, natural gas was first discovered in Iran between 6000 and 2000 BC. The fire-worshipping Persians honored certain spots of "eternal fire," which are now believed to have been natural gas seeps that had been struck by lightning. Various other societies "discovered" and used gas for utilitarian purposes, such as the Chinese, who burned gas to dry rock salt. In 1609, manufactured gas made its debut, when a Belgian chemist discovered that gas escapes heated coal. Progress continued until London boasted the first public streetlights to use gas in 1807. In 1812, the first U.S. gas company was established to provide streetlights to Baltimore. The first long-distance pipeline was built in the 1870's, transporting gas 25 miles within New York State. (5, pp. 16-17)

Edison's invention of the electric light in the 1880's, however, and the ensuing growth of the electric industry, nearly killed the gas industry. Most gas markets remained localized around known gas fields. This trend began to change somewhat as more gas reserves were discovered in the U.S. in the first half of the 1900's, and as a method for making longer-distance pipelines was developed in the 1920's. (5, p. 17)

Like the electric industry, gas remained a monopolistic market until it was deregulated in the late twentieth century. (5, p. 19) In 1978, the federal government passed the Natural Gas Policy Act, which eliminated wellhead price controls. (http://www.cpuc.ca.gov/published/report/natural_gas_report.htm#P89_3811ref) In 1985, FERC ordered pipelines to become open-access carriers for both producers and users. In 1993, FERC Order 633 forced pipeline companies to use a marketing unit, rather than sell directly to customers. On the regulatory side of things, interstate trade is regulated at the federal level; however, intrastate trade and retail sales are regulated at the state level. (What FERC Does. (2005, January 4). Retrieved on May 26, 2005 from the FERC website, http://www.ferc.gov/about/ferc-does.asp.)

With the increasing popularity of gas as an energy source, and with the stiffer market competition from deregulation, utilities began searching for other ways to achieve economies of scale at the turn of the twentieth century. This led to a consolidation of the gas and electric utilities (5, p. 21), with many gas companies' buying up electric utilities in the late 1990's and providing multiple services to end users. (6, p. 10)

Electric Market History

The U.S. electric market has undergone several changes since its inception. Originally conceived as a monopolistic structure, this industry moved from municipal franchise control to state regulatory control to split state/federal regulatory control. Then it underwent gradual deregulation from the 1970's to 1990's. By the time FERC investigated Enron in 2002, the market was fully deregulated (in at least California), and the states and federal government shared regulatory control of the industry. Closer details of this history follow.

The Birth of the Electric Power Industry

The electric power industry's birth is often attributed to the discovery of the induction principle, which enabled the development of the electric generator, in 1831. In 1882, New York City built the world's first permanent, commercial central power system using electricity. It could not carry the electricity very far, however, as it used only direct current (DC). By 1891, Germany boasted the world's first operating alternating-current (AC) generator. The AC systems could carry electricity significantly further than DC systems, so this enabled long-distance power transmission. (5, pp. 11-13) Thus was born the electric industry.

As might be suspected, the industry lent itself well to a monopolistic structure, because any company's initial investment in building a generating plant and setting up a transmission and distribution system is great. Thus the industry began as a monopoly, and remained that way until deregulation efforts began in the late twentieth century.

Regulation of the Electric Power Industry

Before the turn of the twentieth century (1900), the electric industry was in the hands of small number of private utilities. These operated as franchises of the municipal governments, and so were basically under the cities' control. The reason for this arrangement was that businesses were legally required to obtain special permits/franchises to use public land at that time, and the utilities tended to use streets (which were municipally owned) for their transmission/distribution system. This arrangement did not work out very well, however, as the municipalities often arranged for overlapping franchises (to encourage competition), which led to numerous complaints of high prices, unsafe systems, and poor service.

