

Statement of
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Chairman Leiberhan and Members of the Committee, I am pleased to submit this written statement on the lessons that should be learned about regulating energy markets from the California electricity crisis and the Enron bankruptcy and how these lessons should change way the Federal Energy Regulatory Commission (FERC) carries out its statutory mandate to set just and reasonable wholesale prices for electricity.¹ This issue is particularly timely given the current state of electricity re-structuring in the United States, and the recent Notice of Proposed Rulemaking (NOPR) issued by FERC outlining a standard market design (SMD). It is essential that the right lessons be learned from these two regulatory failures before FERC issues it final order on standard market design. Otherwise, it is very likely that these standard market rules will introduce market design flaws that can enhance the ability of market participants to exercise significant unilateral market power, and therefore increase the likelihood of future regulatory failures like the California electricity crisis and the Enron bankruptcy.

My testimony proceeds as follows. First, I will provide a diagnosis of the causes of the California electricity crisis. This is followed by a discussion of the actions taken at the state and federal level to end this crisis and their impact on the performance of the California electricity market. I then will describe the state and federal actions that ultimately ended the crisis. This is followed by a discussion of what I believe are the major lessons for electricity market design to be learned from the California crisis and the Enron bankruptcy. My testimony concludes with a recommendations for how FERC should change the way it carries out it statutory mandate to set just and reasonable wholesale prices as a result of these lessons learned. In this discussion, I describe

¹I am a Professor of Economics at Stanford University. 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. The MSC is an independent committee that monitors the performance of the California market and the California ISO for the Federal Energy Regulatory Commission. A discussion of my academic research and the role of the MSC in the California electricity market is given the end of my testimony. This is followed by a listing of the reports prepared by the MSC that have been submitted to the Federal Energy Regulatory Commission since the start of the California market.

a worst-case scenario for how another California electricity crisis could occur if these recommendations are not followed.

Diagnosing the California Electricity Crisis

At the outset, I would like to emphasize that the California electricity crisis was not a market failure, but a regulatory failure. As has been shown in recent research that I have carried out with Severin Borenstein and James Bushnell of the University of California, the relationship between the underlying market fundamentals and the level market power exercised in the California electricity market was not appreciably different between the summer of 2000 and the summers of 1998 and 1999.² As is becoming increasingly clear as more information becomes publicly available about the behavior of market participants in the California market during the period May 2000 to June 2001, there was never a shortage of generation capacity to serve consumers in California and the rest of the West. Instead, the observed scarcity electricity of during the crisis period was caused by market participants creating an artificial shortage of electricity that would enable them to sell the electricity they did provide at substantially higher prices. A number of independent studies by the California ISO's Department of Market Analysis, the California Public Utilities Commissions and several academic studies using publicly available data have documented this withholding behavior by generation unit owners during the crisis period.³ This artificial scarcity during the crisis period also allowed suppliers to charge substantially higher prices for any electricity delivered under any forward financial contract with a delivery date in the future less than the time necessary bring a substantial amount of new generating capacity on-line to serve California. Operationally, this meant that any forward financial contract signed during the period January 2001 and May 2001 that delivers any electricity during the period June 2001 to December 2003 would reflect the level of

²Borenstein, Severin, Bushnell, James, and Wolak, Frank. (2002) "Measuring Market Inefficiencies in California's Restructured Wholesale Electricity Market," available from <http://www.stanford.edu/~wolak>.

³Joskow, Paul and Kahn, Ed, (2002) "A Quantitative Analysis of Pricing Behavior in California's Wholesale Electricity Market During the Summer of 2000: The Final Word," available at <http://econ-www.mit.edu/faculty/pjoskow>, is the most widely cited study using publicly available data. The ISO's Department of Market Analysis produced a number of reports using confidential data quantifying the extent of withholding behavior among the large California market participants. The California Public Utilities Commission recently released a study of withholding behavior during the period January 2001 to May 2001 by the large California market participants available at <http://www.cpuc.ca.gov/published/Graphics/19417.PDF>.

market power that suppliers expected (at the time they signed the contract) to exist in the spot electricity market at the delivery date.

Market participants did not need to coordinate their behavior to create this artificial shortage of electricity that allowed them to set extremely high electricity prices during the period May 2000 to June 2001. Because of water availability for hydroelectric production in the Pacific Northwest during the summer of 2000, market participants found this behavior unilaterally profit-maximizing given the actions of other suppliers in the West. Evidence of this significant decline in import availability is that the average hourly quantity of imports into California during the latter part of the summer of 2000 was roughly half the average hourly value of imports during the same time period in 1999, despite average electricity prices in during the latter part of the summer of 2000 more than 5 times higher than average prices during the latter part of the summer of 1999. To understand the importance of import availability to performance of the California market, it is important to recall that, historically, California has obtained roughly one-quarter of its electricity needs from imports.

