CALIFORNIA'S ELECTRICITY MARKET: THE CASE OF PEROT SYSTEMS

HEARING

BEFORE THE

SUBCOMMITTEE ON ENERGY POLICY, NATURAL RESOURCES AND REGULATORY AFFAIRS

OF THE

COMMITTEE ON GOVERNMENT REFORM

HOUSE OF REPRESENTATIVES

ONE HUNDRED SEVENTH CONGRESS

SECOND SESSION

JULY 22, 2002

Serial No. 107–215

Printed for the use of the Committee on Government Reform

Available via the World Wide Web: http://www.gpo.gov/congress/house
http://www.house.gov/reform

CALIFORNIA'S ELECTRICITY MARKET: THE CASE OF PEROT SYSTEMS

CALIFORNIA'S ELECTRICITY MARKET: THE CASE OF PEROT SYSTEMS

HEARING

BEFORE THE

SUBCOMMITTEE ON ENERGY POLICY, NATURAL RESOURCES AND REGULATORY AFFAIRS

OF THE

COMMITTEE ON GOVERNMENT REFORM

HOUSE OF REPRESENTATIVES

ONE HUNDRED SEVENTH CONGRESS

SECOND SESSION

JULY 22, 2002

Serial No. 107–215

Printed for the use of the Committee on Government Reform

Available via the World Wide Web: http://www.gpo.gov/congress/house
http://www.house.gov/reform

U.S. GOVERNMENT PRINTING OFFICE

87–293 PDF WASHINGTON : 2003

For sale by the Superintendent of Documents, U.S. Government Printing Office
Internet: bookstore.gpo.gov Phone: toll free (866) 512–1800; DC area (202) 512–1800
Fax: (202) 512–2250 Mail: Stop SSOP, Washington, DC 20402–0001

COMMITTEE ON GOVERNMENT REFORM

DAN BURTON, Indiana, *Chairman*

BENJAMIN A. GILMAN, New York
CONSTANCE A. MORELLA, Maryland
CHRISTOPHER SHAYS, Connecticut
ILEANA ROS-LEHTINEN, Florida
JOHN M. MCHUGH, New York
STEPHEN HORN, California
JOHN L. MICA, Florida
THOMAS M. DAVIS, Virginia
MARK E. SOUDER, Indiana
STEVEN C. LATOURETTE, Ohio
BOB BARR, Georgia
DAN MILLER, Florida
DOUG OSE, California
RON LEWIS, Kentucky
JO ANN DAVIS, Virginia
TODD RUSSELL PLATTS, Pennsylvania
DAVE WELDON, Florida
CHRIS CANNON, Utah
ADAM H. PUTNAM, Florida
C.L. "BUTCH" OTTER, Idaho
EDWARD L. SCHROCK, Virginia
JOHN J. DUNCAN, JR., Tennessee
JOHN SULLIVAN, Oklahoma

HENRY A. WAXMAN, California
TOM LANTOS, California
MAJOR R. OWENS, New York
EDOLPHUS TOWNS, New York
PAUL E. KANJORSKI, Pennsylvania
PATSY T. MINK, Hawaii
CAROLYN B. MALONEY, New York
ELEANOR HOLMES NORTON, Washington, DC
ELIJAH E. CUMMINGS, Maryland
DENNIS J. KUCINICH, Ohio
ROD R. BLAGOJEVICH, Illinois
DANNY K. DAVIS, Illinois
JOHN F. TIERNEY, Massachusetts
JIM TURNER, Texas
THOMAS H. ALLEN, Maine
JANICE D. SCHAKOWSKY, Illinois
WM. LACY CLAY, Missouri
DIANE E. WATSON, California
STEPHEN F. LYNCH, Massachusetts

BERNARD SANDERS, Vermont
(Independent)

KEVIN BINGER, *Staff Director*
DANIEL R. MOLL, *Deputy Staff Director*
JAMES C. WILSON, *Chief Counsel*
ROBERT A. BRIGGS, *Chief Clerk*
PHIL SCHILIRO, *Minority Staff Director*

SUBCOMMITTEE ON ENERGY POLICY, NATURAL RESOURCES AND REGULATORY AFFAIRS

DOUG OSE, California, *Chairman*

C.L. "BUTCH" OTTER, Idaho
CHRISTOPHER SHAYS, Connecticut
JOHN M. MCHUGH, New York
STEVEN C. LATOURETTE, OHIO
CHRIS CANNON, Utah
JOHN J. DUNCAN, JR., Tennessee
JOHN SULLIVAN, Oklahoma

JOHN F. TIERNEY, Massachusetts
TOM LANTOS, California
EDOLPHUS TOWNS, New York
PATSY T. MINK, Hawaii
DENNIS J. KUCINICH, Ohio
ROD R. BLAGOJEVICH, Illinois

EX OFFICIO

DAN BURTON, Indiana

HENRY A. WAXMAN, California

DAN SKOPEC, *Staff Director*
ROBERT SULLIVAN, *Professional Staff Member*
ALLISON FREEMAN, *Clerk*
GREG DOTSON, *Minority Counsel*

CONTENTS

CALIFORNIA'S ELECTRICITY MARKET: THE CASE OF PEROT SYSTEMS

MONDAY, JULY 22, 2002

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON ENERGY POLICY, NATURAL RESOURCES AND REGULATORY AFFAIRS,
COMMITTEE ON GOVERNMENT REFORM,
Washington, DC.

The subcommittee met, pursuant to notice, at 2:03 p.m., in room 2154, Rayburn House Office Building, Hon. Doug Ose (chairman of the subcommittee) presiding.

Present: Representatives Ose, Kucinich, and Waxman (ex officio).

Staff present: Dan Skopec, staff director; Barbara Kahlow, deputy staff director; Yier Shi, press secretary; Allison Freeman, clerk; Robert Sullivan, professional staff member; Greg Dotson, Elizabeth Mundinger, and Paul Weinberger, minority counsels; and Jean Gosa, minority assistant clerk.

Mr. OSE. Good afternoon, everybody. Welcome to today's hearing of the Subcommittee on Energy Policy, Natural Resources and Regulatory Affairs. Under the rules of the committee, I am going to welcome Mr. Waxman; we now have a quorum. We are going to commence with the 2 o'clock hearing.

In the last few months, the news media has been filled with examples of companies attempting to game the California electricity market. Many elected officials in my home State of California have pointed to these examples as proof that Californians were taken advantage of by corporate greed. Today this subcommittee will investigate these matters to get a better understanding of their true role in the California energy crisis.

I do look forward to the testimony of the witnesses today. I am eager to hear firsthand about the activities of Perot Systems in particular. Did it, in fact, share confidential information with other market participants? Was it running what some have called a "crime school" in this regard? Did it notify the California Independent System Operator or the California Power Exchange of the flaws in the market design that it found?

More importantly than the actions of any market participant, I am interested in how the CAISO responded to the various challenges that it faced. When it learned of the outside marketing activities, how did it respond? Did it deem such activities a threat to the market? Was the CAISO aware of and did it understand these games at the time? If so, did it attempt to fix the holes in the market structure? Finally, will the CAISO's Market Design 2002 pro-

posal, which FERC approved last week, prevent the kind of activities that occurred in California from recurring?

As I continue to state on every occasion I can, getting the electricity market design right should be our foremost priority. As we continue to review this issue, I will be particularly focused on how market design contributed to or prevented the types of games that were played in California.

Now, as an aside, I will tell you, I am not happy today. We have asked a couple people to join us, and they have declined the opportunity. I happen to think that, particularly in light of the activities going on in the financial markets, having folks who were actively participating in these efforts is critical in assuring the American people that this type of thing will be brought to a halt, and that they can be confident in corporate America and their personal portfolios, if nothing else. I am profoundly disappointed at the absence of Mr. Perot and Mr. Belden, and I am not happy about it, and it is probably not the last time we are going to hear about this matter.

[The prepared statement of Hon. Doug Ose follows:]

Chairman Doug Ose
Opening Statement
California's Energy Market: The Case of Enron and Perot Systems
July 22, 2002

In the last few months, the news media has been filled with examples of companies attempting to game the California electricity market. Many politicians in my home State of California have pointed to these examples as proof that Californians were taken advantage of by corporate greed. Today, the Subcommittee will investigate these matters to get a better understanding of their true role in the California energy crisis.

I look forward to the witness testimony today. I am eager to hear first hand the activities of Perot Systems. Did it share confidential information with other market participants? Was it running a "crime school" as some observers noted? Did it notify the California Independent System Operator (CAISO) or the California Power Exchange (PX) of the flaws in the market design?

More importantly than the actions of any market participant, I am interested in how the CAISO responded to the various challenges that it faced. When it learned of the outside marketing activities, how did it respond?

Did it deem such activities a threat to the market? Was the CAISO aware of and did it understand these games at the time? If so, did it attempt to fix the holes in the market structure? Will the CAISO's Market Design 2002 proposal, which FERC approved last week, prevent the kind of activities that occured in California?
As I have stated on numerous occasions, getting the electricity market design right should be our foremost priority. As we continue to review this issue, I will be particularly focused on how market design contributed to or prevented the types of games that were played in California.

Mr. OSE. I would like to yield to my friend from California, Mr. Waxman, for the purposes of an opening statement.

Mr. WAXMAN. Thank you very much, Mr. Chairman.

I, too, share your unhappiness with those witnesses that are not here today. Before I give my opening statement, I want to point out that you and I have had discussions about other witnesses, particularly State Senator Dunn from California, and in our conversation you agreed that we would have another opportunity to have a meeting of this committee to hear from him and other witnesses recommended by the Democrats.

Mr. OSE. If the gentleman will yield?

Mr. WAXMAN. Certainly.

Mr. OSE. I guarantee you, we will visit this issue, and I will work with you to make that happen.

Mr. WAXMAN. And that we will have——

Mr. OSE. And we will have a hearing, and it will be the minority witnesses.

Mr. WAXMAN. I thank you very much.

Mr. Chairman, it is important that we investigate what happened in the Western energy markets in 2000 and 2001. However, the way this hearing has been set up is very odd. It is more notable for who is not here today instead of who is.

This hearing is entitled, "The California Energy Market: The Case of Enron and Perot Systems." Yet today not only don't we have any witness from Enron testifying, but Ross Perot, who is supposed to be this afternoon's key witness, isn't here either.

As of Friday, we had been told that former Enron employee Mr. Tim Belden would be testifying today. Mr. Belden would have been a very useful witness to hear from since he headed the Enron office, which apparently cooked up the trading schemes that manipulated Western markets. The odd thing is, Mr. Chairman, that we learned over the weekend from Mr. Belden's lawyer that Mr. Belden never had any intention of testifying today.

I do not think it is inappropriate to expect that we should have Enron witnesses at a hearing that focuses on Enron.

We should also benefit from other ongoing investigations when it is possible to do so. The one person who has uncovered the most information on Perot Systems is California State Senator Joe Dunn, and I hoped he would be here today, but I appreciate that you have offered to have him testify at an additional day of hearings.

It is worth taking a moment to recall how we got here and why this is such an important issue. In 2000 and 2001, Western families were ruthlessly price-gouged by energy companies. The future of families in California and other Western States was in effect mortgaged for the short-term benefit of energy executives like Ken Lay and Jeffrey Skilling. The economic welfare of the entire West was jeopardized as energy prices skyrocketed out of control.

The wholesale cost of electricity for California in 1999 was $7 billion. In 2000, it was $27 billion. And, if not for timely actions taken by the State government, it would easily have surpassed that number in 2001. At the time, evidence from government, academia and the private sector showed that energy companies were manipulating markets to increase profits. For example, over 18 months ago

Enron chairman Ken Lay publicly discussed his view that, "the system invites gaming," yet the administration refused to acknowledge the price gouging. Energy Secretary Spencer Abraham dismissed claims that energy companies were conspiring to drive up prices as a "myth."

What a difference a year makes. Enron has stunningly collapsed, and industry documents and admissions confirm that market manipulation was an important cause of the energy crisis. This market manipulation cost California consumers billions of dollars. The most serious manipulation involved energy generators exercising market power by selling electricity at exorbitant prices or by holding supply off the market in order to drive up those prices.

Power marketers also engaged in various trading strategies that increased costs and the possibility of rolling blackouts. These strategies are discussed in internal Enron memos which became public this spring. They include submitting phony power schedules; deliberately overstating load to create the appearance of congestion on transmission lines, which would result in the State paying Enron to cut back on its load; and megawatt laundering or exporting power out of State, and then immediately importing it back in order to evade price caps. The Enron memos gave these ploys names like Fat Boy, Death Star, and Get Shorty.

Perhaps the most cynical ploy was the simplest: buying price-capped power in California and exporting it to other regions without a price cap. According to one memo written in December 2000, Enron believed that this strategy, "appears not to present any problems other than a public relations risk arising from the fact that such exports may have contributed to California's declaration of a Stage 2 emergency yesterday." In their own memos, they said that's what they thought would make sense from their perspective, although they worried about the public relations problem.

Recent admissions by at least seven major energy traders that they participated in fake round-trip trades have further underscored the extent to which energy markets are subject to manipulation. Those companies, several of which conducted business in California, all conducted trades in which they exchanged the same amount of power at the same price with another company. The trades were apparently intended to exaggerate the company's revenues and make it appear that markets were more active than they really were. They may also have contributed to higher energy prices. One energy analyst described the trades as having enormous potential significance.

And, we have also recently learned that Ross Perot's company, Perot Systems, may have had a hand in California's energy crisis. In 1997, Perot Systems gained significant expertise with California's newly deregulated energy market by contracting with the California Independent System Operator. Apparently, Perot Systems then turned around and tried to market this expertise to energy companies seeking to increase their profits in the West.

For months, many Members of Congress have been calling on the Energy and Commerce Committee to hold hearings about the outrages that occurred in Western energy markets. Unfortunately, the Republican leadership has refused to allow hearings in that committee.

So, I am pleased that we are finally holding a hearing on the schemes that traders used to manipulate the markets in 2000 and 2001. Unfortunately, I am concerned that this hearing will simply provide Perot Systems the opportunity to provide its unrebutted side of the story. I understand why that is good for Ross Perot, but I don't understand how that will help us understand what happened in California and prevent it from ever happening again.

I want to thank the chairman for agreeing to a minority day of hearings on this issue. At that hearing we will finally be able to hear from Enron and Senator Dunn. I would like to reach agreement on a date for that hearing before the end of this afternoon's hearing, Mr. Chairman, if that is possible.

I would also like to ask unanimous consent to introduce into the record a prepared statement from Senator Dunn, along with a letter he has written to the chairman. And, I would also like to request that the hearing record be left open so that Members can submit relevant materials and written questions to today's witnesses, and those witnesses which declined to appear today, so that we can get responses to put into the record.

Mr. OSE. Mr. Waxman, as it relates to the record, the record will be left open for 10 days for Members to submit questions.

I have sent the clerk to get the schedule of the committee and the availability of the room, and hopefully during the course of the hearing we can work that out. And, let me think about the other things you—what were the other items you mentioned?

Mr. WAXMAN. Whatever else it was to put in the record.

Mr. OSE. Whatever else it was——

Mr. WAXMAN. All the documents that we have available.

Mr. OSE. We will work together. We will make sure that the documents you reference get in the record and the other issues that you rose, we'll work those out, too.

Mr. WAXMAN. Thank you very much, Mr. Chairman, for your spirit of cooperation and your willingness to try to get all these facts on the record. It is important that we do so for our State. And, it is not a partisan matter; it is a matter of simply trying to understand what happened in California and the other States in the West, and make sure we don't have this sort of thing happen again. I know that's your intent as well.

Mr. OSE. Thank you, Mr. Waxman.

[The prepared statement of Hon. Henry A. Waxman follows:]

Statement of Rep. Henry A. Waxman
Subcommittee on Energy Policy, Natural Resources, and Regulatory Affairs
California's Energy Market: The Case of Enron and Perot Systems
July 22, 2002

Mr. Chairman, it is important that we investigate what happened in the Western energy markets in 2000 and 2001.

However, the way this hearing has been set up is very odd. It is more notable for who is not here today instead of who is.

This hearing is entitled "California's Energy Market: The Case of Enron and Perot Systems." Yet today we learn that we do not have any witnesses from Enron testifying. And at a time when we should be holding CEO's more accountable, Ross Perot has been permitted to cancel his appearance as well.

As of Friday, we had been told that former Enron employee Mr. Tim Belden would be testifying today. Mr. Belden would have been a very useful witness to hear from since he headed the Enron office which apparently cooked up the trading schemes that manipulated Western markets.

The odd thing is, Mr. Chairman, that we learned over the weekend from Mr. Belden's lawyer that Mr. Belden never had any intention of testifying today.

I do not think its inappropriate to expect that we should have Enron witnesses at a hearing that focuses on Enron. We should also benefit from other ongoing investigations when its possible to do so.

The one person who has uncovered the most information on Perot Systems is California Senator Joe Dunn. I had hoped he would be here today. But I appreciate that you have offered to have him testify at an additional day of hearings.

It's worth taking a moment to recall how we got here and why this is such an important issue.

In 2000 and 2001, Western families were ruthlessly price gouged by energy companies. The future of families in California and other Western states was in effect mortgaged for the short-term benefit of energy executives like Ken Lay and Jeffrey Skilling.

The economic welfare of the entire West was jeopardized as energy prices skyrocketed out of control. The wholesale cost of electricity for California in 1999 was $7 billion. In 2000 it was $27 billion and if not for timely actions taken by the state government, it would easily have surpassed that number in 2001.

At the time, evidence from government, academia, and the private sector showed that

energy companies were manipulating markets to increase profits. For example, over 18 months ago, Enron Chairman Ken Lay publicly discussed his view that "[t]he system invites gaming." Yet the administration refused to acknowledge the price-gouging. Energy Secretary Spencer Abraham dismissed claims that energy companies were conspiring to drive up prices as a "myth."

What a difference a year makes. Enron has stunningly collapsed, and industry documents and admissions confirm that market manipulation was an important cause of the energy crisis. This market manipulation cost California consumers billions of dollars. The most serious manipulation involved energy generators exercising market power by selling electricity at exorbitant prices or by holding supply off of the market to drive up prices.

Power marketers also engaged in various trading strategies that increased costs -- and the possibility of rolling blackouts -- for California. These strategies are discussed in internal Enron memos which became public this spring. They include submitting phony power schedules; deliberately overstating load to create the appearance of congestion on transmission lines, which would result in the state paying Enron to cut back on its load; and "megawatt laundering," or exporting power out of state and then immediately importing it back, in order to evade price caps. The Enron memos gave these ploys names like "Fat Boy," "Death Star," and "Get Shorty."

Perhaps the most cynical ploy was the simplest -- buying price-capped power in California and exporting it to other regions without a price cap. According to one memo, written in December 2000, Enron believed that this strategy "appears not to present any problems, other than a public relations risk arising from the fact that such exports may have contributed to California's declaration of a Stage 2 Emergency yesterday."

Recent admissions by at least seven major energy traders that they participated in fake "round-trip" trades have further underscored the extent to which energy markets are subject to manipulation. Those companies, several of which conducted business in California, all conducted trades in which they exchanged the same amount of power at the same price with another company. The trades were apparently intended to exaggerate the companies' revenues and make it appear that markets were more active than they really were. They may also have contributed to higher energy prices. One energy analyst described the trades as having "enormous potential significance."

And we have also recently learned that Ross Perot's company, Perot Systems, may have had a hand in California's energy crisis. In 1997, Perot Systems gained significant expertise with California's newly deregulated energy market by contracting with the California independent system operator. Apparently, Perot Systems then turned around and tried to market this expertise to energy companies seeking to increase their profits in the West.

For months, many members of Congress have been calling on the Energy and Commerce Committee to hold hearings about the outrages that occurred in Western energy markets. Unfortunately, the Republican leadership has refused to allow hearings in that committee.

So I am pleased that we are finally holding a hearing on the schemes that traders used to

manipulate the markets in 2000 and 2001.

Unfortunately, I am concerned that this hearing will simply provide Perot Systems the opportunity to provide its unrebutted side of the story. I understand why that is good for Ross Perot, but I don't understand how that will help us understand what happened in California and prevent it from ever happening again.

I want to thank the Chairman for agreeing to a minority day of hearings on this issue. I hope at that hearing we will finally be able to hear from Enron and Senator Dunn.

California State Senate

SELECT COMMITTEE TO
INVESTIGATE PRICE MANIPULATION OF
THE WHOLESALE ENERGY MARKET

JOSEPH L. DUNN
CHAIR

LOCATION
1020 N STREET
ROOM 259
SACRAMENTO, CA 95814
TEL: (916) 324-7080
FAX: (916) 324-7081

MAIL
STATE CAPITOL
ROOM 2080
SACRAMENTO, CA 95814-4900

July 22, 2002

VIA FACSIMILE & US MAIL (202) 226-1298

The Honorable Doug Ose
215 Cannon House Office Building
Washington, D.C. 20515

Dear Congressman Ose:

It is unfortunate that your committee decided not to invite any representative from the California Senate Select Committee to Investigate Price Manipulation of the Wholesale Energy Market to testify at your July 22 hearing regarding Perot Systems Corporation's (PSC) role in the California energy markets. As you are aware, our committee is the most knowledgeable about PSC, Policy Assessment Corporation (PAC) and their activities in the California energy markets. Our committee is the only entity that has examined thousands of PSC and PAC documents, both those publicly available and those being withheld from the public on a claim of confidentiality by PSC and others. In addition, we have interviewed numerous witnesses relating to PSC's conduct in California. We are the only entity that can respond with evidence to each of the defenses asserted by PSC.

In an effort to assist your committee, enclosed please find my written testimony responding to PSC's defenses. I hope you will make this testimony part of the record of today's proceedings.

Please be assured that our senate committee stands ready to assist your investigation in any way. We look forward to hearing from you in the near future. I can be reached at any time, including during today's hearing, at (916) 445-5831.

Very truly yours,

JOSEPH L. DUNN
Select Committee Chair

JLD/am
Enclosure
cc: Subcommittee members

PEROT SYSTEMS: PIED PIPER OF GAMING OR INNOCENT ENTREPENEUR?

The evidence uncovered by the California State Senate investigation

Written comments of Senator Joseph Dunn[1]
July 22, 2002
Washington, D.C.

INTRODUCTION

This testimony is submitted by California State Senator Joseph Dunn, chair of the Senate Select Committee to Investigate Price Manipulation of the Wholesale Energy Market. In the course of the state senate's 18-month investigation, Perot Systems' possible involvement in the manipulation of the California energy market was uncovered. The comments herein explain that role as evidenced by internal Perot Systems' documents and examine the validity of the defenses asserted by Perot Systems. Simply put, Perot Systems was instrumental in the setup of the computerized California energy market as well as in the marketing of flaws in that market.

BACKGROUND

Perot Systems' involvement in the California energy market predates its successful bid in 1997 to build the computerized system within the California Independent system Operator (CAISO). Prior to the 1996 passage of Assembly Bill 1890, the legislation that created the CAISO and began the state's deregulation of the wholesale energy markets, Perot Systems was under contract to other market participants in California, including Southern California Edison (SCE) and the Los Angeles Department of Water and Power (LADWP). Perot Systems, in fact, was hired by LADWP to create a business plan for the municipal utility as it emerged into the deregulated era.

The company's expertise in this area was based upon its involvement in the United Kingdom's electricity deregulation of the early to mid-1990s. Perot Systems (including several key employees who later worked for CAISO) was involved with East Midlands Energy in the UK. It was here that Perot Systems first recognized the opportunities for market gaming by private energy companies in newly deregulated energy markets. Market gaming was rampant in the

[1] Senator Dunn chairs the California State Senate Select Committee to Investigate Price Manipulation of the Wholesale Energy Market. The committee is conducting an extensive investigation into all aspects of the California energy crisis. Since March 2001, the committee has held nearly two dozen hearings, taken numerous depositions, conducted various interviews, held meetings with experts and interested parties and reviewed millions of documents throughout the United States. The committee has become an information clearinghouse for federal and state investigators, regulators, private citizens, non-profit groups and elected officials on a variety of subjects concerning the state's electricity crisis of 2000-2001.

On July 11, 2002, the committee held a hearing regarding Perot Systems' role in the California energy crisis. Ross Perot, Sr., Dr. Paul Gribik and Dr. Dariush Shirmohammadi were among those who testified.

burgeoning UK market and Perot Systems expected the trend would hold true under similar conditions elsewhere.

During the national behind-the-scenes push in the United States for electricity deregulation in the late 1980s and early 1990s (led by Enron and other market participants), several independent "working groups" were formed to discuss possible market structures and rules. Perot Systems employees were part of these groups. For example, one working group ultimately became the Western Power Exchange (WEPEX), which in turn became CAISO. In 1996, Dr. Paul Gribik, a Pacific Gas & Electric (PG&E) engineer before his tenure at Perot Systems, was a member of the pre-WEPEX working group. The conclusions of his group became recommendations for market "protocols," or rules that govern behavior in the market. Some of the flaws later exploited for private profit were buried in these early protocols.

George Backus, the CEO of Colorado-based Policy Assessment Corporation (PAC), first contacted Perot Systems in January 1997 to discuss opportunities for a joint venture between the two corporations. Dr. Backus had studied the UK deregulation and observed the market gaming that took place there. In fact, Dr. Backus made a presentation to the Western Systems Coordinating Council (WSCC), now the Western Electricity Coordinating Council (WECC)[2], on the subject in November 1996. Perot Systems and PAC subsequently teamed up to pursue California opportunities.

In March 1997, Perot Systems successfully bid and subsequently signed a contract with CAISO as part of the "ISO Alliance," a trio of computer systems companies comprised of Perot Systems, ABB and Ernst & Young. The Alliance also signed an ongoing "maintenance agreement" with CAISO for a six-year term. The Alliance contract was for information technology services, both hardware and software, for CAISO's scheduling applications, scheduling infrastructure and business systems.

The effort by Perot Systems and PAC to market the flaws began approximately eight weeks after the Alliance contract was signed. This was almost one year before the market opened. Perot Systems and PAC made marketing pitches to Edison in May 1997, Enron during that summer, Pacific Gas & Electric (PG&E) in late summer and San Diego Gas & Electric in October. Marketing efforts continued through the rest of 1997, through to the market's opening on March 31, 1998, and extended into 2001.

In the midst of these efforts, Perot Systems signed a contract to provide services to the California Power Exchange (CalPX) in August 1998. In the case of the CalPX, Perot Systems' involvement spanned a period that continued beyond the CalPX's bankruptcy filing in January 2001.

[2] The WECC, one of 10 electricity reliability councils in North America, is an energy industry trade association, which states that it is "responsible for coordinating and promoting electric system reliability."

DISCOVERY

On June 3, 2002, a 44-page document authored by Perot Systems was discovered in the document depository of Reliant Energy. Reliant produced the presentation to the committee as part of the committee's June 2001 document subpoena and a May 7, 2002 letter interrogatory sent in response to the release of the "Enron memos" of December 2000.

The 44-page document appeared to be a marketing presentation and discussed "gaming" possibilities in the California market. The presentation touted Perot Systems as an expert in discovering the "holes" and "gaps" in the market and its systems. One slide stated that Perot Systems "knew the warts" of the CAISO system and its protocols. The presentation also made predictions about the instability of the market under certain conditions. Examples of gaming in the document included market manipulation tactics used by Enron.

After verifying with Reliant that the document was not protected under any confidentiality agreement, it was faxed to Perot Systems for comment and released to the public. On June 5, Ross Perot, Sr., chairman of the board of Perot Systems Corporation (PSC), called Senator Dunn, promised to lead a full investigation and offered to testify before the select committee about the results of that investigation.

One day later, on June 6, Mr. Perot and several members of Perot Systems' management team held a conference call with the investment community. During that conference call and before Perot Systems' investigation was much underway, Mr. Perot defiantly proclaimed Perot Systems had *done nothing wrong* and California was simply searching for a scapegoat for its own energy crisis. The select committee believes this conference call was held for the purpose of trying to stabilize Perot Systems' stock price. Its value had dropped drastically in the 24 hours following release of the 44-page document. Perot Systems has spent the last six weeks trying unsuccessfully to support the statements made on the June 6 conference call.

Over the last six weeks, Perot Systems and numerous market participants have produced thousands of documents relevant to Perot Systems. A number of California market participants have admitted receiving presentations from Perot Systems. Perot Systems' lawyers have not made the entirety of Perot Systems' documents public due to a claim of confidentiality.

It is interesting to note that to date, neither Perot Systems nor Reliant has explained how the 44-page document got into Reliant's files.

THE DEFENSES ASSERTED BY PEROT SYSTEMS

Starting with the conference call to investors on June 6, Perot Systems has put forth five excuses in response to the 44-page document. Since that time, including testimony before the committee on July 11, 2002, Perot Systems has attempted to use these excuses to explain its questionable behavior. The excuses are:

1. Perot Systems' marketing efforts were approved by CAISO.
2. Perot Systems did not divulge or have access to confidential information.

3. Perot Systems' marketing efforts were not successful because the company never sold its services to any market participant.
4. Perot Systems had no duty to report "holes" it discovered in the energy markets.
5. In the 44-page document, the use of the term "gaming" is an innocuous term that refers to John Nash's "game theory."

Based upon the state senate's investigation thus far and internal Perot Systems documents, it appears that each of these excuses is baseless. Each one must be examined separately.

1. Did Perot Systems Obtain Approval from CAISO to Market Flaws in the System?

Representatives of Perot Systems, including Mr. Perot himself, have claimed since its investor conference call on June 6, 2002, that the company's marketing efforts were "approved" by CAISO. This is incorrect. Conversations with former CAISO CEO Jeff Tranen, a review of the attorney-client communications of CAISO and its lawyers (Skadden Arps in New York), from the time period in question, and testimony by current CAISO CEO Terry Winter all demonstrate that Perot Systems' marketing presentations were never approved.

In fact, prior to October 1997, its marketing efforts could not have been approved because Perot Systems kept them secret. Perot Systems required non-disclosure agreements from the companies that received its sales pitch. Documents demonstrate that Perot Systems management required secrecy because the company recognized the conflict of interest inherent in its efforts. After one such secret presentation to San Diego Gas & Electric (SDG&E), however, Perot Systems' presentations were brought to the attention of CAISO management. Interestingly, Perot Systems' response to this disclosure was to chastise SDG&E

CAISO management took swift action after it received this information. Mr. Tranen wrote a cease-and-desist letter to Perot Systems management expressing his belief that Perot Systems was violating the conflict of interest provisions in its contract with CAISO. Perot Systems' disagreed with Mr. Tranen's assertions, but never resolved the dispute. Perot Systems continued making presentations despite CAISO objections and without receiving approval.

In fact, Perot Systems' did not abide by its own proposed solution to the conflict. The company offered a three-pronged approach to allay the concerns of Mr. Tranen:

- The creation of an "ethics wall" between Perot Systems' employees responsible for CAISO systems work and Perot Systems employees responsible for marketing efforts, including a well-maintained list of employees that belonged to each category. This provision also required all Perot Systems Associates to sign a copy of the ethics wall;
- The inclusion of a disclaimer in future marketing presentations that Perot Systems was not divulging confidential information; and
- A letter to potential market participants (whom Perot Systems refused to disclose) already solicited by Perot Systems.

Perot Systems undertook none of these steps and since the discovery of the 44-page document, the company has been unable to produce any evidence of CAISO approval.

2. Did Perot Systems Use Confidential Information in its Marketing?

In his testimony before the committee on July 11, 2002, Mr. Perot claimed that no "inside information" was shared with market participants. Perot Systems makes the following reflexive argument to prove this point: "Perot Systems did not share any confidential information because it had no confidential information to share." Perot Systems and its representatives have pushed this argument most aggressively since the company's first public comments on June 6, 2002.

The second half of this argument can be quickly dismissed. CAISO considered the underlying codes of its software systems to be proprietary. Perot Systems was the systems integrator of the group building the software system. Even if Perot Systems employees did not have direct access to the codes of the system, it worked daily and directly with every employee that did have access to the codes. Perot Systems employees, by definition, were there to ensure the quality of work and had to have access to confidential information in order to do so.

The code was protected from outside security breaches, but in November 1997, a CAISO security chief warned in an internal email that Perot Systems, and specifically Paul Gribik, stood to be more of a threat to the security of the CAISO system. The email claims that Gribik posed a threat because of his inside knowledge of protocols he "helped champion."[3]

In addition, Perot Systems' claim that it had no confidential information to share is contradicted by Perot Systems' internal documents, the testimony of experts and the words of Dr. Backus, Perot Systems' business partner. There are hundreds of instances in the documents in which Perot Systems billed itself and its employees as the intellectual foundation of the CAISO and CalPX operations. In its own words, Perot Systems boasts that it "built," "developed," "deployed," and "wrote" the protocols for both CAISO and CalPX. In many instances no mention is made of ABB or Ernst & Young.

Documents written during this period demonstrate Perot Systems' knowledge of the system. In April 1999, in a presentation to BC Hydro, Perot Systems claimed that "California's [c]ongestion management protocol was developed by Paul Gribik of Perot System[s]." By August, Perot Systems' claimed in a presentation to CalPX that it had "completely designed and developed" the computer systems underlying the markets, including those of the CalPX.

That Perot Systems had inside knowledge is relevant only if it can be demonstrated that the company offered to, or did, share the inside knowledge. Hundreds of documents prove that Perot Systems offered to share this knowledge for a price. Perot Systems informed market participants

[3] A November 1997 email written by Jack Allen of CAISO to CAISO chief operating officer Terry Winter states CAISO's concern at the time. Mr. Allen wrote in part: "Significant issues, and perhaps ethics, might arise from 'outside' rather than from the 'inside'. For example, Paul Gribik and Carl Imparato [representing Enron] both had intimate knowledge (and actually helped champion) protocols that are the basis of the congestion management and settlement process...Such knowledge could be used to leverage advantages and influence policy changes that might result in advantages for some interests. We do not see these as 'internal threat to security,' but view them as champions for special interests to game the system...the competitive advantages of knowing the algorithms and positioning to game the market based upon such information would appear to be the greatest 'threat.' There might be a competitive advantage of using knowledge of algorithms to advise clients on actions that could result in advantage."

in other marketing presentations that it "wrote," "developed" and "implemented" the protocols and systems of both CAISO and CalPX.

In acknowledging its role in setting up the systems of CAISO and CalPX, Perot Systems conveyed that it had inside knowledge to share with market participants who purchased its consulting services. This view was shared by CAISO management, as evidenced by its reaction to the SDG&E presentation. However, CAISO management was not fully advised about the extent of the marketing presentations made by Perot Systems (due to their secrecy), or of the full content of each presentation.

As a result, internal CAISO attorney-client communications focus on CAISO's belief that Perot Systems shared confidential information with its business partner, Dr. Backus. A review of the documents supports this concern.

In one memo, speaking on behalf of the joint venture, Dr. Backus explained to an Enron official that Dr. Gribik and Dr. Shirmohammadi were the only pair in the world who possessed the knowledge necessary to game the system. Of Gribik he wrote, "I have searched years, close to world-wide...to find people like [Gribik].... He is the only person I know who brilliantly understands both the 'gaming' issues and understands the details of the ISO/PX." In another marketing memo to Edison International, Dr. Backus reiterates this belief:

> "I can make a proposal that does not include Perot Systems. It would require, however, that [Edison International] staff be completely responsible for quickly building a reduced sized (speedy) model of the PX/ISO that validly represents all the protocols relevant to gaming activities. Perot Systems already knows how to do this.... Staff of Perot Systems already has thought extensively about the gaming issues for some time...It is unclear that this can be done without Perot Systems help, especially Paul Gribik's and Dariush Shirmohammadi's expertise. Both are is [sic] very clever and their minds are devious enough to readily search for and find gaming opportunities among the myriad of individual (and combined!) protocols...Given my experience with utility employees, they all seem too well seasoned and trained on preserving system integrity to let themselves focus on ways to take advantage of the 'rules.'"

Perot Systems and the former employees named in these documents have since expressed unease with this characterization of their expertise and have tried to retreat from these statements. Before his closing comments about the high integrity of Perot Systems, Dr. Shirmohammadi claimed during testimony on July 11 that Perot Systems overstated its role in the market. Dr. Gribik also referred to Dr. Backus as a "blowhard." Perot Systems has cited its ethical standards on numerous occasions. In a November 1997 letter to CAISO, it suggested this language as part of a proposed resolution: "Perot Systems' Standard and Ethical Principals [sic] embody the highest concepts and standards of honesty and integrity."

Perot Systems cannot have it both ways. Either the company was responsible for "building and developing the systems and protocols," as it claimed in 1997 and 1998, or it was untruthful in its marketing representations. The evidence from that time period suggests that Perot Systems did in fact have access to confidential information and that this information was marketed.

3. Did Perot Systems need a "buyer" in order to do damage to the California market?

Faced with mounting evidence of wrongdoing, Perot Systems and its representatives have offered as an affirmative defense that the company is innocent because it was unable to find a "buyer" for its consulting services or software package. This reasoning is also incorrect for a number of reasons, not the least of which is that for the argument to have merit, it would require Perot Systems to admit that its marketing efforts were fraudulent.

During the June 6 conference call and in public comments since, Perot Systems claims that it never had a business relationship with any California market participant. This is false. Perot Systems' internal documents show an ongoing relationship with several market participants for what appear to be consulting services. For example, confidential expense reports produced to the committee reveal that Perot Systems had more than 12 meetings with Reliant representatives in 2000. In addition, Perot Systems was able to sell with at least limited success consulting services it offered as "workshops." After it received a joint marketing pitch with Perot Systems, Southern California Edison paid Dr. Backus $72,000 in July 1997 for software and consulting services.

