

**Statement of
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Members of the Committee, I am pleased to submit this written statement on the California electricity crisis and its implications for short-term and long-term energy policy. 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 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 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, it is helpful to 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 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. 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 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 three issues. The first is the appropriate form of long-term regulatory oversight for competitive electricity markets. The second is FERC's short-term regulatory policy for the California electricity market. The third describes the several essential features of a long-term energy policy.

REGULATORY OVERSIGHT OF COMPETITIVE ELECTRICITY MARKETS

The events of the past year in the California electricity market have exposed the crucial role of an active forward market in making a spot electricity market workably competitive. Different from the markets in PJM, New York and New England, since its inception in April 1998, the California market relied on purchases made at time-horizons less than or equal to one day in advance of delivery for the vast majority of energy consumed in the California ISO control area. This over-reliance on the spot market is the result of two factors.

First, before the start of the market, California ordered the three investor-owned utilities—Pacific Gas and Electric, Southern California Edison and San Diego Gas and Electric—to sell off more than 17,000 MW of their natural gas-fired capacity to new entrants. This sale was made without any corresponding “vesting contract” whereby the seller of the asset has the right to purchase from the new owner a significant fraction of the expected output of the unit at a price set by the regulator.

In all other markets in the US and around the world, when the incumbent monopolist's capacity is sold to new entrants, these assets are sold with vesting contract obligations. For example, suppose the incumbent firm sells a 500 MW baseload unit. A typical vesting contract would require the buyer of this asset to sell 400 MWh each hour for at least the next two years at a price set by the regulator.

The second factor contributing to California's dependence on the spot market is that the state imports historically between 20 and 25 percent of its electricity needs from neighboring states. This electricity is primarily surplus energy not needed to meet the needs of these states. For this reason,

the seller may not know the electricity is available to sell to California only a few hours before it is produced.

A generator selling virtually all of its power on the spot market has a significantly stronger incentive to bid to raise the price in the spot market, because it receives this price for all of its output. However, a generator with a vesting contract for 85 percent of its energy at a pre-specified price receives the spot market price only for production in excess of this forward market commitment. In addition, unless this generator produces more energy than its forward market commitment, it has a strong incentive to set the spot price as low as possible, because if the spot price is low enough, the generator will find it profitable to purchase its forward market commitment from the spot market rather than generating this electricity. Consequently, a generator with a significant commitment in the forward market will bid extremely low in the spot market for at least its forward market commitment.

This logic implies that an industry where all firms have significant forward contract obligations tends to produce competitive spot market outcomes. Because generation unit owners are aware of these incentives for aggressive bidding created by forward contracts, they must be induced to sign these financial arrangements. Fortunately, at time horizons greater than the time necessary to build new generating capacity, the forward market for electricity is extremely competitive. This provides existing firms with the necessary inducement to sign forward contracts at competitive prices because any existing generator faces competition from all possible potential competitors at this time horizon. For example, if the time to construct new capacity is two years, then all existing firms know that a significant amount of new capacity can be constructed within two years. Therefore, if a consumer is willing to purchase a forward commitment for electricity at this time horizon, he can obtain an extremely competitive price from an existing firm because all existing firms know that if they fail to offer a price below the long-run average cost of producing electricity using the most cost-effective technology, the consumer will instead elect to purchase electricity from a new entrant and a new plant using the latest technology will be constructed.

Unfortunately, competition to provide forward electricity at time horizons shorter than the time necessary to construct new capacity only takes place among existing firms. Without regulatory intervention, existing generation unit owners are able to charge whatever the market will bear for forward contracts for energy at these time horizons because the threat of new entry is unable to

discipline the prices existing firms offer. In addition, because the relevant opportunity cost of generators selling a forward contract for electricity over the next two years is the average expected spot price of electricity over this period. If firms know that there are opportunities to raise spot prices during this time period, they will only be willing to sign a forward contract at a price that compensates them for these forgone opportunities to set high prices in the spot market over the next two years.