Owners of fossil-fuel generation facilities serving the California market recognized that higher profits were possible by pursuing a strategy of withholding capacity from the market either by refusing to offer their units to the market, declaring their units unavailable to operate, or by bidding prices vastly in excess of the average variable cost of supplying electricity from their generation units. This withholding behavior by fossil-fuel generation owners during the period May 2000 to June 2001 is documented in the studies referred to earlier in my testimony. Further evidence consistent with this withholding behavior is the unprecedented quantity of generation capacity unavailable to serve California during the period June 2000 to June 2001. For example, during the seven-month period November 1, 2000 to May 31, 2001, the average daily quantity of generation capacity forced or scheduled off-line in California was in excess of 10,000 megawatts (MW).⁴ This figure is slightly less than one-quarter of the total amount of generating capacity in California.

The combination of low import availability and extraordinary high levels of generation capacity off-line in California allowed in-state suppliers to bid the capacity they did make available at extremely high prices and still have their bids accepted. Because the vast majority of imports from the Pacific Northwest are from hydroelectric facilities, the quantity of imports of available to

⁴The California Energy Commission compiles summary statistics on the average daily amount of capacity off-line on a monthly basis at http://www.energy.ca.gov/electricity/monthly_off_line.html.

California was not likely to change until water conditions in Pacific Northwest improved. Water levels in Pacific Northwest during the last quarter of 2000 and first quarter of 2001 were extremely low and forecast to be as low or lower during the spring and summer of 2001. Consequently, it was reasonable for suppliers to expect that their withholding strategy would be extremely profitable through, at least, the autumn of 2001, because of forecast low water levels (and import availability) in the Pacific Northwest during this time period.

Further evidence that the California electricity crisis was due to an artificial scarcity of electricity is that all of the blackouts of firm electricity customers occurred during the months of January, March and May of 2001, when the daily peak demand for electricity was no greater than 34,000 MW. However, I would like to stress that the California ISO was able serve demand peaks above 43,000 MW during the summer of 2000 and demand peaks above 41,000 MW during the summer of 2001 without curtailing firm electricity customers. Rolling blackouts during these months, the high-consumption period of the annual demand cycle in California, would be consistent with a true shortage of generating capacity. In contrast, rolling blackouts during January and March, the low-consumption period of the annual demand cycle, and early May, a time of comparatively low demand, casts considerable doubt on the existence of a true scarcity of generating capacity to serve California.

While the above description of events in the California market might give the impression that suppliers engaged in illegal behavior to raise electricity prices during crisis period, I would like to emphasize that explicit coordination among suppliers was not necessary. Clearly, coordinated behavior among California participants would have made it easier to create this artificial scarcity, but, the technology of producing and distributing electricity and how it is priced to final consumers, combined with certain market conditions can result in the unilateral profit-maximizing responses of suppliers to these system conditions setting prices vastly in excess of competitive levels. Specifically, the availability imports to California during the crisis period and the very small quantity of forward contract coverage between California suppliers and the three large load-serving entities (LSEs) in California—Pacific Gas and Electric (PG&E), Southern California Edison (SCE) and San Diego Gas and Electric (SDG&E)—combined with the unilateral profit-maximizing actions of these suppliers to raise average energy prices over the period May 2000 to June 2001 to more than five times average prices over the period April 1, 1998 (the start of the California wholesale market) until April 30, 2000.

Fundamental Enabler of Supplier Market Power in California

I will now describe the primary factor that allowed suppliers serving the California market to raise prices vastly in excess of competitive levels during the period May 2000 to June 2001. Different from any other wholesale electricity market operating in the US or any other country in the world, when California sold off approximately 18,000 MW of fossil-fuel generation capacity owned by PG&E, SCE, and SDG&E to Duke, Dynegy, Reliant, AES, and Mirant, the five new entrants to the California market, it was done without an accompanying provision that the new owners agree to sell back to these three firms at fixed-price a large fraction of the expected annual output from these units in long-term contract with a duration of at least 5 years. These mandatory buy-back forward contracts sold along with the generation units are typically called “vesting contracts.” A vesting contract on a 500 MW unit might require the new owner to sell an average of 400 MWh each hour back to the load-serving entity that sold the generation asset at a price set by the regulator (before the asset is sold) for a period of at least 5 years. There are number modifications to this basic vesting contract structure, but the crucial feature of these forward contracts is that they obligates the new owner to sell fixed quantity of energy each year at a fixed price to the (LSE) affiliate of the former owner.

This forward contract sets up an extremely powerful incentive for the new owner to produce at least the contract quantity from its unit each hour of the day. The new owner must purchase any energy necessary to meet its forward contract obligations that it does not supply from its own units at the spot market price and sell it at the previously agreed upon fixed price. Consequently, the supplier only has an incentive to bid to raise the market price if it is assured that it will produce at least its forward contract obligations from its own units. However, this supplier cannot be assured of producing its forward contract obligation unless its bids for this quantity of energy are low enough to be accepted by the ISO. If each supplier knows that other suppliers have vesting contracts and are eager to supply at least their forward contract obligations from their own units, then all suppliers will have strong incentives to bid very close to their marginal cost of production for their forward contract obligation. This aggressive bidding brought about by the desire of suppliers to cover their forward contract positions will set market prices very close to competitive levels in all but the highest demand periods when at least one supplier is confident that it will be needed by the ISO to produce more energy than its forward contract quantity regardless of how high it bids.