As discussed above, the testimony of experts and internal documents show that Perot Systems possessed inside knowledge of CAISO and CalPX systems and protocols. However, its argument in this case is that because the company's marketing efforts were unsuccessful, no damage could have been done to the market. This excuse is predicated on the underlying assumption that the company did not possess inside knowledge. For the sake of examining this argument, assume that the company had no such knowledge.

The lack of a "buyer" is a common defense against claims of criminal fraud because California law requires the existence of an aggrieved party – a "victim" – for a claim of fraud to be made. In simple terms, there is no crime in trying and *failing* to sell a fake Rolex watch to a potential customer (ignoring trademark laws), nor is there a crime committed if the purchaser of the watch knows it is a fake Rolex.

Perot Systems' claim is that the victim in this scenario would be the purchaser of its software or services, i.e., one of the market participants that received its marketing pitch. In this case, the market participant would be victimized if Perot Systems *falsely* claimed in its marketing presentations that it had inside knowledge. Perot Systems, however, claims that it informed potential customers that it did not possess inside knowledge. Its only claims were that it had the ability to "discover" "profitable" gaps in the protocols it wrote.

The other scenario in which Perot Systems could demonstrate its innocence would be to claim that the market participants it pitched were fully disclosed about the false claims contained in its presentations, i.e., that they knew that the Rolex was fake.

In either scenario, Perot Systems would need to admit that its presentations made false promises. Perot Systems has done the opposite. The company has claimed that "there [was] nothing remotely illegal, unethical, or even questionable about what Perot Systems did and/or offered to do...."[4]

[4] Statement of Dr. Charles J. Cicchetti, July 9, 2002.

Further, while Perot Systems failed to garner a multi-million dollar account for a software package or consulting services, it did sell consulting services for "protocol overview" workshops, such as the presentation made to Reliant on June 26, 1998. These "workshops" served as *de facto* marketing presentations because they contained much of the same information as other marketing materials and were intended to demonstrate the same mastery of the protocols. During these presentations, Perot Systems introduced ideas for market manipulation later utilized by market participants. California taxpayers and utility ratepayers may have been victimized as a result of these workshops, as well as the unsuccessful marketing presentations made by Perot Systems and Policy Assessment Corporation in which similar information was disclosed.

For example, Perot Systems officer Ed Smith wrote to Enron Vice President Rich Davis one week after the market opened to suggest that the "good news" was that Enron could participate in one of an "overabundance of strategy categories," including "taking advantage of self-created congestion." Dr. Gribik and Mr. Smith also mentioned to Enron that market participants could profit by intentionally overscheduling energy on the Silver Peak intertie, a 15-MW line. Enron ultimately used both strategies to manipulate the price of electricity in California and in one instance was sanctioned $25,000 for using the tactics.

Perot Systems has offered expert testimony from economists who have sworn under oath that there is no possible connection between Enron's gaming strategies and the strategies suggested by Perot Systems. It is unclear, given the timing and facts, how they can make this claim. Perot Systems suggested creating false congestion in 1998. Enron carried out such strategies in 1999.

4. Did Perot Systems have a duty to report the flaws it found in the systems it was building?

Perot Systems has claimed that it had no duty to report to either CAISO or CalPX officials the existence of flaws in the systems it built. Perot Systems has argued that its job was to "integrate" the software written by ABB with the software written by Ernst & Young and did not extend into reporting flaws.

This narrow definition of Perot Systems' responsibility to CAISO and CalPX is contradicted by the actions of its employees and the comments of Mr. Perot, who testified that Perot Systems' high ethical standards and corporate citizenship were the reason two protocol "gaps" were fixed prior to the opening of the market.

Internal documents demonstrate that this is false. According to several internal emails, Perot Systems' employees and business partners identified "a thousand" other gaps in the protocols that could be exploited and instead chose to ignore them because the future exploitation of those holes would be "fun and profitable."[5] In one email, Dr. Backus claims that Dr. Gribik has insight into which holes "should be plugged, which should be used." Dr. Gribik later confirms: "I think that several areas of the protocols have large potential for gaming. I don't know if we want to try to get the CPUC, FERC, ISO and PX to try to plug the holes."

[5] PSC 007359, email from Paul Gribik to George Backus, May 8, 1997.

Implicit in Perot Systems' contractual responsibility was its duty to ensure that the systems underlying the market could not be compromised. Ron Nash, a Perot Systems vice president, informed Mr. Tranen in October 1997 that "the unauthorized disclosure or use of any legitimate functionality of the ISO System, by any Perot Systems associate or subcontractor would violate our Standards of Ethical Practices that would result in immediate, unequivocal disciplinary action."

Mr. Nash also wrote, "At no time has Perot Systems offered to assist anyone to exploit 'potential weaknesses and shortcomings in the ISO's system,' or suggested that our involvement in developing the ISO's system would allow us to exploit any knowledge we have about the ISO's system."

In addition, Dr. Gribik claims on two occasions he brought to the attention, and subsequently helped fix, holes in the protocols. These two "fixes" were featured in the 44-page document he wrote in late-March 1998. Until now, Dr. Gribik has never indicated that this behavior was voluntary and has never claimed it was not required by the terms of Perot Systems' contract with the ISO Alliance.

Finally, a review of the ISO Alliance contract demonstrates that members of the ISO Alliance had a contractual obligation to avoid material conflicts of interest, as well as avoiding the appearance of a conflict of interest. Selectively fixing holes in the systems and protocols it wrote could have undermined the CAISO and CalPX markets and thus violated its contractual obligations.

5. Does the term 'gaming' ever refer to market manipulation?

Perot Systems, its representatives, Dr. Backus and Mr. Perot himself have stated that investigations into this matter are founded on a misunderstanding of the term "gaming." There are hundreds of references to gaming in the Perot Systems and PAC documents. Mr. Perot said on June 6, "I think it's very important for all of you to understand that 'gaming' is an abbreviation for 'gaming theory.' This is a complex, mathematical theory developed by Nobel Prize recipient, John Nash."

This representation is inaccurate. Gaming, when used to convey game theory or a theoretical gaming model, is a well-established word among economists. But it is not the only meaning of the word, as all parties have acknowledged directly in either testimony or in documents obtained by the committee. Gaming has an alternative, pejorative meaning that is closer to "manipulation" than it is to "modeling."[6]

Used in its most benign sense, game playing is theoretical. "Gaming," taken to mean "strategic behavior in a market," can be modeled using software, role players and scripted scenarios. This is sometimes called "war gaming." There is a shift, however, when the gaming takes place in an

[6] Dr. Backus wrote in part in a letter to a PG&E employee in July 1997: "Gaming may be a dirty word to FERC and the California commission, but the sooner the market clears out the distortions, the better it works for everyone...There may be ethical issues related to 'the end justifying the means' but there is a large region of opportunism between what is ethically viable (profitable) and ethically dangerous (illegal)." In another presentation he wrote that gaming took place on a continuum and that there was a "large domain between genteel and illegal."

operational market (meaning not theoretical) by actual market participants where the stakes are real. Gaming, in an operational market, is not necessarily illegal – but it can be.

Dr. Backus proves this point when he refers to a list of "games" observed in the United Kingdom. Some of the games, such as "Down and Up Games" are noted as "(Now Illegal)." Another game is referred to as "(Now Sort of Illegal)." In the context of most of Dr. Backus' writings, the term is used to convey an offensive strategy of market behavior that goes beyond theoretical modeling.

This begs the question: If one accepts the claims that "gaming" refers only to market modeling, under what circumstances could a *model* ever be illegal? The only circumstance is when gaming takes place in a real, operational market and the strategies deployed by actual market participants result in economic gains made through unlawful practices.

Internal documents demonstrate that Dr. Backus and Perot Systems used the term gaming to describe possibly illegal market behavior. Evidence also shows that Dr. Backus and Perot Systems were aware of this behavior and encouraged its adoption in various marketing presentations. In fact, the market manipulation Dr. Backus predicted in California was the result of many of these illegal games. Dr. Backus explained in a letter to representatives of Pacific Gas & Electric in late October 1997 what to expect:

> "Enron is aware that they can extract over $1B from PG&E and SCE in as little as the first 9 months [of the market]. The $1B noted above comes from only one 'game tactic.' There are at least two other 'game tactics' that are almost as powerful (plus hundreds of others [sic] minor 'games' that they can legally and stealthily play on the side...BPA has to be an unwitting accomplices to these activities...P.S. I am not contracted with Enron to play games in CA, although it appears that they will me [sic] use me to help them play the 'new and improved' games now showing in the UK. When these sophisticated tactics come to the US, a few eyes should open – too late."

Therefore, contrary to the claim by Perot Systems, gaming in the Perot Systems presentations was not theoretical, but rather represented "real" strategies to extract huge profits from an unwitting public.

CONCLUSION

Mr. Perot has had seven weeks to review the documents. He has admitted that he has not done a comprehensive review of those documents. He promised he would lead the internal investigation. Yet, in testimony on July 11, Mr. Perot cited only the assurances of Perot Systems' lawyers and the company's hired experts as proof that his company did not engage in illegal or unethical behavior. The committee believes that Perot Systems' lawyers have not fully advised Mr. Perot about the behavior exhibited by his company. The evidence demonstrates that Perot Systems built the systems, intentionally left them flawed, and then attempted to sell its knowledge of these flaws to market participants. The committee believes the evidence further demonstrates that the market dysfunction displayed in California can be attributed in part to the role Perot Systems played in the marketing flaws in the computer systems and underlying protocols it built to market participants.

Mr. OSE. I know we delivered a copy of the letter from Perot to the minority. We are going to enter this into the record also at this time.

[The information referred to follows:]

July 19, 2002

perotsystems

The Honorable Doug Ose, Chairman
House Subcommittee on Energy Policy, Natural Resources and Regulatory Affairs
2157 Rayburn House Office Building
Washington, D.C. 20515-6143

Dear Congressman Ose:

Thank you for your invitation to appear at Monday's hearing of your subcommittee. Given the complexity of the issues under your review, I believe that it would be most useful for your subcommittee to hear from individuals who have first-hand, substantive knowledge of California energy markets and deregulation. Since I have no first-hand knowledge or expertise on these topics, I do not believe I can provide any useful testimony to your subcommittee and therefore will not attend the hearing.

As you know, we have worked hard to get information to you and your staff and to help arrange the appearance of others who have first-hand knowledge and expertise in these matters. Dr. Paul Gribik is the former Perot Systems employee who dealt with these issues five years ago. In addition, Dr. Charles Cicchetti is a national expert not only on energy issues in general, but on the California energy market in particular. I trust that the information you will receive from these two gentlemen will be of great benefit to your deliberations.

Perot Systems previously provided a detailed, 41-page presentation on this issue, a copy of which has been provided to the subcommittee, and which also is posted at URL=access.perotystems.com or may be accessed through http://www.perotsystems.com.

Mr. Chairman, I also want to thank you and your staff for your courtesy and professionalism as you review these issues.

Very truly yours,

Ross Perot
Chairman, Perot Systems

Perot Systems Corporation P.O. Box 269005 2300 West Plano Parkway Plano, TX 75026-9005 tel 972.577.0000

Mr. OSE. Now, gentleman, this committee is an investigative committee. This is not judgmental in the sense about what we are going to do. We swear everybody in. So, we are going to ask you all to rise, raise your right hand. Those who would advise you, in the background, whose names we may need to have on the record; if you think they are going to provide input here, we are going to need to have them rise, be identified, and raise their right hand and be sworn in also. So, gentlemen.

[Witnesses sworn.]

Mr. OSE. Let the record show that the witnesses all answered in the affirmative.

Now, the way we proceed here is that each of the witnesses is given 5 minutes for the purpose of an opening statement. We have received your written statements, and we have reviewed them. I know that Mr. Waxman and I are very interested in getting to questions. I am going to be punctual on the 5-minute rule this afternoon. So to the extent that you can, you need to make sure you can constrain yourselves to 5 minutes.

Now, we have four witnesses with us today. We have Terry Winter, who is the president of the California Independent System Operator. We have Dr. Charles Cicchetti, who is the occupant of the Jeffrey Miller Chair in Government, Business and the Economy, from the University of Southern California. We have George Backus, who is the president of the Policy Assessment Corp.; and we have Paul Gribik, who is a former Perot Systems Corp. employee.

As Mr. Waxman indicated, we also had invited Mr. Perot and Mr. Belden. Those invitations have been declined, and we have no written statement from them.

Mr. Winter, you are our first witness. You are recognized for 5 minutes.

STATEMENTS OF TERRY WINTER, PRESIDENT, CALIFORNIA INDEPENDENT SYSTEM OPERATOR; CHARLES J. CICCHETTI, OCCUPANT, JEFFREY MILLER CHAIR IN GOVERNMENT, BUSINESS AND THE ECONOMY, UNIVERSITY OF SOUTHERN CALIFORNIA; GEORGE BACKUS, PRESIDENT, POLICY ASSESSMENT CORP.; AND PAUL GRIBIK, FORMER EMPLOYEE, PEROT SYSTEMS CORP.

Mr. WINTER. Mr. Chairman, members of the committee, thank you for inviting me here to discuss the importance of electric consumers in California and throughout the Western United States.

I would like to emphasize four points today. First, you have invited me to discuss, among other things, the trading schemes described in the materials produced by Enron and Perot Systems in the past few months, and I will do so in a moment. I must stress, though, that as disturbing as some of the strategies described in the Enron and Perot Systems materials are, the greatest potential harm to electric consumers in California and elsewhere comes not from the games that some clever traders may play, but from the persistent exercise of market power by suppliers and traders. By market power, I mean the ability of a single seller or group of sellers to command excessive prices on a sustained basis. It is this ex-

ercise of market power that cost California literally billions of dollars in the last 2 years.

From startup 4 years ago, the ISO has placed particular emphasis on documenting and mitigating both suppliers' exercise of market power and their use of gaming strategies such as those described by the Enron/Perot Systems materials. I am providing the committee with a chronology of activities the ISO has pursued in the past 4 years, directed to market power, gaming, and providing relief to consumers that have been victimized by the market. You will see there a strong and consistent emphasis on detecting, constraining, and combating market power. Through the turmoil of late 2000 and early 2001, our market analysis department and the independent market surveillance committee repeatedly documented both the presence of market power in the California markets and its impact on the consumers, and we have proposed measures to control that market power.

There have been times indeed when people have thought we have acted too aggressively. For instance, in June 1998, we imposed a $250 price cap when prices suddenly rose to $9,000 plus.

How have we responded to market manipulation? First, the ISO detected and issued directives specifically prohibiting some of the gaming strategies identified in the Enron memo.

Second, the ISO modified its market designs to withhold payments to suppliers who were engaged in gaming strategies.

Third, the ISO persuaded FERC to impose regional price caps to address strategies involving the laundering of powering to avoid limitation of bids in the ISO markets and has recently asked FERC to extend those regional protection measures.

Fourth, the ISO levied penalties on suppliers who have withheld energy even when we instructed them to provide it to avert blackouts.

Five, the ISO referred other matters involving questionable activities by suppliers to FERC for their review and further action.

And, six, the ISO issued directives to participants in its markets identifying trading practices, including those in the cited Enron memos, that the ISO considered these contrary to its market rules and would subject a trader employing them to sanctions.

The ISO's interaction with Perot Systems, which has recently been the subject of press reports, represents an example of the ISO's efforts in the past to protect its markets against manipulation. When the ISO was established in 1997, its first task was to oversee the development of the computer systems and software needed to run the electric grid in its energy markets. In March 1997, the ISO contracted with the ISO Alliance, a joint venture of Perot Systems and ABB Power T&D Co., for the development of that computerized system. It should be noted that a few months after startup, Perot Systems withdrew from the ISO Alliance.

It should also be understood the role that Perot Systems had in the development. They were not the market designers; they were not the code writers. That was ABB and their subcontractor, Ernst & Young, who did the actual code. Perot's responsibility was to integrate those systems and make sure that all of them worked together, and that they had been tested out before we went live. As

such, they gained considerable knowledge about the systems, but clearly they were not the ones writing the code.

The ISO demanded in 1997—when we learned from a board member that there was marketing activity going on—the ISO demanded that Perot Systems provide assurances that any service that it provided to market participants would employ only publicly available information, that it make the limitation clear to its potential customers and those that they may solicit in the future, and that it enforce what we called a Chinese wall so that those working at the ISO would not have contact with those who were doing the marketing activities.

We never came to a resolution to that discussion, but we determined that most of the material which they had used, or at least the written material that we had seen, in fact was publicly available material. We have reviewed that material and chose not to continue a discussion with Perot on those items. However, with some of the recent information we have had made available to us, we are certainly going back and looking at those activities.

The most effective means of deterring the exercise——

Mr. OSE. Mr. Winter.

Mr. WINTER. Yes.

Mr. OSE. You are a minute over.

Mr. WINTER. Oh.

Mr. OSE. How much more have you got?

Mr. WINTER. I have just got one more paragraph.

Mr. OSE. Please continue.

Mr. WINTER. The most effective means of deterring market power and unfair gaming is, of course, establishing the correct market rules, and we feel that we have done that with our recent market design, which was approved by FERC. They also gave us some mitigation control items that we think will tend to buffer those. Most important of that is a "must offer westwide," so that you don't have the activities going from out of State versus power that's produced in State.

And, with that, I will come to a close. And then, if you ask me questions about what Congress can do, I would be happy to tell you, but it's in my testimony. Thank you.

Mr. OSE. Thank you, Mr. Winter.

[The prepared statement of Mr. Winter follows:]

Statement of
Terry Winter
President and Chief Executive Officer
California Independent System Operator Corporation
Before the
Congress of the United States
House of Representatives
Subcommittee on Energy Policy, Natural Resources, and Regulatory Affairs

July 22, 2002

Mr. Chairman, Members of the Committee:

Thank you for inviting me to join you in an inquiry that is most important to electric consumers in California and throughout the western United States.

I would like to emphasize four points today, and then I would be happy to respond to your questions.

Market Manipulation and Market Power

First, you have invited me to discuss, among other issues, the trading schemes described in materials produced by Enron and Perot Systems in the past few months, and I will do so in a moment. I must stress, though, that as disturbing as some of the strategies described in the Enron and Perot Systems materials are, the greatest potential harm to electricity consumers in California and elsewhere comes not from "games" that some clever traders may play, but from the persistent exercise of market power by suppliers and traders. By "market power," I mean the ability of a single seller or group of sellers to command excessive prices on a sustained basis. It is the exercise of market power by suppliers that has cost California consumers billions of dollars since the summer of 2000.

From start-up four years ago, the ISO has placed particular emphasis on documenting and mitigating both suppliers' exercise of market power and their use of gaming strategies, such as those described in the Enron/Perot Systems materials. I am providing the Committee with a chronology of activities the ISO has pursued in the past four years, directed to market power, gaming, and providing relief to consumers that have been victimized by market power. You will see there a strong and consistent emphasis on detecting, constraining and combating market power. Through the turmoil of late 2000 and early 2001, both our Department of Market Analysis and the independent Market Surveillance Committee repeatedly documented both the presence of market power in the California electricity markets and its impact on consumers. And we have proposed measures to control that power. There have been times, indeed, when we have been accused of reacting too vigorously to the potential for market power to be exercised or market rules flouted as, for example, when we unilaterally imposed price caps on the

ISO's markets and only afterward sought the authority to do so. I stress these points because market power has been the means by which the greatest profits have been extracted from the California markets, and because it has been the enabler for many of the gaming strategies identified in these markets.

The ISO's Responses to Market Manipulation

Second, with regard to gaming of the type described in the Enron/Perot Systems materials, the ISO consistently has monitored for such activity, and when appropriate, we have taken action. I am providing the Committee with a description of the actions the ISO has taken in response to each of the gaming strategies described in the Enron memos, all of which were identified by the ISO's market monitors. Those actions include the following:

- The ISO detected and issued directives specifically prohibiting some of the gaming strategies identified in the Enron memos;
- The ISO modified its market rules to withhold payments to suppliers who engaged in gaming strategies;
- The ISO persuaded FERC to impose regional price caps to address strategies involving the "laundering" of power to avoid limitations on bids in the ISO's markets, and has recently asked FERC to extend those regional protection measures;
- The ISO levied penalties (following FERC approval) on suppliers who have withheld energy even when we instructed them to provide it to avert blackouts;
- The ISO referred other matters involving questionable activities by suppliers to FERC for review and further action; and
- The ISO issued directives to participants in its markets identifying trading practices, including those cited in the Enron memos, that the ISO considered contrary to its market rules and would subject a trader employing them to sanctions.

The ISO's interaction with Perot Systems, which has recently been the subject of press reports, represents an example of the ISO's efforts in the past to protect its markets against manipulation. When the ISO was established in 1997, its first task was to oversee the development of the computer systems and software needed to run the electricity grid and the energy markets. In March of 1997, the ISO contracted with ISO Alliance, LLC, a joint venture of Perot Systems and ABB Power T&D Company for the development of the computerized system that would run the ISO's markets. (I should note that in July 1998, a few months after the ISO's markets commenced operations, Perot Systems

withdrew from the ISO Alliance.) The role assigned to Perot Systems largely related to the integration and testing of systems for which the detailed design work had been performed by its Alliance partner, ABB, and its subcontractors.

In October, 1997, the ISO became aware that Perot Systems was offering to provide consulting service to companies that expected to participate in the ISO's markets, offering to help them identify market opportunities and develop market strategies. My predecessor as the ISO's Chief Executive Officer vigorously protested Perot Systems' solicitations, which the ISO viewed as a potential breach of the obligations of ISO Alliance to hold confidential the details of the systems it was integrating and testing for the ISO and to avoid actual and apparent conflicts of interest with its work for the ISO. The ISO demanded that Perot Systems provide assurances that any services it would provide to market participants would employ only publicly available information, that it make that limitation clear to its potential customers (both those previously solicited as well as those to be solicited in the future), and that it enforce that limitation by taking steps to "wall off" its employees who worked on the systems provided by ISO Alliance. The ISO reviewed the materials that Perot Systems purportedly used to solicit potential business from market participants and satisfied itself that in fact only publicly available information was presented in those materials. Those ISO-reviewed materials focused on the market rules and did not appear to disclose proprietary information on how the ISO's computer systems would operate.

Based on the ISO's review of the materials made available to it and on the representations made by Perot Systems, including its commitment to comply with the demands made by the ISO, the ISO elected not to pursue any further action at that time. We are continuing to review the information that is now coming to light to determine whether that decision should be reconsidered and, in particular, whether Perot Systems lived up to the assurances that it had offered when the ISO challenged its conduct.

In the meantime, the ISO has also commenced a review of its current market oversight and investigation authority to identify additional authority that it may require to detect and deter market manipulation. Additionally, the ISO has proposed a comprehensive revision to the market rules that were the subject of Perot Systems' presentations to prospective clients, and this leads me to my third point

Comprehensive Market Redesign

The most effective means of deterring the exercise of market power and unfair gaming of market rules is to establish market rules that encourage appropriate behavior – by which I mean offering all available electricity supplies at prices that reflect the suppliers' costs – coupled with enforcement programs that rest on clearly defined rules and consequences for non-compliance.

On May 1, 2002, we filed with the FERC a detailed proposal for a comprehensive market redesign that adapts the best features of the market design employed in the Mid-Atlantic

region to the unique circumstances we face in California. We followed up with a second filing providing additional details on the rules that would govern the redesigned electricity market. The ISO's proposed design centers around a day ahead integrated market for procurement of electric energy and reserves and the management of congestion on the grid; and a day ahead residual unit commitment, which will permit the ISO to require suppliers to make preparations to generate to meet tomorrow's demand to avoid the situation in which the ISO must scramble at the last minute to secure the power needed to "keep the lights on." It also includes an obligation on utilities and others serving customers to arrange for a surplus of supply in advance to meet their customers demands, so that the short-term market never again becomes the primary vehicle for serving customers' needs.

Our proposal also includes an integrated set of market monitoring and mitigation proposals to deter both the exercise of market power and the types of gaming strategies exemplified in the Enron memos. Last Wednesday, FERC issued an order largely accepting the ISO's market redesign proposal. We are currently evaluating the order but greatly appreciate the prompt response from the FERC enabling us to go forward quickly to implement the new market design.

What Can Congress Do?

Fourth and finally, let me anticipate the questions that you rightfully should expect me to answer and also to suggest a number of steps that Congress might take to help the ISO and other operators of regional electricity markets to deal effectively with market manipulation and the exercise of market power:

- Would the market design changes we propose address and close the opportunities for market manipulation described in the Enron memos? We think so, for the most part.

- Can I assure you that if we succeed with our redesign, all opportunities for market power abuse and market manipulation will be eliminated? Of course not. Many of the problems that contributed to the market failure in 2000-2001 -- deficiencies in supply, failure to engage in long-term contracting for resources, limitations on demand responsiveness, and inadequate transmission infrastructure -- can only be addressed through close cooperation not only between the ISO and FERC but also among state officials and market participants, in California and in our neighboring states. Moreover, I cannot tell you how often in the past we acted with the conviction that we closed a door to abuse only to find market participants creating new opportunities. What I can tell you is that our design will draw from the teachings across the country and do all that we now know to be feasible to assure a fair, efficient and competitive market.

There are three areas in which Congress can help the ISO and other operators of regional electricity markets to detect and deter market manipulation and the exercise of market power.

- Currently, the ability of an ISO or regional transmission organization to compel market participants to comply with its market rules is quite limited. The federal courts have held that an ISO or RTO cannot obtain injunctions against violation of its market rules, even if the violations involve the withholding of electricity urgently needed to avert blackouts. The FERC does not have a procedure in place under which and ISO or RTO can obtain enforceable orders mandating compliance with regional market rules on a timely basis. To ensure that ISOs and RTOs can obtain swift relief against market participants that flout the applicable rules, Congress should give FERC the authority to issue orders analogous to temporary restraining orders to mandate compliance with the market rules of an ISO or RTO and should direct FERC to act promptly on any application of an ISO or RTO for such an order.

- Congress should also close a gaping hole in the Federal Power Act's consumer protection scheme. The FERC has ruled that it cannot, even in the context of a market-based rate tariff, order recovery of excessive charges back to the date that the charges first were assessed. Rather, in FERC's view, it may only order recovery of excessive charges back to a date following the filing of a complaint – indeed, sixty days after the filing of such complaint – by an aggrieved party. We believe that the FERC is taking an unduly narrow view of its statutory authority, but Congress should remove all doubt by explicitly giving FERC the power to order refunds of all amounts charged under market-based wholesale rates that are later determined to exceed just and reasonable levels, unless the seller had submitted for FERC's prior review the specific prices it proposed to charge in particular transactions.

- Congress should also confirm that when the FERC determines the need for a cap or other limitation on prices in market-based wholesale transactions in order to ensure that prices do not exceed just and reasonable levels, FERC cannot arbitrarily remove the limitation absent a finding that the market will yield just and reasonable wholesale prices.

* * * *

Mr. Chairman, Members of the Committee, let me close with a pledge to each of you and to electric consumers in California and throughout the West: We at the ISO will learn from experience. We will utilize all means available to us and make every contribution we can toward assuring that consumers never again suffer a repetition of past market power abuses, but instead, reap the benefits of a robust competitive market which I continue to believe can be substantial.

Highlights of ISO Actions re: Gaming and/or Market Power

Date	Forum	Objective	Result
3/31/1997	FERC: ISO Files Market Power Monitoring Plan	ISO makes initial Tariff filing. Defines "gaming" and proposes penalties and sanctions, including suspension of trading authority.	FERC accepts ISO gaming definition but rejects the ISO's proposed penalties and sanctions , directing the ISO to pursue penalties for specific incidents of alleged misconduct on a case by case basis as events occur. 81 FERC ¶ 61,122 at 61,552-54.
3/3/1998	FERC: EC96-19-017	ISO files for approval of Amendment 4. Seeks $250 cap on default usage charge to counter potential intra-zonal congestion gaming.	Accepted for filing, subject to possible refund and further Commission orders as one of the "Unresolved Issues" (Issue No. 205 / Issue L.2) that has been pending in Docket Nos. ER-98-3760, EC-96-19, and ER96-1663 since the Spring of 2000. 3/30/98, 82 FERC ¶ 61,327.
5/21/1998	FERC: ER98-2343 ER98-2844 ER98-2883	ISO challenges market-based rate authority for AES on grounds that AES had not made proper showing (that market was competitive and/or AES lacked market power). Urges FERC to conduct time-differentiated study and to authorize bid cap pending proper showing by AES.	FERC approved market based rates and rejected bid-caps in an order dated June 30, 1998. 83 FERC ¶ 61,358. FERC responded on July 17, 1998 to requests for rehearing by ISO by allowing the ISO to impose temporary interim price-caps although it denied the motion to stay. 84 FERC ¶ 61,046. The follow-up order re-affirmed the temporary bid-cap. 85 FERC ¶ 61,123 (1998).

Highlights of ISO Actions re: Gaming and/or Market Power

Date	Forum	Objective	Result
6/01/1998	FERC: ER98-1127 ER98-1796 ER99-1115 ER99-1116 ER99-4160 ER94-1612	ISO challenges market-based rate authority for Dynegy on grounds similar to those asserted in AES docket.	FERC approved market based rates for Ancillary Services on July 10, 1998. 84 FERC ¶ 61,011. The follow-up order re-affirmed the ISO's temporary bid-cap authority. 85 FERC ¶ 61,123 (1998).
6/2/1998	FERC: ER98-2977	ISO challenges market-based rate authority for Reliant on grounds similar to those asserted in AES docket.	FERC granted market based rate authority on July 10, 1998. 84 FERC ¶ 61,013.
6/08/1998	FERC: ER98-2343 ER98-2844 ER98-2883	ISO makes supplemental filing challenging market-based rate authority for AES.	See above.
7/09/1998	FERC: ER98-3416 ER98-3417 ER98-3418	ISO challenges market-based rate authority for Duke, stressing the thinness of the market and ability of individual suppliers to set the market clearing price.	Accepted Market Based Rates for Filing on August 17, 1998. (84 FERC ¶ 61,186).
7/13/1998	FERC: ER98-2843 ER98-2844 ER98-2883 ER98-2971 ER98-2972 ER98-2977	ISO files an Emergency Motion in the AES and Dynegy dockets to set a cap of $500 on ancillary services markets to counter exercise of market power after a bid of $9,999 set the price for Replacement Reserves.	FERC responded on July 17, 1998 by allowing the ISO to impose temporary interim price-caps. 64 FERC ¶ 61,046. A follow-up order re-affirmed the temporary bid-cap. 85 FERC ¶ 61,123 (1998).

Highlights of ISO Actions re: Gaming and/or Market Power

Date	Forum	Objective	Result
7/16/1998	FERC: ER98-3416 ER98-3417 ER98-3418	ISO makes second filing challenging market based rate authority for Duke, stressing the potentially "enormous adverse consequences" to the California Markets.	Accepted market based rates for Filing on 08/17/1998. 84 FERC ¶ 61,186.
7/16/1998	FERC: ER98-3106	ISO challenges market-based rate authority for Williams, and seeks authority to cap Williams' bids at $500/MWh pending a proper showing by Williams.	FERC approved market based rates for Ancillary Services in a July 24, 1998 order. 84 FERC ¶ 61,072. FERC also noted that the ISO had temporary bid cap authority. ISO reduces cap to $250/MWh for Imbalance Energy, Ancillary Service, and Adjustment Bid markets.
7/27/1998	FERC: EC96-19-035	ISO files for approval of Amendment 10. Seeks approval to counter market power by procuring ancillary service outside the ISO control area.	Conditionally accepted, with procedures instituted, request by Commission for further explanation of proposed change, 7/31/98, 84 FERC ¶ 61,121.
8/18/1998	FERC: ER98-2843	MSC publishes preliminary report on ancillary services markets. Among other conclusions, the MSC finds that preliminary results suggested that the RMR contracts were most likely creating incentives to withhold capacity.	ISO and RMR unit owners enter into partial settlement in 4/99, effective 6/99, removing incentives for withholding.
8/24/1998	FERC: ER98-3106	ISO seeks rehearing of order granting market-based rate authority for Williams, again asserting need for time-differentiated study.	FERC granted rehearing on September 21, 1998. By order addressing several requests for market based rates, FERC approved market based rate authority and reaffirmed the ISO's authority to implement temporary

Highlights of ISO Actions re: Gaming and/or Market Power

Date	Forum	Objective	Result
			bid-caps. 85 FERC ¶ 61,123.
9/1998	ISO Governing Board	ISO Market Surveillance Unit (predecessor to the current Department of Market Analysis or "DMA") issues Market Redesign Status Report and Recommends approval of measures designed to, among other objectives, correct settlement price signals to close gaming opportunities for uninstructed imbalance energy deviations, and eliminate uninstructed energy and capacity payment for ancillary service deviations.	ISO Governing Board approves recommended redesign at 9/24/98 meeting.
9/09/1998	FERC: ER98-4301 ER98-4302	ISO challenges market-based rate authority for Mountain View and Riverside Canal Power, again stressing potential "extremely serious consequences in the ISO's Regulation and Reserve Service markets, permitting the exercise of market power, and producing extraordinarily high market clearing prices in some hours." Sought continuing authority to cap ancillary services bids.	FERC granted authority to sell Ancillary Services and Energy at market based rates in an order dated October 16, 1998. 85 FERC ¶ 61,060.
9/16/1998	FERC: ER98-3416 ER98-3417 ER98-3418	ISO seeks rehearing of orders granting market-based rate authority without a time-differentiated study or giving the ISO bid cap authority.	By order dated October 28, 1998, FERC authorized market based rates for all sellers of ancillary services and replacement reserves in California and directs the ISO to submit a proposal for the redesign of the Ancillary Services market, which ISO completes on 3/1/99. 85 FERC ¶ 61,123. This order also addressed AES dockets.

Highlights of ISO Actions re: Gaming and/or Market Power

Date	Forum	Objective	Result
9/29/1998	FERC: ER98-4498	ISO challenges market-based rate authority for San Diego Gas & Electric, stressing previous concerns.	FERC conditionally approved market based rates for the sale of certain Ancillary Services for SDG&E and Sempra by order dated October 28, 1998. 85 FERC ¶ 61,122.
12/4/1998	FERC: ER99-826	ISO files for approval of Amendment 12. Seeks to extend the ISO's authority to impose caps on energy bids.	Rejected, but allowed ISO to establish purchase price caps on an interim basis, 1/27/99, 86 FERC ¶ 61,059.
12/11/1998	FERC: ER99-896	ISO files for approval of Amendment 13. Seeks to rescind payments to suppliers when they deviate from prior scheduled commitments without ISO approval (i.e. "Nonpayment for Uninstructed Deviations")	Accepted as modified (e.g., to make the language more precise as to when the payment will not be made), 2/9/99, 86 FERC ¶ 61,122.
3/1999	Market Notice	ISO changes operating procedure M401 to counter intra-zonal congestion gaming.	New procedure authorizes use of RMR units to resolve congestion. All intra-zonal congestion where there were less than three suppliers (except on Path 26 that was intra-zonal at the time) was declared non-competitive and subject to mitigation by RMR units if available.
3/1/1999	FERC: ER99-1971	ISO files for approval of Amendment 14. Proposes redesign of Ancillary Services markets to make them workably competitive (i.e. to eliminate opportunities for the exercise of market power). ISO proposes "Rational Buyer" program in which lower cost higher quality services could replace higher cost lower quality (longer to start-up) services. ISO also seeks authority to impose costs (effectively to penalize) for extra replacement reserve on market participants that either over-schedule	Accepted (5/26/99), subject to certain conditions, e.g., that purchase cap on imbalance energy be eliminated by 11/15/99, 87 FERC 61,208.

Highlights of ISO Actions re: Gaming and/or Market Power

Date	Forum	Objective	Result
		generation or under-schedule load.	
4/6/1999	FERC: ER98-2843	MSC and Market Surveillance Unit issue final report on impact of RMR units on California markets. Report confirms and expands upon findings in preliminary report (e.g. RMR contract design promotes withholding) released on 8/18/98.	ISO and RMR unit owners enter into partial settlement in 4/99, effective 6/99, removing incentives for withholding.
5/25/1999	N/A	Enron submits schedule in the PX market calling for delivery of more energy (2900 MW) across Path 13 (Silverpeak) than the path's known capacity (15 MW); both ISO and PX conduct investigations.	ISO Department of Market Analysis assisted the PX Market Compliance Unit investigation and suggested measures which would prevent this event from re-occurring. PX concluded a settlement agreement with Enron on April 28,2000 by which Enron agreed not to engage in conduct again and paid fine to defray investigations costs. Investigation filed with FERC.
6/14/1999	FERC: ER99-896	ISO begins manual implementation of "no pay" policy. Under the policy, the ISO rescinds payments for ancillary services capacity where the source units are unavailable for dispatch in real time (to provide reserve energy in real time if needed).	Approximately $57 million in payments rescinded to date.
6/18/1999	FERC: ER99-3301	ISO files for approval of Amendment 18. Proposes redesign of market rules for managing intra-zonal congestion in real time to eliminate opportunities for the exercise of market power. To address strategic bidding behavior, the ISO proposed to use the lower of	Accepted, 7/30/99, 88 FERC ¶ 61,146.