These characteristics of competitive electricity markets imply that unless there are a substantial number of consumers willing and able to alter their demand in response to wholesale prices at time horizons shorter than two-years, the amount of forward contracts signed between consumers and generators will play a major role in determining the level and volatility of wholesale electricity prices. Less forward contracts between generators and loads will increase the number of hours of the year when generators can significantly raise spot prices through their bidding and scheduling behavior. This will lead to higher average prices and more volatile prices. More forward contracts between generators and loads will reduce the number of hours when generators can raise spot prices through their bidding and scheduling behavior. This will lead to lower average prices and less volatile prices.

Stated differently, the total amount of forward contracts that consumers have purchased from generation unit owners determines the magnitude of spot price risk that consumers must bear. If consumers own a substantial quantity of forward contracts for electricity, only a small fraction of their total consumption must be purchased from the spot market. Changes in the spot price exert very little influence on their average monthly price of wholesale electricity. Moreover, because of the incentives discussed above, generators have less incentive to attempt to increase the spot price. So the consumer's average monthly wholesale price remains stable. In contrast, with little forward contract cover, movements in the spot price exert an enormous influence on the average monthly wholesale price by consumers. In addition, generators with few forward obligations have increased incentives to attempt to increase the spot market price, so the consumer's monthly price for wholesale electricity is extremely unstable.

By owning more generation, a firm can exert a greater influence over the spot price. This has two benefits to the firm. First, it has more opportunities to raise the spot of price electricity. However, this ability to move the spot price electricity also allows the generator to reduce the risk

associated with commitments it makes to supply electricity in the forward market. For example, if a firm knows that it can influence the spot price at a future date, and this fact is unknown to other market participants, then the firm can engage in financial contracts with these market participants that it can later profit from by using its ability to alter the spot price of energy.

This financial aspect of the electricity supply industry did not exist in the former vertically integrated monopoly regime, where firms earned higher profits by operating their generating facilities at a lower average cost than the regulated retail price of electricity. Competitive electricity markets allow power marketers to speculate on the level of spot electricity prices at future dates. Virtually every hour of every day power marketers sell obligations to supply electricity that they have no ability to produce or buy commitments to demand electricity they have no intention of consuming. Electricity has now become like any other commodity market. In order for firm to make profits in this industry it is no longer necessary for it to own generation. To extent that a firm has superior information about the future pattern of spot prices, it can profit from this information by taking the appropriate forward market position and closing it out before the delivery data occurs.

This is not just a theoretical possibility. Enron owns no generating capacity in California. Nevertheless, it has managed to carve out an extremely lucrative power marketing business using its ability to forecast spot electricity prices in California and the rest of the western US.

Different from the market for pork bellies or wheat, the spot market for electricity presents a formidable engineering challenge to operate. Supply must equal demand at every instant in time and it is extremely costly to store electricity. The production of electricity is subject to severe capacity constraints: a 500 MW facility can only produce 500 MWh in a single hour. Electricity must be delivered over a transmission grid that is often subject to congestion which limits the number of firms that can deliver energy to a given geographic area. In short, there are number impediments to the efficient operation of a spot electricity market that do not exist for these other commodity markets. These impediments imply that consumers face more risk than exists for other commodities when they rely on the spot market for a significant fraction of their electricity needs.

This dramatic change in the structure of the electricity supply industry, requires a corresponding change in the regulatory oversight of this market. The growing financial side of the electricity supply industry makes it essential that the regulator of this market be able to secure information on the bidding, scheduling and production decisions of generating facilities and the

forward financial market positions of the energy trading affiliates of each generating company. The Federal Energy Regulatory Commission has limited authority to request information on the financial transactions unregulated affiliates of these generating unit owners.

The Public Utility Holding Company Act (PUHCA) of 1935 granted the Securities and Exchange Commission the authority to examine all affiliate transactions of a public utility. Given the role of power marketers and financial transactions in a competitive electricity market, it will be very difficult to protect consumers from firms making use of affiliate transactions to raise electricity prices without some regulatory agency having this authority. For this reason, the outright appeal of the PUHCA makes very little sense, particularly in light of the current situation in the California electricity market. Moreover, transferring this authority to FERC also makes very little sense, given its inexperience in monitoring the financial side of wholesale electricity markets.

The increasing degree of integration between electricity and natural gas suppliers underscores the need to monitor transactions between natural gas and electricity affiliates in order to effectively oversee competitive wholesale gas and electricity markets. California's experience with natural gas prices during the winter and spring of 2001 highlights the importance of regulatory transparency on the interface between natural gas and electricity markets. Over this time period, natural gas prices were the major cost driver of higher electricity prices in California. Natural gas prices were consistently more than double and often more than triple the prices in neighboring western states.