To remedy these problems, several state governments began creating state public utility regulatory commissions. By the 1920's, most of the power over the electric industry had switched from the cities to the states through this arrangement. The state regulatory bodies began giving each utility a monopoly over a given geographic area. In exchange, the utilities accepted a price-setting schedule[50]. This eliminated duplicate transmission systems and service areas – thereby allowing the utility companies to take advantage of the cost efficiencies of having no competition in their areas - and provided guaranteed, reasonable prices to the public. The result was several vertically integrated[51] monopolies which owned and ran the generation, transmission, and distribution facilities within their jurisdiction, and whose rate-of-return was regulated by state regulatory commissions. (10, p. 4; 6, p. 5; 16, p. 3) See Figure 7 for a view of this monopolistic market, and the division of its regulation.

The times continued to change. By the mid-1920's, many of these utilities had been acquired by holding companies[52] (6, p. 5), which were later found to be corrupt (10, p. 4; 8, p. 1). Moreover, most of the highly leveraged[53] holding companies collapsed in the U.S. stock market crash of 1929[54], as they could not service their debt. (8, p. 1)

The corruption and failure of the holding companies led to the federal government's involvement. In 1935, Congress passed the Public Utility Holding Company Act (PUHCA), which required major electric holding companies to provide detailed financial information to the Securities and Exchange Commission (SEC). (10, p. 5; 8, p. 1) Also in 1935, Congress amended the Federal Power Act of 1920. The 1920 Act had created the Federal Power Commission (the predecessor to FERC) and given it the power to regulate the licensing of non-federal hydroelectric ventures. (6, p. 6) The 1935 amendment gave the Federal Power Commission the right to regulate interstate transmission and to monitor wholesale electric power rates. (6, p. 6)

Meanwhile, state public utility commissions (PUC's) maintained jurisdiction over the intrastate trade of electricity, and regulated retail rates for customers. This remains the case today. (15, p. 13)

The net result was that the federal government gained regulatory control over the left side of Figure 3 below (i.e. the wholesale market), and state gained control over the right side (i.e. the retail market). This division of regulatory duties continues today. (15, p. 3)

---

[50] In a regulated environment, these prices are calculated based on the utility's embedded costs, plus a negotiated rate of return on the investment. (15, p. 63)

[51] Vertical integration refers to the situation wherein one company owns all the aspects of a product's manufacture, from the raw materials to the distribution system. (104) For the electric industry, then, this would mean that one company would own the generating, transmission, and distribution elements. Some authors argue, however, that vertical integration just means owning the generation and transmission facilities (16, p. 1).

[52] Holding company is a company that owns enough voting stock in another firm to control management and operations by influencing or electing its board of directors. (103)

[53] Leverage is "the degree to which an investor or business is utilizing borrowed money. Companies that are highly leveraged may be at risk of bankruptcy if they are unable to make payments on their debt; they may also be unable to find new lenders in the future." (105)

[54] For more information about (and the dates of) the Crash, see (106).