Highlights of ISO Actions re: Gaming and/or Market Power

Date	Forum	Objective	Result
		adjustment bids or imbalance energy bids to manage intra-zonal congestion rather than being required to exhaust adjustment bids prior to calling on imbalance energy.	
7/20/1999	DMA Monthly Market Analysis Report (6/1/99-7/13/99)	The ISO highlights two large negative price spikes "caused by market participants submitting large negative bids for upward regulation with the apparent belief that other bids for downward regulation would set the market-clearing price during these hours. This bidding strategy would allow market participants to gain large market shares for upward regulation while receiving a positive price set by high demands for downward regulation. In these particular hours, this strategy backfired as market participants collectively bid enough capacity at negative bid prices to cover demand for both upward and downward regulation.	The ISO implemented software changes necessary for clearing of the upward and downward regulation markets at separate market clearing prices. This change went into effect in August 1999.
8/26/1999	ISO Governing Board	ISO Governing Board approves recommended changes in protocols for paying for out of market purchases.	Protocols reduce opportunity for gaming in the congestion management market.
9/17/1999	FERC: ER99-4462	ISO files for approval of Amendment 21. Seeks to extend the ISO's authority through November 15, 2000 to cap Ancillary Services and Imbalance Energy prices.	Accepted, 11/12/99, 89 FERC 61,169 (1999).
9/27/1999	FERC: ER99-4545	ISO files for approval of Amendment 22. Seeks to amend FTR (firm transmission rights) tariff provisions to allow for more effective monitoring and possible mitigation of market power.	Conditionally approved, 11/24/99, 89 FERC ¶ 61,229.

Highlights of ISO Actions re: Gaming and/or Market Power

Date	Forum	Objective	Result
11/10/1999	FERC: ER00-555	ISO files for approval of Amendment 23. The ISO proposes revised methodologies for out-of-market payments for Participating Generators dispatched to meet system needs without having placed a bid into the ISO Markets. The ISO also proposed an amendment to mitigate problems associated with the exercise of locational market power.	FERC accepted the modified payment for out-of-market purchases but rejected the proposed mitigation of locational market power and ordered an integrated redesign of intra-zonal congestion management. 1/7/00, 90 FERC ¶ 61,006. FERC denies rehearing on 4/12/00, 91 FERC ¶ 61,026.
3/2000	ISO Governing Board	DMA releases analysis of then existing price cap ($750). Recommends that cap be retained.	Recommendation is adopted by the ISO Governing Board.
3/9/2000	ISO Market Surveillance Committee	ISO MSC publishes report concluding, based on bid data, supply ownership and conditions, and lack of demand response, that the ISO energy and ancillary services markets are not workably competitive.	N/A
4/5/2000	Market Notice	ISO modifies target price methodology to prevent game in which suppliers submit phantom decremental energy bids.	Eliminated specific game but created other problems addressed in further modification in 10/2000.
5/2000	N/A	ISO DMA commences investigation of AES/Williams unit outages resulting in use of higher priced market units in place of less expensive RMR units; concludes that gaming has occurred and refers matter to FERC.	FERC and AES/Williams agree to settlement in 4/2001 by which AES/Williams agrees to restore $8 million to the California markets; California attorney general initiates antitrust investigation which is still ongoing.

Highlights of ISO Actions re: Gaming and/or Market Power

Date	Forum	Objective	Result
5/2000	N/A	ISO DMA investigates out of market sales to ISO by PowerEx in which ISO forced to commit to block purchases of energy, resulting in more power than needed during select hours.	ISO determined that purchase costs approximated amounts that would have been paid through real time market; no further action taken against PowerEx; block sales practices of all market participants monitored during remainder of Summer 2000, with no further action required.
6/14/2000	Market Notice	ISO changes method of procuring replacement reserve in order to counter exercise of market power and reduce costs.	N/A
6/28/2000	ISO Governing Board	ISO convenes special Board meeting and recommends reducing price cap from $750/MWh to $500/MWh.	Price cap reduced from $750/MWh to $500/MWh
7/21/2000	FERC: EL00-91	ISO MSC publishes report for submission to FERC noting that bidding evidence, continuing and newly created market flaws between March and July 2000 further supports conclusion that ISO energy and ancillary services are not workably competitive.	N/A
7/21/2000	ISO Market Participants	ISO issues market notice to all participants forbidding a form of gaming in the ISO congestion market (practice of scheduling non-firm exports to resolve congestion and subsequently canceling delivery before real-time operations--identified as the "non-firm export" strategy in the 12/8/00 Enron memorandum).	ISO has not detected a recurrence of the strategy since the notice was issued.
8/1/2000	ISO Governing Board	ISO recommends reducing price cap from $500/MWh to $250/MWh.	Price cap reduced from $500/MWh to $250/MWh

Highlights of ISO Actions re: Gaming and/or Market Power

Date	Forum	Objective	Result
8/10/2000	DMA Market Analysis Report	DMA publishes Report on California Energy Market Issues and Performance: May-June, 2000. Report concludes that, even accounting for high demand, doubling gas prices and no new generation being built, energy prices between May and June 2000 were abnormally high and suggest the exercise of market power by major suppliers.	N/A
9/1/2000	FERC: ER00-2383	Implemented automated "No Pay" system to eliminate payments for unavailable Ancillary Service capacity and energy.	Approved 91 FERC ¶ 61,324. $72 million in capacity payments rescinded to date.
9/10/2000	FERC: ER00-2383	Implemented 10-minute settlement to improve load following function of ISO Imbalance Energy market.	Approved 91 FERC ¶ 61,324.
9/14/2000	FERC: ER00-3673	ISO files for approval of Amendment 31. Seeks to extend price cap authority to all ISO markets and for period extending beyond November 15, 2000.	Rejected, 11/1/00, 93 FERC ¶ 61,121.
9/14/2000	FERC: ER00-3673	MSC files report on events of Summer 2000. Report concludes: [T]he California Electricity Market "[i]s" composed of a relatively small number of firms, some of which own a sizable fraction of the total electricity generating capacity located in the ISO Control Area. The geographic distribution of generation unit ownership can allow some owners to exercise locational market power during certain system conditions. In addition, the amount of generating capacity owned by some market participants allows them to exercise market power during high load conditions, when there is not a physical scarcity of available generating capacity to serve this load."	N/A

Highlights of ISO Actions re: Gaming and/or Market Power

Date	Forum	Objective	Result
10/20/2000	FERC: EL00-95	ISO files Offer of Settlement with FERC in the docket covering FERC's investigation into the Western Electricity Markets. Offer proposes balanced program of mitigation and incentives to reduce underscheduling of load and to commit resources in advance of real time to serve California load. Key elements include: a $100/MWh price cap with exemptions: (1) if an owner demonstrates that a payment of $100/Mwhr would be insufficient to cover the variable operating cost of a unit and make some reasonable contribution to fixed cost recovery, a higher cap would be fixed for that unit but that price would not establish the Market Clearing Price; (2) Generation fired by renewable resources would be exempt; (3) owners and operators whose units do not exceed 50 MW would be exempt; (4) incremental Generation (additions to existing units and new units) would be exempt; (5) any owner or marketer who demonstrates that it has committed 70% or more of the availability of its in-State portfolio to an in-State Load-serving entity for a term extending at least through October 15, 2002, would be exempt, and (6) imports would be exempt.	In its November 1 and December 15 Orders, FERC proposes to remove constraints on utilities forward purchases, but imposes no specific requirements on either load serving entities or suppliers.
10/20/2000	FERC: EL00-95	ISO files Declaration of Eric Hildebrandt (ISO DMA) in support of Offer of Settlement. Declaration provides evidence of the exercise of market power by suppliers based on analysis of actual bid data and urges adoption of mitigation measures of the type proposed in the offer of settlement.	N/A

Highlights of ISO Actions re: Gaming and/or Market Power

Date	Forum	Objective	Result
10/25/2000	ISO Governing Board	ISO Governing Board adopts plan for load differentiated bid caps (with higher caps based on the greater needs at higher load levels).	Rendered moot by FERC's November 1 and December 15 orders.
11/2000	N/A	ISO commences inspection of power plants in conjunction with CPUC and FERC, seeking evidence of physical withholding.	Insufficient evidence of withholding through deliberate use of forced outages. CPUC and FERC both independently performed follow-up and obtained confidential information pursuant to their oversight authority.

Highlights of ISO Actions re: Gaming and/or Market Power

Date	Forum	Objective	Result
11/22/2000	FERC: EL00-95	ISO files comments to FERC's 11/1/00 Order. The comments urge a west-wide, rather than California-only, mitigation approach, in order to counter "megawatt laundering" (aka "ricochet") and express concerns that the FERC order would further encourage under-scheduling of load. The comments urge the imposition of symmetrical penalties for both under-scheduling load and over-scheduling supply. Illustrative excerpts: "We believe that, to be effective, the approach proposed in the November 1st Order would require imposition of similar bid caps throughout the Western region with which the California market is integrated. A price mitigation approach applicable only to California markets could give rise to gaming.... The ISO is also concerned that the Commission's approach may actually exacerbate underscheduling.... Depending on how high these bids are relative to the real-time penalty for underscheduled load, load serving entities may prefer to have their load not clear the PX market and consequently rely on the ISO real-time market. Clearly, this outcome would be at odds with the intent of the November 1st Order." "There is absolutely no disagreement that the very high level of commerce regularly being transacted in the ISO's real time market is entirely unacceptable, from both a reliability and cost mitigation standpoint....[A balancing market] must not be a principal commodity market for load which could have been anticipated and therefore scheduled." "We have concerns with the proposal in the November 1st Order for addressing underscheduling. First, it does not mandate forward contracting by supply – a necessary requirement that we already have addressed as part of our market power mitigation proposal. Second, it properly imposes a penalty for real-time deviations but improperly assigns that penalty just to one side of the market, to load. The penalty must apply to both load and supply if the negotiating leverage is to remain in balance."	FERC delayed implementing west-wide mitigation measures until its June 19, 2001 order. FERC granted the ISO's emergency request for under-scheduling penalties on December 8, 2000, but rejected a subsequent request (see below) for penalties for schedule deviations by both suppliers and load in March 2002. A new request for deviation penalties is now pending.

Highlights of ISO Actions re: Gaming and/or Market Power

Date	Forum	Objective	Result
12/2000	FERC	ISO's DMA initiates investigation of generators' failure to follow dispatch instructions and refers documentation of circumstances surrounding this matter to FERC.	FERC staff elected not to pursue matter.
12/1/2000	FERC: EL00-95	The ISO's Market Surveillance Committee (MSC) files comments to FERC's November 1, 2000 Order. These comments express concern about the opportunities for megawatt laundering and urge the imposition of symmetrical deviation penalties on suppliers and load serving entities.	FERC delayed implementing west-wide mitigation measures until its June 19, 2001 order. FERC granted the ISO's emergency request for under-scheduling penalties on December 8, 2000, but rejected a subsequent request (see below) for penalties for schedule deviations by both suppliers and load in March 2002. A new request for deviation penalties is now pending.
12/8/2000	FERC: ER01-607	ISO files an emergency petition for approval of Amendment 33. Seeks penalties for under-scheduling of load and for withholding of supply (refusing to comply with emergency dispatch instructions). Also seeks to advance by 3 weeks FERC's previously announced plan to replace "hard" price cap with a "soft" cap. Seeks review and refund regime for excessive charges.	Accepted on an emergency basis, 12/8/00, 93 FERC ¶ 61,239 ISO to date has fined suppliers $122 million in penalties for failure to abide by dispatch instructions. In an Order dated 12/19/01, FERC suspended the ISO's authority to assess the penalty during the pendency of FERC's west-wide mitigation measures (beginning 6/19/01 and due to expire on 9/30/02). 95 FERC ¶ 61,418

Highlights of ISO Actions re: Gaming and/or Market Power

Date	Forum	Objective	Result
			Subsequent ISO refund requests (see below) have been granted and a formula established for recovery of refunds. A proceeding to determine recovery amount is ongoing.
12/13/2000	DOE	ISO seeks emergency order from the U.S. Secretary of Energy to compel in-state and out of state suppliers to offer available capacity to the California markets.	ISO's request is granted in a series of orders beginning on December 14, 2000 and continuing until February 6, 2001.
1/16/2001	FERC: EL00-95	ISO seeks rehearing of FERC's December 15, 2000 Order, again asserting serious concerns regarding under-scheduling, withholding and megawatt laundering. Also seeks to apply review and refund regime to ISO out-of-market (OOM) purchases. Illustrative excerpts: "OOM transactions with suppliers of Energy from outside the ISO's Control Area should be subject to the same reporting and cost justification requirements that apply to suppliers whose accepted Energy bids are above the breakpoint. Otherwise, in-state suppliers could seek to avoid both the OOM payment provisions in the ISO Tariff and the reporting and justification requirements of the December 15 Order by arranging exports to third parties outside the ISO's Control Area.... Furthermore, even in the absence of ricochet transactions with in-state suppliers, if suppliers outside the ISO's Control Area are not subject to the reporting and justification	Commission issues April 26, 2001 Order, 95 FERC ¶ 61,115, modifying mitigation methodology from December 15, 2000 decision. However, the Commission restricts mitigation only to California and only during system emergency conditions. ISO seeks further rehearing (see entry for May 25, 2001).

Highlights of ISO Actions re: Gaming and/or Market Power

Date	Forum	Objective	Result
		requirements of the December 15 Order, they will have an incentive to withhold bids from the ISO markets and wait for OOM negotiations in order to avoid those requirements."	
1/23/2001	FERC; EL00-95	ISO DMA presents draft market power mitigation proposal at FERC technical conference. Proposal includes measures to mitigate locational market power, to eliminate underscheduling of load and gaming of congestion management markets, and to counter physical withholding of supply.	N/A
2/3/2001	N/A	ISO sends letter to every in-state supplier seeking confirmation that they will comply with ISO emergency dispatch orders upon expiration of the last Department of Energy Order.	All but 4 suppliers provide such confirmation and continue to comply with emergency dispatch instructions.
2/6/2001	Federal Court	Upon expiration of DOE order, ISO files lawsuit in federal court against non-complying suppliers for temporary restraining order and injunction compelling compliance with emergency dispatch instructions.	Federal District Court grants a series of temporary restraining orders against the suppliers. FERC joins the suppliers in an appeal challenging the ISO's authority to assert a private right of action against the suppliers under the Federal Power Act. The appeal is sustained and the TROs dissolved in April 2000.
2/6/2001	FERC: EL00-95	ISO files comments in response to technical conference by FERC on market monitoring and mitigation measures. ISO argues that FERC's methodology for determining market power is antiquated and ineffective.	N/A

Highlights of ISO Actions re: Gaming and/or Market Power

Date	Forum	Objective	Result
		Illustrative excerpt: "The ISO long ago concluded that market concentration levels alone are not a very good indication of an entity's ability to exercise market power in the California electricity markets. The ISO believes that while such indicia may be appropriate in one-time (i.e., static) determinations as to whether an entity can exercise market power (such as in a traditional horizontal merger analysis), market concentration analyses based on installed or contractually committed capacity are inappropriate for dynamic hourly markets, such as those in California. Moreover, if such hourly markets have very inelastic demand and tight supply margins, such as exists in California's wholesale electricity markets, even a supplier having only a small market share can exercise market power during certain conditions."	
2/6/2001	FERC: EL00-95	DMA files more detailed statement of proposal presented at the January 23 FERC technical conference.	N/A
3/1/2001	FERC: EL00-95	The ISO and EOB request that the Commission issue a Notice to Market Participants that wholesale sales pursuant to bids above the $150 breakpoint continue to be subject to review beyond the 60-day period approved in the December 15, 2000 Order. The ISO and the EOB also request that the Commission: (1) require generators to provide the ISO and California state officials with cost data provided to the Commission; and (2) institute a hearing regarding the justness and reasonableness of sales by public utility sellers in the PX and ISO markets since December 8, 2000.	FERC grants the request in part, in a series of orders beginning 3/9/01, and orders refunds totaling $124.6 million (3/9- $69 million, 3/16- $55 million, 4/16 $587,000, and $5/14 - $0). However, FERC's methodology is limited to a proxy clearing price applied only during Stage 3 emergency conditions. FERC grants the rehearing requests of the ISO and other parties in the June 19, 2001 and requires additional refunds for the period

Highlights of ISO Actions re: Gaming and/or Market Power

Date	Forum	Objective	Result
		The ISO responds to statements in FERC's November 1 and December 15 Orders, wherein FERC staff found no evidence of market power exercised by specific suppliers, by filing two DMA studies of market power by specific suppliers. Illustrative excerpts: "Many suppliers used well planned strategies to ensure maximum possible prices at all load conditions. A 50 MW increase in the amount demanded from a supplier's portfolio would have increased the market clearing price substantially. A review of suppliers' bid prices above and below the actual dispatch quantity revealed the strategic nature of their bid schedule."	beginning October 2, 2000. The June 19 Order uses a different methodology that applies to all sales in all hours but still fails to take into account strategic withholding (i.e. doesn't consider units that were not bidding into the market). Preliminary estimates indicate that refunds under the ordered methodology could approach $1 billion. A proceeding to determine the specific refund recovery is currently pending before a FERC administrative law judge.
3/22/2001	FERC: EL00-95	ISO files comments to FERC Staff's Recommendation on Prospective Market Monitoring and Mitigation for the California Wholesale Electric Power Market. Again, urges west-wide, rather than California-only, mitigation in order to avoid megawatt laundering	Commission limits mitigation to California only in its April 26 order, but then grants rehearing and applies mitigation on a west wide basis in June 19, 2001 Order.
3/22/2001	FERC: EL00-95	DMA files a report to FERC with empirical evidence supporting the existence of strategic bidding behavior in the ISO real-time markets. This report focused on the question of whether the behaviors of individual suppliers caused price increases in the real-time markets, and examined bids and bidding strategies of individual suppliers. The report ultimately concluded that individual suppliers' strategic behaviors did increase prices in the real-time imbalance energy markets.	N/A

Highlights of ISO Actions re: Gaming and/or Market Power

Date	Forum	Objective	Result
3/22/2001	FERC: EL00-95	DMA files a second report to FERC regarding the exercise of market power in the California electricity markets. Relying again on the ISO's mark-up methodology to assess market power, this analysis explicitly includes the costs and limitations associated with the emission of nitrogen oxides (NOx) and the associated imposed resource scarcity. Ultimately, the report concludes that over 30% of wholesale energy costs may be attributed to market power, at a net cost of $6.7 billion to California consumers.	N/A
4/2/2001	FERC: ER99-1722	ISO challenges renewal of market-based rate authority for Williams, citing overwhelming evidence of the exercise of market power by Williams and insufficiency of the showing made by Williams.	FERC has never responded to the request.

Highlights of ISO Actions re: Gaming and/or Market Power

Date	Forum	Objective	Result
4/6/2001	FERC: EL00-95	ISO files a proposed market stabilization plan, to be implemented before the start of Summer 2001, to combat market power. Plan includes measures to mitigate market power in all hours and to prevent megawatt laundering. Specifically the plan called for: (1) establishment of a new availability payment to ensure full recovery of costs by all participating generators in exchange for an obligation to satisfy demand in California; (2) implementation of resource-specific bid caps; and (3) creation of a forward energy market in which procurement of energy and ancillary services would be "optimized". Illustrative excerpts: "[T]here is no doubt that market power has been exercised in all hours and under various conditions. Therefore, if mitigation were limited to a narrow set of transactions or circumstances, there would still be ample opportunities and incentives for resources to withhold supply from California until the pressure of real-time operation forces the CAISO to purchase large quantities of power at exorbitant prices. The only alternative the CAISO sees to the measures proposed in this Market Stabilization Plan are either to be forced into regular System Emergencies, which might necessitate the curtailment of exports in real-time on a regular basis, thereby increasing the volatility of real-time operation and threatening system reliability. California would also continue to suffer the impacts of outrageously high power costs. Absent a regional approach to the tight supply conditions throughout the western region, California must have stronger ability to direct native resources to serve native load.... If the Commission wishes to see competitive electricity markets develop and thrive in the West within the next few years it must give us the tools needed for this summer to navigate between the Scylla and Charybdis of extensive rolling blackouts and devastating power costs. Unlike Odysseus, the capacity indigenous to California easily and often finds its way home and returns as high-priced MWs purchased out-of-market. Therefore, it is critical that the Commission permit the CAISO to call on resources to serve in-control area load, subject to adequate compensation."	Commission adopts its own mitigation plan by order dated April 26, 2001, 96 FERC ¶ 61,115. However, the Commission's plan only imposes price mitigation during periods of reserve deficiencies and doesn't address megawatt laundering.

Highlights of ISO Actions re: Gaming and/or Market Power

Date	Forum	Objective	Result
4/9/2001	FERC: EL00-95	ISO seeks rehearing of March 9 refund order, arguing that the methodology used, including limitations on hours for which refunds were granted, was erroneous.	See discussion above. The March 9 order effectively was superceded by FERC's June 19, 2001 order adopting a different methodology applicable to all hours of operation.
4/9/2001	FERC: EL00-95	DMA completes a follow-up analysis in response to inquiries from FERC regarding the two previous analyses. Again relying on DMA's mark-up methodology, the report arrives at the following conclusions: 1) $4 billion in excess revenues associated with market power can be tied to specific schedules and transactions in the PX and ISO markets. 2) $2.4 billion in excess revenues took place in the ISO markets, $1.9 billion in the real-time markets. $3 billion in excess revenues in the PX and ISO markets involved sales by entities under FERC jurisdiction possessing market-based rate authority. $1 billion in excess revenues involved public utilities or other entities not under FERC jurisdiction.	N/A
5/25/2001	FERC: EL00-95	ISO seeks rehearing of FERC's April 26, 2001 order, arguing that the proposed mitigation was improperly limited in scope (emergency hours only, California only, and energy markets only) and would leave unchecked megawatt laundering. Illustrative excerpts:	FERC effectively overturned the 4/26 order in an order dated 6/19/01, which provided for west-wide mitigation across all hours of the ISO's operations.

Highlights of ISO Actions re: Gaming and/or Market Power

Date	Forum	Objective	Result
		"If, in the face of overwhelming evidence of market power abuse, the Commission sits silently by or responds ineffectively out of an unfounded faith that the market itself will resolve the current crisis, the evolution to a competitive electric market will surely be stalled, if not ultimately abandoned." "The April 26 Order, the denouement of the Commission's passion play on market power mitigation, is further evidence of the Commission's failure to address the obvious, constant exercise of market power. Frankly, it does not and should not require detailed analysis by economists to recognize that the phenomenal transfer of wealth is the product of supplier exploitation of the current market situation. Thus, while the public outrage is understandable, what is unimaginable is the Commission's failure to impose broader mitigation measures. The Commission has totally abdicated its responsibility to ensure just and reasonable rates. Despite championing the attributes and benefits of regional coordination and markets, the Commission has left wide open California's regional "back door" and totally failed to address the "MW laundering" issue – a problem that can only be effectively addressed through regionally-applicable price mitigation measures....The life blood is flowing, and a tourniquet must be applied now in the form of comprehensive, effective measures applied region-wide. It is high time to put down the fiddle and to extinguish the fire that is rapidly consuming California's economy."	
5/25/2001 6/7/2001	FERC: ER99-1722 ER98-2184 ER98-2185	In separate dockets, ISO files emergency motions immediately to suspend or terminate market-based rate authority for the five largest California suppliers (AES/Williams, Duke, Dynegy, Mirant, Reliant)	FERC has never responded to the requests. In AEP Power Marketing, 97 FERC ¶ 61, 219, the Commission, concluded that, because of significant

Highlights of ISO Actions re: Gaming and/or Market Power

Date	Forum	Objective	Result
	ER98-2186 ER98-2680 ER98-2681 ER98-2682 ER99-2774 ER99-1785 ER99-2784 ER98-1127 ER98-1796 ER99-1115 ER99-1116 ER99-4160 ER94-1612 ER97-4166 ER99-1833 ER99-1843 ER99-1841 ER99-1842 ER98-927 ER98-928 ER98-930 ER98-931 ER98-2878 ER99-1801	pending establishment of effective mitigation plan and refund program, and conclusion of proceedings to determine whether suppliers had exercised market power.	structural changes and corporate realignments that have occurred and continue to occur in the electric industry, its hub-and-spoke analysis (the basis upon which the prior market based rate authorizations were granted) no longer adequately protects customers against generation market power in all circumstances. The Commission proposed to implement a Supply Margin Assessment to determine if suppliers are pivotal to the market. FERC proposes to exempt from the SMA screen all sales, including bilateral sales, into an ISO or RTO with Commission-approved market monitoring and mitigation program.
6/19/2001	FERC: EL00-95	DMA completes an updated analysis of excess payments attributed to market power in the California wholesale electricity markets. Building on previous analyses, the	N/A

Highlights of ISO Actions re: Gaming and/or Market Power

Date	Forum	Objective	Result
		report arrives at the following conclusions: 1) Energy costs by the ISO and the California Department of Water Resources between March and May 2001 exceeded competitive levels by $2.3 billion, in excess of the roughly $6.7 billion in excess revenues already charged to California consumers, bringing the total up to $8.9 billion (discrepancy due to rounding) 2) Up to 5.4 billion is attributable to suppliers with FERC-granted market-based rate authority.	
6/25 - 7/9/2001	EL00-95	ISO presents evidence and testimony in refund settlement conference before FERC administrative law judge in Washington, DC	Parties were unable to achieve a settlement. In an order dated 7/25/2001, FERC set the matter for hearing before another administrative law judge. Proceedings are ongoing.
7/6/2001	FERC: ER98-2680 ER98-2681 ER98-2682 ER99-1785	ISO challenges renewal of market-based rate authority for Duke, reiterating arguments from the ISO's 6/7/01 filing.	FERC has never responded to the challenge.
7/26/2001	ISO Compliance Department	ISO observes an unusually high number of Dispatch instructions declined in apparent violation of a "must-offer" obligation established under FERC's June 19, 2001 Order and reports the discovery to the FERC Office of Market Oversight and Enforcement.	Pending.

Highlights of ISO Actions re: Gaming and/or Market Power

Date	Forum	Objective	Result
7/30/2001	FERC: ER99-2079 ER99-2081 ER99-2082 ER99-2083 ER99-1801	ISO challenges renewal of market-based rate authority for Reliant, reiterating arguments from the ISO's 6/7/01 filing.	FERC has never responded to the challenge.
8/15/01	ISO Compliance Department	ISO provides FERC Office of Market Oversight and Enforcement with transcripts concerning an under-frequency event in early August..	Pending
9/2001	N/A	DMA commences investigation of under-generation by suppliers, possibly in order to gain offset against amounts owed suppliers from earlier months.	DMA found no evidence of a consistent pattern by suppliers to under-generate; no further action taken
9/7/01	ISO Compliance Department	ISO provides FERC Office of Market Oversight and Enforcement with: information regarding perceived violations of the 'must-offer" obligation including taking generation off-line without the permission of the ISO and continuing to declined dispatch instructions.	Pending
12/14/2001	FERC: EL00-95	ISO files Second Quarterly Report in response to FERC's April 26, 2001 and June 19, 2001 mitigation orders and reported that for the period of September through November 2001, the ISO continued to see certain suppliers submitting energy bids well in excess of their proxy bid cost, *i.e.*, incremental cost. Approximately 20 percent of the total volume bid into the ISO BEEP stack in September and October 2001 had prices above the $91.87/MWh Non-Emergency Clearing Price Limit.	Following the Commission's June 19 Order, Western regional Spot prices dropped from over $120/MWh to under $60/MWh in two days. Prices have since continued downward and stabilized between $20/MWh and $30/MWh. The ISO believes that these prices confirm that the Commission's *comprehensive* mitigation measures have been effective in moderating prices throughout the Western *regional*

Highlights of ISO Actions re: Gaming and/or Market Power

Date	Forum	Objective	Result
			marketplace.
12/28/2001	FERC: ER02-651	ISO files for approval of Amendment 41. Seeks to counter over-generation strategy by applying cap to "negative decremental" dispatches (dispatches in which suppliers are paid to reduce output).	Accepted for filing, suspended for five months, effective July 26, 2002 subject to further Commission order, 2/26/02, 98 FERC ¶ 61,187
1/31/2002	FERC: ER02-922	ISO files for approval of Amendment 42. Seeks to impose additional penalties on participants who deviate from prior scheduled commitments without ISO approval (i.e. uninstructed deviations), and to mitigate locational market power.	Rejected pending the ISO's comprehensive market redesign, 3/27/02, 98 FERC ¶ 61,327
2/4/2002	FERC	ISO provides FERC Office of Market Oversight with a comprehensive listing of Dispatch instructions declined for "Economic Considerations" or for which there was no response to the instruction in apparent violation of the must-offer obligation between June 21 and October 20, 2001.	N/A
3/26/2002	FERC: EL00-95	ISO files Third Quarterly Report in response to FERC's April 26, 2001 and June 19, 2001 mitigation orders and provides extensive data demonstrating the extent that market power continues to be a factor in the California energy market. Analysis of the bidding of individual suppliers showed that at least four of the five major owners of gas-fired generators have consistently bid significant amounts of capacity well in excess of variable operating costs. Moreover, bid prices appear to remain relatively constant, rather than reflecting	Following the Commission's June 19 Order, Western regional Spot prices dropped from over $120/MWh to under $60/MWh in two days. While prices increased for a brief period in late June and early July 2001 due to a heat wave in the Southwest, overall prices remained below the "soft cap" level of $91.87/MWh, except at Palo Verde. Following this brief occurrence of

Highlights of ISO Actions re: Gaming and/or Market Power

Date	Forum	Objective	Result
		significant variations in spot market prices over time, the heat rates of different units, or other factors that would be expected to affect bid prices under competitive conditions. In addition, 70 to 80 percent of the capacity from combustion turbines, as well as significant quantities of excess capacity from on-line steam units, have been bid into the Real Time Market at prices at or near the price caps that have been in effect. The ISO's analysis in the Third Quarterly Report also demonstrates that numerous suppliers bid into the Real Time Market excess capacity from steam units that are on-line and scheduled to operate at prices far in excess of marginal costs. For example, the average bid price for these units in October 2001 was about 75 percent higher than marginal costs. The ISO also observed "hockey stick" bidding where suppliers bid all peaking capacity (combustion turbines) at a price at or near the price cap, while bidding excess capacity from on-line steam units at prices that are somewhat lower (but often still significantly in excess of marginal costs).	prices above the cap, prices continued downward and stabilized between $20/MWh and $30/MWh. The ISO believes that these prices confirm that the Commission's *comprehensive* mitigation measures have been effective in moderating prices throughout the Western *regional* marketplace.
3/26/2002	ISO Compliance Department	ISO provides FERC Office of Market Oversight with a comprehensive listing of Dispatch instructions declined for "Economic Considerations" or for which there was no response to the instruction in apparent violation of the must-offer obligation between October 21, 2001 and December 31, 2001.	N/A

Highlights of ISO Actions re: Gaming and/or Market Power

Date	Forum	Objective	Result
		Illustrative excerpt: "This report summarizes 783 instances totaling over 23,000 MW in which generators have declined Dispatch Instructions because of "Economic Considerations". The report goes on to include nearly 590 instances totaling roughly 24,000 MW in which generators have failed to respond to Dispatch Instructions in the time allowed."	
4/19/2002	FERC: ER01-1267 ER01-1270 ER01-1278	ISO challenges renewal of market-based rate authority for Mirant, citing overwhelming evidence of the exercise of market power by Mirant and need for a factual record demonstrating that the California markets are competitive. Also requests that the matter be set for hearing.	FERC has not responded to the request.
5/1/2002	FERC: ER02-1656	ISO files proposal for comprehensive Market Redesign. Includes elements designed to thwart withholding, megawatt laundering, and uninstructed deviations. Seeks continuation of current west-wide mitigation measures pending finding that the markets are competitive or full implementation of the redesign (scheduled for Spring 2004).	Pending
6/14/ 2002	ISO Department of Market Analysis	ISO issues a Market Notice describing five trading practices that it has determined are clearly detrimental to the operation and efficient functioning of a competitive market. These practices are described as prohibited market activities.	Market Participants are advised that certain practices are prohibited. The ISO is in the process of working with Market Participants to clarify the specific aspects of these practices that cause them to be prohibited market

Highlights of ISO Actions re: Gaming and/or Market Power

Date	Forum	Objective	Result
			activities.
6/14//2002	ISO Compliance Department	ISO issues a Market Notice describing the initiation of a comprehensive review by the ISO of its oversight, investigation and enforcement authority. As part of the review, the ISO will develop a comprehensive strategy for further clarifying market rules and assuring that consequences for violating those rules are appropriate, and that necessary changes to those rules or consequences can be efficiently designed, approved and implemented as required over time.	Market Participants are advised of the ISO's intent to thoroughly review and enhance its oversight and investigations activities, and encouraged to provide comments and work with the ISO to design effective mechanisms.
6/17/02	FERC: ER02-1656	ISO files detailed tariff provisions regarding the long term elements of its market redesign proposal. Submission includes revised procedures for ISO commitment of generators and a capacity requirement on load serving entities. These measures attempt to ensure adequacy of supply and efficient use of generating resources.	Pending
June 21, 2002	ISO Compliance Department	The ISO issues a draft white paper on its Oversight and Investigations Activities Review. The draft white paper describes the project purpose, objectives, and timetable; possible approaches; and enforcement issues to be addressed.	Stakeholders are advised of the ISO's initial ideas and the areas to be addressed in the initiative. Input is obtained from a conference call on June 26, a presentation at the June 27 Market Issues Forum meeting, and written comments that were due to the ISO on July 1.

Highlights of ISO Actions re: Gaming and/or Market Power

EXHIBIT 2

California Independent System Operator
Summary Analysis of Gaming Strategies Described in Enron Memoranda

Trading/ Gaming Strategy	Summary	ISO Detection/ Investigation	ISO Action	Impact on Market	Current Conditions/ Potential Future Actions
1. Inc-ing Load into Real Time Markets (A.1.) a.k.a "Fat Boy" (B.6)	This is a form of "uninstructed deviation", also referred to as "overscheduling of load" through which suppliers can receive real time market price (as price takers) for power provided without ISO dispatch instruction. This can be done by in-state generators without overscheduling of load simply by overgenerating in real time. Since imports must be scheduled over inter-ties and cannot simply "overgenerate", importers can schedule imported generation against	ISO aware of the possibility of overscheduling of load at start of the market. To work, this practice counts on systematic load underscheduling by utilities and other major buyers.	Higher penalties for uninstructed deviation were implemented in September 2000 and additional penalties requested in January 2002. Actions taken in 2000 to create disincentive for uninstructed deviations include (1) a new target price methodology (which resulted	Like load underscheduling, load overscheduling can destabilize market and cause reliability concerns by providing erroneous information to ISO operators. Thus, as a general rule, accurate forward schedules are more consistent with reliable grid	Current and proposed new market design further discourages uninstructed deviations by generation resources and imposes explicit penalties. Incentive for this behavior is significantly reduced as load forward schedules. If most loads have been forward

Trading/ Gaming Strategy	Summary	ISO Detection/ Investigation	ISO Action	Impact on Market	Current Conditions/ Potential Future Actions
	"phantom load", which creates a positive uninstructed deviation in real time for which they receive the real time market clearing (MCP).		in a price of $0 for uninstructed deviations when excessive over-generation existed), and (2) new 10-minute settlement rules, under which positive uninstructed deviations are paid a decremental energy price, which is often lower than the price of incremental energy dispatched by the ISO.	operations. However, in the face of the massive, systematic load underscheduling experienced in Summer 2000, this practice reduced the aggregate under-scheduled load, and may not have had detrimental impacts under such conditions.	scheduled, then such practice will depress real time prices to the disadvantage of the party who over-scheduled.
2. Export of Power from California (B.1)	During some periods when prices hit the ISO price caps, Enron and others could buy power from CA	Of intensive concern during 2000 when "hard caps" were in	ISO's filing with FERC in October 2000 noted that the	This problem led to the implementation of a "soft cap" in	This is always a concern when spot market supply is tight and price caps

Trading/ Gaming Strategy	Summary	ISO Detection/ Investigation	ISO Action	Impact on Market	Current Conditions/ Potential Future Actions
	and sell to outside markets at higher prices	place. Monitoring of prices in regional markets through early November showed that prices in regional markets tended to follow (and not exceed) the ISO real-time price. Until late November 2000, the ISO rarely made out-of-market purchase at prices exceeding the "hard caps" in effect in California during this period, providing further	potential for such behavior required (1) emphasis on FERC-sanctioned long-term contracts between suppliers and load in CA, and (2) region-wide approach to market power mitigation (which did not get implemented by FERC until June 19 2001). The dramatic spikes in the natural gas prices in late November and early December 2000 (along with	December, and aided in the eventual collapse of PX in January 2001. Financial impact on consumers will ultimately depend on level of refunds ordered by FERC for sales of imports to buyers in ISO system (including CERS) during May 2000-2001. FERC's December 15 Order (2000) removed the "must sell" requirement on IOUs, and	in one area are lower than the surrounding areas. Requires continuation of regional market power mitigation, not a California-only solution.

Trading/ Gaming Strategy	Summary	ISO Detection/ Investigation	ISO Action	Impact on Market	Current Conditions/ Potential Future Actions
		evidence that regional prices did not tend to exceed the ISO's price caps during this period.	other factors constraining supply met through the PX and ISO markets at this time), forced the ISO to procure significant quantities of energy out-of-market at prices in excess of the $250 price cap in order to meet ISO system load.	starting in January 2001 the IOUs stopped selling power to PX, ending the possibility of any utility-owned generation being exported.	
3. Relieving Congestion with "Non-firm Export" (B.2)	Scheduling of "non-firm export" that supplier does not intend to deliver or cannot deliver. If importing inter-tie is congested, the supplier receives the congestion revenue, and then cancels the export after the close of the Hour-Ahead	ISO detected this practice in July 2000.	ISO acted by banning this activity in a market notice of July 21, 2000 and notified market that DMA will be investigating any	Adds to probability of real time congestion, and may impose detrimental impact system cost and reliability if real	Continues to be prohibited by ISO. The ISO is considering a Tariff amendment that would allow rescinding of counterflow

Trading/ Gaming Strategy	Summary	ISO Detection/ Investigation	ISO Action	Impact on Market	Current Conditions/ Potential Future Actions
	market, so no delivery takes place. Provides false relief of congestion prior to real time, and does not actually relieve congestion in real time since export does not occur. This general gaming strategy could also be employed by submitting firm energy or wheeling schedules that create counterflows to collect congestion revenues in the Day Ahead or Hour Ahead market, and then cutting these schedules in real time.		Market Participant found to be engaging in this activity and would be subject of corrective actions.	time congestion occurs. The practice of cutting non-firm schedules was detected and stopped after it occurred during 9 hours in July 2000, accounting for only approximately $54,000 in congestion relief payments. The ISO has also reviewed of all import/export schedules (non-firm, firm and wheeling) that were cut prior to real time after congestion revenues were	congestion relief payments for schedules that are cancelled prior to real-time

Trading/ Gaming Strategy	Summary	ISO Detection/ Investigation	ISO Action	Impact on Market	Current Conditions/ Potential Future Actions
				earned in the Day Ahead or Hour Ahead market during the 2000-2001 period. Results of this indicate that total congestion payments for these import/export schedules were only $1.1 million.	