The February 6, 2001 report of the MSC argues that the \$150/MWh soft-cap imposed by FERC on January 1, 2001 played a major role in maintaining these higher announced gas prices in California. The soft cap allowed all generators who could cost justify their bids above the \$150/MWh level to be paid as bid if their capacity was necessary to meet demand. The MSC report outlined how these firms could use affiliate transactions to raise the announced spot price of natural gas in California and thereby cost-justify higher electricity bids in the ISO markets under the FERC soft-cap. It also presented evidence that the persistent divergence in natural gas prices in California relative to the rest of the western US could be attributed to this activity.

Although many other provisions of PUHCA are no longer necessary, for the reasons discussed above, it is essential that some regulatory agency maintain the wide-ranging authority that it gives the SEC to collect information on the affiliate transactions of public utilities. Given the evolution of electricity from a commodity that is produced and sold at a regulated price to one where

financial transactions play such a major role, the obvious agency to transfer the authority to request access to affiliate transactions, audits and access to books and records is the Commodity Futures Trading Commission (CFTC). Because electricity is now traded like all other commodities, it should be regulated in the same manner as other commodities.

There is also a role for a self-regulation of these markets. As noted above, a major risk in competitive electricity markets is an over reliance by consumers on the short-term market. For the same reason that banks are required to hold a pre-specified fraction of their deposits in liquid securities and cash, the CFTC or FERC could require that all generation unit owners have physical or financial hedges for some minimum fraction of their expected output with final consumers. In this way, the incentive for these firms to attempt to increase prices in the spot market through their bidding and scheduling behavior would be reduced. An independent market monitoring committee formed by the industry could certify compliance with these forward contracting requirements and administer penalties to market participants not in compliance. In this way the role of regulatory oversight in the electricity industry would evolve from one of setting output prices to making sure that consumers are not exposed to unnecessarily high levels of short-term price risk.

SHORT-TERM MARKET POWER MITIGATION IN CALIFORNIA

Before discussing the specific case of market power mitigation in California, I would first like to state two goals of market power mitigation. Then I will briefly explain why I believe the plan recently implemented by the Federal Energy Regulatory Commission is unlikely to achieve these two goals. Finally, I will summarize a market power mitigation plan proposed by the Market Surveillance Committee of the California Independent System Operator in its December 1, 2000 report to FERC that I believe satisfies these goals.

The first goal of market power mitigation is to reduce the average price of wholesale electricity paid by California to a level that would be occur in a competitive electricity market with California's current supply and demand conditions and fuel costs. Any successful market power mitigation plan must provide a guarantee that it can at least achieve this goal. One implication of this goal of market power mitigation is that producers will necessarily receive lower prices and therefore less revenues from selling the same amount of electricity as a result of a market power mitigation mechanism. This conclusion is the result of the accounting identity which states that the

amount the producers receive for electricity must be greater than or equal to the amount that consumers pay for wholesale electricity.

The second goal of market power mitigation is to alter the incentives faced by market participants so that it will no longer be profit-maximizing for generation unit owners to withhold capacity from the spot market by bidding substantially in excess of their variable cost of producing electricity. The idea is to alter the market rules in such a way that after implementing a mitigation plan, the spot market functions in a manner consistent with a competitive market for the vast majority of hours.

By altering the incentives of generation unit owners to produce their output in the most efficient manner possible, the profits of generators may need to be reduced much less than the revenues to generators in order to achieve a given level of market power mitigation. This possibility exists because exercising market power typically requires a generation unit owner to produce a given level of output in an inefficient manner. For example, it may make sense given the rules of the market to run the firm's inefficient units in order to drive up the market price earned by all units. This strategy may maximize the profits of the owner of the generating facilities, but it does not minimize its costs of producing the observed level of output.

