

**Statement of  
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Members of the Committee, I am pleased to submit this written statement on Enron's role in the California electricity crisis in the light of recently disclosed documents describing the strategies Enron's traders used in the California market. I am a Professor of Economics at Stanford University. I began my work on energy and environmental issues at the Los Alamos National Laboratory (LANL) in 1980. The following year I entered graduate school at Harvard University, where I received an S.M. in Applied Mathematics and Ph.D in Economics. For the past fifteen years, I have been engaged on a research program studying privatization, competition, and regulation in network industries such as electricity and natural gas. A major focus of my work is the empirical analysis of market power and, more generally, market design issues in newly restructured electricity markets. I have studied the design and operation of the PJM (The Pennsylvania, New Jersey, and Maryland Interconnection), New York, New England and California electricity markets, as well as virtually all restructured electricity markets currently operating around the world. Since April 1, 1998, I have been the Chairman of the Market Surveillance Committee (MSC) for the Independent System Operator (ISO) of California electricity industry.

**MARKET SURVEILLANCE COMMITTEE**

To provide further background on my expertise on the California electricity market, I will describe the role of the Market Surveillance Committee of the California Independent System Operator and the activities that I have undertaken as its Chairman. The MSC is an independent committee charged with monitoring the California electricity market for the exercise of market

power and for market design flaws which may enhance the ability of market participants to exercise market power. The MSC was required by the Federal Energy Regulatory Commission (FERC) as part of the market monitoring protocols of the California ISO. Because the California ISO had a board of governors composed of employees from firms participating in the California market, as well as stakeholders from state agencies and regulatory bodies, FERC mandated the formation of an independent market monitoring entity to prepare and file with FERC periodic reports on the performance of the market. In this capacity I have written or co-authored more than ten reports on aspects of the design and performance of the California electricity markets during my four years as Chairman of the MSC. In preparing these MSC reports I have analyzed confidential data made available by the ISO on bidding, scheduling and production by all generation unit owners selling into the California market. In addition, the MSC has worked closely with the Department of Market Analysis and management at the ISO in preparing these reports. These reports, along with other papers I have written on competitive electricity markets, are listed at the end of my testimony.

My testimony focuses on four issues. The first is the what new information about the causes of the California electricity crisis is revealed by the recently released memos describing the strategies pursued by Enron's traders in California. The second is to describe the distinction between the unilateral exercise of market power and market manipulation, and the role that the unilateral exercise of market power played in the California electricity crisis. The third is to clarify the role these two concepts play in the Federal Regulatory Commission's (FERC) statutory mandate to set just and reasonable wholesale electricity prices. The fourth is to propose a long-term market performance measure and market monitoring protocol that FERC should adopt to fulfill its statutory mandate to protect consumers from unjust and unreasonable wholesale electricity prices.

## **ENRON MEMOS AND CAUSES OF CALIFORNIA ELECTRICITY CRISIS**

The Enron memos reveal one an important fact about the behavior of electricity suppliers that was strongly disputed by many observers of competitive electricity markets but is a maintained assumption for economists studying these markets. That is, sellers intend to make as much money as possible and will use all available strategies to achieve this goal.

Although some of the strategies outlined in the Enron memos may be violations of market rules or illegal under US anti-trust law, it is difficult to tell for sure because of the incomplete and sometimes inconsistent descriptions given in the memos. However, the vast majority of the strategies described in sufficient detail to understand them are standard arbitrage strategies that were known to the independent market monitoring committees for California ISO and Power Exchange well before the summer of 2000.

Power markets are not fundamentally different from common stock, commodity, and foreign exchange markets. Traders in financial markets constantly attempt to earn profits from arbitraging differences in the prices for same product across time, space and maturity. For example, if the price of gold in London is sufficiently less than the price in New York, then traders will buy gold in London and sell it in New York until this price difference is less than or equal to cost of transporting gold between these two locations. Because 1 kilowatt-hour (KWh) of electricity contains the same amount of energy regardless of which firm produces it and the cost of transporting electricity over very long distances is extremely low, we would expect that there are many opportunities for power traders to earn profits from arbitraging small differences in electricity prices across locations in the transmission network.