Trading/ Gaming Strategy	Summary	ISO Detection/ Investigation	ISO Action	Impact on Market	Current Conditions/ Potential Future Actions
4."Death Star" (B.2(sic))	Circular schedule, part of which is outside the ISO Controlled Grid, that is not backed by any physical resource. Export schedule creates a counterflow on a congested path for which the Schedule Coordinator may earn congestion revenues. Counterflows on AC transmission paths with no phase shifter control would not provide congestion relief in real time if not backed by actual (physical) supply resources and load in different control areas outside of the ISO system.	Analysis indicates that Enron earned a total of $2.7 million in congestion revenues during 1998-2002 from import/export schedules that may have been "circular" and not resulted in any energy flow to relieve congestion in real time. About $2.3 million of these congestion revenues could be from the specific scenario described as "Death Star" in the Enron memos.	In March 2000, ISO proposed a new rate design to encourage the inclusion of other transmission lines in California in the ISO system, which would reduce opportunities to employ this strategy. As noted in the Enron memos, the ISO does not have sufficient information to verify the actual (physical) source and sink of import/export schedules, which is necessary to	If import/export schedules on AC transmission lines are "circular" and are not backed by physical supply resource and physical load in two different control areas outside of the ISO system, these can impose detrimental impact to system reliability if real time congestion occurs.	Market Rules may be modified to explicitly require that all schedules be backed by physical resources and feasible schedules (and be in different control areas for wheel through schedules). Also, market rules may be modified to require enhanced reporting requirements for imports/exports tying schedules to specific resources in other control areas. Requires coordinated monitoring on regional basis by all control areas.

Trading/ Gaming Strategy	Summary	ISO Detection/ Investigation	ISO Action	Impact on Market	Current Conditions/ Potential Future Actions
		The quantity of the potential "circular flows" scheduled by Enron during any individual hour was typically limited to 10 MW. Analysis of other schedules indicates that up to $13.6 million of congestion revenues over 1998-2002 period could be associated with "circular schedules" by other SCs.	determine whether import/export schedules are "circular" and would not result in any flow of energy that would actually relieve congestion in real time. Also, additional circular schedules could be "disguised" if export/import schedules were submitted under two different Participant IDs (combined with a separate bi-lateral transaction between the two		

Trading/ Gaming Strategy	Summary	ISO Detection/ Investigation	ISO Action	Impact on Market	Current Conditions/ Potential Future Actions
			SCs). ISO is collaborating with FERC and other legal entities investigating "Death Star" described in Enron memo.		

Trading/ Gaming Strategy	Summary	ISO Detection/ Investigation	ISO Action	Impact on Market	Current Conditions/ Potential Future Actions
5. "Load Shift" (B.3)	Requires that Enron have FTRs connecting ISO zones (i.e. Path 26). First, FTR owner creates congestion (when it would not otherwise exist) by false scheduling of load in different zones. FTR owner may then relieve the congestion by decreasing flow on path by eliminating or reducing false load through adjustment bids (which may also help set the congestion charge applied to remaining flow on line) The FTR owner can then collect additional congestion revenues for FTRs it does not use to schedule its own load/generation. The discussion of oversheduling of load in the	The general gaming scenario of driving up congestion charges by scheduling of false load or generation was identified by ISO in the context of designing the initial auction of FTRs.	The ISO monitors scheduling activity of FTR owners, and performed analysis of unusually high congestion Path on Path 26. ISO's DMA had also requested position limits to limit FTR ownership by single entities (and affiliates), but ISO Board did not approve these. ISO DMA has enhanced the FTR monitoring system to track	Enron earned $34 million in congestion revenues on Path 26 in the year 2000, but only $165,000 of these revenues occurred in hours when Enron could have caused congestion through its load scheduling practices. Additional analysis of the impact of a more general strategy of "oversheduling load" in SP15 indicates that "oversheduling	Continued monitoring of FTR market critical. Enron memo illustrates prudence of imposing position limits and other scheduling limitations on entities purchasing FTRs.

Trading/ Gaming Strategy	Summary	ISO Detection/ Investigation	ISO Action	Impact on Market	Current Conditions/ Potential Future Actions
	Enron memos does not mention how such a strategy could also be used to increase FTR revenues. However, in addition to seeking to "create congestion" by scheduling false load, the FTR owner may also seek to increase congestion revenues through a more general strategy of "overscheduling load" in order to reduce the "supply" of available transmission capacity remaining on the line. This can drive up the congestion charge by requiring that additional flow on the load be curtailed.		FTR revenues potentially attributable to overscheduling to cause or exacerbate congestion as well as schedule adjustments to relieve congestion	of load" by Enron could account for only about $1.3 to $3.1 million of the $34 in congestion revenues earned by Enron for FTRs on Path 26.	

Trading/ Gaming Strategy	Summary	ISO Detection/ Investigation	ISO Action	Impact on Market	Current Conditions/ Potential Future Actions
6."GetShorty" (B.4)	Rather than purchasing all projected Ancillary Service (A/S) capacity requirements in the DA market, the ISO defers a portion of A/S purchases to the HA market. This helps minimize overall A/S purchase costs, by lowering the MCP in the DA market (due to reduced demand), and taking advantage of some additional lower cost supplies of A/S that are often available in the HA market. To encourage economic trades between suppliers, the ISO also allows sellers to have the ISO "buy back" A/S capacity they sold in the DA market from other suppliers in the HA market. If A/S prices are	The problem of the sale of A/S capacity that is not actually available has been a concern since market opened, and has been the subject of increasing levels of monitoring and penalties by the ISO Compliance Unit.	ISO Compliance Unit has monitored logs and eliminated payments for unavailable A/S since June 1999. The ISO March 2002 Tariff filing included a provision requiring that participants "buying back" A/S in the Hour Ahead market pay the higher of the Day ahead and Hour ahead market clearing prices. This eliminates the financial incentive to "sell short" in the Day	The ISO's overall strategy of deferring some A/S purchases from DA to HA market reduces overall A/S costs for consumers, since HA prices are frequently lower. However, selling of A/S capacity that is not actually available imposes potential risk to system reliability. Enron made $5 million by "selling high" in	Prevention of this strategy requires monitoring on regional basis by all control areas. Market Rules can be modified to require that all A/S schedules be backed by identified resources, and require enhanced reporting requirements for imports tying schedules to specific resources in other control areas.

Trading/ Gaming Strategy	Summary	ISO Detection/ Investigation	ISO Action	Impact on Market	Current Conditions/ Potential Future Actions
	systematically lower in the HA Market, then Sellers may seek to "sell short" in the DA market, by selling A/S capacity in the DA market, then buying back this capacity in the HA market. The first Enron memo indicates that Enron used this market feature to play a "paper trading" game where it sold A/S capacity that was not actually available, planning to buy this capacity obligation back in the HA market at a lower price.		Ahead A/S markets.	DA and "buying back" low in HA market (out of total A/S sales of $20 million) The degree to which Enron sold A/S capacity that was not actually available (but was not called upon to provide energy) is very difficult to determine after-the fact since, since A/S sales by Enron were from imports.	
7."Wheel Out" (B.5)	When available capacity on an intertie is set to zero (downed line), Enron schedules a flow through the line using the PX as its Schedule Co-ordinator (SC).	The ISO is aware of this problem, which first occurred in the PX market in 1999, causing	The PX monitoring unit reported this game to FERC	The practice of seeking to collect congestion revenues for counterflows for	Currently, participants can defend against this possible gaming

Trading/ Gaming Strategy	Summary	ISO Detection/ Investigation	ISO Action	Impact on Market	Current Conditions/ Potential Future Actions
	The traders know that the schedule will be cut due to the downed line, and may earn a congestion counterflow payment without having to actually send energy through the intertie (if other entity scheduling through the PX schedules energy in the opposite direction)	problems between entities using the PX as their SC.	in 1999. Following this initial incident, the ISO proposed modifying congestion management software to cancel out schedules on downed lines. However, the PX objected to this modification due to other complications this software modification would create.	schedules on a downed line has done little harm to the market. On one occasion involving the Silver Peak line, Enron took advantage of other entities using the PX as their SC. On one other occasion in Spring 2000, $3.5 million in congestion charges (including $220,000 by Enron) were received by a several participants (non-UDCs)	strategy by eliminating any schedules on a downed line. Other options include (1) modifying the ISO congestion management software to cancel out schedules on downed lines, and (2) implementing a settlement rule that would provide for non-payment of Day Ahead/Hour Ahead congestion charges/payments when schedules were cut in real time.

Trading/ Gaming Strategy	Summary	ISO Detection/ Investigation	ISO Action	Impact on Market	Current Conditions/ Potential Future Actions
				using the PX as their Schedule Co-ordinator for counterflows scheduled on a line (El Dorado) that was out of service for several hours due to fire.	

Trading/ Gaming Strategy	Summary	ISO Detection/ Investigation	ISO Action	Impact on Market	Current Conditions/ Potential Future Actions
8."Ricochet" (B.7)	Buying low from the PX Day Ahead market and sell back high in real time. NOTE: The Enron memo did not discuss use of "ricochet" schedules as a way of "MW-laundering", or trying to circumvent the ISO's hard price caps in effect until December 2000 or to circumvent cost-justification/refund obligations under the "soft caps" in effect starting in December 2000. However, "ricochet" schedules also represent one of the key mechanisms that could be used in trading strategies designed to "launder" MWs generated in California into imports in order to circumvent price mitigation rules in effect in the ISO system.	The ISO was very much aware and concerned about this problem based on monitoring of scheduled exports, subsequent imports in real time, and prices paid for imports purchased out-of-market. ISO invoked its authority under both Amendment 33 and its MMIP to require all sellers to justify costs for all sales above the "soft caps" in effect from Dec. 2000-	The ISO's concern about high prices being demanded by imports (despite no actual shortages of reserves or load shedding being reported by other control areas) was identified to FERC in Summer 2000. Since October 2000, the ISO had been requesting west-wide mitigation measures that effectively addressed potential "MW laundering," which FERC	Exacerbated the impact of overall market power on system reliability and costs to consumers. Ricochet scheduling allowed sellers to exercise market power and take advantage of tight supply/demand conditions by effectively withhold power from the Day Ahead market and demanding high prices in real time. Helped defeat	This is always a concern when spot market supply is tight and price caps in one area are lower than the surrounding areas. Requires regional market power mitigation, not a California only solution.

		June 2001. For imports, cost justification requirements specified by the ISO included the source of any power sold as an import. When virtually all suppliers failed to submit any cost justification to the ISO, FERC declined to compel suppliers to provide this information to the ISO.	ultimately approved in the June 19, 2001 Order. As previously noted, the ISO's efforts to require suppliers to submit cost justification for imports provided at prices over the $250/$150 soft caps under Amendment 33 and the ISO's MMIP was not supported by FERC.	the effectiveness of price caps in the absence of region-wide market power mitigation. Financial impact on consumers will ultimately depend on level of refunds ordered by FERC for sales of imports to buyers in ISO system (including CERS) during May 2000-2001.	

Trading/ Gaming Strategy	Summary	ISO Detection/ Investigation	ISO Action	Impact on Market	Current Conditions/ Potential Future Actions
9. Selling Non-firm Energy as Firm Energy	This is a type of transaction involves falsely representing the terms of supply. Firm energy export (into CA for example) must be certified by exporting control area.	Since importing control area must certify the "firm" status of the import, detection should occur at that end of transaction. ISO operators typically are not aware of specific instances where this strategy has been employed.	ISO would complain and report to WSCC if it is aware of any incidence of this	Causes disconnection between control areas and add cost to system operation and reduce system reliability	Not allowed under current WSCC rules. Requires monitoring on regional basis by all control areas.
10. Scheduling Energy to Collect the Congestion Charge II (B.9)	This again involves the submission of a schedule that appears to relieve congestion based on the congestion management model used in the Day Ahead and Hour Ahead markets, but will not actually be delivered in real time.	ISO is aware of the potential game.	ISO investigated the game, found it could rarely be profitable, and continued to monitor the actual incidence of congestion prices that exceeded real time energy	Submission of "phantom schedules" increases chance of congestion in real time. However, this gaming strategy was rarely profitable.	This gaming opportunity should be effectively eliminated in the new congestion management model. An additional and interim safeguard is to amend the ISO Tariff to allow the

	Since the incremental energy price that an SC submitting a "phantom schedule" will pay in real time for undelivered energy can (very rarely) be lower than the congestion credit, this gaming scenario can only be profitable when the usage charge is more than the price cap.		prices. Amendment 33 (December 8, 2001) also reduced this gaming opportunity by imposing a significant additional charge on uninstructed deviations. Under Amendment 33, negative uninstructed deviations are charged the real time energy MCP plus charge for out-of-market (OOM) costs incurred by ISO.	Congestion charges exceeded real time energy price on import ties only about 50 times from 1998-2002.	ISO to decline to make congestion payments to entities that fail to deliver the associated energy.

Mr. OSE. Dr. Cicchetti, for 5 minutes, please.

Dr. CICCHETTI. Thank you, Congressman Ose.

First, let me express my pleasure at appearing before the committee. I follow electricity matters, and I have done so for more than 30 years. I am very aware of the so-called California electricity crisis. In fact, I have served at Governor Davis's invitation on the ISO's market advisory group, and I was principal author of the California State Audit Report on electricity deregulation. I also work for the utilities in the Pacific Northwest that sold power that kept the lights on during the energy crisis; the Navajo Nation that supplies power and coal to California; and most recently, Perot Systems, which has been accused of training energy companies in the art of gaming the California market.

Let me begin by explaining why people confuse several electricity market matters and, in the process, fail to recognize that each is quite different. I think part of the confusion comes from the fact that all three of these terms that I am going to go through include the word "market."

First, there are market forces. These include supply, namely, did California build enough generation; demand, did anyone forecast the spectacular economic growth in California, particularly in the high-tech areas; and the prices for inputs, a fivefold increase in natural gas prices nationally and a thirtyfold increase in California, as well as a twentyfold increase in pollution compliance costs.

The answers to the supply and demand questions were both "no." That is, we didn't get supply and demand right in California. Worse, the climate shift in the West made supply shortages 10 to 20 percent worse than they otherwise would have been. That's 5,000 to 8,000 megawatts. And, the input cost in California alone associated with natural gas would have made the price of electricity $1,000 in late 2000.

In addition to market forces, there is market power. Economists define market power as the ability of one seller or an illegal conspiracy of several sellers to withhold supply to force up prices; or, alternatively, buyers acting in a similar manner to cause prices to fall. The issue is straightforward and is related to moving all prices in the entire relevant market.

Despite the claims to contrary, in my work for the State Audit Report I found no example of market power abuse in the sense of withholding supply from the entire California market.

The third issue is called "market gaming," or "market manipulation." This refers to individual market participants engaging in various actions, mostly contrary to the overall market. Gamers don't try to move the full market; instead, they seek profits from anticipating the moves of others and, in effect, betting against the overall market. This is an offensive game. Gaming works best when it is applied individually, not collectively. In the games in which everybody moves the same way, it's simply an equivalent of a horse race where everybody bets on the same horse, in which nobody wins but the horse and the house that controls the betting arena.

Of the three, market forces just can't be legislated by laws of regulation or by laws of Congress. Any attempts to regulate markets

almost always fail, and it is utterly futile to try to attempt to control market forces.

Market power is and should be closely regulated, and the potential for actual antitrust violations should be vigorously ensued and enforced.

The third issue, gaming, this word is very much often confused. Essentially, all commodity markets are gamed. The issue is whether or not the games are within the rules, or whether they are attempts to frustrate the rules and end run around the rules. Those kinds of activities need to be fixed, and indeed in the California design the whole market surveillance process was put in place in order to inform decisionmakers on how to fix and refine the market rules based upon the actions of the gamers in the market.

Let me turn now to Perot Systems. I have prepared a report that I submit as part of this testimony today. My conclusions are explained in that report, and I repeat them here just for emphasis.

The facts, as I view them, are that in 1997 and 1998, Perot Systems offered to provide training to participants in the new California power market based on public information, employing the accepted principles of game theory, that is, operating within the rules. No market participants, however, were interested in this training. In late 2000, competitive market forces, the kind that I described earlier, combined with structural flaws in the design of the California market, as well as a series of regulatory and political missteps caused the California energy crisis. Allegations that Perot Systems was in any way responsible for this crisis are, in my opinion, totally unfounded, as I explained to the California Senate Committee.

What happened in California in 2000 and 2001 could not have reasonably been anticipated in 1997 and 1998, when Perot Systems was marketing its training services. The strategies employed by Enron and other market participants evolved in quite a different set of circumstances than when Perot Systems was making its presentation. There is nothing in any of those documents that I reviewed that would come even remotely close to supporting the allegations, where people have attempted to link Perot Systems to the California energy crisis.

I will be happy to answer any questions that you might have on this or any other subject. Thank you.

Mr. OSE. Thank you, Dr. Cicchetti.

[The prepared statement of Dr. Cicchetti follows:]

Oral Statement Before the Subcommittee on Energy Policy, Natural Resources, and Regulatory Affairs

by

Charles J. Cicchetti, Ph.D.
The Miller Chair in Government, Business and the Economy
University of Southern California

July 22, 2002

1. Introduction

Congressman Ose, Ladies, and Gentlemen. First, let me express my pleasure in appearing before this Committee. I follow electricity matters generally and have done so for more than 30 years. I am also quite aware of the so-called California Electricity Crisis. I served, at Governor Davis' invitation, on the Market Advisory Group. I was a principal author of the California State Audit report on Electricity Deregulation. I also work for electric utilities, primarily in the Pacific Northwest, that sold power into California during the crisis, the Navajo Nation that supplies power to California with their coal and water resources, and Perot Systems that has been accused of training energy companies in the art of gaming the California market.

2. Forces, Power and Games

Let me begin by explaining why people confuse several electricity market matters and fail to recognize that each is quite different. Part of the confusion might arise because each phrase contains the word "market."

First, there are *Market Forces*. These include supply (did California build enough generation?), demand (did anyone forecast the spectacular economic growth in California particularly in high tech areas?), and prices for inputs (a five-fold increase in natural gas prices nationally and thirty-fold in California, as well as a twenty-fold increase in air pollution compliance costs). The answers to the supply and demand questions were both "no!" Worse, the climate shift in the west made the supply shortage ten to twenty percent worse. As for the cost of inputs, the natural gas prices in California alone would have increased the cost of electricity for California in December 2000 to more than $1,000 per MWH versus $30 per MWH in 1999.

Second, there is *Market Power*. Economists define this as either the ability of one seller or an illegal conspiracy of several sellers to withhold supply to force up prices; or, buyers acting in a similar manner to cause market prices to fall. This issue is straightforward and is related to moving all prices in the entire relevant market. Despite the claims to the contrary, we found no seller market power abuse. Indeed, we found that sellers mostly operated their units beyond the limits of their engineering capabilities.

Third, there is *Market Gaming*. This action refers to individual market participants engaging in various actions (often legal and within the rules) that are

mostly contrary to the overall market. Gamers do not try to move the full market. Instead, they seek profits from anticipated market price moves and, in effect, from betting against the overall market. Gaming works best when it is applied individually, not collectively. If everyone "games" the same way, there are no opportunities for "gamers" to beat the market, just as when everyone bets on the same horse, no one wins but the horse and the house. We did find two types of gaming: (1) Buyers underscheduled demand in the Cal PX market; and, (2) MWHs were laundered, often through municipal utilities.

Of the three, *Market Forces* cannot be contained by laws or regulation. Attempts to do so always fail. The utter futility inherent in trying to control market forces does not; however deter some politicians from attempting such efforts.

Market Power is, and should be, closely regulated for potential and actual antitrust violations. The standard here is simple: did sellers or buyers withhold quantities to force all relevant market prices up or down. Or, do they have enough market share to do so if they chose to do so?

The third issue is "gaming." This word is not pejorative. All commodity markets are gamed in the sense that buyers and sellers adopt, refine, and revise their business strategies. They often hedge their bets. Their actions improve efficiency and help to identify any necessary rule changes. Most important, "gaming" is mostly distinct and contrary to *Market Forces* and *Market Power.* Gaming is mostly the play of "little" guys in the market because they typically win when they go against, not when they lead, others. Gamers do not like imitators or followers. Gaming works best in the shadows or niches in the market, not

when actions are exposed to the bright light of broad market shifts and deep volumes traded. Gaming is most successful when market structures and rules are complex and multifaceted.

3. Perot Systems

I have prepared a report that I submit as part of my testimony. My conclusions are explained in that report. I repeat them here for emphasis. The facts are, in 1997 and 1998 Perot Systems offered to provide training to participants in the new California power market based on public information, employing accepted principles of Game Theory. No market participants, however, were interested in this training. In late 2000, competitive market forces, combined with structural flaws in the market and regulatory and political missteps caused the California energy crisis. Allegations that Perot Systems was in any way responsible for this crisis are totally unfounded.

What happened in California in 2000 and 2001 could not have reasonably been anticipated in 1997 and 1998 when Perot System was marketing its training services. Therefore, strategies employed by Enron and other market participants could not have had their genesis in Perot Systems presentations. Certainly, there is nothing in any of Perot Systems' documents I reviewed that would come even remotely close to supporting the allegations linking Perot Systems to the California energy crisis. I will be happy to answer any questions that you may have.

Statement of Charles J. Cicchetti, Ph.D.

The Miller Chair in Government, Business and the Economy

University of Southern California

And

Founding Member of Pacific Economics Group L.L.C.

July 22, 2002

1. Introduction

I am Charles J. Cicchetti. My business address is Pacific Economics Group, L.L.C., 201 South Lake Avenue, Suite 400, Pasadena, California 91101. I attended the United States Air Force Academy and received a B.A. degree in Economics from Colorado College in 1965 and a Ph.D. degree in Economics from Rutgers University in 1969. From 1969 to 1972, I engaged in post-doctoral research at Resources for the Future.

I began my professional career as the chief economist for the Environmental Defense Fund from 1972 to 1975 and was a faculty member at the University of Wisconsin from 1972 to 1985, ultimately earning the title of Professor of Economics and Environmental Studies. From 1975 through 1976, I served as the Director of the Wisconsin Energy Office and as Special Energy Counselor for the Governor. In 1977, I was appointed by the Governor as Chair of the Public Service Commission of Wisconsin and held that position until 1979 and served as a Commissioner until 1980. In 1980, I co-founded the Madison Consulting

Group, which was sold to Marsh and McLennan Company in 1984. In 1984, I was named Senior Vice President of National Economic Research Associates, and held that position until 1987. From 1987 until 1990, I served as Deputy Director of the Energy and Environmental Policy Center at the John F. Kennedy School of Government at Harvard University.

From 1988 to 1992 I was a Managing Director and, ultimately, Co-Chairman of the economic and management consulting firm Putnam, Hayes & Bartlett, Inc. In 1992, I formed Arthur Andersen Economic Consulting, a division of Arthur Andersen, LLP. In 1996, I left Arthur Andersen to co-found Pacific Economics Group, L.L.C. ("PEG"). In 1998, I accepted the Jeffrey J. Miller Chair in Government, Business, and the Economy at the University of Southern California. As a co-founding member of PEG, I actively consult with clients on electricity market, environmental, natural gas market, and antitrust policies, particularly as those policies relate to regulated industries. I was a principal author of the California State Auditor's Report on deregulation in California and served as a member of the independent Market Advisory Group at the invitation of Governor Davis. Some of my current or recent clients include electric utilities from the Pacific Northwest and their marketing affiliates, The Navajo Nation (highly discounted), the Baldwin Hills Neighborhood Association (*pro bono*), Duke Energy, Edison International, and the Government of Bangladesh (*pro bono*) through the World Bank. (Attached as Appendix A is my full resume, including major consulting assignments, testimony, and publications).

My statement addresses several matters relevant to this Committee's investigation. These include: (1) gaming, bidding and strategic behavior as a matter of economic theory; (2) gaming in the context of the California energy market, and how Perot Systems' attempts to market training materials were perfectly ethical and proper; (3) Perot Systems' marketing presentations in 1997 and 1998; (4) Enron's self-described trading strategies and why Perot Systems' 1997 and 1998 presentations could not have been the source of Enron's later bidding strategies; (5) the non-confidential content of Perot Systems' training materials, based on my independent assessment of Perot Systems' documents; and (6) my comments on various allegations made about Perot Systems' role in the California energy crisis, as reflected in the reports of an economist whose work has been relied upon by a California Senate Committee.

2. Gaming, Bidding and Strategic Behavior

Modern economic and finance theory is predicated on the role that Game Theory, or "gaming," plays in competitive markets. Many of us were entertained and inspired by Professor John Nash's triumphs in A Beautiful Mind when he received the Nobel Prize in Economics for his work on Game Theory and Strategic Behavior.[1]

For thirty years, I have taught economics, public policy and finance. I have seen first-hand many changes in economics and finance theory and happily share these changes with my students. At the core of many of these changes

[1] Nash shared The Bank of Sweden Prize in Economic Sciences in Memory of Alfred Nobel in 1994 with two others "for their pioneering analysis of equilibria in the theory of non-cooperative games."

are topics such as risk, uncertainty, options, hedging, arbitrage, bidding, auctions, etc. All of these involve a field that scientists and mathematicians call Game Theory. The practitioners of this modern school of conceptual thought call the implementation of this theory into practice "Gaming" or "Strategy". A brief search of the Internet or university curricula yields a wealth of references to these varied but melding topics of thought and practice.

The first thing that catches one's eye is the somewhat colorful descriptions and names attached to the various "Games" and strategic behavior that we teach to our students. Many have names that employ startling vernacular to describe rather complex theoretical game theory models of strategic behavior. For example, some are called:

- Almost Perfect
- Wars of Attrition
- Prisoner's Dilemma
- Zero Sum
- Battle of the Sexes
- Signal Jamming
- Escape and Evasion
- Frogs Call For Mates
- Hawk Versus Dove
- Majority Rule

Indeed, attaching a catchy phrase to describe complex Game Theory behavior, or gaming for shorthand, is the norm for most modern theoreticians in the fields of mathematics, economics, finance, and behavioral sciences.

Game theory applies: (1) to auctions; (2) to bidding and economic behavior when markets are uncertain; (3) when there are risks; (4) when there are transaction costs; and usually (5) when time values are important. Varied

commodities such as corn, pork bellies, oil, natural gas, stocks, foreign exchange, and now electricity are often traded in commodities markets. Traders are taught "games" and trained to participate so they can learn the discipline, tools, and behavioral patterns in such markets. This is also how athletes train, military personnel prepare, and politicians plot how to garner votes and win elections. There is nothing sinister about any of this. The name "Game Theory" and its derivative forms are not pejorative. Strategic behavior can help to woo a mate, win a war, or help energy traders buy and sell successfully.

An example of Game Theory, or "gaming," drawn from the list of colorful names listed above is the Prisoner's Dilemma. The Prisoner's Dilemma is a simple game that has non-theoretical appeal. Suppose two people are arrested for a crime. If neither confesses, the evidence would send both to jail for two years on a lesser charge. Both prisoners are separately offered a deal – confess to the crime and testify against the other prisoner, who will then serve 10 years if convicted. In return, the prisoner who accepts the deal goes free. The dilemma is that if both confess to the greater crime, each would get a five-year jail term. Game Theory involves analyzing what the prisoners would do under these circumstances. The moral of the Prisoner's Dilemma story is that a strong defense may be the best offense.

The cinematic depictions of college boys attempting to pick up dates in A Beautiful Mind, demonstrates, in prosaic terms, how Game Theory, or just plain "gaming," operates. These strategic behavioral examples of Game Theory are

far from the scurrilous epithet of offering courses in a "Crime School" recently thrown at Perot Systems.[2]

There are two very important surveys of modern Game Theory. These are Paul Walker's *An Outline of the History of Game Theory* (April 1, 1995) and Donald Ross' *Game Theory* from the *Stanford Encyclopedia of Philosophy* (updated in 2001). Both articles introduce the Game Theory strategy and explain how this behavioral theory complements and redirects neo-classical economic theory. The articles succinctly demonstrate that all commodity markets, regardless of their design, will be "gamed." This same lesson is becoming very apparent among even the most "politically correct" elementary school teachers who attempt to ban all playground games in which there are "winners and losers." To the teachers' chagrin, the kids eventually restore games to their natural purpose by restoring "gaming" and "winning."

General MacArthur recognized that the nation is better off because kids compete when he said, "On the fields of friendly strife are sown the seeds that on other days and other fields will bear the fruits of victory." Modern Game Theory brings this verve and reality into economics and finance. The nation is better off because Americans compete. Playing within the rules is very important. That said, we must not think that "the rules" ever mean no "gaming" and no winners.

---

[2] *See* The McCullough Report prepared for the California Senate Select Committee.

3. Gaming in the Context of the California Power Market

The California electricity restructuring was designed as a hybrid between two extreme market designs: (1) Poolco; and (2) Bilateral. There were significant debates about mandatory and voluntary participation, as well as the types of bidding systems and number of sequential markets. A collaborative process yielded compromises from which arose the California hybrid system. A Poolco approach was ordered. However, bilateral trades were possible through a newly created market entity known as a Scheduling Coordinator.[3]

Many industry observers predicted that structural changes would be necessary and inevitable. Some analysts predicted that California's compromise hybrid system would require a complete overhaul to fix future problems. Others explained that "single price" bidding would affect market behaviors and would result in strategic behavior, or gaming. The most thoughtful analysts correctly explained that all bidding schemes would result in gaming.

Respected independent-minded strategic theoreticians recognize that "perfect games" are quite different from "perfect competition." Game Theory recognizes that market participants seek to maximize their expected value by taking into account the actions of others. Think about a great sporting match where both teams compete and contest the outcome with courage, skill, and vigor. We have all experienced such athletic contests where, despite any *ex ante* loyalty, we recognize, *ex post*, that we witnessed a truly "great game."

[3] I can provide a collection of the major articles that describe the early California debates.

Tactics, strategy, and effort are based upon actions and reactions. We frequently describe these activities as "plays." One team decides what to do based on their skills and talent. This much is similar to traditional theories of perfectly competitive markets. Teams also attempt to anticipate the possible actions and activities of their opponents. This is the contribution that modern game theory makes to commodity trading markets. None of this is sinister.

The critics of the California Independent System Operator's ("CAISO's") final transmission congestion pricing rules promised gaming and anomalous market behavior. Indeed, the CAISO actually relied upon these behaviors to expose market design flaws. The California market was designed to achieve efficiency through transparency, with market monitors positioned to change the terms and rules when and if required to do so.

Consequently, the current CAISO tariff section entitled "Market Monitoring and Information Protocol" ("MMIP"), made effective by the Federal Energy Regulatory Commission in December 1997, did not actually prohibit gaming. After first defining gaming as behavior that takes "undue" or "unfair" advantage of the rules,[4] the CAISO tariff merely subjected gaming to scrutiny. Even as defined, gaming behavior did not automatically lead to the imposition of remedies. Instead, the CAISO tariff authorized the Market Surveillance Unit ("MSU") to review gaming behavior in order to assess its potential effect. Such

[4] MMIP 2.1.4. Gaming is defined as taking unfair advantage of the rules and procedures set forth in the CPX or CAISO tariffs, or of transmission constraints in periods where there is substantial congestion, to the detriment of and efficiency and consumers. Gaming, under this CAISO tariff provision, can also include taking undue advantage of other conditions that may affect the availability of transmission and generation capacity, such as loop flow, facility outages, hydropower output levels and seasonal limits on out of state energy imports, or actions or behaviors that may otherwise render the system and the CAISO markets vulnerable to price manipulation to the detriment of their efficiency.

assessments could result in recommendations by the MSU to make structural changes, to make tariff changes, *or to proscribe specific behavior.*[5]

The CAISO tariff underscores the valuable and necessary function these natural market activities play in a commodities market – and how the CAISO itself recognized that gaming could constitute legitimate aggressive competition.

4. The Perot Systems Marketing Presentations

It was in this environment that Perot Systems attempted to sell services to participants in California's newly restructured markets. It offered to provide training based on public information about the various California Power Exchange ("CPX") and CAISO markets. It offered to design a model to test bidding strategies. It also offered to analyze the inevitable rule changes (or opportunity gaps). While there apparently were no takers, Perot Systems offered what is widely recognized as a necessary skill set for market participants, especially for firms that previously were comprehensively regulated and who would buy energy on behalf of their customers in this new marketplace.

Generally, Perot Systems failed to sell to energy companies its various Game Theory training courses or its models. I suspect that the reason for this failure was due to the fact that energy companies went outside their industry and brought in experienced commodity traders who, in turn, trained a new generation of bright traders who learned on the job and were never influenced by the former comprehensive regulatory culture of the firms they joined.

[5] MMIP 2.3.3 ("Response to Gaming Behavior")

Under these circumstances, there is nothing remotely illegal, unethical, or even questionable about what Perot Systems did and/or offered to do in California's markets. California's problems and the ultimate requirement to redesign the flawed hybrid design proved inevitable, as well as nearly fatal.

The best analogy might be to contrast individual training and preparing for the big game with actually playing the game. Individual training is about conditioning and honing specific skills. A fighter pilot or football player works to react quicker, improve eye hand coordination, etc. In battle or in a football game, these skills and conditioning matter. However, the battle or game is mostly about how individual performance fits in with wingmen and teammates, as well as how the opposition acts and reacts.

This means that sometimes a player does what others do and sometime it means that a player makes moves that are defensive reactions to expected moves or countermoves made by others. There is nothing wrong with Perot Systems or anyone else attempting to train market participants in the best way in which to pick up patterns and opportunities by following and imitating the actions taken by others. For example, if several sellers seem to be succeeding by shifting sales to the CAISO's real time market and away from the main CPX energy markets, it would be logical and reasonable for other sellers to pick up this information. Again, this is not illegal or unethical. It is expected behavior in markets as competitors closely follow the actions taken by competitors. It is no different than Burger King developing a new fish sandwich because McDonald's successfully introduced one.

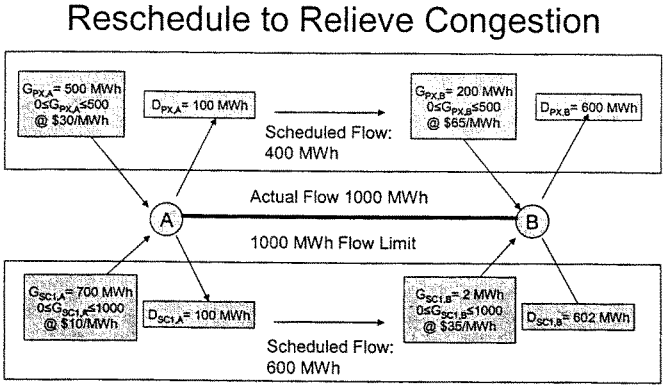
In the California electricity market, buyers came to understand that they could reasonably, on average, pay less for electricity by under-scheduling demand in the single-price CPX markets. Under-scheduling by a buyer would put downward pressure on the price for the bulk of its purchases even if it paid more in the CAISO's real time market for a smaller fraction of its energy requirements (i.e., the amount it underbid in the CPX market). Other buyers would, and did, relatively quickly pick up on this strategy and tacitly imitated this behavior by under-scheduling their own demand. Sellers would also be paying attention and would probably not stand pat. Instead, sellers would begin to under-schedule sales into the CPX market, hoping to sell more of their energy into the higher priced CAISO real time market, while assuming the risk that they would be unable to make a sell in that market.

Two things are important here. First, Perot Systems offered to develop and provide training courses and simulation models well before any actual strategic trading or games were implemented in California's electricity markets by either buyers or sellers. It is incorrect and naïve to believe that, without Perot Systems' marketing presentations, the eventual strategic behavior or gaming that took place in California would not have occurred. To the contrary, nearly everyone predicted and expected this behavior to happen, and it did. Perot Systems' marketing presentations were not the catalyst.

Second, even if Perot Systems had managed to sell such training and computer modeling to energy traders, there would have been nothing improper or unethical about helping traders learn how to act, react, defend, respond, alter

behavior with new rules, etc. This is how vigorous competition works. There is more to success than merely giving it one's best. To succeed, whether it is on the battlefield, the football field, the elementary school playground, or in the commodity markets, one must learn how to compete against other fit and well-prepared adversaries.

Further, Perot Systems was not alone in offering to provide training to market participants. I will invoke the old adage that "a picture is worth a thousand words." The following Game Theory or Strategic Behavior Chart seems to have been included in many of Perot Systems' marketing presentations to participants in the California electricity markets in 1997 and 1998:

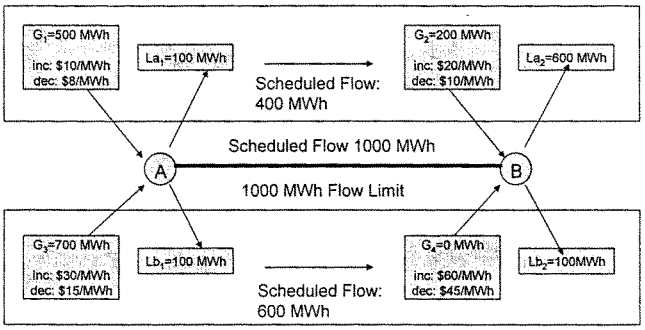


ISO shifts 2 MWh of SC1's generation from $G_{SC1,A}$ to $G_{SC1,B}$
ISO does not arrange trades to lower cost.
Arranging such trades is left to the SCs who run the energy forward markets.