I believe the market power mitigation plan recently implemented by FERC is unlikely to achieve either of these goals, particularly the second goal. In this first place, this plan proposes to pay market-clearing prices for energy based on unit-specific, cost-based bids in addition to reimbursing firms for verifiable start-up and no load costs and NOx emissions costs. This mitigation scheme implies that all but the lowest cost generators is receiving more than its regulated production costs for supplying electricity. This scheme therefore guarantees that consumers pay more for wholesale electricity than they would pay under cost-of-service pricing. Under the FERC plan, consumers have the potential to pay significantly more than total production costs to receive the same amount of electricity in order to preserve a market-clearing price mechanism which provides incentives for generators to produce in an inefficient manner.

In particular, if a firm would like to receive a higher level of revenues, then it only needs to declare some of its lower cost units unavailable to supply electricity in order to set the market-clearing price (earned by all of its remaining units) with its highest cost unit or the highest cost unit of its competitors.

For this reason, the FERC proposal does little to eliminate the incentive generators have to withhold capacity from the spot market. Because it caps the spot price in the ISO's real-time energy market, the FERC also plan dulls the incentive for generators located in and outside of California to supply electricity into the California market. Consequently, this plan should increase the likelihood of capacity shortfalls in California this summer, because it truncates the level of potential profits an out-of-state supplier can receive from selling into the California market and therefore reduces the likelihood these facilities will remain on for as many hours for the option to sell into California.

By offering generators the opportunity of higher prices during system emergency conditions than during normal system conditions, the FERC plan creates further incentives for generators to withhold capacity in order to cause system emergencies.

Because this plan allows generators to cost justify their bids beyond the proxy price contained in the order and be paid as bid if their capacity is necessary to serve demand, the FERC plan can provide no guarantee that consumers will be protected from the same runaway natural gas prices that occurred in California during the winter and spring of 2001. For this reason, the FERC plan provides little incentive for generators to procure fuel and other inputs in a least cost manner, because the remedy guarantees recovery of all justifiable costs associated with supplying electricity. This plan assigns all of the risk associated with managing these costs to California consumers, who have little ability to manage it. Some, if not all of these risks should be assigned to the generation unit owners. They are major players in the natural gas market and have the resources and expertise to manage this risk.

Finally, the FERC plan provides no incentive for generation unit owners to maintain their facilities in top working order. This plan assigns all outage risks to California consumers who are in no position to manage them. Their only choice is to pay higher market-clearing prices because the ISO is forced to operate higher cost units due to forced outages. This plan faces California consumers will the real possibility of a repeat of the winter and spring of 2001, when generation outages reached unprecedented levels. In fact, this plan creates incentives for unit owners to maintain their high cost facilities in top working order and their low cost facilities in poor working order to increase the likelihood the market prices will set by their higher cost units.

In summary, FERC's market mitigation plan does not alter the incentives of generators to attempt to raise prices in the spot market. It only limits the range of actions they can take to accomplish this. However, many of the potential actions that generators might take to raise prices can have dire consequences for the reliability of the ISO grid. As a consequence, California consumers face the real possibility of paying unnecessarily high prices for electricity for a lower level of reliability under this mitigation plan.

The December 1, 2000 Market Surveillance Committee report outlines a market power mitigation plan which I believe achieves both of the goals mentioned above. This remedy does not impose a price cap on the spot market, but it does require FERC to make a one-time regulatory intervention that results in just and reasonable rates in California for the next two years. This plan would allow all sellers in the California market during 1998 to 2001 (besides the three California investor-owned utilities) to continue to be eligible for market-based rates only if they offer 75% their expected annual sales in the form of two-year forward contracts at a price set equal to the average of the perfectly competitive benchmark price over this time period. This is the market price that would prevail under the no market power standard explicitly stated in FERC's competitive market requirement for allowing a market participant to substitute market prices for cost-based prices.

The potential upside profits for each market participant is still unbounded, because they have the opportunity to sell any remaining energy beyond their forward contract commitment at market-based rates. However, because of the forward commitments that all generators selling into California will have under this plan, the opportunities for these generators to exercise market power in the energy and ancillary services spot markets will be significantly reduced. The details of how each participant's contract quantity and price are set are outlined in the December 1, 2000 MSC Report. The February 6, 2001 MSC Report computed a just and reasonable price of \$55/MWh for these forward contracts for this two-year period using futures market gas prices at that time. Current futures prices for gas are even lower.