All electricity markets have a number of forward markets where power suppliers can sell energy in advance of actual delivery of the electricity to the transmission network. For example,

before January of 2001 in the California market, power delivered to the grid during each hour of the day could have been sold in the Power Exchange (PX) day-ahead market, the PX day-of market, a variety of forward bilateral markets, or the California ISO's real-time market. These opportunities to buy and sell electricity in various markets in advance of delivery offer power suppliers ample opportunity to arbitrage price differences across these markets. For example, if a power supplier thought the price in the ISO's real-time market was going to be higher than PX's day-ahead price, then it could buy power that it had no intention of consuming in the PX market and sell it in the ISO's real-time market. This is one explanation for the "Inc-ing Load Into the Real-Time Market" strategy described in the Enron memos.

Similar explanations involving attempts to arbitrage price differences over time and location in California's energy, ancillary services and congestion management markets can be constructed for the vast majority of the other strategies described in the Enron memos. It is important to emphasize three other points about these strategies. First, versions of most of these strategies exist in the wholesale electricity markets operating in the eastern US. Second, none of these strategies involved zero risk on the part of the trader executing them. For example, a trader would lose money from buying energy in the day-ahead market and selling it in the real-time market if contrary to the trader's expectations, the price in the ISO's real-time market was less than the price in the PX's day-ahead market, a circumstance which often occurred in the California market. Third, all of the arbitrage strategies described in the Enron memos were available to all buyers and sellers in the California market. Like all arbitrage strategies, as more market participants gained experience participating in the California market, their profitability most likely declined.

An argument can even be made that many of these strategies enhanced the efficiency of the California electricity market. Taking an analogy from the gold market, because gold traders are

constantly looking to exploit profitable arbitrage opportunities due to geographic price differences, consumers in any location be assured of getting the best possible price for gold in their own location.

The above logic implies that the strategies described in the Enron memos are, at best, a small part of the cause of the California electricity crisis. Of the more than \$10 billion of refunds that the California ISO has calculated are owed to California consumers from paying unjust and reasonable wholesale electricity prices over the period June 2000 to June 2001, the strategies outlined in these memos, at most, account for \$500 million when aggregated over all California market participants.

### **MARKET POWER, MARKET MANIPULATION AND THE CALIFORNIA CRISIS**

The major cause of the California electricity crisis was the unilateral exercise of market power by suppliers to the California ISO control area. A firm exercises its unilateral market power by withdrawing generating capacity from the market either by bidding extremely high prices for some or all of its capacity or by refusing to make a portion of its capacity available to the market at any price. The goal of both of these strategies is to create an artificial scarcity of energy in order to drive up the market price.

The extent to which firms find the unilateral exercise of market power profitable depends on the impact their capacity withholding has on the market price. For example, if a generator withholding 5 percent of its capacity from the market manages to increase the market-clearing price by 50% (not an unusual tradeoff in the California market during the period June 2000 to June 2001), this small amount of withholding is extremely profitable for the firm pursuing this strategy. Studies by the independent market monitoring committees for the California market, the ISO's Department of Market Analysis and other independent researchers have shown that the unilateral exercise of market power was the cause of the unjust and unreasonable in electricity prices that occurred during the period June 2000 to June 2001.

It is important to emphasize that it is not illegal under US antitrust law for a firm to exercise its unilateral market power. Markets not dominated by a small number of firms face sufficient competition to discipline the unilateral attempts of these firms to raise market prices. Even in a market with a large number of firms, each one will still attempt to exercise all of its available unilateral market power. However, in a workably competitive market, each firm will find it unilaterally profitable to withhold very little supply from the market because the price increase it achieves from withholding very little supply from the market is very close to the price increase it achieves from withholding a significant amount. This logic implies that the firm's unilateral profit-maximizing strategy leads it to exercise very little market power.