From this document, Perot Systems' pitch appears to have been that businesses and other entities that hired Perot Systems would be taught, through Game Theory principles, how the market worked, and would be trained to implement the strategy behind this graphical presentation of California's transmission congestion pricing. Depending upon supply and demand (old school and still relevant economic theory), as well as the behavior of other market participants in the face of uncertainty, as well as complex and evolving market rules (modern Game Theory), the companies who trained using this game board would be able either to gain an edge or protect their position, or both. In other words, Perot Systems would run a pre-season training camp for prospective market participants.

It turns out that there was another training camp or preparatory regime that traders could take. It even had a clever name CONG (like King Kong without the King and the K). The CONG's playbook diagram is the next picture that I show below.

Deriving Final Schedules using Adjustment Bids to Resolve Congestion (Post CONG)



A: Zone 1
B: Zone 2
G_1: Generator One (SC1)
G_2: Generator Two (SC1)
G_3: Generator Three (SC2)
G_4: Generator Four (SC2)
La_1, La_2: Demand in each zone for SC1
Lb_1, Lb_2: Demand in each zone for SC1

The similarity between these two pictures is startling and beyond any chance of random coincidence. And the source of Cong (without the King and K) is the Settlements Guide published by the CAISO at the same time as the Perot Systems materials.

In short, Perot Systems offered the *same training* as did the CAISO in using complex rules under bidding and market uncertainty. Perot Systems also offered to teach an array of potential strategies being played by and evolving among the different teams of players in this new economic game; to wit: the California Energy Market. Perot Systems offered courses to train market participants about how to think and react to others. These were, in my view, analogous to "chalk talks." The game board, diagram, and training drills are

similar to teaching the "Nickel Defense" in a pre-season football camp. They were theoretical discussions akin to reviewing football "game films" during a pre-season training camp to learn in general what works, what doesn't work, and what to expect.

The real football game played out on a Sunday afternoon is quite separate and distinct. Perot Systems' detractors have misinterpreted the product Perot Systems offered, and they are attempting to heap scorn on a successful business enterprise that offered the same training material and course work that the CAISO (the sports league) also ultimately offered.

5. The Enron Trading Strategies Allegations

I now want to turn to the allegations against Perot Systems relating to Enron's trading strategies.

For this type of "guilt by association" to stick under even a relaxed or weak view of justice, there must be some modicum of correlation between the allegation and the alleged perpetrator. Here, the raging fire is the Enron scandal. The arsonist who set the blaze is allegedly identified in the "bad" Enron memo written by "Yoder and Hall."[6] (Even their names sound like *Star Wars* characters). Perot Systems is now accused of providing the matches used by the arsonist to ignite the blaze. But as I show below, this accusation is unfounded. Perot Systems did not and could not have provided the matches.

[6] This memo sometimes is referred to as the "Stoel Rives" memorandum, for the law firm on whose letterhead the memo was written.

Before examining the specific strategies discussed by Yoder and Hall, two fundamental facts should be kept in mind. Each one of these facts would warrant the complete dismissal of any notion of association, let alone causation, between Perot Systems and the California electricity crisis:

- The California crisis was caused by a "perfect storm" made up of traditional strong competitive market forces (such as climate, natural gas prices, lack of new supply, and a wildly successful economic expansion in California [demand]) combined with major structural, or market design flaws, regulatory failure, and profound political ineptitude. So-called "gaming" had about as much to do with this crisis as a diseased tree in a forest has to do with the forest's destruction as a result of a severe forest fire.

- Enron was not a major or even a significant player in California. Indeed, Enron owned no generation in or near California. Political nets pulled in Enron when its financial difficulties shared the headlines with the release of the Yoder-Hall memo, and politicians are now fingering that now well-beaten firm out of ease and self-interest.

These fundamental facts make ludicrous the whole idea that Perot Systems fed Enron the "secret" game plan to bring down California's energy markets. That said, I will simply (albeit incorrectly) suppose these fundamental facts did *not* exist because they are not necessary to prove that Perot Systems has been wrongly accused of having played any role in the California energy crisis.

Instead, I will examine whether there is any connection between what Perot Systems said in 1997 and 1998 to prospective firms that might have been interested in Perot Systems' training camp, and what Enron, at least in its "bad" memo, strategized about doing in the California electricity markets in late 2000 and early 2001. In undertaking this examination, I also will ignore the fact that Perot Systems was *not* hired by Enron (or anyone else) to train its traders, to develop a trading strategy, or to produce a game plan. (This is yet another of those troublesome facts that "conspiracy proponents" find easier to disregard than accept.)

Below I examine each of Enron's colorfully labeled games identified in the Yoder-Hall memo[7] and explain why Perot Systems' sales presentations could not reasonably have been the source of these ideas and strategies.

[7] In his Enron Report, Mr. McCullough references additional alleged Enron strategies and their colorful names (*e.g.*, Black Widow, Big Foot, Cong Catcher, Forney's Perpetual Loop, and Red Congo). These alleged game strategies were not discussed in the Yoder-Hall memo. I do not have access to, nor have I examined, other Enron documents to which Mr. McCullough refers.

Game 1: "INC-ing" (or "Fat Boy")

Under market rules, Scheduling Coordinators were required to submit balanced supply and demand schedules to the CPX. The behavior described as "Fat Boy" in the Yoder-Hall memo was designed to circumvent this requirement. This strategy involves artificially increasing ("INC-ing") load (demand) on the balanced schedule submitted. Since the entire demand does not exist, sellers are then able to supply energy to the CAISO's real-time or imbalance energy market. This game evolved when the utilities in California adopted the strategy to underschedule purchases in the day-ahead market.

Three key points about "Fat Boy": first, the essence of "Fat Boy" – buying low and selling high – is not an original or novel concept. Perot Systems would find few clients if it pushed such an obvious concept, much as a professional football coach would find few job offers if his/her game strategy simply was to tell athletes "try to do your best."

Second, Perot Systems informed the CAISO of the potential for market participants to overschedule load. In fact, the Perot Systems presentation featured in Mr. McCullough's June 21 "Report," which he links to Enron's "Fat Boy" strategy, was actually a presentation made to the CAISO in November 1997.

Third, and perhaps most important, market developments in California in late 2000 caused the "INC-ing" game to take a major and totally unanticipated direction and to reach an unimaginable level. Specifically, when the CAISO was

designed and launched and Perot Systems was trying in 1997 and 1998 to land new clients in the energy trading businesses, the California market was designed anticipating that the CAISO's real-time market would represent, at most, about 3 percent of California's overall electricity market. By late 2000, the CAISO's real-time market grew by more than ten-fold, and made up more than 30 percent of the electricity market in California, owing to the underscheduling of load in day-ahead markets by the California utilities.

When this happened, the level and strategies in the "game" changed: the odds dramatically improved that the "INC-ing" strategy would be very profitable. Neither Perot Systems nor anyone else anticipated in 1997 and 1998 that California utilities' underscheduling of demand would drive the CAISO's real-time market to make up more than 30 percent of the overall California electricity market – or that "INC-ing" would become a safe bet.

Game 2 "Death Star:"
Relieving Congestion and Counterflow Payments

In this game, market participants can bid to sell energy and also bid to relieve congestion by either selling against the primary direction of energy flow or by reducing demand. The rules and prices for congestion relief are complex. At the core of the CAISO tariff is the same diagram that Perot Systems presented to prospective training clients and that the CAISO also uses in its training materials. There can be no guilt by association here. Traders would simply put their own numbers into the CAISO diagram and determine their own best strategy under different scenarios for congestion, energy prices, and the trading behavior of

others. Perot Systems did not add a single unique insight here and provided traders with the same playbook diagram available from the CAISO. Perot Systems certainly cannot be faulted for producing a diagram that was virtually identical to the diagram also produced by the CAISO. Thus, I conclude that Perot Systems had nothing to do with Enron's developing the Death Star strategy, which could easily be based on CAISO's own diagrams.

Game 3: Load Shift

In this game, market participants would submit multiple bids in advance of a market's close; and, based upon updated information (e.g., emergency warnings, weather conditions, etc.) alter their bids. The tariffs in California were designed to encourage this form of arbitrage behavior because this is how all commodity markets work and such arbitrage and hedging activities are essential for markets to be efficient.

By 2000, there were different price cap and other restrictions in place in the various CPX and CAISO markets. For example, the CPX price cap was ten times greater than the CAISO's market cap. Buyers could protect themselves by under-scheduling in the CPX market, which had a significantly higher $2,500 per MWh price cap, by shifting purchases to the CAISO's market, which had a $250 per MWh price cap. Some sellers responded as described below through a practice some called "ricochet." As noted above, these developments were completely unanticipated, as was the profound shift in load from the CPX energy markets to the CAISO's real time (or energy imbalance) market. None of these tariff charges and unanticipated market shifts to the CAISO could have been, or

were, foreseeable back in 1998 when Perot Systems pitched its trader training products. There can be no association or connection with Perot Systems to this game because these "opportunities" or "problems," depending on your position in the market, were simply not foreseeable in 1998 and did not emerge until 2000. Thus, I conclude that there was nothing in the Perot System presentations that would have assisted Enron in developing this particular strategy.

Game 4: "Ricochet" or "Megawatt Hour Laundering"

This game took advantage of a 2000 CAISO tariff provision that "capped" the price of electricity sold by "market participants" in California to the CAISO. A second factor, which I discussed above, was that the CPX market cap was ten times greater than the CAISO market cap. Exempt California entities such as municipally owned utilities (e.g., LADWP and SMUD) were exempt from the CAISO's price cap. Many out of state generators were also exempt from this price cap. Under "Ricochet" or Megawatt Hour Laundering (some call it leakage) entities that were subject to the price cap for energy sold to the CAISO could sell the energy to exempt entities (either LADWP, SMUD, or out-of-state entities) at prices above the price cap. These exempt entities could then sell that same energy to the CAISO unfettered by the CAISO's price cap. When the strategy works, energy is sold at prices above the CAISO cap. When the strategy fails, energy is sold at prices below the price cap.

No one, certainly not Perot Systems, could have foreseen this 2000 "opportunity" or tariff "gap" in 1998 because the CAISO price cap and cost opportunities for Ricochet strategy did not exist. It is surprising that it took the

FERC months to fix or fill this gap in 2001. Regardless, no guilt by association can attach to Perot Systems here, and I conclude that nothing in the Perot System presentations could have led to the development of this game.

Game 5: Get Shorty

This game has a flashy name, "Get Shorty." This "game" is a common practice among all commodity and stock traders. Quite simply, a trader agrees to buy or sell a product at a specified price in advance. As the date or time to execute the transaction approaches, the actual trading price's value becomes more certain. The trader may change or alter his/her position based upon the updated current price information. Again, there is nothing sinister here. Short selling is a Trading 101 concept. Perot Systems did not need to, nor did it, stress the value it could add to traders for this rudimentary trading practice that has existed virtually from the beginning of commodity trading in the world. I conclude that nothing in any of the Perot System presentations advanced this game.

Game 6: Wheel Out

This game suggests that there is value in information related to transmission line outages. This is akin to suggesting that there is value in weather service forecasts for "orange juice" futures. (Recall Eddie Murphy and Dan Akroyd in their comedy Trading Places). There is nothing sinister in valuing information. Perot Systems could not provide value to market participants by telling them that information was valuable.

6. The Non-Confidential Content of Perot Systems' Marketing Materials

I have reviewed various marketing materials included in the documents that Perot Systems produced to this Committee. I conclude that these materials are virtually identical to the same material provided publicly by the CAISO and CPX. Specifically, I have independently reviewed the various presentations that appear directed to Enron, Reliant, Southern California Edison, Pacific Gas & Electric (PG&E), Sempra, the California Department of Water Resources (CDWR), and others. I also have reviewed in some detail various marketing plans for Enron. These include:

1. *Profit Maximizing Under UK and US Deregulation,"* (Backus, Gribik and Lall) to Enron, January 1998.

2. Two draft letters intended for Rich Davis of Enron Capital and Trade Resources, dated February 16, 1998 and April 8, 1998, respectively.
3. Statement of George Backus, dated June 19, 2002.

The documents that I reviewed in detail are attached to this Statement as Appendix F.

I conclude that these specific Enron proposals and potential proposals did not contain any proprietary or even useful information that Enron could not have learned or gleaned from numerous other sources. These materials use outdated examples of past gaps or gaming strategies. Perot Systems had identified these gaps to the CAISO. The CAISO revised its rules to eliminate these gaps, which no longer existed and were illustrative examples only.

Further, after reviewing these materials, I conclude that suggestions of cooperation and the value of learning about other traders that may have had similar goals, objectives, and positions did not represent any proposal or suggestion for illegal collusion. At most, the presentations advised traders to pay attention to what others were doing in the market, and perhaps play a game based on expected moves or countermoves, where Trader A might imitate or follow Trader B. This behavior is no more illegal than telling Trader A to sell in the real time market if it observes that significant blocks of buyers are bypassing the day-ahead market.

Game strategies can be based upon following the pack, counter attacking, anticipating the actions taken by others, and the like. None of this is illegal or

bad. Attempts to ban "winners and losers" in commodity markets is truly an impossible mission, much like the elementary school teacher who attempts to keep kids from experiencing victory or defeat.

Perot Systems offered to teach market participants the rules and to develop programs to train their personnel on the manner in which the CAISO and CPX worked. Rudimentary strategies could then be sketched out. Using a football analogy, this is akin to the first day of training camp. Perot Systems also may have offered more advanced sessions including computer simulations and actually running game simulations to test and refine strategies. Expanding the football analogy, this is like developing a playbook to be used on a Sunday afternoon. Perot Systems also pitched an even more advanced analysis using actual market data as it became available to further analyze market behavior and refine strategies. This would be like reviewing game film on Monday (Monday morning quarterbacking). But these particular potential products were neither prescribed nor defined in the Perot Systems presentations.

Perot Systems was not successful, for whatever reason, in even selling the initial full training camp type seminar to explain the way in which the California market worked. Perot Systems never even made it to training camp with Enron or any other entity to which it made a presentation. No trader ever purchased playbooks, game plans, or Monday Morning quarterbacking skills.[8]

[8] In May 1998, Perot Systems did sell a ½ day market overview workshop to Reliant/Houston Industries for which it received an $8,000 fee. However, this workshop was not equivalent to the Phase 0 work that was to be, but never was, pitched to Enron. Additionally, Dr. Backus may have received $1,000 for work he performed for Enron independent of Perot Systems.

Thus, my conclusion is that Perot Systems did not and could not have contributed to the California energy crisis because no California trader that I reviewed ever hired Perot for basic training, let alone: (1) "game plan development," (2) "play book formulation," or (3) "Monday Morning Quarterbacking." Even had Perot Systems been hired and assisted on these matters, this would not have made Perot Systems a co-conspirator. Recall the games were played under rules prescribed by CAISO and CPX tariffs and accurate accounting protocols. These rules were also changed over time and major shifts in the market transpired after Perot Systems attempted to sell its services in 1997 and 1998.

7. Mr. McCullough's "Reports"

I conclude my statement with comments directed to certain "reports" prepared by Robert McCullough, some of which Chairman Dunn and other members of the California Senate Select Committee have posted on their official Web sites. It seems clear that the Committee relied heavily on Mr. McCullough's analyses, and that they formed the basis for at least some of the CA Senate Committee's allegations reported by the media.

For example, Mr. McCullough singled out for criticism one of the documents I reviewed, a presentation to PG&E. In doing so, he speculated about the causes of the Stage 3 energy emergency "that occurred on January 17, 2000."[9] Mr. McCullough apparently sees the Stage 3 emergency on this date

[9] Here, I assume that Mr. McCullough meant to refer to January 17, 2001, not 2000, which he describes in detail in a subsequent report.

as proof of Enron's gaming the market and asserts that the "combative moves" slide in the PG&E presentation describes the actions of the generators on January 17, 2001.

Mr. McCullough fails to explain that California generators and sellers had reached a conclusion prior to January 17, 2001 that there was no creditworthy buyer in the market. This caused Governor Davis to issue an Emergency Order on January 17, 2001 authorizing the CDWR to purchase power for SCE and PG&E. On this date, the "game" that caused the Stage 3 emergency was a high-level political game: would the Governor direct the CDWR to guarantee purchases or not?

Regardless of who drafted the PG&E presentation, the events of January 2001 were not about Game Theory strategy within the markets' rules and protocols. The lack of creditworthiness could not have been anticipated under any circumstances or facts that existed in 1997 and 1998 when individuals attempted to market energy market training services. Thus, contrary to Mr. McCullough's speculation, the "combative moves" slide prepared in 1997 could not have had any effect on generator dispatch on January 17, 2001.

In other respects, reports published by McCullough Research are inflammatory and insulting. Perot Systems did not run a "crime school." Indeed, game theory or gaming is not a crime. If it were, several Nobel Prizes would need to be returned. Worse, Mr. McCullough probably knows very well that Perot Systems' marketing materials had nothing to do with strategies employed by California market participants. He admits that traders like Enron were

developing their own sophisticated real-time market and congestion schemes without the aid of Perot Systems by using publicly available rules, protocols and guides. Mr. McCullough has said, "many of these [Enron] schemes could easily have been invented independently [of the Perot System material]."[10]

The only weak connection between Perot Systems' marketing materials and Enron's trading strategies to which Mr. McCullough repeatedly points is Perot Systems' reliance on the Silverpeak transmission intertie to explain transmission congestion pricing. Mr. McCullough ignores the overwhelming facts that:

- Numerous documents, including those that the CAISO freely provided, explain the same transmission pricing and bidding system using Silverpeak as an example. Silverpeak was not an obscure congested transmission line that only Perot Systems knew about. In fact, market participants in California were well aware of the capacity limitations of this line, as there are relatively few transmission lines into California and even fewer as small as Silverpeak. The CAISO's own Settlements Guide identifies this line. Using it in an example of congested transmission imparts no secret or confidential information;
- Perot Systems worked for the CAISO to fix these gaps or design flaws;
- The second Enron Memo (both Enron Memos are attached to this statement as Appendix G) stated that Enron did not participate in

[10] FERC Docket Nos. EL02-26-000, *et seq.*, Exhibit SNO-17 at page 35, lines 3 and 4.

congestion counter-flow strategies to the extent suggested in the first Enron memo;

- Perot Systems never used the Silverpeak example in the presentations it had planned to present to Enron; and
- Enron never hired Perot Systems.

8. Conclusion

The facts are, in 1997 and 1998 Perot Systems offered to provide training to participants in the new California power market based on public information, employing accepted principles of Game Theory. No market participants, however, were interested in this training. In late 2000, competitive market forces, combined with structural flaws in the market and regulatory and political missteps caused the California energy crisis. Allegations that Perot Systems was in any way responsible for this crisis are totally unfounded.

What happened in California in 2000 and 2001 could not have reasonably been anticipated in 1997 and 1998 when Perot System was marketing its training services. Therefore, strategies employed by Enron and other market participants could not have had their genesis in Perot Systems presentations. Certainly, there is nothing in any of Perot Systems' documents I reviewed that would come even remotely close to supporting the allegations linking Perot Systems to the California energy crisis.

Mr. OSE. Dr. Backus for 5 minutes.

Dr. BACKUS. Good afternoon, Mr. Chairman, and thank you. My name is Dr. George Backus. I am the president of Policy Assessment Corp. of Denver, CO. I was originally a nuclear design safety engineer, providing simulations to make sure that nuclear facilities remain safe and secure under all possible events. I trained under the simulationists who helped ensure the success of the Apollo space program using the same methods. My degree is in system dynamics, which primarily considers how physical or economic systems change over time as a result of human behavior. I focus on policy assessment. I simulate potential behaviors and failure modes and how to modify the policies to ensure the desired results.

In 1978, I coauthored the FOSSIL2 simulation model used by DOE for U.S. national energy policy, including oil and gas deregulation. I later extended that work to look at State and regional energy and utility planning. I currently focus on stress testing potential climate change policies for various governments.

In 1986, for the State of Illinois, I looked at potential electric utility deregulation and found some discouraging dynamics, much like what has now been experienced in California and elsewhere. In 1996, I prepared a report for the U.S. DOE on the dynamics of deregulation. That report was based on the deregulation experience in the U.K. and elsewhere, and showed that the United States was now heading for the same problems. I presented the results to the Western System Coordinating Council in 1996. I then provided a workshop to the Western Interstate Energy Board, whose members are all the commissions within WSCC. I also made a presentation to the California Energy Commission and offered to make presentations to the California PX, ISO, and CPUC. I then made presentations to trade groups, power authorities, consumer groups, utilities, and commissions throughout the United States, as I saw the same misguided deregulation efforts appear in the Midwest, New England, etc.

The California approach to deregulation was much worse than any I had seen or imagined. It would obviously destroy the distribution companies and make the supply market a chaotic nightmare. I saw my simulation skills as presenting a consulting opportunity.

In 1997, I assisted Southern California Edison, who had seen my WSCC presentation, to review potential California market rules for problems as well as to recommend alternatives that would alleviate those problems. At Edison, I was introduced to Hemant Lall of Perot Systems, who saw the broad applicability of my work. We decided that combining Perot Systems' IT expertise with my work would provide a capability unavailable anywhere else. The product could be offered to market operators, commissions, and market participants worldwide. It would allow them to understand the market dynamics and plan accordingly.

Perot felt the obvious place to start the effort was in California, and specifically with Edison, because we were already there. These efforts included no proprietary information or data. I had no confidential data or any kind related to California or any other markets. All information was obtained from published reports and news articles. I never advised anyone to do anything unethical or

illegal. I made sure everyone was aware of the systems problems so that the problems could be addressed, hopefully, with my consulting assistance. Unfortunately, no such consulting business materialized in California.

The fundamental problem in California is that it violated the basic concepts of economics. Ordinarily, supply and demand will come into balance orchestrated by price. Some key problems were that the California market did not let consumers see the market prices. The distribution companies were forced to buy independent of the prices. It would take 30 to 60 days before the ISO and PX could tell distribution companies and suppliers the accounting results, and thus, there was no market transparency.

Further, on the supply side, setting rules precluded needed additional supply. Stranded cost agreements initially suppressed market prices, further discouraging adequate supply. On the demand side, the negotiated reduced consumer prices stimulated demand. Confronted with high demand and low supply, the market was incapable of achieving balance. This precipitated the crisis.

The fatal flaws come not only from the mistakes in market design, but also from not planning for them and in letting the problems perpetuate. Public documents show that the ISO and PX were aware of many of the problems. Many academic investigators demonstrated the problems and proposed solutions.

While it is easy to cast the blame on the market rules, it is the regulatory process that needs to be recognized as the crux of the California crisis. The problems and solutions I discuss in my written testimony will be revisited until regulators recognize that markets are imperfect, and that they must plan ahead to accommodate those limitations. Thank you.

Mr. OSE. Thank you, Dr. Backus.

[The prepared statement of Dr. Backus follows:]

Testimony of George Backus
for the
Subcommittee on Energy Policy,
Natural Resources and Regulatory Affairs
July 22, 2002

Preface

I worked in conjunction with Perot Systems to develop and market to ISO's, power companies, regulators, and traders a capability for understanding and surviving the dynamics of electric market deregulation. Given the importance of the California deregulation efforts, it became the focus of marketing efforts. From experience with computer modeling and with experience derived from other countries' encounters with deregulation, as well as numerous studies and news articles related to deregulation phenomena, we observed the numerous and expected limitations inherent in the market systems designed in California and elsewhere. We offered market participants a capability to determine strategies that would allow them to successfully operate within the new market environment and within the established rules. Unfortunately, we did not succeed, either individually or jointly, in convincing any potential clients to utilize our services.

The primary purpose of my testimony is not just to point out the obvious and fundamental failings of California's deregulation construct, but to show the failing of the regulatory ***process*** that allowed the acceptable and legal attempts of companies to maximize their profits to result in unacceptable market conditions. Additionally, I describe my role in working alongside Perot Systems in attempting to generate a successful consulting business in this area (which efforts failed).

Moreover, I explain the process I employed in running computer simulations to accurately predict the events and pricing as a result of deregulation dynamics. The discovered dynamics can be described in the context of six causally-related phases, one of which is "market gaming." This concept of "gaming" is, in the context of generic game-theory, routinely employed by countless industries for strategic planning. Published international and national examples of both "good" and "bad" gaming were used to show the grave consequence of not recognizing the dynamics of this phase of deregulation.

I have never possessed or divulged any confidential information concerning the operation of the California energy markets, nor did this work ever promote any activities other than publicly known, legal, competitive-market activities.

Lastly, I describe what the simulations indicate are the minimalist set of market rules that self-correct for adverse market conditions and behaviors.

Bottom line Summary

While the market rules of the California market did uniquely violate almost every economic condition required for a market to function, these rules are not the fatal-flaw. The flaw is in the process both in California and in all other US markets. Few would board an airplane that had not been tested under extreme conditions for airworthiness, yet states and regions continue to implement market designs based on the untested-compromises of committees, composed of members with vested-interests. Market and RTO designs need to be stress-tested before implementation. Market rules need to be designed to ensure self-correction mechanisms as the first priority, and possibly only priority. In most, if not all cases, market gaming, would then become a non-issue. The market would automatically find and use counter-games to enforce efficient market operation. It should primarily be competitors that punish or reward other competitors via moves and counter-moves.

Legal gaming is a standard part of strategic thinking.[1] Markets work because of legal gaming. Market designs that contain self-correcting mechanisms limit the impact of gaming to produce the beneficial outcomes that occur in other commodity markets. Electricity consumers recognize this fact: "Gaming can be considered any business behavior that exploits weaknesses or flaws in the market design, and that produces market results that are inconsistent with the objectives of the market design (e.g., efficiency, competition, no undue discrimination, or reliability), while not being in violation of a tariff or market rules. In other words, gaming is behavior that would not have been permitted or possible under a tariff or market rules, had the designers of the tariff or rules anticipated the behavior and were able to preclude it from being exercised in the first place."[2]

Current market oversight is not independent. Consumers need to be as much a part of the market as suppliers. The oversight has to come from a truly independent board composed of individuals outside the region and its interests. That board needs to have authority to modify the rules to bring added or to maintain compelling competitive pressures and ensure a resilient market. Such an approach will always place added unwanted pressure on all market participants (but produce beneficial market outcomes).

Going from a regulated to a deregulated market is like society making the transition from using a horse-and-carriage to using automobiles. The rules of the road needed to change as the transition progresses. As the electric markets make the transition and mature, the rules must change in concert. My 1997 work indicated that California would surely recognize its failures and begin radical changes to its rule philosophy by the beginning of

---

[1] Brandenburger 1995: Adam M. Brandenburger and Barry J. Nalebuff, "The Right Game: Use Game Theory to Shape Strategy," *Harvard Business Review*, July-August 1995, pp. 57-71and "It's Only a Game," *The Economist*, June 15th 1996. and Nalebuff 1992: Barry Nalebuff and Avinash K. Dixit, *Thinking Strategically*, W. W. Norton, NY, 1991 and Nalebuff 1996: Adam M. Brandenburger and Barry J. Nalebuff, *Co-opetition*, Doubleday, 1996.

[2] *Preventing Market Failures On The Road To Competition: Analysis & Recommendations of the Electricity Consumers Resource Council (ELCON).* Washington, DC June 2001, page 10. Available at http://www.elcon.org/Documents/Publications/CaliforniaSpecialReport.pdf

1999. That one prediction proved wrong. The extreme tardiness and the counterproductive nature of the California response can only add to the cynicism about the deregulation process throughout North America. A failure to design for the dynamics of deregulation guarantees that the deregulation process will result in failure.

Introduction and Background

From a distance, deregulation is not the chaotic unpredictable phenomena that it appears to be moment-to-moment and place-to-place. Our combined economic-behavior and engineering-simulation work from 1995[3] is batting near 1000 in its predictions and its understanding of what would happen in California and other areas, worldwide. In fact, page 9 of a 1996 presentation on deregulation dynamics to the WSCC[4], discussed, as a part of the sequence of events stated then, the strategic litigation and political investigations currently pursued. The only place where the results of the 1995 simulation erred is in the assumed timing of regulator intervention that would reevaluate the market rules, implement more workable alternatives, and prevent the market dynamics from escalating to crisis levels. The US federal and state regulatory process has been many times slower than other countries to face problems realistically and to respond to limit the damage of non-viable market rules. The 1995 and subsequent simulations did show what impacts this lethargy would cause.

Essentially all deregulated industries were once regulated in history. We only need to think of the industrial revolution and modernity itself to realize the great long-term benefits of competition brought forth by deregulated markets. What is not often recognized is the distress associated with the transition of going from a regulated to a deregulated environment. Humans hate change. As such, it is only natural that incumbents from the old regime will try to protect vested interests. Even more so, they are so accustomed to previous ways of doing business that all change must be referenced to past processes. To a hammer, everything looks like a nail. The lone process of adding the change-avoidance behavior allowed the simulation to produce most of the experienced events associated with the dynamics of deregulation.[5]

Because deregulation requires approaches that are often opposite of those associated with the "old" regulated regime, it remains a mistake for ISOs and RTOs to be governed by a board of stakeholders. The stakeholders should have the right to express concerns and issues, but a "free market" cannot be imprisoned by guards who are self-selected to

[3] *The Dynamics Of U.S. Electric Utility Deregulation*, By George Backus (Policy Assessment Corporation, Denver, Colorado) and Susan Baylis (Cambridge Econometrics, Ltd., Cambridge, England) Prepared for the United States Department of Energy, Office of Utility Technology, Draft August 1995, Updated August 25, 1996 under contract DE-AP-P6R810225.

[4] "Dynamics of Deregulation" Presentation to the 1996 Annual meeting of the Western System Coordinating Council by George Backus, Policy Assessment Corporation, November 21, 1996.

[5] This testimony focuses on dynamics, as opposed to statics. The limited analyses used to design market rules to-date rely solely on equilibrium static approaches that at focus only on "instantaneous" dispatch issues.

protect personal needs.[6] Further evidence of this dilemma, is that, to my mind, the new California market rules have as many, if not more, problems as the old rules.

In a world of "sounds bytes," the "next new thing," and the "right thing to do," a false sense of human wisdom exists. The greatest failure of the deregulation has been the failure to plan for failures. The markets evolve and it should be expected that the unavoidability of unforeseeable events would routinely lead to revisiting past, no longer applicable, decisions. Policy makers wanted the perfect deregulation where everybody wins, the system operates perfectly, and 100 years of remembered regulated history are replaced by new behaviors learned immediately when the deregulation switch is pulled. The behavioral transition from regulation to deregulation is the key missing consideration of current deregulation activities. The most important part of a trip is to plan for the journey, not the arrival. It appears no one planned for the inevitable complications of the electric deregulation transition. We would not implement a radically new form of public transportation, such as a new space-plane, without making sure it was failure tolerant, that is, it was fail-safe. That the plane could operate in idealized conditions would be taken for granted. Basic engineering design principles demand that developers know how a product operates when (inevitably) things do not work as planned. One can design around "Murphy's law," but one cannot disregard it.

Safety engineering has a long history – from test pilots, to nuclear safety, to the Apollo Space program, to auto safety, to Underwriter's Laboratory. A primary tool of safety engineering is simulation. With simulation, the system and its dynamic interactions can be tested on the computer until failure. Those failure modes can then be eliminated or avoided. The system is then failure tolerant. It self-corrects for unforeseen situations.

Any system that changes over time, such as markets, must have a control system. In a market, the control system is the market rules. Any system that changes over time is in disequilibrium. All economic analyses used for deregulation relied on equilibrium approaches. Equilibrium works well for mature markets, and is therefore the primary stock and trade of economists. The dynamics, not the equilibrium, need to be the focus of the analyses. The conventional optimal (equilibrium) tools of regulated utilities and economists are not only poorly suited for such analyses, they mislead policymakers into a false sense of comfort. They tell what the best of all possible worlds should look like. They provide no help in how to get to that world. The control system must be flexible and allow the system to self-correct under all possible conditions. The control system must be simple yet capable of doing its job. A complicated control system will often be wrought with contradictory responses that create catastrophic interactions – experienced in all the electric deregulated markets to date.

My work is analogous to being the Underwriter's Laboratories for deregulation. Because my experiences originally came from a nuclear engineering background, my focus is not on how the system should work under idealized conditions, but how it will self-correct or

[6] "Every market participant has a different ax to grind: Companies clash over U.S. Eastern Power Grid plans." Dow Jones News Service, Aug 14, 2001

fail safe under the most adverse conditions. We would not ask the population to use the previously-mentioned "space-plane" for routine intercontinental travel without thorough testing and simulation under all conceivable conditions, yet we risk state economies based on the political and untested compromises of self-serving committees. My simulations show that deregulation holds the promise many believe, but it also shows that the economic idealization used to finesse market concerns are wholly inadequate to analyze the dynamics of deregulation.

History:

My initial work on deregulation started shortly after the first OPEC Oil crisis with the 1978 development of the FOSSIL2/IDEAS model that was used for US national energy policy analysis through approximately 1998. That initial work focused on oil and gas deregulation as well as the market impacts of new technologies. Disenchantment with the federal process led to applying that work to state and energy-company level policy analyses. That resulting simulation framework is the basis for the deregulation work of interest here.

In 1986, I worked to develop a model for the State on Illinois to simulate electric industry deregulation.[7] To move out into the future, the model had to allow mergers, acquisitions, and bankruptcies. All three topics were considered frivolous at the time. Further, the model indicated that it took time to make the deregulation transition. Suppliers and consumers needed to learn how to respond in the new environments, as a trial and error process. The fabric of the market will mature and change over time. The rules of the market will need to change in concert with the market during the transition.

Market dynamics are understandable, but they are complex. During a transition, the dynamics are noisy and unpredictable in their moment-to-moment behaviors, much like the stock market is today, as it goes through a *minor* transition. The model developed for the State of Illinois was called CIGMOD, the Competitive Industry Gaming MODel. It showed that price would be very volatile and would follow unanticipated, but fully understandable dynamics. I presented this gaming model to show the dynamics of deregulation to commissions, utilities, consumers, states-- anybody I found who would at least accept the fact there could be critical issues with deregulation that were not being considered. The Western Interstate Energy Board (Committee on Regional Electric Power Cooperation - which consists of the public utility commissions, energy agencies, and facility siting agencies in the western states and Canadian provinces in the WSCC electricity grid, played CIGMOD in early 1996. The workshop participants themselves produced the consequences of bad rules and learned what was needed to avoid those consequences. CIGMOD did contain basic real world data, but did not contain the real rules of deregulation. The rules are determined by the players. The model realistically captures the generic responses of both competitors and consumers as they adapted to the

[7] "A System Dynamics Gaming Model for Deregulation of the Electric Utility Industry," Zhang 1988: Zhang, Xiaobo, George Backus, and Jeff Amlin, *1988 Winter Simulation Conference*, San Diego, January 5-9, 1988.

new and ever changing environment. The model performs the basic physical and financial accounting, but the players make all the decisions.

Although the model does not contain transmission constraints (i.e., no consequential geographical distinctions), hourly details (it is at best a seasonal model updated annually), or any details on generation units (i.e., just plants by type), workshop attendees quickly realized that the gaming among competitor becomes the key concern. Gaming among competitors is universal among deregulated commodities, but was a totally new concept for the previously protected regulated electricity industry. The model can only reflect strategic gaming issues common to productive industry practices;[8] yet, workshop participant recognized that they needed to understand gaming both defensively and as a routine process within any market environment. Further, it became clear to many participants that the market rules must accommodate gaming while simultaneously preventing adverse consequences.

I spent the 1994/1995 academic year working for a macroeconomic, energy, and environmental consulting firm associated with the Departments of Applied Economics at Cambridge University in England. I had a ringside seat to the UK deregulation process at the supplier, consumer, academic, and governmental level. What was happening there looked like what happen in CIGMOD a decade earlier. A further look at previous non-energy deregulation transitions showed that the dynamics were universal. Humans appear to learn little from the experience of others and they do hate change. By just adding the physical constraints and some basic economics, the causes and effects that lead to the dynamics of deregulation jump out.

When I returned to the US, I made presentations on these dynamics to everyone I could: states, commissions, utilities, etc., warning them of what would happen if they followed the same mistakes experienced throughout history. I knew of no organization in the WSCC who did not see the presentation. Most of the NERC regions, proposed ISOs, the states actively promoting deregulation, and their commissions had some contact with my work and the dynamics of deregulation presentation. At the time, the envisaged behaviors seemed outrageous: $1000/MWh prices, shortages when there was adequate capacity, market gaming, changing rules, mergers, and acquisitions. Even as the events unfolded, as they inexorably would, the work remained a curiosity. Again, if a plane takes off, it must eventually come back to the ground. Simple causality could determine the unfolding of events, not by specific name and exact date, but it could qualitatively state the inevitable sequence of events in broad terms, still detailed enough to haunt us today.

---

[8] Brandenburger 1995: Adam M. Brandenburger and Barry J. Nalebuff, "The Right Game: Use Game Theory to Shape Strategy," *Harvard Business Review*, July-August 1995, pp. 57-71and "It's Only a Game," *The Economist*, June 15th 1996. and Nalebuff 1992: Barry Nalebuff and Avinash K. Dixit, *Thinking Strategically*, W. W. Norton, NY, 1991 and Nalebuff 1996: Adam M. Brandenburger and Barry J. Nalebuff, *Co-opetition*, Doubleday, 1996.