Any market participant that does not offer these two-year forward contracts would lose its market-based price authority and be subject to cost-of-service rates for all of its sales of energy and ancillary services into the California market and surrounding markets in the western US for at least this two-year period. These cost-of-service prices would be subject to a prudence review by both the FERC and the California Public Utilities Commission.

Once these forward contracts are in place, all market participants still eligible for market-based prices will not be subject to bid caps or price caps in any of the ISO markets. This will maximize the likelihood that sufficient generation capacity in the western US will be available to serve California's demand during all hours of the summers of 2001 and 2002. Moreover, because all California suppliers will face a significant risk of having to purchase out of a potentially very high-priced spot market to fulfill their forward market commitment in the event that they do not have sufficient generating capacity available to meet their forward energy commitments, these firms will have very strong incentives to maintain their generating unit in top working order.

All market participants with capacity located in California, including those subject to cost-based rates, would be subject to the following availability standard. All generators would be required to submit on an annual basis planned outage schedules. These would be reviewed by and approved by the California ISO. At all times besides those previously scheduled with the ISO, all generation units would be required to submit standing bids into the ISO's real-time energy market for the difference between the unit's nameplate capacity and its final energy schedule at whatever price the owner chooses. If a unit owner's bid is selected and it is unable to respond to the ISO's dispatch instruction, either with its own unit or some other unit in the same local area, the unit owner will be required to purchase this quantity of energy from the real-time energy market at the current market price. This availability standard effectively assigns the risk of forced outages to the unit owner, rather than the ISO.

With 75% percent of the expected sales of all market participants locked-in for the next two years at a price in the neighborhood of \$60/MWh and 100% of the expected production from the assets of the three investor-owned utilities available at production cost, California will have wholesale price certainly for between 80 and 85 percent of expected electricity consumption over the next two years at a wholesale price of less than \$65/MWh.

California can allow prices in a significantly smaller spot market to rise to the point necessary to attract sufficient supply into state to avoid rolling blackouts and to provide the necessary signals to final demand to cut back during high-priced periods. In order to provide signals to final demand to cut back during these high-priced periods, California is in the process of implementing real-time pricing program to accomplish just this. With this mitigation plan in place and California's efforts

in implementing these demand-responsiveness programs, the California electricity market will function in a manner that benefits California consumers and consumers in the rest of the western US.

This intervention corrects the fundamental flaw with the California market described above—the over-reliance on the spot market. The immediate result will be a competitive spot electricity market that will require no further regulatory intervention by FERC and not require bid or price caps. This is in stark contrast to the enormous administrative burden associated with implementing the FERC mitigation plan. Moreover, the MSC plan takes away any incentive for generators located in and outside of California to withhold energy from the spot market. They have a forward commitment for 75% of their expected sales whether or not their plant is available and any additional sales can be made at an unrestricted spot price. This creates both a carrot and stick to maintain their generating units in top working order and to operate them in a least-cost manner.

By intervening in the forward market, as opposed to the spot market, California consumers are able to purchase the lowest cost energy of each generation unit owner in the forward market at a price that at least recovers the cost of supplying this quantity of energy over the next two years. The remaining high cost energy of each supplier will be purchased in a competitive spot market at the market-clearing price. In contrast, the FERC mitigation plan will pay a market-clearing price based on the regulated cost of the highest cost unit operating in each hour for all of the energy consumed. It is highly unlikely that the FERC scheme will result in lower average energy prices over the next two years than the scheme proposed by the MSC which mitigates market power in the forward market by guaranteeing the price that consumers will pay for 75% percent of each market participant's expected output over the next two years.

LONG-TERM ENERGY POLICY

Properly functioning competitive markets provide very strong incentives for new entry to occur. The best example of this comes from the US natural gas market where the increase in the price of natural gas beginning in the autumn of 2000 led to an explosion in new drilling activity. Consequently, it is difficult to see the need for a long-term federal energy policy where there are competitive markets for energy. In this case, the only role for a Federal energy policy is to eliminate the barriers to entry of new firms and allow normal market forces to operate.

However, when market forces cannot operate, there is a clear role for a long-term Federal energy policy. For a variety of legal and technological reasons, it is difficult for market forces to

operate in the transportation network for both electricity and natural gas. This is particularly true for the electricity transmission network. The technology favors no more than one transmission network for a single geographic area. For this reason, even in a competitive electricity market transmission services are provided by a regulated monopoly. Similar logic applies to natural gas pipelines, although the scope for market forces to signal opportunities for new investment seems greater than in electricity transmission.