In contrast, if suppliers have little or no forward contract obligations, their incentive to bid substantially in excess of the marginal cost supplying electricity from their units can be much greater. That is because they will earn the market-clearing price on all of electricity they produce. Because these suppliers have no forward contract obligations to meet, they are net suppliers of electricity with the first MWh of electricity they produce. To understand this dramatic change in the incentive to raise prices caused by having no forward contract obligations, consider the 500 MW unit described earlier. Suppose this supplier actually produces 450 MWh of energy. In a world with vesting contracts, if it manages to raise market prices by \$1/MWh, this will increase its revenues by the difference of 450 MWh (the amount energy it actually produces) and 400 MWh (the amount of its forward contract obligation), times \$1/MWh or \$50. In contrast, in a world with no forward contract obligation, if this firm manages to increase the market price by \$1/MWh is earns an additional \$450 in revenues, because it is paid this price for all of its sales. In this simple example, the lack of any forward contract obligation for the suppliers has resulted in a 9 times greater incentive to raise market prices by \$1/MWh, than would be case if the firm had the forward contract obligation to supply 400 MWh. Extending this example to the case of suppliers that own a portfolio of generation units, one can immediately see the tremendous increase in the incentive bid in excess of marginal costs during certain system conditions caused by the lack of vesting contracts. The five new entrants to the California market had very limited forward contract commitments to the three large load serving entities in California.⁵ Consequently, any increase in the market price could be earned on virtually all of the energy produced by these suppliers.

This same incentive for suppliers to raise spot prices in the eastern ISO is limited to extreme demand conditions, because all of the large load-serving entities in these markets either own sufficient generation capacity to meet virtually all of their final demand obligations or have vesting contracts with the new owners of their units for substantial fraction of the expected output of these units. Consequently, the exercise of significant market power only occurs during very high demand conditions.⁶ Although it is difficult to get precise estimates of extend that final demand is covered

⁵The California Power Exchange ran a “block forwards” long-term financial contract market, and some of the California LSEs had purchased a limited amount of long-term financial contract coverage from this market.

⁶James Bushnell and Celeste Saravia. "An Empirical Assessment of the Competitiveness of the New England Electricity Market" (May 2002, available from <http://www.ucei.berkeley.edu/ucei/PDF/csemwp101.pdf>) shows that significant market power exists during high demand conditions in the New England and PJM electricity markets.

by forward contracts, estimates for the PJM, New York and New England Markets suggest that more than 90 percent of annual demand is covered by forward financial obligations either in the form of generation ownership or forward financial contracts . In California during the period May 2000 to June 2001, this figure was close to 40%, which is the approximate average percentage of the total demand of the three large investor-owned utilities that could be met from their own generation units. As noted above, the five new entrants—Duke, Dynegy, Reliant, AES and Mirant—had very limited forward contract obligations to supply to these three large LSEs.

The very limited forward contract obligations to the three LSEs by the five new fossil-fuel capacity entrants combined with low import availability during the second half of 2000 created an environment where the unilateral profit-maximizing bidding behavior of these suppliers resulted in prices vastly in excess of competitive levels. If California had forward contract coverage for final demand at the same levels relative to annual demand as is the case in the eastern ISOs, I do not believe that California suppliers would have found it unilaterally profit-maximizing to withhold capacity to create the artificial scarcity that allowed them to raise market prices dramatically. Moreover, even if they had been able to raise market prices, California consumers would have only had to pay these extremely high prices for less than 10 percent of their consumption rather than for close to 60 percent of their consumption.

The lack of forward contract obligations to final load in California created an additional harm to California relative to other states in the west that used the spot market for less than 5% percent of their electricity needs. The substantially larger spot market share in California meant that the same \$/MWh electricity price increase resulted in wholesale energy payments increases in California that were more than 10 to 12 times higher than the wholesale energy payments increases in the rest of the western US.

Regulatory Dispute that Led to California Crisis

The California electricity crisis was the direct result of the conflict between the Federal Energy Regulatory Commission and the state of California over the appropriate regulatory response to the extremely high wholesale electricity prices in California during the summer and autumn of 2000. The state of California argued that wholesale electricity prices during the summer and autumn of 2000 were unjust and unreasonable and it was therefore illegal under the Federal Power Act of 1935 for California consumers to pay these wholesale prices. However, not until it issued a preliminary order on November 1, 2000 did FERC first state that wholesale prices in California were unjust and unreasonable and reflected the exercise of significant market power by suppliers to the California market. Although FERC reached this conclusion almost four months after California, the ultimate conflict between the FERC and state of California does not appear to be over whether wholesale prices in California during the summer and autumn of 2000 were illegal under the Federal Power Act. Instead, the ultimate regulatory conflict that led to the California crisis appears to be over the appropriate remedy for these unjust and unreasonable prices.