Market Gaming:

I have often publicly and privately mocked the ISO and FERC for defining "gaming" as a dirty word (illegal act). There are over 20 definitions of "game, gamed, gaming" in most dictionaries. Only one has anything to do with illegal activities. The three I use implicitly and often explicitly in my work are:

1. "A competitive activity in which players contend with each other according to a set of rules.
2. An active interest or pursuit, especially one involving competitive engagement or adherence to rule.
3. A model of a competitive situation that identifies interested parties and stipulates rules governing all aspects of the competition, used in game theory to determine the optimal course of action for an interested party."

I started to write my document in England in 1994 and had dealt with gaming issues since 1978 while working on US oil and gas deregulation analysis for the US DOE, long before the FERC and ISO definitions were "formalized." Famous mathematicians and economists dealt with the modern concept of "gaming" from as early as 1944.

A working market, a working competitive system, of any type requires gaming. The most advanced and elegant gaming occurs in the hearing and in the courtrooms. The lawyer interrogates the witness to make the information more focused and have the needed content. The opposing lawyer counters to obtain the information in the form needed from his/her perspective. All this gaming additionally needs to play well with judges, juries, and the reporters. A second highly advanced form of gaming is democratic elections (dominantly in capitalist countries). The opponents spar strategically on demographic fronts, niche issues, and even gerrymandering. Auto manufacturers offer 0% interest loans. Cereal boxes offer prizes and sweepstakes. In all cases, the games balance out between competitors, suppliers, and consumers, when all parties are fully informed. Further, all games do have their legal limits. Lawyers, politicians, and pharmaceutical companies, for example, have to be careful to stay on the legal side of gaming. My work never argues for illegal gaming. To remain faithful to the English-American dictionaries, I think discussions on "gaming" minimally needs to use such distinctions as legal-gaming and illegal gaming.

I saw my work as helping all parties understand and cope with the deregulation transition. The work would help commissions make initially useful rules and plan for the multiple iterations of rule changes, needed as the market changed and matured. Utilities, retailers, traders, consumers, and regulators could not act as they had in the old regulated regime. They would need to live with the necessarily imperfect rules, uncertain information, and transitional markets of a real world. If all understood how to play the game, all had an equal chance at survival. If they relied on past approaches, they would not only destroy themselves but possibly the system as well. The regulators needed to play the game as aggressively as the competitors did.

My work provides the basis for stress-testing any system to determine how it can break and how to fix it. It does not deny the equilibrium optimal economics used by orthodox economists. What it recognizes is that this approach is an idealization that can mislead all stakeholders. The world is imperfect; people do not have perfect information and would not know how to use it if they did. The interactions of a system making a transition from one condition (regulation) to another (deregulation) cause conditions far from equilibrium that require behaviors far different from those of the past. These behaviors in turn cause changes in the market that lead to yet more intertwined interactions. Economics is not called the "dismal science" for nothing. My safety-systems engineering, as applied to the economic dynamics of deregulation are, I believe, critical, to reaping the rewards of deregulation. It is no different from the engineering required to reap the reward of a new technology. Many an untested use of technology has resulted in catastrophe. Self-assured humans tend to see themselves as masters of their unique destiny. That only the names change compared to past events seems to be a lost perspective.

A classical joke is about an economist who is marooned on an island after a shipwreck. He ponders how to get off the island and back home. He writes some equations in the sand and after many hours, stops with a grin of satisfaction. He says to himself, "First, I will assume that I have a boat..." Throughout the deregulation process, the assumption has been to first assume there is a perfect market. No one has ever experienced a perfect market. Mature markets can be approximated, for some analytical purposes, as if they were perfect. In nascent markets, no one sees the variable cost pricing that the idealization assumes. Generation capacity is not in balance with supply. Consumers have not developed the expertise or services to accommodate the new market conditions. These conditions can be understood. A process to ensure that evolutionary pressures lead to a superior market can be assured. It is simply naive to start with the assumption that such a market exists.

My previous work indicated that the deregulation transition would require extensive re-tuning and involves ever-changing adjustments by suppliers, regulators, and consumers for a decade or more. At the time, I could find no other work that focused on accommodating market imperfections, information uncertainty, market transients, and market limitations. All other work focused on the inappropriate optimal analyses assumed under regulation. Even today, I am only aware of one other company with a comparable approach and even it still does not adequately deal with consumer behavior. I had a unique capability in a specialized area that all others had neglected.

The California and US deregulation process was flawed and remains flawed. These flaws determined the outcome – as described in my 1995 work, not just in California but also in essentially all the jurisdictions. In fact, newly proposed ISO (and RTO) rules act to cause even more market distortions that will perpetuate and exacerbate existing problems.

Gaming, designed to expose the system's flaws and to learn how to operate successfully, was not a new concept, exclusively applied to the California electricity markets. I learned of the games discussed in my presentations to market participants, ISO's, and regulators

in the news (energycenrtral.com and powermareting.com). Although many games described in my presentations are now assumed to be of US origin, the games are really described in detail in UK OFFER reports when they investigated market anomalies.[9] Indicative of this is that, there were no US games noted in my 1995 work, because there was no US deregulation at that time. These worldwide games were described in the news articles from 1996, if not earlier. California soon received much press because it provided so many examples of how bad ideas lead to bad problems. I presented New Zealand games with as equal coverage as California games. It was done to show the universality of the problems and the solutions. I expected California regulators to respond, at least to the obvious problems, by 1997.

Joint Perot Systems Efforts

Both Perot Systems and I were working at SCE in late 1996. I think they saw in my work a long-term opportunity that could take advantage of their IT expertise. The service to help all parties; regulators, ISOs, suppliers, traders, and generators survive and legally prosper in the brave new world of deregulation seemed to have worldwide applicability My work successfully simulated deregulation dynamics in Australia, New Zealand, Canada, South America, and Western Europe as well as it did in the UK and the US. Perot Systems and I first acted to show the problems to the primary losers -- SDG&E, SCE, and PG&E. The effort would be to find legal strategies (using only publicly available, non-confidential information) to keep energy prices low. These distribution companies (UDCs) needed low wholesale prices. My perspective had already been offered to the commission as noted above, but interest was limited. As noted by Perot Systems staff testimony, several more problematic limitations to the proposed market rules were specifically presented to the CA ISO and PX (with potential solutions) in the hope the CPUC would fix the problems.

As email records show, we correctly foresaw the dire situation the US and California would experience. In meeting with SDG&E, I included a discussion saying they had a 100% chance of losing and needed to sell generation capacity to get out of the generation business immediately. I believe they put up their remaining generation 2 months later. This was free advice to SDG&E. SCE had previously been told their situation was hopeless. They could act to demonstrate the fundamental flaws of the market design while temporality limiting average prices at the expense of increased price volatility. However, the regulatory grievance process was so flawed that they determined they could only become the perfect victim, offering no defense and hoping the state would take responsibility for their demise, even if the state would not act to prevent it. My understanding is that PG&E led the development of most of the rules that ultimately formed the California markets. The presentation to them informed and warned them of the consequences of causing such distortionary rules in markets. Part of my presentation

[9] "Pool Price Inquiry," Office of Electricity Regulation, Birmingham, 1991 and "Review of Pool Prices," Office of Electricity Regulation, London, December 1992 and "Report on Constrained-On Plant," October 1992, Office of Electric Regulation, London and "The Electricity Pool of England and Wales," *Statistical Digest*, London, Issue No. 67, March 1996 and earlier.

informed them that they would go bankrupt in roughly four years. That same comment was shortly thereafter made at a Northern California Power Agency presentation I made.

I do not remember the details of the first time I met staff from Perot systems. It was at Southern California Edison where I had a small contract to look at potential market rules and to comment on the problems those rules might suggest. I was never given detailed information but only comments or a few sentences on a mostly blacked-out text. Many of the proposal rules I saw had serious problems. I would propose alternatives (usually simpler rules) to ensure a self-correcting market. I would usually hear back that PG&E felt the modified rules would place their financial situation at risk. I would argue the market distortions would ultimately lead to more risk, but, to my knowledge, the PG&E position usually became the basis for the rules that would ultimately happen. [10]

I believe a former associate introduced me, informally in a hallway, to a Perot manager also working at SCE and we became interested in each other's efforts. I do not know if I approached them or they approached me with the joint marketing concept, or if we just both had the same thought. In any event, the joint efforts ended in 1998 with no successes.

I was not made privy to Perot internal business decisions. I was aware of Perot System's concern for conflicts of interest. I was informed from the beginning that Perot Systems was concerned that their one year contract with California would soon end and they might not get a renewed contract. They needed to look for new work and had an expertise that could help all market participants. The marketing was prefaced with the logic that work could not be pursued if the PX/ISO renewed its contact with Perot Systems. No confidential information was ever made available to me by Perot or to potential clients by me. No offer or claim to provide such information in the future was ever made. In any case, these details would have been of little value. The simulation had to resolve legal market strategies in a timeframe that only allowed a minimum of basic information. Computers are sill too slow for an exhaustive analysis of all moves – more potential moves than a chess game with the added feature that you can't clearly see the board (analogous to the imperfect information of real markets).

The marketing to Reliant (in which I did not participate) and that of Enron (in which I did participate) was concluded, to my knowledge not because either potential client decided "no," but rather because Perot felt that they were too close to receiving the new CA contract and could not ethically proceed further. They withdrew abruptly from the marketing process except for a minor, also unsuccessful, foray in to trying to help other forming ISOs. Perot Systems stopped even these ISO efforts because they realized they were too staff limited to pursue efforts beyond the renewed California work.

[10] As quoted in "How PG&E Missteps Preceded Crisis", San Francisco Chronicle, Jan 22, 2001. "TURN's Florio said: PG&E and the other utilities are trying to act like this is something that came from outer space rather than from their own negotiations in Sacramento. I think that PG&E more enthusiastically than any other utility went along with the push for deregulation.", and "PG&E was opposed to restructuring initially and once they realized it would happen they got on board and tried to craft something as beneficial as possible for their stakeholders, said Severin Borenstein, director of UC Energy Institute. In the process, they clearly made some miscalculations..."

Market Dynamics and the Dynamics of Deregulation

Coming independently both from an engineering and an economics perspective, I am dubious, like many opposed to deregulation, about believing that humans will act in close approximation to idealized economic theory. As an engineer, I do not want a perfect system; I want a system that fails safe, that is self-correcting. In the jargon of the digital age, I want a system that is fault tolerant. I doubt many can argue that humans can design fault-free systems, engineering or economic. We can, however, design systems that under all conditions, ultimately head back toward the desired goal. Further, the rules describing the control system need to be relatively simple and few. They need to control the system with limited negative impact on the rest of the system.

Deregulation is not a new phenomenon. Rulers from ancient times would often find it expedient to relinquish partial control of some commodity to a group of merchants or aristocrats in return for "royalties" or just the relief from some associated threat. In all the most important aspects, electricity deregulation is the same as all other deregulation accounts. Deregulation is competition. Going from regulation to deregulation means there is risk that some parties will win and some will lose. Competition must allow winners and losers, start-ups and bankruptcies. It is all the same dynamic. The rules of a competitive game must self-correct for failures to act successfully.

The Wrong Path to Deregulation:

Although this section discuses the problems with the political process of deregulation in general and with California in particular, it is not meant to imply that these problems should be unexpected. They are presented here because knowing what went wrong can serve as a counter-guide to later produce something "right." The mistakes of the California rules are consistent with the expected mistakes that would have been made as part of the "dynamics of deregulation." In my opinion, the only truly valid criticism of the California process (and FERC's handling of it as well) appears to be the ineffectual regulatory response once the problems were recognized as well as the continued lack of viable-rule guidance from regulators thereafter.

The simplest response to the question "Why did the current California deregulation effort fail?" is that California never deregulated.[11] As noted in footnote 33 below, New Zealand successfully accommodated similar shortage events to those experienced in California. Their more complete embrace of deregulation, although not perfect, allowed the self-correcting mechanisms of a working market to mitigate the problems within an acceptable period of time.

As is now widely publicized, California did not allow consumer prices to change. Economics depends on a supply-demand balance orchestrated by price signals. The cardinal rule of economics was violated. Higher prices are meant to reduce demand and

[11] "The Deregulation that wasn't" James B. Robb and Anthony Sugalski, The Mckinsey Quarterly, 2001, Number 3, pg 164.

stimulate supply. California designed a stranded cost process based on supplying energy at variable costs (consistent with the no longer applicable regulatory past). This ensured wholesale prices would initially be too low for any developer to build. This political compromise of price caps and stranded cost recovery would prove fatal.[12] The consumer price cap, that actually reduced prices, stimulated demand. When demand starts to outstrip supply, siting limitations and construction delays assured a worsening shortage. The rules made sure distribution companies had no flexibility to reduce their costs.[13] ISO rules ensured generators would move to the hour-ahead and imbalance market because of uncertainty and congestion chaos. All the basic economic principals were violated. Essentially, all the conditions that allow a market to function and self-correct were abrogated. It would have been hard to do worse. Yet, to be fair to California, some proposed RTO rules would additionally attempt to violate the laws of physics by preventing the RTO from performing the necessary functions to balance supply and demand under congested conditions.

Many others have noted the primary problems with the California market design.[14] The failure to understand the market dynamics led to secondary problems with the rules associated with ancillary services, congestion, and multi-settlement processes.

"The first [fatal flaw] was a freeze on retail electricity rates charged by the state's three largest utilities for a transition period of approximately four years, which in effect disenfranchised marketers who could sell neither cost reduction nor risk management. The retail price freeze was part of a complex deal between the utilities that wanted to recover stranded costs and consumer advocates that wanted immediate benefits from deregulation for all market segments. In addition to the rate freeze, consumers received a 10% rate cut that was funded by refinancing utility debt. The second [fatal flaw] was excessive reliance on the California Power Exchange's (CalPX's) day-ahead and real-time spot markets for wholesale purchases, while risk management was discouraged."[15]

Although Contracts for Differences (CfD) were available in theory, CfDs were discouraged. No insurance, risk management, or hedging was allowed. Simple market tactics that could have limited distribution company exposure, while regulators might hopefully resolve market shortcomings, were prohibited.[16]

Later rules on the ISO reserve process, limitations on buying outside the PX, having the state buying overpriced contracts, etc, just added to the chaos and the damage.[17]

---

[12] Problematic compromises spurred California power crisis, experts say," The Philadelphia Inquirer, January 17, 2001.
[13] *Causes and Lessons of the California Electricity Crisis*, September 2001, Congressional Budget Office
[14] "California: It didn't have to be this way," Business Week January 27, 2001 p. 40
[15] *(De) Regulation Follies* By S. A. Van Vactor and F. H. Pickel, March 2001, as can be found on http://www.tca-us.com/publications/pub2.htmlww.tca.com., p. 10
[16] UDC could have randomly over and under bid in the day-ahead and hour ahead market to confuse generator bidding strategies but this would supposedly affect state-promoted QF contracts negatively.
[17] Other Bonehead Plays: Top Ten Bonehead Play of the California Crisis., California Assemblyman Rod Wright, Public Utilities Fortnightly, July 1, 2002, p. 42

The crisis "that gripped the Western power market ... need not have been a tragedy. But the failure by politicians and regulators to heed or understand market signals has compounded the problem and created a crisis."[18]

As the recent GAO report[19] notes and as my work indicates, California is not out of the woods and the current administration of the CAISO and the CAISO rules will perpetuate both the future supply shortages and excessive price volatility within California. It does not appear California can learn on its own how to make a workable market.[20] The process and rules appear to be just as counterproductive now as they were four years ago.

To again be fair to California, even the often "admired" PJM system has problems just like the other RTOs/ISOs.[21] It is not a market. It is merely a coordination process of limited capability. It has not been stress-tested by simulation and it does not provide a basis for sustainable deregulated markets.

While it should be expected that a new venture will have its bumps, it should have been clear from the beginning that part of the deregulation plan needed to be a plan to change the plan as needed. "The British experience suggests that the market rules cannot be gotten right on the first try if the goal is a pre-designed supervised market. The regulatory interference has prevented the types of market mechanism ... normally seen in a commodity type market."[22]

A sustainable market definitionally needs to be self-correcting and resilient to the activities that can take place within it. The design of such a market can only come by testing the rules and finding those that do not fail. Simulation is a means to test market dynamics. The simulation of market gaming activities provides the means to test the efficacy of the market rules.

Simulation and Market Gaming:

Economists are wedded to optimization analysis-tools limited to idealized (perfect) assumptions, just as the incumbent utilities are to their optimal planning analysis-tools. Optimization works very well for regulated utilities, and the optimization approach allows economists to glean much information about market propensities. Economists focus on the equilibrium and forget about the more important issue of how to get from

[18] *(De) Regulation Follies* By S. A. Van Vactor and F. H. Pickel, March 2001, as can be found on http://www.tca-us.com/publications/pub2.htmlww.tca.com., p. 13.
[19] Restructured Electricity Markets: Three States' Experiences in Adding Generating Capacity, Report to Congressional Committees, United States General Accounting Office, May 2002, Report GAO-02-427
[20] "Restructuring the UK Energy Industries: What have we learned?," David M Newbery. *The UK Energy Experience: A Model or Warning*, BIEE/Warwick University Energy Economics Conference, Warwick University, UK, 11-12 December, 1995.
[21] Market Players in PJM Complain about Generators Withholding Power Markets Week, May 20,2002. Don't Rush the Seamstress: Second Thoughts on the Marriage of the Northeast Grids, By Marija Illic and Leonard Hyman, Public Utilities Fortnightly, Vol. 139, No. 16, September 1, 2001, pp. 28-29
[22] Tabors 1996: "Lessons from the UK and Norway", Richard D. Tabors, *IEEE Spectrum*, New York, August, 1996, pp. 45-49.

here to there. The do not ask "What forces and mechanism move the market, with its baggage from the regulated era, to a stable "equilibrium" deregulated future?"

Additionally, the economist's assumed idealizations and perfections of the equilibrium do not exist in the real world. The secondary focus should then be on how to accommodate those imperfections. Regulators, utilities, and economists are using the wrong tools (conceptually and analytically) to develop workable market rules. The field of System Dynamics focuses on causal processes that move the market toward the beneficial behavior economists suggest. It simulates the transition and the all-important impact of unavoidable imperfections that the economists neglect.

Market rules must have as their primary goal to ensure that human imperfections do not limit the functioning of markets. System Dynamics simulations include rigorous economics, engineering, physics, accounting, etc, as needed. They also naturally include human behavioral responses and the feedback interactions that drive responses.[23] Several consulting firms, such as PA Consulting Group, and several academic institutions, such as MIT, offer System Dynamics capabilities that have the pedigree and rigor needed for analyzing the dynamics of deregulation. Economists, regulators, and utilities want to continue to use the old tools that help cause the current crisis rather than use the system dynamics tools that did come close to perfect in addressing a large number of events and situations over two decades.

The recommendations that will be presented later are not opinions. They are the result of simulations that attempted to find rules that provide self-correcting behavior and stable markets. My software uses a procedure called HYPERSENS that was originally developed to deal with nuclear safety. In nuclear safety, all possible failures have to be tested but there is little enthusiasm for running actual tests on operating nuclear devices to see if safety systems could be catastrophically compromised. HYPERSENS can search for loop-holes, games, and unstable operating conditions as well as search for counter games and rules to mitigate any negative effects. There may be market alternatives that I have not considered but certainly most of the currently assumed rules are shown to be faulty, counterproductive, or destructive.

The rules can be destructive in the sense they force market participants to make the market work despite them. They are often faulty or counterproductive because they remain tied to the paradigm of the regulated past. "The message from the UK is clear. It was incorrectly assumed that the new commercial entities would continue to operate by the intent of the rules, even if not formally stated, when the new structure began. But commercial markets are commercial markets, profits are profits and any commercial advantage will be taken."[24]

---

[23] Need for feedback. Utility Corporate Models applied to the "End-Use versus Supply" decision. Dominic Geraghty, September 10, 1981.

[24] Tabors 1996: "Lessons from the UK and Norway", Richard D. Tabors, *IEEE Spectrum*, New York, August, 1996, pp. 45-49.

I do not work with specific games but rather generic games. The generic games are adequate to determine the design of market rules and guide all market participants in legal strategies to survive within that market. A convoluted game appears to only be viable if there are convoluted rules that allow it to cause damage. As such, all the games I discuss are from public documents. I know to test for types of games in the simulation because the news media, governments, and academics publish them as they occur or were conceptualized.[25] I was never made (nor wanted to be made) privy to any confidential information regarding ISO/PX rules. All the games I reported came first and foremost not from California but from the OFFER documents from the UK.[26] When California made its rules, it appears it did not accept the lessons from the UK, including the critical idea to quickly change the rules when they are found not to work. The California rules followed many of the failures already known in the UK and added additional rules to limit the economic flexibility of players. This flexibility is a critical point I will continue to stress. The additional games that appeared in my later presentations did often focus on California, but also noted games in New England, Australia, New Zealand, Argentina, etc. California and its problems dominated energy news from the beginning of its process. My public and private presentations discussed the sequence of events and that the rules had to change as the problems became evident. They were evident four years ago and still the rules have not changed adequately.

Dynamic Phases of Deregulation

Starting with an expansion of the WSCC presentation noted above, I made presentations every other year to the Northern California Power Agency's annual meeting to verify for its attendees that the deregulated-market events were not a surprise and could have been avoided. Other organizations have also asked me back to give presentations to show staff that the earlier work was passing the test of time. The dynamics of deregulation are the results of human nature and relatively simple causes and effects. This section reviews those dynamics and provides evidence of their validity.

A review of many deregulation accounts indicates the deregulation event sequence can be divided into six (albeit arbitrarily defined) phases. These are

1. Transition Control
2. Massive Market Deregulation
3. System Divestiture
4. Market Gaming
5. Re-regulation
6. Massive Consolidation

---

[25] For example, see energycentral.com archives form 1995 to the present, as well as the powermarketing.com archive. Also see, for example, "Generation Strategies for Gaming Transmission Constraints," Marija Ilic and Ziad Younes, Proceedings of the 31st Annual Hawaiian International Conference on Systems Sciences, 1998 IEEE, Pg 112-121, my 1995 report on the Dynamics of Deregulation, and footnotes 40 and 41. A review of the reports at the UCS Berkeley energy website also describes many games: http://www.ucei.berkeley.edu/ucei/pubs-pwp.html

[26] See footnote 9.

Each phase will be discussed in detail below. The phases are not strictly linear. As conceived in my work, they reflect overlapping distributions. Thus, a new phase starts before the previous phase is completed. The phases peak in sequence, but the transition from one to the other can have iterative features. For example, even during the massive consolidation phase, there may still be a group of people who continue to try to limit the deregulation process -- an act associated with the transition control phase. The current position in the US appears to be the iteration between re-regulation and gaming. The executions of these phases constitute what I call the dynamics of deregulation.

While the detail may exhibit chaotic tendencies, the overall process has a cause and effect relationship that is deterministic and robust. So far, the dynamics of deregulation and the six phases seem to be batting 1000. That is true except in one area, timing. The dynamics would have indicated that the deregulation transition would stabilize by this time and that the long-term picture would become apparent. An initial overview of the phases can be used to indicate the accuracy of the dynamics of deregulation in determining the events that have already occurred.

In the first phase of deregulation, regulators, customers, and the energy industry hope that free market pressures will alleviate the problems that confront them. They want the market to work, yet simultaneously, want to maintain control over the market. The FERC Mega-NOPR[27] was part of this phase. The dynamics indicated that the Mega-NOPR rule would be the one of many rulings, with each changing the other. FERC itself eventually came to the same conclusion. (O2K, p.26)[28]

Once deregulation has begun, however, every facet of the marketplace wants to receive the benefits of deregulation. This second phase pressure then leads to deregulation that is much more rapid and dramatic than originally anticipated. This phase is noted by efforts to protect the status quo (e.g., stranded costs) and the development of impossible, unsustainable rules (e.g., contract-path logic and the CAPX/ISO rules.) FERC Order 2000 (OK2) noted that all states were reviewing deregulation/retail wheeling (OK2 p. 16). The 1995 discussion noted that generation companies would make more money for not generating than for generating – as had occurred in the UK. FERC noted that ISO NE & CA ISO generators did profit more from not generating than generating (O2K, p.634). The 1995 effort also noted that utilities and commissions would be consumed by a scramble to protect stranded assets and that rules (such as PURCHA) would see (successful) reversal pressure. Major players would focus on activity outside of their historical service area (e.g. Mirant, Reliant, Duke, and PG&E)

As the market deregulates more in faze three, the energy industry itself develops internal conflicts. The distribution company wants to maintain a low-cost reliable supplier of energy. It also remains regulated with limited but supposedly reliable rates of return.

---

[27] FERC 1995: Federal Energy Regulatory Commission, Promoting Wholesale Competition Through Open Access Non-discriminatory Transmission Services by Public Utilities, Docket No. RM95-8-000 and Recovery of Stranded Costs by Public Utilities and Transmitting Utilities, Docket No. RM94-7-001, Notice Of Proposed Rulemaking And Supplemental Notice Of Proposed Rulemaking, March 29, 1995.
[28] O2K: FERC Order 2000, Regional Transmission Organizations, Docket No RM99-2-000, Dec 20, 1999

The generators on the other hand, must build new capacity and suffer volatile prices. These higher risks mean that generators and traders must try to increase its rate of return in the short-term so that it may accommodate any future downturns in the market. The marketing arm of the utility sees opportunities to expand its business. The transmission portion of the company finds itself in conflict with the other parts of the company -- should it focus on maximizing company profitability or the regulatory requirements of the distribution company. These conflicts force most utility companies to separate their operations into separate business units. We call this the system divestiture phase. The 1995 work indicates that this would be the beginning of weak mergers where some parties acted out of fear to consolidate (both with electric and gas partners) for safety of scale. It also noted that ISOs would first form during this period (as they did). Essentially all utilities now have separate business units as predicted. Over 27 utilities have sold their generation (O2K, p.14). My work predicted over capacity in all working markets (as FERC later discovered -- O2K, p.13). A then "outrageous" result of the modeling work was that the generation capacity would now suffer boom and bust business cycles as experienced in every other commodity. Others now agree with that assessment.[29] The 1995 work claimed there would be the need for a single transmission system "owner" (O2K p.121), and that there has to be only market-based generation and transmission (O2K, pp. 334, 335, 345-384).

As the different business units compete in the marketplace with the business units of other utilities, they struggle to find tactics and strategies that will help them survive and prosper in the new marketplace. If the rules of deregulation have a disadvantage for them, they must find tactics that limit the impact of those rules. This process is called market gaming. The 1995 work indicated that compliance monitoring would become necessary and that Australia, Amsterdam, and all newly formed US markets would see prices in excess of $1000/Mwh – routinely. Based on review of international inquiries, the 1995 work also concluded that inquires of gaming would remain unresolved in the US as well. (FERC agreed in OK2 pp.36, 53). The 1995 work indicated that there would be excessive price volatility followed by excessive political efforts to protect consumers. Price caps would come and go repetitively. Low cost producers would be hurt disproportionately (e.g., BPA, PacifiCorp). Market prices would look like anything but optimal. Retailers would fail in droves. As noted earlier, the 1995 work predicted that about 3/4ths of the way through the gaming phase there would be the current strategic litigation and political investigation efforts.

Rules only change because one party feels that another part is unfairly taking advantage of them. Those who feel they have the most to lose are the ones who most actively attempt to change the rules in their favor. As the market gaming provides benefits to the clever and punishes the passive, losing entities demand more favorable rules. Unfortunately, they usually get what they asked for. These fairer rules quickly benefit the resourceful companies and extinguish the conservative companies. This process is

[29] Dr. Andy Ford at WSU has take some of the insights of my early work to recently produce a simulation and publish numerous article that focus on the generation capacity cycles that will make the market rules even more difficult to formulate using conventional economic approaches. This work can be accessed at http://www.wsu.edu/~forda.

the 5th phase called re-regulation. This phase is not the idea of going back to regulation, but rather a complete re-assessment of past deregulation rulings to derive a (de) regulatory framework that closely approximates the final set of rules. The 1995 work on this phase showed the need for a "national grid" RTO. FERC came to the same conclusion (O2K p 242). Aggressive anti-trust efforts were noted in 1995 and remain an avenue for proposed RTO definition. The 1986 work for the State of Illinois noted this as a time of bankruptcies (as discussed earlier).

The resourceful companies then consolidate their position in the market. Part of this consolidation involves mergers and acquisitions that increase the market flexibility of the winning players. A prediction for this phase is that there will soon be only a small number of national (or international) players with many niche players. Nonetheless, only a small fraction of the initial companies (including public power entities) would then remain. Prices actually rise a bit from the average values in this phase, but they still show improvement over what they were in the beginning of phase one.

I reference the 1995 work to make the point that there were no surprises in what happened other than the ineffectual response of regulators. From 1995 to the present, the work has been revisited and reevaluated, only to find it still valid and that some vague concepts can now be filled in with more details to provide more insight.

I will now discuss each of these phases in some detail. Further information on the dynamics of deregulation is provided in the reference of footnote 3. (That 1995 work presented in the still reads well considering it is seven years old, but some aspects could use an updating.) The discussion below was produced 5 years ago and based on the 1995 work. Other than for adding clarity in some sections, it has NOT been modified beyond its original version. It reads as though it was written expressly for this testimony that focuses on recent US/CA events. The text was written to describe the deregulation in … Brazil.

Phase 1: Transition Control

The initial transition control phase is usually initiated by price or financial shocks. Customers, utilities, or governments then respond and believe that the only recourse is to deregulate the market. During the transition, there are many rumors of change but no noticeable actual change. Almost all rules and legislation are meant to protect or improve the status quo of the existing entities. In an attempt to satisfy everyone, the regulators essentially impose a set of physically impossible rules. The regulators and politicians are put in a position where they must not be seen as standing in the way of progress. They must try to produce a new letter of the law that protects the status quo as well as honoring new claims to market participation. Utilities scramble to protect their assets and demand the requirement that their past investments be recovered. A national or regional system operator or grid operator becomes a focal point of deregulation effort.

Many weak companies attempt to merge with one another in an effort to ward off the inevitable decline of their market position. In many cases, the rules of deregulation focus

on contractual rights. These contractual rights conflict with the actual flow of electricity that will take place. The transmission system and the rules of its operation then become the key factors in how the market is gamed and the sequence of future events.

Phase 2: Massive Market Deregulation

Because everyone wants to have a claim to the benefits of deregulation, a chain reaction occurs where every participant in the marketplace demands a deregulation process to their benefit. This precipitates a broader and more rapid deregulation process than was originally anticipated. Because the deregulation now has many more aspects, customers see many options and form expectations.

Many industries expect that reduced electric rates will prove their economic position but data indicates electricity has a minimal impact on macroeconomic conditions compared to other fuels. Regulators began to accept that deregulation will make their historical position unnecessary. Because of the conflicts within the energy system, legislative activity will act to reverse existing rules or to insure that the proposed rules can be implemented.

Utilities become confused and re-evaluate their business focus. Will they be in generation, distribution, marketing, or some other business? Because the volatility of the market, they focus on preserving their financial conditions rather than their market segment. Those companies that struggle to defend their current market will certainly lose. There will always be a market niche where a competitor can acquire new customers. If the original utility then further focuses on protecting that incursion on its customer base, it weakens its hold in other areas. Competitors soon have complete advantage and the defensive utility collapses in on itself. A deregulated market requires competition. Competing is an aggressive process.

Hunt argues strongly that once the genie is out of the bag, the dynamics of change push deregulation forward to its universal end that includes retail wheeling and the full divestiture of assets.[30]

Phase 3: System Divestiture

As noted earlier, the different business units of companies participate in different parts of the markets, and have different risks and goals. These goals are often in conflict with the other business units. The distribution company will take the lowest price source of energy even if it is at the expense of its sister generation company. The marketing company realizes that the only way it can expand its business is to market in other geographical areas.

---

[30] *Competition and Choice in Electricity*, by Sally Hunt and Graham Shuttleworth, John Wiley and Sons, 1996, p 61, and Hunt 1996a: Unlocking the Grid, Sally Hunt and Graham Shuttleworth, *IEEE Spectrum*, July 1996, pp. 20-25.

Customers now see the world as changing; that there is a break between the old way and the new way. The marketing companies compete aggressively and customers have many options from which to pick. The regulators are overwhelmed by all of these changes. Cross-fuel mergers become common as an effort to secure customers. Some companies decide to focus on the conventional regulated portions of the company, such as distribution and transmission, and get out of the generation and trading businesses. To help the transition, regulators may encourage or force these divestitures. Several companies are forced to focus on how to maximize their value as they exit the market as an independent entity.

Phase 4: Market Gaming

Many utilities have a difficult time making the transition from a regulated way of thinking to a competitive way of thinking. These utilities attempt to adhere strictly to the rules without consideration of how other market players will use those rules. These "fair players" provide great opportunities to aggressive market participants. The intense competition that ensues later causes prices to drop. Because of the volatility, customers require a billing process that averages out the volatility.

On a daily basis, the actual physical operation of the energy system versus the legally-defined operation of the system is so much at odds that regulators are forced rethink the entire process of deregulation. A new "minimal" set of rules is developed that localize any negative impacts of deregulation within generation and trading.

Market participants try many tactics in an effort to maintain their profitability and to prosper in the new marketplace. Just as in the game of chess, these tactics must be continually changed and refined. These tactics not only cause price volatility in the market, they cause increasing revenue volatility for the market participants. Low-cost suppliers do not necessarily win under competition. If they use their low cost to win market share, they tend to have limited margins. More aggressive companies can use their cash reserves and implement tactics that force the low-cost supplier out of business. Those assets can then be purchased for a fraction of their cost -- and then be used by the winning participants.

Phase 5: Re-Regulation

The previous phase has its largest negative impact on the suppliers. The financial failure of some of these companies can impact customers. Those companies and customers suffering the consequences of the market shakeout demand rules that they consider to be more beneficial to themselves. Ultimately, a small number of rules that focus on antitrust issues come forth. This limited number of rules allows the market to work effectively and minimize the benefit, and thereby limit the activity, of market gaming. With fewer ways to take advantage of the market, energy traders/brokers have fewer options to offer customers for reducing energy bills. This process was seen in both the airline and telecommunications deregulation in the US.

With the coming of these, now truly, free market rules, the old regime of electric utilities comes to an end. The market can now reassess the value of the remaining energy suppliers. Assets are re-priced. In many countries, a national independent-system-operator or grid company is required to maintain a sustainable, stable market.

Although it is possible that the private sector can integrate nuclear power into its routine business activities, the evidence indicates that the federal government may be required to maintain an active and costly role in ensuring the safe use of nuclear power.

Phase 6: Massive Consolidation

If we look at mature deregulated markets, we can name the top five companies in those markets. We cannot name the top ten companies because only a small number of companies can compete for the majority of the market in the long-term. There can be thousands of niche players but there can only be a handful of primary players in the market. For example, in the U.S., we can name the top five airlines but not the top ten; we can name the top five telecommunications companies but not the top ten. In some industries such as software and diamonds, there are even fewer than five industries dominating the market.

My work shows that this limited number of players does establish a relatively efficient market. The niche players are always available to step in should the dominant players increase prices far beyond efficient levels. The existence of larger companies maximizes economies of scale and keeps prices lower than they would otherwise be.

In the energy industry, this means a large number of mergers and acquisitions need to take place in most markets. Because of the price competition prior to this point, the remaining companies will need to firm up prices, to both compensate for previous losses and to insure viable financial conditions in the future. Those companies that do not participate in industry consolidation will necessarily have to decline to eventually be, either niche players or nonexistent. The existence of a few dominant players does require a substantive regulatory oversight responsibility for antitrust issues and possible market abuse.

In the early phases of deregulation, companies broke into separate business units. In this later phase of consolidation, they will reintegrate. Because the companies are again vertically integrated, albeit across different geographical areas and markets, and because no dominant player has the ability to control the market, there will be less price volatility. At this point, the deregulation transition is complete.

After the electric industry deregulation dynamics mature, electricity will be just another commodity.

It normally takes about five to seven years for the market to accommodate the transition from a regulated to deregulated condition. In the US case, lack of timely and productive regulatory intervention has added periods of damage recovery to the sequence. This does

not mean the transition is fully completed in seven years. It simply means the market would finally be on a path towards maturity. Additionally, the path taken will be circuitous and bumpy. A forward motion will often be offset by backward movement. Some rules may be reversed and then reinstated in a different form. The early experimentation to find the correct rules and guide the industry through the transition will necessarily create loopholes that cause market volatility and market gaming. Those companies adversely affected by the market volatility and market gaming will demand further changes in the rules. Because of the financial and social implications, regulators will be forced to react under pressure. No level playing field is possible. Market participants will demand changes whenever the playing field no longer tilts in their direction. The rules will change as conditions change. It is critical to consider how the rules will need to change "tomorrow" rather than to simply focus on what the rules imply "today."

What If We Really Wanted Deregulation To Work?

This section describes the results of my early and recent work on deregulation dynamics as it relates to recommendations for going forward (or revisiting the past). Recent independent support for these recommendations from various authors is provided as footnotes.

In evolution, each organism struggles against the environment and other organisms for survival. In the process, survivors acquire new characterizes that uniquely make them compatible with its situation. Those who refuse to change become extinct. Competition is not about minimizing risk and protecting the status quo; it is about improving (economic) efficiency. The rules of competition and evolution are not determined by the participants. The rules are not designed to do what is good for the participants individually but rather to do good for them in total. These interacting adversarial processes, among all the participants, produce the "good" competitive result of achieving the lower costs and prices with minimal regulatory interference.