Because virtually all new generating capacity proposed throughout the US is natural gas-fired, significant cost-savings can be realized by placing the oversight of the national natural gas network and national transmission network in the same regulatory agency. There is a clear need to give this agency the authority to site electricity transmission facilities. Currently, the authority to site transmission facilities is the responsibility of state governments, despite the fact that the siting of natural gas and oil pipelines is the responsibility of the Federal government. For the full benefits of competitive wholesale electricity markets to be realized, this regulatory agency must have the authority to coordinate the siting of transmission facilities for natural gas and electricity.

Another source of benefits from a competitive electricity market comes from expanding the size of the market that each generator can sell into. This can only be accomplished if the amount interstate transmission facilities is significantly increased. If this process is coordinated with the development of the interstate gas pipeline network the competitiveness of both the electricity and natural gas markets will be enhanced.

A second area when market forces have not been allowed to operate is in determining the level of environmental quality. The historical method for regulating environmental quality is through the use of engineering standards set through a complex and tedious administrative process. As a result, many environmental markets have been developed to price environmental bads such as nitrous oxides and sulfur emissions. These markets endow each market participant with an initial allocation of emissions credits that decline over time. Firms then have the option to either install emissions control technology in order to meet these limits, or purchase emissions credits from other firms and which then allows them to emit at higher levels than their initial endowments.

A Federal energy policy can foster the development of markets for environmental goods and bads. By creating markets for these environmental goods and bads, consumers have the opportunity to vote with their money to reduce the levels of these environmental bads and increase the level of

environmental goods. The prices of these environmental goods and bads will then become tangible costs which must be borne by users of the energy sources which produce these environmental bads.

Only if the full costs, including environmental costs, of all energy sources are charged to the firms producing and consuming these energy sources will producers and consumers make economically efficient energy consumption decisions. By developing the necessary environmental markets to price all of these environmental goods and bads in a transparent manner will it be possible to the marketplace to make the socially efficient long-term energy investment decisions.

A long-term energy policy is also needed to redesign a regulatory structure to oversee and foster a competitive electricity market. As the events of the California market have demonstrated, it is an extremely challenging regulatory problem to honor all of the mandates of the Federal Power Act in a wholesale electricity market. Specifically, there is no guarantee that a market will set just and reasonable wholesale electricity prices. For this reason, another role for Federal energy policy is to implement revisions to the Federal Power Act that would make it compatible with a competitive market. It is unacceptable to have law in place that requires that FERC set just and reasonable wholesale electricity prices without a clear definition of how to determine whether prices are in fact are just and reasonable. Moreover, this agency should also have a clear definition of how to determine refunds of any unjust and unreasonable prices given that the Federal Power Act also requires that FERC issues refunds for any payments in excess of just and reasonable prices. A deliberately vague definition of just and reasonable prices and an unspecified procedure for determining the level of refunds in the event that prices are determined to be unjust and unreasonable only invites future problems between FERC and another state that decides to introduce wholesale competition at some date in the future, similar to those that have occurred over the past year between California and FERC.

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.
- “Report on the Redesign of the California Real-Time Energy and Ancillary Services Markets,” October 18, 1999.
- “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.
- “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.
- “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 on Prospective Market Monitoring and Mitigation for the California Wholesale Electricity Market,’ March 22, 2001.

Other Papers and Presentations on Electricity Markets

- The Impact of Market Rules and Market Structure on the Price Determination Process in the England and Wales Electricity Market, mimeo, February 1996 (with R. H. Patrick).
- The Time Series Behavior of Market Prices and Output in the England and Wales Electricity Market, mimeo, October 1996 (with R. H. Patrick).
- Estimating the Customer-Level Demand for Electricity Under Real-Time Market Prices, mimeo, August 1997, (with R.H. Patrick).
- An Equilibrium Model of a Multi-Unit Auction Market: The Case of a Competitive Electricity Market, mimeo, January 1999.
- 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).
- An Empirical Analysis of the Impact of Hedge Contracts on Bidding Behavior in a Competitive Electricity Market, International Economic Journal, Summer 2000, 1-40.
- 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.