All privately-owned firms in all markets continually attempt to exercise all available unilateral market power. Their shareholders' demands to earn the highest possible returns on their investment require the firm to do it. However, the competitiveness of the market suppliers sell into and the responsiveness of consumer demand to price increases determines the amount of unilateral market power that firms are ultimately able to exercise.

Wholesale electricity markets are extremely susceptible to the unilateral exercise of market power. The aggregate demand for electricity in any hour of the day is virtually insensitive to the hourly wholesale price. Electricity is very costly to store and its production is subject to extreme capacity constraints. A 500 megawatt (MW) generating unit can't produce much more than 500 MW-hours (MWh) in a single hour. All of these factors imply that, a single firm owning 5 to 10 percent of the generating capacity in the market can, under a range of demand levels, increase the price of electricity substantially by withholding a very small fraction of its capacity from the market.

The incentives for capacity withholding from the spot electricity market are even greater the larger is the fraction of the firm's capacity that receives this elevated spot price. In addition, the

larger the fraction of demand that must be purchased on the spot market the greater the consumer harm that occurs as result this elevated spot price.

This logic illustrates three important points. First, because of the characteristics of the electricity production process and how it is priced to final consumers, this market is extremely susceptible to the unilateral exercise of market power. Second, because price can increase substantially as result of the unilateral exercise of market power by firms in a wholesale electricity market, consumers can experience significant harm in a very short time. Finally, the incentive to exercise market power and the extent of consumer harm that it can cause is greater the larger is the fraction of demand that is served from the spot market.

Now I would like to make the distinction between the unilateral exercise of market power and market manipulation. As discussed above, the unilateral exercise of market power is equivalent to the firm using all legal means to serve its fiduciary responsibility to its shareholders to earn the highest return possible on their investment. Market manipulation does not have a generally agreed upon definition. However, most would agree than market manipulation implies intent to harm competition or market efficiency and certainly implies “bad” behavior on the part of the manipulator. However, it is virtually impossible to infer intent from a firm’s actions. Returning to my earlier example, how do we know if the intent of a power supplier in buying power in the day-ahead market and selling it the real-time market was to harm competitors, and not just attempt to serve its fiduciary responsibility to its shareholders? Unless the market participant tells us their goal is harm competition or market efficiency we cannot tell.

### **FERC’S STATUTORY RESPONSIBILITY UNDER THE FEDERAL POWER ACT**

The designers of the Federal Power Act understood this problem of distinguishing market manipulation from the unilateral exercise of market power. They also recognized the extreme

susceptibility of electricity markets to the unilateral exercise of market power and the tremendous consumers harm that could occur if it happened. The Federal Power Act, the enabling legislation for the Federal Power Administration (the predecessor to FERC) requires that FERC ensure that wholesale electricity prices paid by consumers are just and reasonable. The Federal Power Act does not require that FERC show that wholesale prices are the result of market manipulation in order for them to be unjust and unreasonable. Market prices that reflect the exercise of sufficient unilateral market power are also unjust and unreasonable. As discussed above, because of a number of features of wholesale electricity markets, a small amount of withholding of generating capacity by a few electricity suppliers can result in price that reflect the exercise of significant market power under system conditions such as those that occurred during the period June 2000 to June 2001.

Consequently, it is unnecessary to prove market manipulation by suppliers to the California market in order for California to receive refunds for unjust and unreasonable prices during the period June 2000 to June 2001 and for the forward contracts negotiated during the winter and spring of 2001. As discussed above, there is definitive evidence from a variety of sources that significant unilateral market power was exercised in California during the period June 2000 to June 2001 and that this led to the unjust and unreasonable wholesale electricity prices that existed during that period and were expected to exist for next 18 months to 2 years. Whether a portion of this unilateral exercise of market power was in fact market manipulation is irrelevant. In either case, the Federal Power Act states that it is illegal for FERC to allow consumers to pay unjust and unreasonable wholesale electricity prices. Moreover, both FERC and California agree that prices during the period June 2000 to June 2001 were unjust and unreasonable.