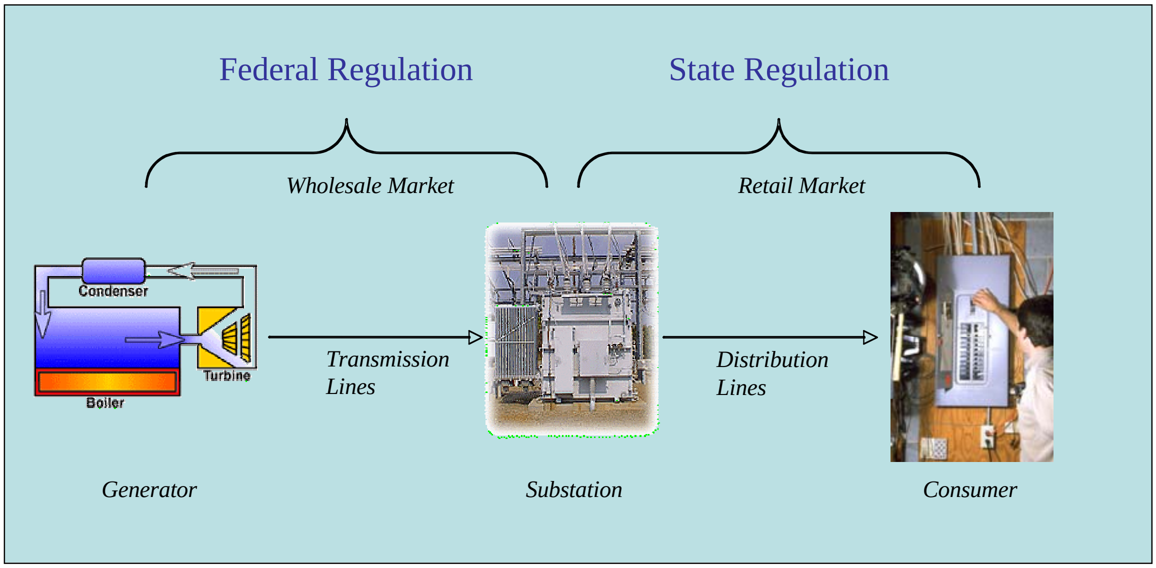

Figure 16: Electricity's Original Monopoly Structure and Oversight

In 1977, Congress dissolved the Federal Power Commission, replacing it with the Department of Energy and the Federal Energy Regulatory Commission (FERC). (6, p. 7) FERC was made responsible for regulating wholesale electric rates (15, p. 14), interstate energy commerce, and access to / regional development of the transmission grid. (15, p. 61) It is worth noting FERC was made responsible primarily for the physical assets market, rather than the financial assets market. (73, p. 1) However, it is difficult to examine one without also examining the other, as one affects the other. Hence, FERC's investigation covered both markets.

Deregulation of the U.S. Electric Power Industry

There appears to be some disagreement in the literature as to when the electric industry began deregulating. Some authorities claim it started with the Public Utility Regulatory Policies Act of 1978, and some choose the Energy Policy Act of 1992. This paper will take the longer view on this issue, and start with 1978. This and subsequent federal-mandated acts all affected only the wholesale side of the equation, namely the generators and transmitters.

Deregulation of Generation Assets

The Public Utility Regulatory Policies Act of 1978 (PURPA) appears to have been geared towards deregulating the far left-hand side of Figure 3, namely the generators. PURPA allowed non-regulated, independent producers to generate electricity for sale to the utilities. This was a very successful Act, in that independent producers ended up being responsible for half of the generating capacity that the U.S. actually used in the 1980's. (5, p. 4)

Deregulation of Transmission Assets

In 1992, Congress passed the Energy Policy Act, which largely deregulated the middle-left-hand side of Figure 3, namely the wholesale/transmission market. This Act granted all participants in the industry wholesale transmission rights, or "wheeling of power"[55] rights. In effect, this granted the independent power producers access to the utilities' transmission lines. (6, p. 9) The Energy Policy Act also allowed utilities to buy power from each other *across state lines* (5, p. 5), and to operate independent generating plants outside of their home service territories (8, p. 2). It continued to leave the regulation of retail electric sales, however, in the hands of the states. (8, p. 2)

In April 1996, FERC passed Order No. 888 (15, p. 66), which required public utilities to offer to sell their electric power to other providers or utilities at the same rates they charged themselves. Although the transmitting (wheeling) utility would be compensated for the use of its line, (6, p. 9) it was now basically required to offer non-discriminatory access to its power grid – even to its competitors. (8, p. 2) FERC also passed Order No. 889 in April 1996 (15, p. 66). This Order required electric utilities to establish electronic systems for sharing information about their available transmission capacity. This further opened up access to utilities' transmission lines. (6, p. 9)

FERC Order 2000, passed in December 1999, encouraged the voluntary creation regional transmission organizations (RTO's), which would bring the nation's transmission systems under regional control. (15, p. 67) (This effort seems to have floundered somewhat.) It also allowed each region to decide whether or not to create a (regional) power exchange (PX) to help with this. (15, p. 71) A power exchange was indeed created in California; its role will be discussed later.

Hopefully that broad overview of the national scene will help the reader put California's deregulation efforts into a more informed context.

[55] Wheeling occurs when a transmission-owning entity (a utility) permits another energy entity (a utility or independent power producer) to move (wheel) power over its transmission lines. (15, p. 63)

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