Competition is about feedback and the interactions among the market participants. The natural selection of the market has to weed out the bad and promote the good within the marketplace. The market rules are to ensure this process takes place despite unforeseen circumstances and real world imperfections. The market and its participants learn how to protect themselves from undesirable impacts. Prices cannot be static or only move in one direction anymore than we can expect the stock market to only show upward movements everyday. The long-term trend in the stock market is up and the long-term trend in prices under deregulation is down (compared to what they would have otherwise have been). Flexible financial instruments can protect both consumers and suppliers from risk, but at a cost. The market needs to trade off its risks, costs, and benefits.

The market needs access to the full spectrum of financial options. Flexibility is again related to the process of evolution. It gives options to allow survival. Many deregulated markets, and California in particular, limited the options to a non-survivable set. Flexibility does produce inefficiencies, but those inefficiencies efficiently ensure the

market can function under all conditions in a *near* optimal manner. A machine designed to only operate at optimal conditions is only optimal for the designated optimal environment. It is generally highly sub-optimal for other conditions. A market spends very little time working perfectly.

On the point of flexibility, Kilbourne and Maxant note the market needs financial instruments in combination with physical operations. They note that modern financial instruments are still foreign to the RTO/ISO designers. " ...Exchange clearing houses employ rigorous and responsible practices that have not been comprehended by today's' RTOs."[31] The GAO also noted that the lack of flexibility was a key issue in the California problems.[32] The market simply needs to have options and the flexibility to use them. It needs to have the flexibility to find alternative approaches to overcome any problems thrown its way.

Companies need to be allowed to go bankrupt. Competition is about winner and losers, not just winners. History and economics show that there will be more winners than losers, but protecting special interests is to make certain everybody loses. The deregulation process can guarantee minimum welfare by subsidizing the underprivileged. This could be performed directly as a state function or the ISO/RTO could impose a usage fee to cover such cost – the same as distribution companies do now in many states.

Adding special protections for market participants only thwarts the benefits of competition. Deregulation needs to be allowed to work.[33] As is now widely publicized, California did not allow consumer prices to change. Economics depends on a supply demand balance orchestrated by price signals. The cardinal rule of economics was violated. Higher prices are meant to reduce demand and stimulate supply. California designed a stranded cost process based on supplying energy at variable costs (consistent with the no longer applicable regulatory past). This ensured prices would initially be too low for any developer to build. The consumer price cap, that actually reduced prices, stimulated demand. When demand start to outstrip supply, siting limitations and construction delays assured a worsening shortage. The rules made sure distribution companies had no flexibility to reduce their costs. ISO rules ensured generators would move to the hour-ahead and imbalance market because of uncertainty and congestion chaos. All the basic economic principals were violated. Essentially, all the conditions that allow a market to function and self-correct were abrogated. It would have been hard to do worse. Yet, some proposed RTO rules will additionally attempt to violate the laws of physics by preventing the RTO from performing the necessary functions to balance supply and demand under congested conditions.

---

[31] "Making Markets Work: How ISO Rules Still Cause Problems," Becky Kilbourne and Robert Maxant, Public Utilities Fortnightly, January 1, 2002, pp28-31

[32] *Causes and Lessons of the California Electricity Crisis*, Congressional Budget Office, September 2001

[33] New Zealand suffered some large sustained prices. In his Presentation on "Sustainable Markets to the APEx meeting 2001," Philip Bradley, chairman of The Marketplace Company, of Wellington, New Zealand, noted that the fully deregulated market came through huge stress, because it was deregulated -- no price cap, full retail contestability, dynamic nodal pricing, and consumer demand response.

There is little that can be done about exiting stranded cost decisions, although if state long-term contracts for power can be revisited, stranded costs "agreements" would also seem in open season. Stranded costs were and still are calculated based on the difference between the price the market would produce under idealized variable-cost pricing conditions and the price needed to recover all costs. If a developer owns a peaking unit, it may run less than 100 hours per year. Given capacity costs, a price greater than $500/MWh is needed to justify building that individual plant. In regulated times, all the capital costs were part of a "sunk-cost" rate base and only the average of all the costs showed up on the customers' bill as a fixed $/MWh charge (and occasionally, a fixed $/month charge). That logic doe not apply in deregulated markets. The market price must ultimately recover all costs plus give the signal to build new capacity by producing a price exceeding the marginal cost of a new unit.

The calculation of stranded cost should be, at best, the difference between the real price the market needs to sustain the market and the price needed to recover the contentious "regulatory-approved" investments. The assets not covered by stranded costs would be "at risk," but that is what competition is about. The current stranded cost process began as a risk-free payout to incumbent utilities. It sowed the seeds for initially producing costs too low to stimulate new capacity (competitors) and guaranteeing that demand would eventually outstrip supply with huge price impacts. It does not take a large supply-demand imbalance to produce high prices. The "conventional" stranded cost approach ensured that the market price would remain too low until the "surprise" occurred. If the stranded costs were absent or based on the expected sustainable market price, then price signals would lead to capacity investments and demand responses that would prevent market crises.

Luckily, retail choice is not as important as wholesale deregulation. There are 8760 hours in a calendar year. Each hour can require base, intermediate, and peaking capacity. Additionally, ancillary services (such as voltage control) are required. This represents many thousand of niche markets. Further, price depends on location. Price varies only because of transmission constraints. Eighty percent of the time, all WSCC wholesale markets are at one price. When congestion occurs, price varies on either side of the congestion point. The location marginal price (LMP) gives the signal to build new capacity or to improve transmission. Many authors have noted that the transmission system must be a monopoly to derive maximal economic benefits.[34] My work and that of others indicates that all regional transmission must be physically controlled by one RTO authority, including that owned by public power or under contract.[35] Any other approach allows distortions that lead to detrimental and counterproductive gaming.[36] Grandfathering can at best, be a financial consideration. All transmission owners need to

[34] *Competition and Choice in Electricity*, by Sally Hunt and Graham Shuttleworth, John Wiley and Sons, 1996, p. 184.
[35] *Transmission Markets: Stretching the Rules for Fun and Profit*, Narasimha Roa, Richard Tabors. Tabors, Caramanis and Associates, Cambridge, MA, June 2000, www.tca-us.com
[36] "Northeast Power Markets: The Argument for a Unified Grid," A study presented by Mirant Corporation, Public Utilities Fortnightly, September 1, 2001, pp. 36-45

provide the transmission to the RTO as a sale or as a lease. The owners can only maintain the asset account, much like a bank.

The RTO/ISO has to be part of the market. It needs to have the both taxation and debt authority as will be made clear shortly. If the RTO has full transmission authority, it can publish an intent to expand transmission. The response is for independent power producers to respond that they will add capacity, including the possible guaranteed direct load control or distributed generation. By "guaranteed" is meant that there is a binding contractual agreement by all parties ensuring the MW involved are available for market-use as needed or agreed. If the capacity is not forthcoming, the RTO builds the line. It can accept third party ownership but again the rights are provided to the RTO in return for a lease or some other negotiated financial agreement. Any economic or financial damage to existing generators because of the new line is deemed a non-issue. They had their chance to "prevent" the line by adding generation elsewhere. Competition is not designed to protect energy suppliers or consumers from themselves.

Current ISO/RTO rules worry about minimum ramp-up times, minimum run times, etc. It is the responsibility of the supplier to deal with the limitations of its plants. It can build added flexible capacity or merge to have a more flexible portfolio. It needs to bid into the ISO/RTO in a way that guarantees that its plants run as needed. Many base-load plants will need to bid-in below variable costs on low-load hours so that they come-online/stay-online in the manner needed for operation. Later hour prices will then rise to justify having run the plant earlier. Otherwise, the logic is to keep the plant off-line. Simulation training with realistic market models can teach generators how to bid. Portfolios can produce a collection of plants that allow any needed operational dynamics to keep plants on-line. The combination of a modest combustion turbine (CT) and a nuclear plant can even provide 100s of MW of intermediate power by having the very fast CT dynamics compensate for very slow nuclear dynamics. This is an extreme example just to make the point. A portfolio of generation resources does have geographic consideration for congestion, but the LMP allows the generator and RTO to plan and operate adequately.

As noted earlier, a very marginal CT may only be needed to serve the super peak for a few hours a year. The building of such a unit would entail large financial risks. The $/MWh bid would need to be quite high. My work shows that $1000/Mwh price should be considered routine for some peak hours (or any hours when supply and demand get tight). The work also indicates that the higher the peak power prices, the lower the average price. The high price signal promotes capacity expansion. This process leads to over and under capacity building cycles. From overbuilding, competitors have the choice to reduce bids and cover cash flow or to just go out of business. The "bankrupt" plants would not be lost to the RTO-system but rather bought by others for a "going out of business" price. The lower price of excess capacity places pressure on competitors to be more efficient and to reduce costs. When demand comes back into balance with supply, added demand pressure causes prices to rise, stimulating new capacity to restart the cycle. This is not optimal to economist but business cycles are part of real markets and serve

them well. The cycle is the mechanism for self-correction and improved long-run economic efficiency.

The idea is to keep the rules simple and let the market fix its own problems. The RTO accepts bids and determines dispatch. If a generator oversupplies, that was not the request of the RTO and it comes free. Under-generation means the generator must obtain the energy elsewhere for what ever the price required.[37] The RTO also has "economic accounting" responsibility for the "physical" operation of the system. There are minimally two economic accounting markets: physical and financial. The financial markets are contracts of any length, price, or type between generators, traders, and aggregators. (Aggregators are in some aspects similar in concept to retailers but with greater capabilities. They will be discussed more fully later.). Those financial arrangements are independent of the physical economic-accounting on the RTO side. The RTO bids are to determine how plants will be dispatched. If a generator has a financial contract, the generator is best to bid in at variable costs. That way, if another generator can supply the power for a lower cost, the generator makes more money. The generator can bid at the price of the financial contract or above, but this gives up economic opportunities. Capacity that is not covered under contract can be bid in as desired but a too high of bid may result in not being called to generate. Being accepted too often for excessively high bids would result in anti-trust leasing agreements as will be discussed below.

Similarly, aggregators must schedule power from the RTO via bids. Presumably, the generator will have a complementary bid related to scheduling power but that need not be a forgone conclusion. The aggregator bids are minimally at the hourly level while generator bids will almost assuredly have a higher resolution because of significant pricing dynamics at the sub-hour level.

With a contract, the aggregator is immune to price. It simply bids demand at essentially infinite price. The RTO guarantees the price will allow service and the aggregator sends the bill for power from the RTO to the contracted generator.[38] The generator pays the bill in return for the pre-agreed revenue from the aggregator. The generator is paid for any generation it produced from the RTO. If some of the energy was not under contract, the aggregator may set a maximum price it will pay for "X" MW for an hour from the RTO imbalance markets. It may have multiple bids in any hour for various MW levels, just like a generator, depending on other options available. The aggregator may be able to reduce load at a given price (some industry does not want the energy if it is over a given price level). The aggregator still may take some MW at any price to handle load that it cannot control and for which it has no supply contract. The aggregator may also have distributed generation resources (DG) under its controls. It can treat this as generation to bid in or it may use the DG as load control if it reduces RTO load without the need for

[37] Fines for violating RTO dispatch order would also be appropriate.
[38] A trader can also make a contract with generator and an aggregator. It then adds a minor intermediate step of accounting balancing.

RTO transmission services.[39] With proper risk management, even extreme prices have a minimal effect on average costs/prices and only act to stimulate new supply or better control of load.

A trader is simply an entity that can aggregate generation or load to provide economies of scale or economies of diversity. In that sense, the rules that apply to a generator or aggregator can apply to a trader depending on the conditions.

The imbalance energy market is then just like the rest of the market to the ISO/RTO. Note again that the RTO simply dispatches based on bids. While only allowing bids to be entered no closer than the day before the dispatch provides stabilizing features for both ramp-rate limited and fast response units, the justification for closer-to-dispatch-time bid-adjustments is still an open issue. In all cases, the close-to-dispatch-time adjustments would need to be limited to only beneficial market adjustment. The idea is not to protect the market participants (as normally argued), but to add flexibility to the market's ability to adjust to changing situations.

A state is not a market. As noted above, my work concluded at a very early date that FERC would need to focus on very large regional markets delineated by physics and economics, and not political boundaries. While there is some latitude available to states for retail market definition, there is no such latitude relative to the interstate nature of wholesale markets. Further, if the retail load affects the operations of the wholesale markets, state level specifics of retail operations must be limited more to qualification of participants rather than operational limitations. Consumer protection is a financial issue within the realm of the tax authority of the states. Market operation issues are to promote efficient competition and not to protect special interests.

While having a multi-state wholesale market would seem daunting, it appears the Western Area Power Administration (WAPA) with its multi-state reach already has the software to allow the dispatch and market processes discussed here.

By averaging costs over the year or paying an insurance premium that guarantees that price will be maintained at some predetermined value, consumers can limit their price risk as desired. They need options that they can choose to match their preferences. Competition is a democratic process. Consumers cannot opt out of the market and must be proactive. They are protected if they protect themselves. The regulatory effort may need to underwrite those options via the RTO, but intervention to directly protect

[39] The ability to aggregate many DG units to produce a large virtual power plant dispatchable via RTO requirements means that a "mini-grid" at the distribution company level must also exist. This "grid" uses the distribution lines to either transfer energy or to move the power to the main transmission lines. Preliminary analysis indicates that the mini grid does not need to coordinate with the RTO system. It merely publishes the limits on maximum MW of DG that it can accommodated by location. The aggregator can pay to have the capacity expanded dependent on siting limitations. As in the case of the RTO, a third party can add the "distribution" capacity. The DG owner pays the cost but allows the Distribution company to use the line if compensated. Because DG is distributed among multiple load centers, it helps the RTO's ability to control congestion. Therefore, the RTO could act to underwrite the debt for such distribution improvements.

consumers will only cause greater damage later by distorting the market price and making the market inefficient (i.e., yet higher prices).

This approach also means the distribution company is not the supplier of last resort. This is similar in concept to the breakup of AT&T that led to a random share-out of customers, to for example, MCI and GTE. The distribution company is primarily a wires company. It can get into the retail business if desired, but it cannot be mandated. The flexibility needs to be kept in the markets. There is a concern that aggregators (retailers) can go bankrupt. There simply needs to be a mechanism to reassign customers as needed or to allow them to reassign themselves, similar to what occurs in the telecommunications industry. The insurance fund to cover the costs of such transactions could be under the umbrella of the RTO that requires fees for participation in the market by generators, aggregators, traders, etc. The price can also be a third party function with the requirement to be "insured" or to underwrite the collection of fees, most easily accomplished as part of the RTO function.

As others have pointed out, firm transmission rights (FTR) or variants thereof, as well as the special privileges to serve native load, only lead to detrimental gaming.[40] Self-dispatch provides similar opportunities for mischief. The unbundling of the industry means the load of a service area and the generator to serve it are independent entities, only linked via the market the RTO orchestrates. FTRs do not protect consumers but rather act to protect or allow profiteering by generators. The supposed benefits of FTRs can better be provided by financial instruments. Mixing financial risk and physical operational issues together begs for abuse.[41]

Additionally, if bids are by the hour or less, a MW of capacity is the same as a MWh. The market bid needs to include fixed capacity as well as energy and other costs in one $/MWh number. The energy bids alone can act as adequate signal of supply and demand balance. Many ISO and RTO proposals still include the unnecessary capacity charges. These capacity charges are only providing additional gaming opportunities and protecting special interests without evidenced benefits to the market.

Early analyses of the CAPX and CAISO market showed that energy and ancillary service markets could not simultaneously clear. While some markets can be bid capacity more than once, such as energy, voltage support, capacity, and black start-up, most market needs are not separable.[42] Counterproductive gaming becomes a major issue when

---

[40] *Transmission Markets: Stretching the Rules for Fun and Profit*, Narasimha Roa, Richard Tabors. Tabors, Caramanis and Associates, Cambridge, MA, June 2000, www.tca-us.com and Transmission Rights and Market Power on Electric Power Networks, Paul Joskow and Jean Tirole, April 27, 2000 and Economic Analysis of Financial Transmission Rights (FTRs) With Specific Reference to the Transpower Proposal for New Zealand, by Lewis Evans And Richard Meade, New Zealand Institute for the Study of Competition and Regulation, Inc., 28 September 2001.

[41] *Assessment of ISO New England Proposed CMS, MSS, FCR, and DSB Rules*, George Backus, Policy Assessment Corporation for ISO NE, April 31, 2000

[42] Eric Hirst, March 2000, "Maximizing Generator Profits Across Energy and Ancillary-Services Markets," *The Electricity Journal* **13**(5), 61-69, June 2000. available at http://www.ehirst.com/publications.html

economic theory provides indeterminant (non-unique) solutions to the market price equation, as experienced in California and New England.

Non-productive gaming is caused by rules that do not lead to self-correction.[43] Having both ancillary service markets (other than for such items a black start-up) and an energy market can only lead to non-productive gaming. A process that does appear to work is to have the supply of ancillary services as a "tax in-kind" for the right to use the RTO/ISO transmissions lines. All transactions must go through the RTO/ISO so if a generator does not have the "right", it does not do business. This tax corresponds to roughly 2%-3% of the capacity a generator offers. Thus, if the generator offers 100 MW, it only has 97-98 Mw it can utilize as desired. The rest is for the sole use of the RTO/ISO to cover its costs and to control the system. History and preliminary analyses indicate that only 2% of running capacity is needed to relieve most congestion and to provide adequate ancillary services. While CTs have a greater ability to provide ancillary service than say a nuclear plant, the CT has a high value on the market and a nuclear plant has a lower value. Therefore, the percentage value of the tax remains reasonably equitable.[44] With direct control of 2-3% of the operational capacity, the RTO/ISO can relieve most congestion and readily control system operations.

Many of the supposed "Enron" games noted in the Sanders' Memorandum, would have no impact if the RTO could provide arbitrage. This is not arbitrage at the financial level but at the physical level with the result of a game resistant system with balanced price pressures. As noted above, the market is independently separated in the financial economic accounting and physical economic accounting. The bids for dispatch have nothing to directly do with the cost of energy to customers or contractual relationships. Supply and demand would not be linked as interdependent, balanced entities, such as was the case for California Schedule Coordinators. The RTO simply balances the total of supply and the total of demand by location as best allocated based on the dispatch bids.[45] Path dependant contracts have a physical but no financial meaning. There can be no counter-flow congestion. Based on the bids, the RTO/ISO simply provides the best allocation to minimize cost while balancing supply and demand. Congestion simply shows up as the difference in the LMP. The RTO/ISO charges for use of the transmission system. With the proposed dispatch and ancillary service process, a flat rate based on $/MW or the equivalent hourly $/MW has little impact on operation relative to

[43] Self-correction is the process by which a market player can compensate for the actions of another. Further the compensation activity is in the best interest to the one compensating, detrimental to the perpetrator of the original act, and price reducing in its overall affect.

[44] The purpose is not to develop a "fair" market; only one that self-corrects toward highly efficient operations and needs a minimal number of transparent rules.

[45] "ISO economics: How California Flubbed IT on Transmission Pricing," Laurence D Kirsch Public Utilities Fortnightly, October 15, 1998. pg 24-32 "the bottom line is that California's transmission pricing makes it needlessly difficult for its ISO to relieve congestion and makes [wholesale] prices needlessly high. "... The ISO would relive congestion through the least cost combination of the bids offered by [all] merchants, including all types of supply and load responses...

alternative, more complicated choices. The proposed separation of financial and physical markets with the proposed bid-only dispatch makes most gaming productive or benign[46].

The current design of the RTO/ISO monitoring and surveillance function has little economic value. If it were the "market efficiency" department, it could use its knowledge, not to prosecute, but to quickly publish potential gaming processes and possible counter games plus it would change the rules to make the gaming self-limiting. This would be in the form of typically relaxing rules rather then adding new rules. Every added rule can add economic distortion. The distortion allows added gaming. Again, the process is not to protect the victim, but rather to give the victim the ability to fight, compete, or game back. If the RTO/ISO additionally takes the position that it keeps limited track of financial transactions, it can post any indicated financial gaming. SEC rules alone may be adequate but the RTO will likely need to set some limited rules for financial transactions. Making traders fully aware of wash trades makes the practice benign. Regulators can decide wash trades are illegal, as in other commodities, but what is the purpose if not to protect the non-competitive?

Market power often becomes an issue associated with merger/acquisitions and with apparent run-ups in market prices. The current approaches to market power assessment serve little purpose in guaranteeing efficient market operation. Simulation (called the direct analysis of market power - DAMP) can show the capability for capacity to exercise market power. When ERCOT reviewed its deregulation options, one approach was a "forced lease." If an entity has the ability to exercise market power, the capacity (or fraction thereof) would need to be temporarily leased to others until market topology from transmission, new generator, or load changes again limited the ability to use the capacity to the detriment of the market. The capacity would be auctioned to bidders to guarantee a fair price. In tight capacity conditions, companies holding limited capacity, have the choice of bidding in or losing out. Detrimental withholding of capacity becomes a non-viable option. If price still rises, it is due to a true shortage and the price signal will provide added capacity or reduced demand to self-correct the system conditions (see footnote 33 above). This "forced lease" does not take the asset away from the owner. It merely says that if the owner wants to maintain a license to produce any power, it needs to lease the required portion to another market participant.

The same process, helps with must run conditions. Dividing up the must run unit can reduce the ability for a single owner/lease-holder to demand excess rents. Note that both of these situations are transients during the early phases of deregulation and vanishing rare occurrences in the later phases of deregulation. Under the proposed system, new capacity, reduced load, or new transmission would alleviate the situation in a reasonable time. The LMP in a given area will rise during a shortage period, but that is the correct price signal to all involved. If an aggregator finds it worthwhile to invest in capacity and load control as well as offer financial instruments to limit price increases in the short-term to retain customers, so be it. The aggregator has the same anti-trust limitations and may be required to "lease/sell" customers, load control, or capacity to a third party.

[46] Benign indicates that it only helps the position of the gamer relative to another competitor but does not adversely affect the market other than for a short term transient until other competitors compensate.

With the anti-trust lease assumption, a system with significant distributed generation becomes un-gameable in the detrimental sense. Normal minor jockeying (limited gaming) of competitors for strategic advantage is the limit of activities. These are no worse than automakers offering zero-interest loans, cereal manufacturers offering sweepstakes, and banks offering free checking. An additional 10,000MW probably would have mitigated the California crisis. California alone has nearly 20,000 MW of economically-sized, distributed generation already in place.[47] Incumbent utility bickering over the connection rules to allow the use of DG prevents its application. Modern technology can satisfy almost any reasonable rules. The use of the DG available in all WSCC (nearly 40,000MW) would have totally limited the problems of the crisis.

DG does typically have costs that exceed $150/Mwh, but it is only needed for a small number of the hours. $250/MWh is far better than sustained $5000/MWh prices. DG is also much more efficient in reducing congestion than conventional plants. Load causes congestion. For a conventional power plant to alleviate 10 MW of congestion, typically 60 to 70 MW of capacity must be reduced or re-dispatched (often called a TLR -- transmission line relief). The DG is at the load center. It can reduce the apparent load as needed. Further, it can be used to balance the transmission system and increase the effective transfer capacity of the system. If an aggregator has a large, low-cost coal plant that is constrained off,[48] having DG in the portfolio may allow the large plant to run and reduce overall market prices. If the DG is bid in well under its variable while the coal is bid in above its costs, then the added revenue would more than compensate the aggregator for the low DG bid. (This is an example of productive gaming.) DG is a critical option that gives market flexibility and limits essentially all forms of detrimental gaming.[49]

Lastly, we must consider the aggregators. The retail deregulation can only be called a failure in all markets to date. The cause is primarily stranded costs that initially keep market prices too low for retailers to find a better deal and make an adequate profit. Further, the current definition of retail is very limited. They are redundant middlemen compared to market traders. Aggregator is the term used here to capture the concept of a super-charged retailer. They focus on the customer side and are the only channel for consumers to buy electrical energy. (The distribution company is just a wires company for the current discussion.) The aggregators can also offer direct load control to the customer if the customer wants a lower price.[50] They can offer financial instruments to

[47] "Saving California with Distributed Generation," Mark, B Lively Public Utilities Fortnightly June 15, 2001 pp 14.

[48] In the proposed system, a constrained off plant receives no compensation. And a constrained-on plant sets the marginal price.

[49] "California Energy Crisis or Market Design Crisis?," Vernon Smith, Stephan Rassenti, and Part Wilson, *Regulation*, 24(3) Fall 2001 pg 57-76 "To summarize, we need to deregulate both entry [of distributed resources] and prices in our highly regulated retail power markets and allow technology to make consumer demand as responsive to prices as consumer choose to make it when exposed to the reality of time-variable supply costs."

[50] "Price Responsive Retail Demand: The key to competitive markets," Eric Hirst, Public Utilities Fortnightly March 1, 2001, pg 34-41

limit price volatility or price exposure. They can aggregate distributed generation and will certainly contract for generation directly to cover their load obligations. They are licensed by the RTO and pay insurance cost to the RTO incase anybody defaults. RTO must pay them to subsidize low-income consumers. These particular functions could be performed by the state with RTO cooperation. With load control, an economically adequate size of customer load for negotiating discounted generation contracts, and DG, the aggregator can control its costs, attract new customers, and act as a competitive counterbalance to traders and generators. Demand side management programs would often be mutually beneficial to the aggregator and the consumer. There would be no concept paying for customer to reduce load. They reduce load to avoid costs. The customer responds via a contact with the aggregator that allows direct load control or through behavioral responses directly from the price signal. The market produces transparent price signal and lets people make decision accordingly. In the proposed framework, aggregators represent a profitable and important sustainable component to the deregulated markets.

Once the services in the marketplace are unbundled, they can be rebundled, just as we see in the telecommunications industry. The unbundling resets the playing field. Generators can also be aggregators. Distribution companies can get into generation or aggregation. The anti-trust logic above limits any negative ramifications for such joint activities.

Summary

Dynamics of Deregulation

In summary, the above proposal makes the RTO the center of the market. The RTO is comparable to the SEC for the stock market. It uses a minimum of simple transparent rules. It allows gaming and ensures they are productive.[51] It places maximum pressure on competitors to perform and compete. By giving a truly independent RTO (not run by stakeholders) authority to prevent adverse market conditions, the benefits of deregulation are assured. The proposed recommendations above come not from opinion or idealized theory but from numerous analysis and workshops using the CIGMOD model where participants can test new rules and discover their implications.

The past and present deregulation efforts are fatally flawed in execution, implementation, approach, and philosophy. The design needs to focus on maximizing competition and the concomitant benefits. It needs to focus on self-correction and fault tolerance and not on perfection and impossible to realize idealizations. Gaming should be an accepted feature of the market, not a pariah to it. I believe the tools and approach described above, although completely at odds with current thinking, provides the means to ensure the dynamics of deregulation lead to a beneficial outcome.

[51] Productive implies that the games place pressure on other competitors to act more efficiently or to compensate such that further similar gaming has limited benefit. The gaming produces a draw among the competitor with possibly lower costs or negligible impact on the market.

Perot Systems

One of my business efforts over the last decade or more has been to help government regulators, consumers, utilities, ISOs/RTOs, developers, traders, etc. to plan for the dynamics of deregulation and to operate successfully within deregulation environments be they in California, New England, England, Germany, Japan, or anywhere. Perot System and I jointly marketed in this business area to leverage Perot Systems IT capabilities and my system dynamics capabilities. We were unsuccessful in our joint efforts and Perot eventually abandoned it involvement in its marketing efforts. Gaming discussions were part of the effort but did not entail promoting illegal activities or the use of any confidential information. I only used publicly known and available information with no claim to provide confidential information. In any case, I am not and never was in possession of any confidential information related to California market activities or those of any other markets.

Mr. OSE. Our last witness is Dr. Gribik, for 5 minutes.

Dr. GRIBIK. Good afternoon, Mr. Chairman and members of the committee. My name is Paul Gribik. As you know, I have experience in and am familiar with the California energy markets. Much of this knowledge stems from my employment with Perot Systems Corp.

I began working for Perot Systems as an associate in May 1995 and remained employed there until January 2001. I was hired to provide consulting to clients on energy market matters, which later included the California ISO and P X.

In March 1997, Perot Systems joined with ABB to create the ISO Alliance. Perot was the project manager and computer systems integrator, and ABB created the ISO's computer system. Perot was not responsible for drafting the ISO's protocol, nor was I. My job at the Alliance was to explain the formulation of the congestion management problem that resulted from the public WEPEX process to the computer programmers. I also read other public protocols issued by the ISO to advise the computer programmers, when asked, as to how the related elements of the market were supposed to work. I also participated in open meetings held by ISO where the progress in implementing the public protocols was discussed.

I left the ISO Alliance team in September 1997 to provide part-time assistance to the PX. At the PX I reviewed the ISO and PX public protocols so I could advise the PX on ways to ensure that their markets would work with ISO's. In addition, at the PX's direction, I interacted with market participants.

Outside of my work for the ISO and PX, I only recall having contact with two market participants through marketing efforts by Perot Systems. The first meeting that I attended was with Southern California Edison in early 1997. I did not set this meeting up, give a presentation there, or write or create any document that was given to Edison.

In October 1997, I prepared a document for and participated in a presentation to San Diego Gas & Electric. I discussed the California energy market structure and the gaming process a participant would need to employ to make strategic decisions. When I use the word "game" or "gaming," I am referring to a strategic decision-making process whereby different strategies are used to determine the risks and benefits each strategy may present, given the strategies that other participants may employ. Of course, these strategies must comply with certain market rules.

It later came to my attention that someone at San Diego Gas & Electric misunderstood some of the things I said in the presentation, and told the ISO that we were talking about proprietary information. That was not the case. At no time did I offer to disclose nor disclose any ISO or PX proprietary information.

A meeting with Enron was set for January 13, 1998, but it did not occur due to a severe snowstorm. I do not recall participating in any subsequent meeting with Enron, and I never made a presentation to Enron.

These marketing efforts, about which much has been made, resulted in no consulting work from any market participant. I believe that we were not hired by anyone because we were offering nothing more than a way to analyze the market and our knowledge of the

public protocols, nothing particularly unique. Much of the misunderstanding about the marketing efforts in which I and others at Perot engaged stems from the 44-page document that Reliant Energy turned over to the California Senate. The facts surrounding this document are laid out by full statement, but basically this document was never presented to anyone. It was not a blueprint for any type of illegal trading. It was created after the markets opened on April 1, 1998, and I have no idea how the document made it to Reliant Energy's files.

The examples of the flaws in the protocols that appear in the 44-page document regarding the real-time market and negative price problems are two of the problems I brought to ISO's and PX's attention. I also brought an additional problem to the ISO—with the ISO's default usage to their attention. All three of these were fixed before the markets opened. I recommended that the protocols be revised to address these problems, because I believe they could have enabled a single market participant to create instability in the market.

Mr. Chairman and members of the committee, I am a California resident and have paid more for my electricity and suffered the same inconveniences that other California residents have encountered. I can assure you, however, and the facts show, that neither my nor Perot Systems' work contributed in any way, shape, or form to high energy prices, brownouts, or blackouts, or other aspects of the California energy crisis.

Thank you. And, I will do my best to answer any questions you may have.

Mr. OSE. Thank you, Dr. Gribik.

[The prepared statement of Dr. Gribik follows:]

STATEMENT OF MR. PAUL GRIBIK, Ph.D.
BEFORE THE U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON GOVERNMENT REFORM
SUBCOMMITTEE ON ENERGY POLICY, NATURAL RESOURCES
AND REGULATORY AFFAIRS
JULY 22, 2002

Good afternoon Mr. Chairman and members of the Committee, my name is Paul Gribik. I have a B.S. in Electrical Engineering, a M.S. in Industrial Administration, and a Ph.D. in Operations Research. As you may know, I have experience in, and am familiar with, the California energy markets. My knowledge stems from applications of economic theory and reality to the California energy markets and from reviewing the public protocols promulgated by the California Independent System Operator ("ISO") and the California Power Exchange ("PX"). Today, I want to clarify my role at the ISO and PX through my employment with Perot Systems Corporation, and clarify the 44-page document that initiated the California Senate's present inquiry into the California energy markets.

I began working for Perot Systems as an Associate in May of 1995 and remained employed by Perot Systems until January 2001. Prior to joining Perot Systems I was employed as an energy consultant with two other companies. While employed by those entities I worked on projects for a variety of energy companies, including Pacific Gas & Electric (PG&E),

Southern California Edison (Edison), and San Diego Gas and Electric (SDG&E). I was hired by Perot Systems to provide consulting to clients on energy market matters.

My initial assignment with Perot Systems was with Southern California Edison where I provided advice on developing a contract management system. I reviewed various contracts and performed a cost-benefit analysis of the proposed contract management system. After completing my work on that project, I began a consulting assignment with the three Investor Owned Utilities (IOUs), Pacific Gas & Electric, San Diego Gas & Electric, and Southern California Edison, which had joined together to help create California's deregulated energy market. I was engaged to provide advice to a sub-team tasked with developing a congestion management system for the energy markets. "Congestion Management," as some of you may know, is simply managing the transmission of electricity across a grid that has limits on the energy flows that various elements can support - it is controlling how much electricity can flow through the wires that make up the grid that gets power from one point to another. I worked on this sub-team for the IOUs, and later for the Western Power Exchange ("WEPEX") after its formation by the IOUs.

ISO Work

In March of 1997, I was assigned to the Perot Systems team that was part of the ISO Alliance with ABB. Perot Systems was the project manager and computer systems integrator. ABB created the ISO's computer system. My job was to explain the formulation of the congestion management problem that resulted from the public WEPEX process. I explained the formulation, which was described in the public protocols, to the ABB subcontractor that was to develop the algorithms and computer codes to implement the congestion management process. I also read other public protocols promulgated by the ISO so I could provide advice to the computer programmers, when requested, as to how the related elements of the market were supposed to work. ABB programmers would then create the ISO's computer system programs that implemented the market protocols.

As is mentioned in a November 17, 1997 email that I wrote and voluntarily turned over to the California Senate Subcommittee: I had "no knowledge of the inner workings of any of the code, including congestion management." I did not "even know how to start their computer systems." I am not a computer systems engineer and I did not write any of the software code that implemented the final market rules. My only involvement with the ISO's computer systems was to test one portion of their congestion

management software, again referring to my November 17, 1997 email, "to verify that it works AS PUBLISHED."

I also participated in open meetings held by ISO and the ISO Alliance where the public protocols and the progress in their implementation were discussed with market participants, who would make their own suggestions. Perot Systems was not responsible for drafting the ISO protocols, and it was not within my job description to do so.

Part Time Work At The PX

I worked on the Perot Systems ISO Alliance team until September 1997 when I left the ISO Alliance Team to provide part-time assistance to the PX. I was asked by Jim Kritikson, then Director of Scheduling for the PX, to take an assignment to assist the PX in reviewing the ISO and PX public protocols. Mr. Kritikson asked me to advise the PX on ways to ensure that their market process would work with the ISO's system. To accomplish this task, I reviewed the PX protocols and made suggestions as to how they might be changed to improve the PX's interaction with ISO. I did not, however, write any of the PX's protocols. In addition, at the PX's direction, I interacted with market participants and advocates. The PX also told me on occasion to stop spending my time dealing with certain participants and individuals. I

continued providing consulting services to the PX, which eventually turned into a full-time assignment, until I left Perot Systems in January 2001.

Problems With ISO And PX Protocols

As I mentioned, one of my jobs was to review public protocols on congestion management. I also reviewed additional ISO and PX protocols because I believed it was important to know how the whole energy market system was going to work. In late April 1997, I discovered a problem in the ISO's public protocols dealing with the real-time market. I immediately notified the ABB and ISO personnel developing the software to implement the real-time market of this problem, and I gave them a memo in the beginning of May 1997. I was told by the ABB and ISO personnel that they were well aware of the problem, that a method of correcting the problem had been discussed during the WEPEX process, and that it would be fixed. Months later, however, when I reviewed a new version of the ISO public protocols promulgated on October 31, 1997, I discovered that this problem with real-time markets had in fact not been corrected. By then, I was providing part-time consulting services to the PX, so I immediately informed Jim Kritikson of the PX about the problem. I devised an example to show the seriousness of the problem. In the example, I showed how one large generator could cause the price in the real-time market to spike to any level that it desired. I

presented this example to Mr. Kritikson, and also to the President and to the CEO of the PX. They told me to tell the ISO, which I did as is reflected in a November 7, 1997 presentation I gave to the ISO. Because the ISO acted quickly in revising their public protocols before the market started on April 1, 1998, a large generator could not cause a price spike as described in my example.

A few months later, in the beginning of 1998, I was again reviewing public protocols, this time for the PX. I discovered another problem with the PX's zonal price protocol. I'll refer to this problem as the "Negative Price Problem." This problem, if it had gone unfixed, could have enabled even a small participant to cause the price of electricity in California to spike to $250 per MWh (the then existing price cap on the usage charge for a congested transmission line) by intentionally overloading a transmission line.

There are other elements to this problem, but essentially it was due to the fact that the PX's public protocols stated that a price within a zone or at an intertie scheduling point could not go below zero. To eliminate the problem, the PX needed to allow for negative prices so that neither a small nor a large generator could cause the price to spike to $250 per MWh. I alerted the PX to this problem when I discovered it. The PX presented this to its Board and the Board instructed the PX to discuss methods of

implementing negative prices with market participants. On or around March 23, 1998, at a open meeting the PX informed market participants about the possibility of negative energy prices in the PX through a presentation titled "Protecting Yourself in the Congestion Market[:] Adjustment Bids." In fact, at a meeting on or around March 23, 1998, Mr. Kritikson and I gave the example that appears in the 44-page document to market participants to explain why negative prices were needed and a zero price floor could not be enforced. I picked the Silverpeak intertie, a transmission line between zones, to explain this problem because out of all the interties and interzonal paths, Silverpeak had the smallest capacity and was thus, as anyone could see, an obvious location for congestion. Choosing Silverpeak for my example made it simple to illustrate that even a very small participant could create congestion and cause the Negative Price problem. Ultimately, as the ISO did, the PX acted and fixed this problem before the markets opened on April 1, 1998.