To understand the statutory mandate that FERC operates under that allows this regulatory failure to occur, it is useful to review the provisions of the Federal Power Act that require FERC to set “just and reasonable” wholesale electricity prices and to describe how FERC has managed to introduce wholesale electricity markets in spite of its statutory mandate to set just and reasonable wholesale prices. The accepted legal standard for just and reasonable wholesale prices are those that recover production costs, including a “fair” rate of return on the capital invested by the firm. Moreover, if the FERC finds that wholesale electricity prices are unjust and unreasonable, the Federal Power Act gives it considerable authority to take the actions necessary to set just and reasonable prices. Finally, the Federal Power Act requires that FERC order refunds for any payments by consumers for prices in excess just and reasonable levels.

Approximately ten years ago FERC embarked on an explicit policy to promote wholesale electricity markets throughout the US. The price a generation unit owner receives from selling into a wholesale electricity market is would be determined by the willingness of all generation unit owners to supply electricity, rather than an administrative process that uses the firm’s production costs and a rate of return on capital invested to determine the price it is paid. The just and reasonable price standard for wholesale electricity prices required by the Federal Power Act presented a significant legal and regulatory challenge for FERC because markets can set prices

substantially in excess of the production costs for sustained periods of time. This occurs because one or more firms operating in the market have market power--the ability to raise market prices through their unilateral action and profit from this price increase.

Because of the very large potential harm from the exercise of unilateral market power by firms in a competitive electricity market, FERC has determined that unless a firm can prove that it does not possess market power it is not eligible to receive market-based prices. An implication of FERC's logic for granting market-based rate authority is that only if all firms participating in a market possess no market power will the price set by the market satisfy the just and reasonable standard of the Federal Power Act. Specifically, before it allows any market participant to receive a market price rather than a cost-based regulated price, FERC requires each participant to demonstrate that it does not have market power. My previous testimony submitted to this committee on June 13, 2001 describes FERC's process for determining whether a firm is can sell at market-based prices.⁷

As should be clear from the events in California from June 2000 to June 2001, the process FERC uses to determine whether a firm is eligible to receive market-based prices is fatally flawed. First, the dichotomy implicit in the FERC process that a firm either possesses market power or does not possess market power is factually false. Depending on conditions in the transmission in network and the operating decisions of all market participants, almost any firm can possess substantial market power in the sense of being able to impact significantly the market price through its unilateral actions. Second, it also extremely difficult, if not impossible, to determine on a prospective basis the frequency that a firm possesses substantial market power given the tremendous uncertainty about system conditions and the incentives they create for the behavior of other firms in the market. Finally, the methodology used by the FERC to make a determination of whether a firm has the ability to exercise market power uses analytical techniques that have long been acknowledged by the economics profession as grossly inadequate. My June 13, 2001 testimony describes these shortcomings in detail.

Because FERC granted market-based price authority to all sellers in the California market using a flawed and outdated methodology without any accompanying regulatory safeguards, it is not

⁷Wolak, F.A. "Written Testimony On Role of Federal Energy Regulatory Commission in Functioning of California Electricity Market," June 13, 2001 (available from <http://www.stanford.edu/~wolak>).

surprising that a sustained period of the exercise of significant market power and unjust and unreasonable wholesale prices occurred because of the substantial dependence of California's three large LSEs on the spot market. However, FERC's remedies implemented in its December 15, 2000 order are more difficult to understand. Despite filings by a large number of parties arguing that these remedies (also proposed in the November 15, 2000 preliminary order) would be ineffective at best and most likely harmful to market, FERC still implemented their proposed remedies largely without modification. For example, the Market Surveillance Committee of the California ISO that I chair wrote in its December 1, 2000 comments, "The MSC concludes in its analysis that the Proposed Order's remedies are likely to be ineffective to constrain market power and, in fact, could exacerbate California's supply shortfalls, and thereby, increase wholesale energy prices."⁸ Unfortunately, this is precisely what happened following the implementation of these remedies in January of 2001. The California Power Exchange went bankrupt, PG&E declared bankruptcy, SCE came close to declaring bankruptcy, and rolling blackouts of firm load occurred in January, March and May of 2001.

As noted in the December 1, 2000 MSC report, FERC's soft price cap policy contained in its December 15, 2000 final order amounted to no price cap on wholesale electricity prices, because all suppliers had to do was to cost-justify their bids in excess of the \$150/MWh soft price cap, something they found increasingly easy to do over time because FERC only did a very limited review of the prudence of these cost justifications. Rather than remedying the unjust and unreasonable prices of the summer and autumn of 2000, the December 15, 2000 remedies produced wholesale prices from January 1, 2001 to the end of June 2001 that were substantially higher than average wholesale prices during any preceding or following six-month period, along with the rolling blackouts and bankruptcies and near-bankruptcies described above.