### **PROTECTING CONSUMERS FROM UNJUST AND UNREASONABLE PRICES**



I now describe a market monitoring protocol that will guarantee that FERC fulfills its statutory mandate under the Federal Power Act to protect consumers from unjust and unreasonable wholesale electricity prices, so that a “California electricity crisis” will not occur in another electricity market at some future date. First, FERC must set a clear standard for unjust and unreasonable prices, that if violated automatically triggers regulatory intervention by FERC. This would require specifying a level, a duration, and geographic scope for what constitutes unjust and unreasonable prices. Despite the fact that competitive electricity markets have been in operation in the US for more than four years, FERC has yet to define a standard for what constitutes unjust and unreasonable prices. This makes it impossible for California’s independent market monitoring committees and the ISO’s own Department of Market Analysis to find any evidence that wholesale prices are unjust and unreasonable and therefore illegal under the Federal Power Act.

All market participants should be able to compute this index of market performance using publicly available data. It is also important that the regulatory intervention that would result if this standard were violated is spelled out in detail and viewed as sufficiently undesirable to the power suppliers so that they have a strong incentive to work to fix market design flaws and other market inefficiencies before they develop into problems that can result in the significant consumer harm that would trigger this intervention. This would create a self-regulating market, rather than one that requires day-to-day intervention by the ISO, state agencies and often FERC that detracts from long-run market efficiency.

The California ISO, in its Market Design 2002 filing with FERC, has proposed a version of this market monitoring and regulatory intervention protocol. The details of the 12-month market performance index, automatic intervention trigger, and the required regulatory intervention by FERC are discussed in detail in this filing. The April 22, 2002 opinion of the Market Surveillance

Committee strongly endorses this concept and discusses several important aspects of its implementation.

This 12-month market performance index approach to defining a standard for unjust and unreasonable wholesale electricity prices requiring regulatory intervention by FERC does not distinguish between unjust and unreasonable prices due to the unilateral exercise of market power or market manipulation. Regardless of the cause, consumers are protected from the unjust and unreasonable prices, and intervention to correct the cause of these unjust and unreasonable rates is pre-specified. Consequently, FERC and all of the stakeholders in the California market can immediately stop attempting to find “bad” behavior California market and instead focus on the far more productive goal fulfilling FERC’s statutory mandate of protecting consumers.

## **Market Surveillance Committee Reports/Opinions**

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- “Reliability Must-Run Contracts for the California Electricity Market,” April 2, 1999.
- “Report on the Redesign of the California Real-Time Energy and Ancillary Services Markets,” October 18, 1999.
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- “Comments on ‘Comprehensive Congestion Management Reform--Zonal-Forward Market--White Paper’ by California ISO,” April 24, 2000.
- “Opinion on the California ISO’s Proposal for Interim Locational Market Power Mitigation (‘Interim LMPM’),” June 13, 2000.
- “Recent Events in the California Electricity Industry and the Level of Price Caps on the ISO’s Energy and Ancillary Services Markets,” July 6, 2000.
- “Market Surveillance Committee Opinion on the ISO’s Proposal For Congestion Management Reform,” July 31, 2000.
- “Designing the Market for Local Reliability Service,” August 3, 2000.
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### **Other Papers and Presentations on Electricity Markets**

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“Ten Myths About Competitive Electricity Markets: Lessons for Designing Congestion Management  
Protocols,” May 2001.

“Will FERC See the Light on the Law? (Los Angeles Times, 4/30/01)

“Want 10,000 megawatts? Use Variable Power Pricing” (San Jose Mercury News, May 4, 2001)

“A Comprehensive Market Power Mitigation Plan for the California Electricity Market” April 24,  
2001.