⁸Wolak, Frank A., Nordhaus, Robert, and Shapiro, Carl, "Analysis of 'Order Proposing Remedies for California Wholesale Electric Markets (Issued November 1, 2000),' December 1, 2000 (available from <http://www.stanford.edu/~wolak>).

Solution to California Electricity Crisis

I now address the question of the solution to California electricity crisis. As described above, the lack of vesting contracts between California suppliers and the three large LSEs created strong incentives for suppliers to withhold capacity from the market in order to increase spot prices. By this logic, if enough California suppliers had a substantial amount of their capacity committed in long-term contracts to California LSEs, the incentive California suppliers had to withhold capacity from the market would be substantially reduced and the accompanying very high average spot prices created by this artificial scarcity would be largely eliminated. For this reason, the December 1, 2000 report of the Market Surveillance Committee proposed a joint/federal state regulatory mechanism to implement what amounted to ex-post vesting contracts between California's LSEs and suppliers to the California market at fixed prices set by the FERC. However, this regulated forward contract remedy was rejected by FERC in its December 15, 2000 order. Consequently, if the state of California wished purchase the quantity and mix of forward contracts necessary to commit suppliers to the California market during the summer 2001 and following two years, it would have to pay prices that reflected the market power that suppliers expected to exist in the spot market in California over the coming two years. Suppliers would not voluntarily sell their output in a forward contracts that covered this time period at prices below what they expected to receive in the spot market.

Thus, the only way for California to lower the price it had to pay for a forward contract was to increase the duration of the contract or the fraction of energy purchased in the later years of contract. By committing to purchase more power from existing suppliers at prices above the level of spot prices likely to exist in California more than two years into the future, California could obtain a lower overall forward contract price. However, this was simply a case of paying for the market power that was likely to exist in the California spot market during the period June 2001 to May 2003 on the installment plan rather only during this two-year time period.

During the late winter and early spring of 2001, the state of California implemented this solution, by signing approximately \$45 billion in forward contracts with durations averaging approximately ten years. These forward contracts committed a significant amount electricity to the California market during the summer of 2001 and even more in the summer of 2002 and beyond. While a few of the forward contracts signed during the winter of 2001 began making deliveries in late March and the beginning April and May of 2001, a substantial fraction these contracts began

delivering power to California during June 1, 2001. The vast majority of the remaining contracts delivering power during summer of 2001, began July 1, 2001 and August 1, 2001.

FERC Price mitigation plan described in its June 19, 2001 order was implemented June 20, 2001. This plan established a west-wide price cap and required power marketers to bid as price takers in the California market. However, all sellers other than power marketers were still allowed the opportunity to cost-justify and be paid as-bid for their electricity at prices above this west-wide price cap.

To assess the relative impact on spot market outcomes of this price mitigation plan relative to the forward contracts purchased by the state of California, it is important to bear in mind the following facts. First, the FERC price mitigation plan only applied to sales in the California ISO real-time market. During this time period less than 5% of the energy consumed in California was paid the ISO real-time price. The vast majority of sales during the summer of 2001 were made through the long-term forward contracts signed during the winter of 2001 and medium-term commitments to supply power negotiated by the California Department of Water Resources. Second, according to the California ISO's Department of Market Analysis, average prices for incremental energy were slightly below \$70/MWh during July of 2001 and less than \$50/MWh for the remaining months of 2001. Throughout this entire time period the west-wide price cap was slightly above \$91/MWh. Third, according to the July 25, 2001 Market Analysis Report of the ISO's Department of Market Analysis, the extent to which real-time prices exceeded the competitive benchmark price during the period June 1, 2001 to June 19, 2001 was substantially smaller than it was any previous month during 2001⁹. The result is consistent with the forward contracts beginning delivery on June 1, 2001 providing incentives for more competitive spot market behavior. Finally, it is important to note that demand during each month of 2001 was approximately 5% percent less than demand during the same month of 2000, because of significant conservation efforts by California consumers. All of these facts suggest that the June 19, 2001 price mitigation plan was not a binding constraint on real-time prices during the vast majority of hours of the second half of 2001.

⁹Sheffrin, Anjali, "Market Analysis Report," July 25, 2001 (available from <http://www.caiso.com/docs/2001/07/26/200107260820387855.pdf>)

Monthly average real-time incremental energy prices from January 1, 2002 to September 30, 2002, the end of price mitigation period, averaged between \$50/MWH and \$60/MWh, which provides evidence that this price mitigation plan was not the binding constraint on prices for the vast majority of hours of the first nine months of 2002 as well. Average prices for near-term energy during the period July 1, 2001 to September 30, 2002 were significantly lower than average incremental real-time energy prices over this same time period. This result provides evidence that the long-term contracts signed during the winter of 2001 caused suppliers to exhibit more competitive behavior in the near-term energy market during this time period. More recent analyses of market outcomes by the Department of Analysis of the California ISO that accounts for the impact of the forward contract obligations of the large suppliers finds additional evidence consistent with the view that these forward contract obligation increased the competitiveness of the near-term and real-time electricity markets during the period July 2001 to September 2002.

Although I believe that the FERC July 19, 2001 price mitigation order, at most, had a very limited impact on the competitiveness of the medium-term and real-time spot markets for electricity in California relative to the impact of forward contracts signed by the state of California during the winter of 2001, the greater willingness of FERC to support the actions of the California ISO operators following the June 19, 2001 order significantly benefitted the reliability of the California ISO transmission network. Following the implementation of the June 19, 2001 order, FERC was much more willing to take tangible actions in support of the ISO's efforts to make suppliers comply with FERC's must offer requirement as well as a number of other provisions of the ISO tariff. I believe that these actions convinced California market participants that FERC was now taking a far more active role in regulating the California market and that this more active presence in California benefitted system reliability and market performance.

Lessons Learned from the California Electricity Crisis

Several lessons from the California electricity crisis follow directly from the diagnosis of the causes and solution to the California electricity crisis given in the previous section of this testimony. The most important lesson is that any re-structuring process should begin with a large fraction of final demand covered by long-term forward contracts. Only a very small fraction of total demand should be purchased from the medium-term and real-time markets, particularly given the way that retail electricity is priced to final consumers throughout the US. To the extent that the wholesale

market in a geographic region is highly dependent on imports and highly dependent on hydroelectric power, the fraction of total demand that should be left to the medium-term and real-time market is even smaller. For this reason, the forward contract coverage of final load at the start of the market in California should have been even greater than what exists in any of the markets in the eastern US because none of them are as dependent on imports and hydroelectric energy as California.

The second lesson is that state and federal regulators must coordinate their regulatory efforts to protect consumers. Because FERC disregarded much of the input from California regulators and policymakers and other independent monitoring entities intimately acquainted with the performance of the California market during autumn of 2000 in formulating its December 15, 2000 order implementing remedies for the California market, this order had many unintended consequences that only made matters worse, rather than remedying the extreme market power exercised in the spot electricity market in California. This outcome underscores an important component of this lesson this is particularly relevant for states that have not yet re-structured. State regulators cannot protect consumers from market power in the wholesale market without the cooperation of the FERC because it is the only regulatory body charged with setting just and reasonable wholesale electricity prices. To provide the necessary assurance to states that another regulatory crisis between FERC and state regulators will not occur at some future date, it may be necessary for FERC to implement a formal mechanism that guarantees that it will fulfill its statutory mandate to set just and reasonable wholesale prices in the most timely manner possible should market outcomes that reflect significant market power arise in any wholesale electricity market that it regulates. I am extremely skeptical that the national political process will allow further re-structuring of the electricity supply industry unless FERC is able to provide a greater degree of assurance to state regulators that it will provide the same or a superior level protection to consumers relative to what they received in the former vertically integrated utility regime. The tremendous resistance to FERC's standard market design NOPR expressed by politicians and policymakers in the majority of US states appears to be due in large part to the perception that FERC cannot or will not provide this level of protection to electricity consumers.

An important corollary to the necessity of coordinating federal and state regulatory policies, is that a successful wholesale market design must take into account the existing retail market design. Federal wholesale market policies must be coordinated with state-level retail market policies. The details of state-level retail market policies can have potentially enormous unintended consequences

for wholesale market performance. For example, designing a wholesale market assuming the existence of active participation in the wholesale market by final consumers, when virtually all retail markets in the US does not support such participation, will not create a workably competitive wholesale market. Consequently, a national policy for a standard wholesale market design should at least recognize that certain conditions in the retail market are necessary to support a workably competitive wholesale market. For example, one retail market pre-condition for FERC approval of a wholesale market design would be that all customers above some peak demand level, say 200 KW, have hourly meters at their facility and face a default price equal to the hourly spot price of electricity at their location. FERC may also wish to consider pre-conditions on the retail infrastructure to support participation by small business and residential customers in wholesale market, but some pre-conditions on the retail infra-structure for large, sophisticated electricity consumers is essential.

A third lesson from the California crisis is that FERC cannot set ex ante criteria for a supplier meet in order it to be allowed to receive market-based prices without an ex post criteria for assessing whether the subsequent market prices are just and reasonable. As discussed above, it is impossible determine with certainty on an ex ante basis whether a supplier owning a portfolio of generation units has the ability to exercise significant market power. Consequently, I see no way for FERC to avoid devising a transparent methodology for determining what constitutes a just and reasonable price in a wholesale market regime. Despite over four years experience with wholesale markets in the US, FERC is still unwilling to define what constitutes unjust and unreasonable prices. This FERC policy creates unnecessary regulatory uncertainty and increases the likelihood of another California electricity crisis, where there is a disagreement between FERC and state regulators over the extent to which wholesale prices are unjust and unreasonable and the appropriate regulatory remedies for these prices.

If one is willing to acknowledge that suppliers attempt to exploit all of the unilateral market power that they possess and that conditions in the transmission network and the production and consumption decisions of other market participants determine whether a firm possess substantial market power, then it follows that a supplier cannot be immunized against the ability to exercise market power on an ex ante basis. By this logic, the issue is no longer whether any supplier possesses market power, but whether the unilateral actions of all market participants exercising all available market power results in prices that impose significant harm to consumers. In other words,

do wholesale prices reflect the exercise of a substantial amount of market power for a sustained enough period of time to impose sufficient harm to consumers to justify regulatory intervention? This is the fundamental question that FERC must answer in order to provide a transparent definition of what constitutes unjust and unreasonable prices in a wholesale market regime. Specifically, FERC should be required to define the extent of market power exercised, the geographic market over which it is exercised and the time interval over which it exercised that results in unjust and unreasonable wholesale prices worthy of regulatory intervention. A transparent definition of unjust and unreasonable prices in a wholesale market regime that can be applied to any wholesale market considerably simplifies the process of regulating wholesale markets. If this transparent standard (that can be computed by all market participants) for prices is exceeded then regulatory intervention should automatically occur.

This perspective on just and reasonable wholesale market prices suggests a potential logical inconsistency in FERC's current approach to enforcing the just and reasonable price provision of the Federal Power Act. Specifically, in both public statements and its orders, FERC has stated that it is important to find the bad actors and punish them for causing unjust and unreasonable prices. While it is important to find market participants that violated market rules and take back their ill-gotten gains as well as penalize them for any market rule violations or illegal behavior, these statements by FERC seem to suggest that bad behavior on the part of a market participant is necessary for unjust and unreasonable prices worthy of refunds to occur. However, as emphasized in the above discussion and my June 13, 2001 testimony, the unilateral actions of all privately-owned market participants to serve their fiduciary responsibility to their shareholders and the unilateral actions of all publicly-owned market participants to serve the interests of their captive customers can result market outcomes that reflect the exercise of enormous market power. In short, there is no need for any malicious behavior by any market participant for a wholesale electricity market to produce unjust and unreasonable prices. Moreover, the Federal Power Act does not specify that prices must be the result of malicious behavior by a market participant in order for them to be deemed unjust and unreasonable. The Federal Power Act only requires that if FERC determines that prices are unjust and unreasonable, regardless of the cause, then it must take actions to set just and reasonable prices and it must order refunds for any payments in excess of just and reasonable levels.

The Federal Power Act does not say that these refunds must be paid only by firms that violated market rules or engaged in illegal behavior. This is the fundamental logical inconsistency that FERC faces in attempting to introduce wholesale markets without an explicit statutory mandate to do so. Firms can be required to refund wholesale market revenues despite the fact that no market participant engaged in any illegal behavior or violated any market rule, because their unilateral profit-maximizing actions jointly resulted in unjust and unreasonable market prices. This means that the legal actions of market participants in compliance with the market rules can result in market prices that are illegal and worthy of refunds. I believe the best way for FERC to deal with this problem is once again to set a transparent standard for what constitutes unjust and unreasonable prices in a wholesale market regime and set a pre-specified regulatory intervention that will occur if this standard is violated. This will minimize the potential for future FERC versus state regulatory conflict that can create another California electricity crisis.

Recommended Changes in FERC's Regulatory Oversight of Wholesale Market

A final lesson from California crisis is that FERC must regulate, rather than simply monitor wholesale electricity markets. As should be clear from the previous sections and the description of the earning warning signs of the exercise of market power in the California market discussed in my June 13, 2001 testimony, there was no shortage of effective market monitoring in California from the start of the market in April 1, 1998 to the present time. The Department of Market Analysis of the California ISO, the Market Monitoring Committee of the California Power Exchange, the Market Surveillance Committee of the California ISO, as well as a number of state agencies all documented the exercise of market power in California. However, none of these entities had the authority to implement any market rule changes or penalty mechanisms to limit the incentives firms had to exercise market power or violate California ISO market rules. Only FERC has the authority to implement market rules changes and make regulatory interventions to improve market performance. Rather than focusing its attention of monitoring market performance, FERC should instead concentrate on designing pro-active protocols for rapid regulatory intervention to correct market design flaws as quickly as possible and order refunds as soon as unjust and unreasonable prices are found.

What allowed the California crisis to exist was not a shortage of observers with radar guns recording the speed of cars on the highway. It was the lack of traffic cops writing tickets and imposing fines on cars that exceeded the posted speed limit.

On the topic of the necessity of FERC regulating rather than simply monitoring wholesale market, I would like to use FERC's soft price cap policy during the period January 2001 through June 2001 to illustrate this point. As discussed above, the soft cap policy stated that if a generator could cost-justify a bid in excess of the \$150/MWh soft price cap, then it could be paid as bid for its energy if it was needed to meet demand. However, regulation that simply says a firm must justify their costs in order to be reimbursed, can amount to no regulation at all. The recent revelations that energy traders in California misreported transactions prices during the crisis period suggests that it would be easy for an electricity supplier to obtain an invoice for its natural gas input fuel purchase at prices in excess of the actual cost to its energy trading affiliate. Consequently, without a rigorous prudence review of how input costs are actually incurred and disallowances for imprudently incurred costs, there is little limit on the prices that firms might be able to cost-justify. In fact, during the period January 1, 2001 to June 30, 2001, electricity suppliers often cost-justified and were paid as-bid prices substantially in excess of \$300/MWh under the guise of the FERC soft-cap policy. For this reason, anytime FERC caps the bids that a firm might submit based on its costs of production, it must perform a prudence review of these costs and be prepared to disallow any cost that cannot be adequately justified.

A final point related to the importance of FERC regulating rather than simply monitoring is the necessity of very accurate data on physical characteristics of plants, input fuel prices, other input prices and many other aspects of the operation of the wholesale market to carry out this task. For example, in order to perform a satisfactory review of the prudence of costs a firm would like to recover, FERC must have the best available data on these variables. Moreover, in order to compute the best possible estimate of what constitutes a just and reasonable wholesale market price FERC will need, at a minimum, the best available information on the operating characteristics of generation units, input fuel prices, the physical state of the transmission network. Finally, in order to provide tangible evidence on how well it is doing in delivering economic benefits (in the form of lower prices) to consumers that they would not have received in the former vertically integrated utility regime, FERC will need to be able to determine what prices would have been under the former vertically integrated utility regime. This will require the same information. Consequently, particularly during

the initial transition to a wholesale market regime, FERC should substantially increase, and certainly not reduce, the amount of data that it collects from market participants if it would like to be an effective and credible regulator.

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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 a S.M. in Applied Mathematics and Ph.D in Economics. For the past fifteen years, I have been engaged on research program studying the process of 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 the PJM (The Pennsylvania, New Jersey, and Maryland Interconnection), New York, New England and California electricity markets, as well as the re-structured electricity markets in Australia, Norway and Sweden, New Zealand, Spain, and England and Wales. 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 of California ISO

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 as part of the market monitoring function 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. This is a major role of the MSC. In this capacity I have written or coauthored more than ten reports on aspects of the design and performance of the California electricity markets during my three years as Chairman of the MSC. In preparing the 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. In addition, the MSC has worked closely with the Department of Market Analysis at the ISO in preparing these reports. These reports, along with other papers I have written on competitive electricity markets, are listed below.

Market Surveillance Committee Reports/Opinions

- “ISO Market Surveillance Committee Opinion on Firm Transmission Rights Proposals,” May 22, 1998
- “Preliminary Report on the Operation of the Ancillary Services Markets of the California Independent System Operator (ISO),” August 19, 1998.
- “Report on the Redesign of the Markets for Ancillary Services and Real-Time Energy,” March 25, 1999.
- “Reliability Must-Run Contracts for the California Electricity Market,” April 2, 1999.
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- “The Competitiveness of the California Energy and Ancillary Services Markets,” March 9, 2000.
- “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.
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- “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.
- “An Analysis of the June 2000 Price Spikes in the California ISO’s Energy and Ancillary Services Markets,” September 6, 2000.
- “Long-Term Price Cap Policy,” September 20, 2000.
- “Analysis of ‘Order Proposing Remedies for California Wholesale Electric Markets (Issued November 1, 2000)’” December 1, 2000.
- “Proposed Market Monitoring and Mitigation Plan for California Electricity Market,” February 6, 2001.

“Comments on ‘Staff Recommendation for Market Prospective Market Monitoring and Mitigation for California Wholesale Electricity Market,’” March 22, 2001.

“Comments on ‘Market Design 2002 Project: Preliminary Draft Comprehensive Design Proposal’,” February 20, 2002.

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“Supplementary Comments on the 2002 Market Design Proposal of the California ISO,” May 16, 2002

“Opinion on Oversight and Investigation Review,” July 22, 2002

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Market Design and Price Behavior in Restructured Electricity Markets: An International Comparison, forthcoming in Competition Policy in the Asia Pacific Region, EASE Volume 8, Takatoshi Ito and Anne Krueger (editors) University of Chicago Press, 1999.

Regulation and the Leverage of Local Market Power in the California Electricity Market, July 1999 (with James Bushnell).

Measuring Market Power in the California Electricity Market, mimeo, August 2000 (with Severin Borenstein and James Bushnell).

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Identification and Estimation of Cost Functions Using Observed Bid Data: An Application to Electricity, August 2000.

“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.

FERC Fixes Have Fallen Short (San Jose Mercury News, June 20, 2001)

\$9 Billion Rebate Should Be Just the Beginning, (North County Times, July 11, 2001)

Is Price Gouging Really the Problem? (San Diego Union Tribune, July 27, 2001)

“Designing a Competitive Wholesale Market that Benefits Consumers,” September 2001.

“Measuring Market Inefficiencies in California's Restructured Wholesale Electricity Market,” April 2002 (with Severin Borenstein and James Bushnell).