I found other problems in the public protocols that I brought to the ISO's and PX's attention. I specifically mention the real-time market and negative price problems as they are the ones I placed in the 44-page document. Before I address this document, however, there are other foundational matters that will help this Committee understand the 44-page document.

Marketing Efforts

That 44-page document stems from marketing efforts in which I and other Perot Systems employees, and Dr. George Backus of Policy Assessment Corporation, engaged. I am not certain who introduced Dr. Backus to Perot Systems, but my colleagues and I discussed with Dr. Backus how we might be able to work together. Essentially, we wanted to be able to educate market participants, as the ISO and PX were doing, and provide them with a strategic decision making process that would enable them to participate effectively in the deregulated market. Strategic decision making, in the context of a free market system, or on a battlefield, in a court room, or on a football field, can also be referred to as gaming.

When I use the word game or gaming I am referring to a strategic decision making process whereby you play out different strategies to determine the risks and benefits each strategy has in store given the range of strategies that other participants may employ. Of course, these strategies must comply with certain parameters or rules. I, and others at Perot Systems, knew the rules of the California energy markets because we were familiar with the public protocols and had considered how the various components that make up the market would interact. We also knew that since it was a market that deviated from simple economic theory, market participants

would need to make strategic decisions about how they would operate within the market. In other words, participants needed to run multiple scenarios to decide where they could derive a benefit in the form of acceptable profits on one hand, and avoid risks on the other -- that is, avoid the possibility of unacceptable costs that could destroy a market participant. Because the energy markets are so complex, a computer gaming program that would run multiple scenarios based on the public protocols - the rules and parameters governing the scenarios - was the best option in our opinion. It is my understanding that Dr. Backus had such a program. As such, we marketed, what I'll refer to as a "package," that coupled our knowledge of the public protocols with a strategic decision making process.

We attempted to market this package to Southern California Edison, Pacific Gas & Electric ("PG & E"), San Diego Gas & Electric, and Enron. I attended a meeting at Southern California Edison, but I did not set this meeting up, give a presentation there, or write or create any document that was given. In fact, I did not think Edison was a very good candidate to which to market our package because Edison had been required to sell a large portion of its generation, and regulations barred Edison from entering into new long-term energy contracts. I thought that this severely weakened its competitive position. In any event, Perot Systems, sold nothing to Southern

California Edison. I recently came to learn, however, that on his own, Dr. Backus marketed his program and consulting services apart from Perot Systems and Edison paid Dr. Backus for his program and his individual consulting services.

It is my understanding that Dr. Backus made a presentation to PG & E, but I have no first-hand knowledge of this. I do not recall preparing anything used in any meeting at PG & E, nor participating in any meeting or presentation at PG & E.

The next meeting in which I did participate, and for which I did prepare a document, was at San Diego Gas & Electric. I did not set up this meeting, but I did write the PowerPoint document Perot Systems released in its June 6, 2002 8-K filing. In that presentation I discussed the California energy market structure and the gaming process a participant would need to employ to make strategic decisions about participating in the market. I also used the real-time market problem, about which I alerted the ISO in May 1997, as an example of a problem that had existed in the public protocols as of early 1997. That problem could have presented a risk to a market participant if the protocol had been finalized as it existed in early 1997. The example was put in the presentation to show that it is important to make strategic decisions and to be aware of risks, such as the example of this risk that would have existed had

the ISO not changed the public protocols before the market opened on April 1, 1998.

It later came to my attention that someone at San Diego Gas & Electric misunderstood some of the things I said in the presentation and informed the ISO that we were talking about proprietary information. That is not the case. As I mentioned earlier, I did not have access to ISO source codes, nor do I recall having access to any proprietary information; all I had was access to and knowledge of the public protocols.

When I refer to a system, as I did in that presentation and elsewhere, I mean a market system that is composed of numerous component parts. Those component parts, if not properly fitted or designed, may lead to increased volatility, risk, opportunity for profit, and reduced efficiency. These are the types of "gaps" or "holes" that I refer to in presentations, documents, and emails. I never used the terms "gaps" or "holes" to mean confidential ISO information or some secret deficiencies in computer systems.

I was not privy to any of the conversations that subsequently took place between Perot Systems and the ISO about the complaint from San Diego Gas & Electric. I was told by someone at Perot Systems about the correspondenc but that we could continue to market our package. However, we needed to make some changes. As such, we added a disclaimer, we were clearer that we

were not offering any proprietary information, and that we were discussing the market system as based on public protocols, not a computer system. As such, I modified the presentation to be more explicit about the fact that I was only referring to the market system based on public protocols.

A meeting with Enron in Portland, Oregon was set for January 13, 1998. This meeting, however, did not occur due to a severe snowstorm that prevented everyone from being able to attend the meeting. I do not recall participating in any subsequent meeting with Enron, I never made a presentation to Enron, and to my knowledge, no one from Perot Systems ever participated in a meeting at Enron.

The marketing efforts, about which much has been made, resulted in no consulting work for any market participant because Perot Systems was never hired to perform such work. I believe that we were not hired by anyone because we had nothing more to offer than a way to analyze the market and our knowledge of the public protocols -- nothing particularly unique.

I want to emphasize that I was perfectly comfortable with our marketing efforts because I thought that there were no conflicts with the part-time work I was doing with the PX, and I was not disclosing any confidential or proprietary PX or ISO information. I did not, nor did anyone else from

Perot Systems, to my knowledge, advise anyone to engage in illegal or unethical activity within the California market systems.

The last meeting in which I participated was not a marketing presentation at all, but an educational seminar at Houston Industries, now Reliant Energy. I gave a five-hour seminar based on a 115-page presentation that I voluntarily turned over to the California Senate Subcommittee on June 18, 2002.

The 44-Page Document

Now turning again to the 44-page document, this history provides the background for the 44-page document that Reliant turned over to the California State Senate Subcommittee. The facts surrounding this document are:

- **As we informed the California Senate Subcommittee by letter on June 18, 2002, I wrote the 44-page document. I created the document after our marketing efforts had ended and after the markets opened in April 1998 in case I or someone else at Perot Systems would need such a presentation for possible future marketing efforts, which to my knowledge did not arise.**

- **I have no recollection of giving this document to anyone outside of Perot Systems.**

- **I know of no proprietary or confidential information regarding the operation of the markets to which I had access before or during the time in which I engaged in marketing efforts.**

- **The 44-page document was not part of a presentation to anyone, which is obvious since it is missing a cover page and the disclosure we told the ISO we would put in our marketing presentations.**

- **The document is not a "blueprint" for any type of illegal trading activity.**

- **All of the examples I identified in the document were problems that I discovered while reviewing the public protocols, about which I alerted the ISO and PX, and that the ISO and PX fixed before the markets opened on April 1, 1998. Again, this is evident from the obvious past tense language throughout the document.**

- **The problems in the 44-page document, about which I alerted the ISO and PX, were discussed in open meetings with market participants and in documents and other presentations such as a November 27, 1997 Harry Singh memo and in meetings related to the May 23, 1998 PX presentation titled "Protecting Yourself in the Congestion Market[:] Adjustment Bids."**

- **Finally, I have no idea how the document made it into Reliant Energy's files.**

Mr. Chairman, and members of the Committee, I am a California resident and have paid more for my electricity and suffered the same inconveniences that other California residents have encountered. I can assure you, however, and the facts show, that neither my nor Perot Systems' work contributed in any way, shape or form to increased energy prices, brown outs, black outs, or other aspects of the California energy crisis. I did not engage in any improper activity that conflicted with my obligations to the ISO and PX. I did not expose any proprietary information. I simply read public protocols

that were available to everyone. And, where I saw a problem that I thought should be changed in the public protocols, I brought it to the attention of the ISO and PX for them to fix.

Thank you for the opportunity to make this statement, and I will do my best to answer any questions you may have.

Mr. OSE. All right. We are going to start sorting through some of this stuff here.

Mr. Winter, this discussion about Perot Systems' contract and contractual constraints with the ISO, I know there was a bunch of correspondence back and forth. I want to make sure I get the timeframe correct. Perot Systems and their subcontractors worked with the ISO and PX on the melding of the software systems in what timeframe?

Mr. WINTER. OK. Let me just run back through the chronology. First off, the PX and the ISO were separated as two entities. So we have to keep those ideas kind of straight in our head, too.

The ISO signed a contract with the Alliance in March 1997. They then began the development of the software systems, and it was in late September, early October that we learned of the Perot activities. Now, all of the——

Mr. OSE. Just a second. So ABB and Ernst & Young, from March 1997 to September or October 1997, had worked on the software packages?

Mr. WINTER. Correct. And Perot was part of the Alliance.

Mr. OSE. All right.

Mr. WINTER. Now, their responsibility was to take—there were actually three major systems. The settlement system, which Ernst & Young has developed; there was an energy management system that was developed on another contract with ABB; and then there was a scheduling and pricing system that ABB developed. Well, those three all had to be integrated together and tested so that it worked as one complete, total system. And that was Perot's job was to make sure that testing was completed and that the systems all worked appropriately.

They worked up until—the start date was April 1998, April 1st, March 31st, and then their work in essence, after they did the integration, was completed. And then, they left the Alliance contract in June or July of that 1998.

Mr. OSE. So, from August or September 1997, to some point prior to April 1, 1998, Perot was working to integrate the software so that they could communicate, and they were checking for its operational efficiency. And, if there were flaws, what were they supposed to do with the information?

Mr. WINTER. Well, what we had was we had variances that we identified. And, any time something didn't connect, then we would write up a variance, and they were then responsible for getting back with Ernst & Young or ABB and correcting the code to make sure that it did work.

Mr. OSE. Did Perot do the code adjustments, or did somebody else do the code adjustments?

Mr. WINTER. I believe that ABB and Ernst & Young did the adjustments, but certainly they were working very closely with Perot to make sure that it would then work out in the testing procedures.

Mr. OSE. Who had physical control of the code?

Mr. WINTER. At that time ABB and Ernst & Young would have physical control of the code. I do not know, but I would assume that Perot also had the soft—or the code words to get in so that they could change it if it was deemed necessary. We had a process

in place where any changes would be recorded so that everyone knew what had been changed.

Mr. OSE. Changes recorded? Changes were recorded then; and the person doing the change would have to log on, put their personal identification in there so you knew who had access and who was doing the change?

Mr. WINTER. At that time I don't know whether there were personal or whether there were "blanket codes," because we were not operational. Now, when we went operational on March 31st, we did what we call a lockdown of the system; and we went in and changed all the codes so that we then had absolute control of who was coming in and what changes they were making.

Mr. OSE. Well, one of the things I am trying to get at is whether or not Perot Systems had possession or access to the codes. And, if I heard you correctly, you said you don't know.

Mr. WINTER. You are correct. I don't know. I would be very surprised if they didn't have access to the code, because, as the tester, they had to review it and see how it all fit together.

Mr. OSE. Did your contract with ABB or Ernst & Young allow for the code to be shared with other contractors?

Mr. WINTER. When you say other contractors, we had confidentiality in there. If there was another contractor working for the development of the system, then, yes, it would have been able to be shared.

Mr. OSE. Would they have to come back to the ISO to get signoff from the ISO—or the PX in the case of the PX—for sharing that code with another contractor under the confidentiality agreement?

Mr. WINTER. I don't know. My guess would be that as long as it was the Alliance—in other words, Ernst & Young, ABB, or Perot Systems, they would not; if it went beyond that, then yes, because then you get into the proprietary of software systems.

Mr. OSE. Was a record made of the code changes that occurred from August or September until going live on March 31st?

Mr. WINTER. There was certainly a variance record made of any time that we had the actual code changes. I do not know whether there was a documentation of each individual line change that may have been made.

Mr. OSE. When you say variance, do you mean the code is X; it is not compliant with what we need, so it varies from what we want, and we need to fix this?

Mr. WINTER. Correct. We had those, some 1,045 variances that we had found that needed correction.

Mr. OSE. 1,045?

Mr. WINTER. Right.

Mr. OSE. All right. And, ABB and Ernst & Young were charged with correcting those variances.

Mr. WINTER. That is correct.

Mr. OSE. Would it be—one of the things I just love about elective office is the wordsmithing. Variances, is that the same as saying there were flaws in the system?

Mr. WINTER. Yes.

Mr. OSE. OK. Thank you.

Now, did Perot's work with the Alliance end when you went live on March 31st?

Mr. WINTER. No. They continued. When you go live, you find things that you didn't know were broken, so they had to finish their reports, and they finally left in about July 1998.

Mr. OSE. July 1998. OK.

Now, you had a bunch of correspondence back and forth with Perot Systems in the late fall of 1997——

Mr. WINTER. Yes, we did.

Mr. OSE [continuing]. About the attempts to market the information that they were marketing. If I heard you correctly today, I think your testimony is that you never signed off on the fifth or sixth letter exchange saying, "Go ahead and do it." Did you ever affirmatively say, "Don't do it?"

Mr. WINTER. No, we did not. When we looked at the information that was available to us, they, in fact, were not using anything that was confidential. However, the contract does state that the parties to the contract would not do anything that would give the perception of impropriety. And, we certainly felt that outmarketing, as a knowledgeable person, ways to beat the system was not quite appropriate.

Mr. OSE. Of course, they didn't do a very good job of marketing it, did they?

Now, the correspondence that went back and forth, I know there was a discussion about the Chinese wall issue between people who were attempting to market the program to third parties and the people who were actually working with ISO and PX. There was a disclaimer requirement; there was a letter to all clients about the existence of the ethics wall and the like. Were there things that you asked for that Perot did not do in this correspondence?

Mr. WINTER. Yes. We initially had asked that they cease and desist from their marketing efforts. Later on, when we couldn't show that it was any confidential information that they were providing, then we backed off from that position and just asked for a Chinese wall and disclaimer so that no one would think that they were getting some secret information out of the development of the ISO systems.

Mr. OSE. And, presumably, that was accomplished?

Mr. WINTER. They told us that they were doing that. Yes.

Mr. OSE. OK.

Dr. Backus, in a commodity business, do you find it unusual that participants construct a game model or a gaming algorithm?

Dr. BACKUS. I take that as being a rather common exercise, where a person or a company always goes through the exercise. If it's a car manufacturer, should we have zero interest loans to stimulate demand at a given time?

I would, to my knowledge, say essentially all commodities, all industries involved with commodities, have a strategic planning organization or a marketing organization that tries to figure out how to do as best they can in the market to compete with their competitors, and that process, as Dr. Gribik has pointed out, is what we call gaming; sort of like what Beautiful Mind was about in the show about John Nash. And, it goes clear back to Antoine Carnot in 1850.

Mr. OSE. Being on the Agriculture Committee, whether it is rice or wheat or corn or soybeans, you have participants in those mar-

kets who presumably are factoring into their analysis, whether in transportation and price variances and supply and, you know, number of railroad cars and——

Dr. BACKUS. Yes. Given that my family were all farmers originally, the answer is yes. You always decide whether you wanted to hold the grain until it was midwinter, or whether you wanted to dump it on the market early. So even as individual farmers, they in a sense were doing gaming.

Mr. OSE. All right. Now, your computer model, when did you create it?

Dr. BACKUS. The original work was created for the U.S. Department of Energy as the FOSSIL2 model that was used for oil and gas deregulation starting in 1978 and used for policy through 1998. The first time that it was used in a slightly modified version was for the State of Illinois, who developed the model to take a look at deregulation in Illinois in 1986. That time period was when the new nuclear plants were going to come on, and they were worried about prices going up by a factor of three as the price shock. They wanted to see whether deregulation would help out that process. It didn't go very far, but nonetheless that model already showed the dynamics in quite good detail of what actually happened as we progressed both in the U.K., and in the United States.

Mr. OSE. How did you go about getting the algorithm figured out for your model?

Dr. BACKUS. It is almost funny to me, because we are the only ones who still use it. The idea is that if you are going to deregulate electricity, then why don't you treat it as a deregulated market, where prices attempt to clear and that people don't have perfect information, because most markets aren't perfect? Prior to that—and it is still very much that way today—everybody uses these very sophisticated optimization models that assume there is a perfect market, just like was assumed and could be assumed under the centralized command and control of the regulated markets. So the only thing that we added to our work is to say, well, market logic worked for gas, and it worked for oil, why don't we apply the same algorithm for electricity and see what happens?

Mr. OSE. And, what happened?

Dr. BACKUS. Because electricity is not stored very well, it ends up that you can have very, very volatile markets. A second part of this, that applies even when we talk about the deregulation of oil and gas, is that we tend to have a few rather large companies actually stabilize the market and a lot of niche players. In the United States, we probably still today have 4,500 electric utility players, if we take and add together all the public powers and such. The market is in no shape whatsoever to be a deregulated market.

So, what the model first showed is that we have got to have a lot of mergers and acquisitions. It also showed that during that process, that would be quite disruptive, which would also mean that people wouldn't know what supply and demand actually meant. And, as a customer, who am I buying from today or tomorrow? In fact, it is probably not unlike buying Internet services in the last couple years. We don't know whether the person is going to be there or not the next day.

Mr. OSE. So, if I understand you correctly, the unique feature of your algorithm was the factor accounting for the inability to store electricity?

Dr. BACKUS. That certainly showed up as a dominant characteristic that made things worse. The biggest thing was just a change in assumptions that now that we had a deregulated market, we would have an imperfect world where people were trying to make the best choices they could, and, in a sense, would have to make them in a hurry because we don't have the storage.

The biggest fault that I find with the current regulatory work and the past regulatory work is that the tools that were used for that analysis continued to assume an optimization approach only appropriate to a regulated market, and that's what I considered as a major failure in trying to assess what would be the impacts of deregulation within California, New England, wherever.

Mr. OSE. How did you account in your model for the initial 60 or 90-day lag in price transparency?

Dr. BACKUS. I didn't consider the 60 or 90 days. It was just the concept that I would bid, and I didn't know what the price was until after everything was done. My model actually only runs at a semiannual or annual level, so it is not worried about market day-to-day transactions. It is simply the idea of trying to deal with the idea that you don't really know what prices are, and you as consumer or as a generator have to make a decision without having price transparency.

Mr. OSE. Now, you acted as a consultant under—is it Policy Assessment——

Dr. BACKUS. Yes.

Mr. OSE [continuing]. To Perot Systems?

Dr. BACKUS. I would say the answer to that is no. Since we simply had a joint marketing effort that if it was successful, would combine my understanding of how systems worked with their IT capabilities, and that we would be able to offer a joint product to participants, whether they are commissions or the ISO or utilities, on how to best survive within that market.

Mr. OSE. So your joint venture started when?

Dr. BACKUS. It would be, I would say, mid or early 1997. It's whatever time I met Hemant while I was working at Edison—or doing consulting at Edison.

Mr. OSE. In 1996, you gave a presentation to the Western System Coordinating Council. Who was in attendance, and what did the presentation entail?

Dr. BACKUS. My guess is there was something like—I'm guessing here—1,200 people. To my knowledge, every utility and commission and consumer——

Mr. OSE. Can you name them for us?

Dr. BACKUS. Sorry, I sort of missed all of those. So, they were all there. And, the presentation is basically identical to the presentations that you probably see in the data that's on the Perot Website, which was provided to Senator Dunn. In that sense, it's sort of that one-trick pony, that the 1996 report I provided by DOE lays out in very fine detail all the different dynamics that are going to occur and how they will evolve if people aren't careful. And, as it turned out, nobody was careful.

Mr. OSE. So, in 1996, you made a presentation to the Western System Coordinating Council basically describing these potential flaws in the market?

Dr. BACKUS. Simply the dynamics of deregulation, which just simply said, if you follow the deregulation process as was followed in the U.K. and South America and New Zealand, which the United States was also following, here are the problems you are going to find. And, those problems included mergers that started up about that time; massive divestitures of the different utilities, which we saw, where they broke into their different generating and distribution groups; and certainly market gaming; and then something called reregulation that we are probably talking about right now.

Mr. OSE. Now, you gave a second series of presentations in 1997 and 1998 on this material.

Dr. BACKUS. I was probably giving presentations continuously, probably to hundreds of organizations, almost all identical.

Mr. OSE. Did they track the presentation you made to the Western System Coordinating Council?

Dr. BACKUS. Yes, they did. In fact, it was quite nice to do so, because as time is marching on, 100 percent of the forecasts that I had produced, as to where the problems would be, what would occur next, were actually occurring exactly in the sequence and timing that I had predicted.

Mr. OSE. Now, in your presentation to the Western System Council, you mentioned a game that includes a generator having an outage of one of its units in order to drive up the price for all other units.

Dr. BACKUS. Yes.

Mr. OSE. I guess the question we would have is whether you were advocating such a game in your presentations?

Dr. BACKUS. No. I was certainly not. It was simply to present that and possibly 20 other games as well that occurred in the U.K., including discussions of how to prevent those games from occurring. Again, that particular game was developed by Antoine Cournot in the 1850's, roughly, and is taught in every university in the United States. So it wasn't like a secret.

Mr. OSE. So your testimony is that you were analytical in your presentation rather than advocational?

Dr. BACKUS. Certainly. In all cases it was simply to point out here is the situation, and that both utilities and commissions must recognize that, because certainly the people who are hurt very significantly are going to be people like Edison and PG&E if those prices went up. So it was appropriate that both commissioners, regulators, and the utilities and market participants understood that problem could exist.

Mr. OSE. Now, you state in your testimony that the outage problem was a particular weakness in the California market design.

Dr. BACKUS. It was particularly troublesome simply because supply and demand were so out of balance, as Mr. Winter has pointed out.

Mr. OSE. Is this something you had also recognized in the U.K. system?

Dr. BACKUS. Yes, it was.

Mr. OSE. Now, having recognized this, did you inform the CAISO or the PUC or the PX of this problem?

Dr. BACKUS. I tried to inform the California Energy Commission of that, and certainly had the presentation in 1996 also to the Western Interstate Energy Board, which is all of the commissions. I only had limited contact with the PX and ISO, and they were up to their gills or necks in trying to get the system put up, so they weren't interested in listening to me.

Any contact that I tried to have with the CPUC did not get anywhere either, because they were busy trying to work with the different utilities to try to also get the system up and running.

Mr. OSE. OK. I have an e-mail from you to Dr. Gribik, dated May 8, 1997.

In that e-mail, you state, "I am actually trying to get the CPUC", the California Public Utility Commission, "to recognize the mess they are causing with their pricing and marketing rules, and relieve some of the restrictions so that the market can actually behave like a market."

First, I want to ask you, is that your e-mail?

Dr. BACKUS. Yes, it is.

Mr. OSE. What was the mess that you refer to that the CPUC was causing?

Dr. BACKUS. I had already been looking at the potential rules that were being developed for Southern California Edison. Within those rules, as I looked at it, already at that time it was to the point where you would say there was a 99.9 percent probability that Edison, SDG&R, PG&E, unless it got out of business, would go bankrupt.

It also said that because of the way the stranded costs were put in place, initially the prices would be too low to stimulate supply. Therefore, it gave an almost absolute certainty that the market would start to fall apart by 1999, which I also point out in the WSCC presentation, and said we should have been having this hearing in 1999 instead of now. To have waited that long——

Mr. OSE. I was not chairman then.

Dr. BACKUS. You are forgiven. Thank you.

Mr. OSE. Mr. Winter, let me ask you a couple of questions. I want to read you a couple of quotes. Obviously, I am confused here.

I hear testimony about structural issues, and I have seen the quotes about supply issues, and I have seen the quotes about abatement and conservation and all of that. Frankly, I am a little bit confused. I am trying to determine whether or not we had sufficient supply or insufficient supply, or whether it was market structure or flaws in the market structure, or something else.

I guess I would ask you, just extemporaneously, for an abbreviated response to that. Was it an issue of supply? Was it an issue of declining conservation? Was it an issue of market structure, in looking back, trying to avoid repeating that in the future?

And, I might ask all the witnesses the same question.

What is your input here?

Mr. WINTER. My input is twofold. One is clearly, if you don't have enough supply, the markets aren't going to work and the prices are going to increase. That is the way markets are supposed to work, because then that encourages people to add generation.

I think, in California, because those signals were so distorted, people were trying to guess whether there was a supply or a non-supply shortage; I think it is kind of interesting that we had our outages not during the summer when we had high loads, but during the winter when we had actually reduced loads.

So people want to read the nameplate ratings of all the generators in the area and say, obviously we had plenty of power during that timeframe. As an operator, I don't care what the nameplate rating is, I am interested in how many units are on and what is going to be my supply that day.

Mr. OSE. The nameplate rating is when you look at the turbine—it has the little brass plate on there—and it says at such and such an input, this is the megawattage generated from there?

Mr. WINTER. Right—50 megawatts, 500 megawatts, whatever. But there are so many restrictions on generators. One is, a maintenance unit is out for maintenance or has a tube leak, so it can only generate half; or units are out because the owners are financially incapable of buying natural gas.

Certainly, in the Northwest, one of the other things to remember about California is when people look at the supply, they tend to focus on just the power in California. Well, California has always imported 20 to 30 percent of its power from outside the State, so you've got to look at what is the availability out of the State.

So, structurally, when the PUC forced the investor-owned utilities to buy all their energy from the day-ahead market, they really eliminated their ability to make long-term contracts and go outside the State and in the State and tie up power. So as I look at it, that was a structural flaw.

Then we start buying in real time and not taking into account maintenance, droughts, all the other things, lack of conservation, no demand side transparency of the price, no demand and supply equilibrium being developed, and we have a horrible situation.

Mr. OSE. Dr. Cicchetti, do you have any input on that?

Dr. CICCHETTI. As I said in my opening statement, all three of the factors, supply and demand or market forces, market structural design flaws, and a form of market manipulation or gaming, all three of those were present in 2000 and 2001 in California.

On the supply side, people just did not build fast enough, mostly because the models were all forecasting need in 2001–2002, so supply was in the works, but it was not to come on-line until about 2002.

What made things worse was that the economy in California grew much more rapidly in the late 1990's than anticipated. We had a return of the California miracle, and we also had new buildings and new electronic communications in high-tech industries that had a big surge in demand, so demand was way up, and people just, quite frankly, missed that fact.

But the most important thing that caused supply and demand problems in 2000 had to do with the weather. In the West, about once every 30 years, it is very dry in the north and hot in the south. Normally, when it is dry in the north, it is cooler in the south, and when it is wet in the north, it is hot in the south. This year is a typical year for the West. It is dry in the north, it has been dry in the north, and it is a cool summer in California.

All of us, with the exception of that 1 week back in Sacramento and San Francisco, about 10 days ago, looked at the numbers and said southern California and most of the Southwest are much cooler than normal because it is a dry year. That is the normal condition, this is not just some kind of quirk, because when you cannot import the hydroelectricity from the north and it is very hot in the south, and therefore air conditioning is running, which happened in the year 2000, the summer and spring of 2000. There was effectively about an 8,000 megawatt hours of shortage created by the weather.

The California market is 40,000 megawatts in peak conditions, more or less, so 8,000 megawatts is a 20 percent shortfall. That is the big factor that caused the initial problem in the spring and summer of 2000. Up to that point, the California markets were oversupplied and prices under deregulation were much lower than they had been under regulation.

In fact, when California deregulated in 1998, there was a 30 percent excess supply, and the pricing the first 2 years of California deregulation was half of what it had been under regulation. Everybody was claiming credit for designing this wonderful system that produced prices half of what they had been previously, and this was an incredible success story.

But when that weather changed, coupled with not building the supply fast enough and not forecasting the demand growth soon enough, those things created the equivalent of the perfect supply and demand storm, which made prices jump dramatically. And, in the process, it pointed to the structural design flaw problems that I also mentioned.

Mr. Winter just talked about one of them. That is the issue of having no long-term contracts and requiring the utilities to divest. California was the only market in the world that went to deregulation with virtually 100 percent of its energy to be sold in the spot market. Every other part of the world put maybe 10 or 15 percent of its energy into the commodity or spot market; California put more than 90 percent.

Today, when California prices are once again stabilized and low, we have only 10 percent in the spot market. Back in 2000, we had 90-some-odd percent of all the energy that was in the spot market, by design. People at the time said that was foolish, silly to do, but California did it anyway.

Another structural design flaw we had was, we denied the ability of retail customers to get price signals. This caused demand to be high until the Governor convinced people there was an energy emergency, and then he talked people into conservation. But there were no price signals that anybody in California paid attention to during 2000. In fact, California retail prices, except for San Diego, were not raised until March 2001, well after the height of the energy crisis that began back in May 2000. So that was a second design flaw.

Mr. OSE. Let me go to Dr. Backus here.

Dr. Backus, do you have anything as it relates to the interrelationship on this question? Is it an issue of supply? Is it market structure? Is it lack of conservation?

Dr. BACKUS. I will always argue that, in a sense, it was market structure; and actually if we step back a ways, we can say whenever we design anything from an engineering perspective, we always include contingency planning and always stress-test that system before implementing it in the real world.

Even yet today, for the original and new rules that were made for the market in California, my guess is that, there has not been a formal process by which those rules have been tested on a computer, just as we would on an Apollo spacecraft, to make sure it can withstand all the things the market is going to throw at it. That is a major failing of how we look at determining market structures and deregulation, whether it be in California or any place in the United States.

Mr. OSE. Dr. Gribik.

Dr. GRIBIK. I think Dr. Cicchetti gave a masterful summary of the problems. There are a few things I might add, though.

One, the utilities were forced to buy on the spot markets, which can be extremely volatile, but then they had to sell to their customers at a fixed price. The price signals were never being passed through to the end user, so they had no incentive to conserve whenever supply got short. Their price was fixed.

And, as Dr. Backus said, it was very foolish, I believe, to design such a complicated system from scratch with a lot of different compromises being made, building the systems to implement it; and only testing to make sure that the systems talked to each other, you put numbers in and got the numbers out that you expected. No one sat down and said, let us simulate the operation of this market. Let us actually have teams of people play the roles of various market participants and see how this thing will actually play out, give them rewards, see what types of strategies people will employ.

If we did that, we might have been able to find some of the more egregious flaws and fix them before we actually went live with this. I thought it was rather a bit of insanity to turn over a multibillion dollar segment of the State's economy to a market design which essentially was untested.

Mr. OSE. If I might just be so bold, I want to ask you each a yes or no question. It is dangerous up here.

To those who would contend that this was simply a matter of supply, my question to each of the witnesses, and I will go from Dr. Gribik to Mr. Winter—to those who would contend that this was simply a matter of supply, would you agree or disagree?

Dr. GRIBIK. I don't think I would agree with just supply. I would say no.

Mr. OSE. That is my question.

Dr. Backus.

Dr. BACKUS. I would say "no" with big neon lights on it.

Mr. OSE. Dr. Cicchetti.

Dr. CICCHETTI. It was more than supply or a lack of supply.

Mr. OSE. Mr. Winter.

Mr. WINTER. More than supply.

Mr. OSE. I want to recognize my friend from Cleveland for 10 minutes.

Mr. KUCINICH. I want to thank the Chair for calling this hearing, and certainly our responsibilities as an oversight committee become

very important when we look at what happened in California with the manipulation of the energy market. So I appreciate the Chair's calling the hearing, and I appreciate the witnesses who are here today.

I have some questions that I would like to ask the witnesses, and in particular, start with Dr. Backus. If a yes or no answer would suffice, that would be fine, and we can just move from there.

Dr. Backus, how many meetings did you or Perot Systems hold with Enron?

Dr. BACKUS. Perot Systems held none with Enron. I made two presentations. The first was to the customers of Enron. It was in Palm Springs, and I think it was provided on the Perot Web site. I guess that would have been late 1996, probably late 1996 would be my guess.

Then I also made the same presentation, exactly the same presentation, to Enron again up at their Portland office. So both of those presentations are basically just replications of the WSCC presentation, with some minor updates for the latest breaking news as to how that presentation in 1996 was playing out as advertised.

Mr. KUCINICH. Who attended these meetings?

Dr. BACKUS. At the first meeting there were mostly just several customers there. I didn't keep track of all of them; or in fact, I kept track of one of the customers, The Northern California Power Agency, because they later invited me back to go through the process with their members in that regard. Certainly there were some executives of Enron there as well. In fact, one of them—I am trying to remember his name—Rich Davis, was there, who then invited me out to his organization out in Portland to make that presentation.

Mr. KUCINICH. Do you have any notes of the meetings? Did you take notes at the meetings?

Dr. BACKUS. No. I was just making the presentation, coming in and leaving. I had no notes.

Mr. KUCINICH. Did people have any questions at the meetings?

Dr. BACKUS. Yes, people were worried this was going to happen. My answer to them was, yes, most of these things were going to happen; the problems would occur, the market did have problems.

For the Enron—originally, as Dr. Gribik has pointed out, the original Enron meeting was supposed to be a proposal to Enron similar to that made for Southern California Edison. That did not take place—about that time, it is my understanding, is when Perot felt they were going to get the new contract and therefore really did have a conflict-of-interest problem, and decided that had to stop.

Mr. KUCINICH. Before I came to Congress, I used to do marketing strategies. I am curious, when you meet with a client and make a presentation, you mean to tell me, after that presentation your clients have questions or a prospective client has a question and you don't take notes on that?

Dr. BACKUS. In this particular case, no. I knew it could go nowhere.

Also, in my case, Dr. Gribik and I are sort of what we will call the technical nerds of this. Certainly in the Perot process there was

the vice president, Ed Smith, who was, I guess, the worldwide vice president for energy marketing, and Hemant Lall, I believe the Western States marketing. So that is the four groups, so certainly the marketing process occurred elsewhere.

Mr. KUCINICH. When you say it would go nowhere, what do you mean?

Dr. BACKUS. On my side, all I have is a simulation model that looks at things at a plant-type level; not even plants or plant units, it looks at things at a semiannual level, so it is good for strategic planning. The Portland office is a trading office. There is absolutely nothing that I know or can do that relates to that group.

Mr. KUCINICH. I am missing something here. You are acknowledged to be an expert in marketing. You meet with individuals for some purpose. It is not clear—if you say it would not go anywhere, why were you meeting with them in the first place?

Dr. BACKUS. Because, as noted, I made hundreds of presentations. I would get paid for those presentations. I was paid a half-day to simply make the presentation.

Mr. KUCINICH. Did you wonder why they wanted you to make a presentation?

Dr. BACKUS. No, I did not. Most people did find my presentation to be quite outrageous, controversial, but it sort of hit a chord.

Mr. KUCINICH. I have not been asking questions for that long, so I can't say that yet.

Dr. BACKUS. I am saying that is what I found. Basically, people were coming back to me and saying, we would like other people to hear this presentation, because it is a real eye-opener and will change the way we think about the regulation, which was actually, in many cases, my function—that I felt that was something very useful.

Mr. KUCINICH. How do people end up looking at it differently? Does that mean that they suddenly discover that, hey, there is a game here we can play?

Dr. BACKUS. I don't think that is the response. People like to argue that American corporations run on fear and greed. I like to argue they only run on fear.

Mr. KUCINICH. I think there has been evidence in the last few weeks that we have both of those covered.

Dr. BACKUS. Not that time—maybe I was naive. Most of those companies were very afraid of what was going to happen in the marketplace. I think that is what dominated most of their concerns.

Mr. KUCINICH. You were there to address their fears. Would you be surprised to learn that you also appealed to their greed?

Dr. BACKUS. No, I would not be surprised at all. In fact, I do believe that Enron—and certainly in those days it was considered as good a company as any other company in the sense of its approach to business—also needed to understand that the old methods of the regulated market no longer applied and that they had to think differently about how the system would operate, and that the experience that I had and was telling everybody about, how the markets worked everywhere, including indications they were going to work that way in the United States, that they needed to know that.

Mr. KUCINICH. When you were in these meetings, can you recall whether or not the participants discussed gaming or any gaming strategies?

Dr. BACKUS. Certainly they discussed gaming. It is more the idea of a war story, that almost everybody likes to hear. It doesn't matter whether you are at the Commission or wherever you are, they want to hear about what happened in the U.K.

In my regard there, I take it as simply that I was reporting public information. There was no discussion there to say, here is a game that you should do and this is going to make you lots of money. It was merely saying, here is the full spectrum, and here are all the problems that caused.

Mr. KUCINICH. Did you discuss self-created congestion, for example?

Dr. BACKUS. That was a line item already in the WSSC 1996 report that I talked about.

Mr. KUCINICH. Let's talk about that for a moment. Let us recreate the discussion. You can be the market strategist and I will be Enron.

What is this about self-created congestion?

Dr. BACKUS. I don't think I ever received a question like that. Note that I am not a market strategist; my work is designing simulation models. That is my expertise, as an engineer. So certainly, given that I am a one-person company——

Mr. KUCINICH. Let us talk for a moment about the simulation model of self-creating congestion. Tell me about it.

Dr. BACKUS. All I can tell you is that it exists in the U.K., it exists in any system, and that all price differentials in the market occur across congestion.

My own work, just because of your interest——

Mr. KUCINICH. Do you want to translate that? Let us say I am just a person who pays exorbitant electric rates, and I want to know how that happens, if you want to translate that.

Dr. BACKUS. If there is an abundant demand on one side of the transmission line where that load cannot be delivered by generation on that side, then the plants on the other side of the transmission line simply cannot deliver, and the price now must be determined on the side where the demand is, which could be a very high price, especially in an isolated market. So that would be what basically causes prices to rise.

Eighty percent of the time the WSSC is one market, and the price is basically uniform everywhere, and 20 percent of the time there is usually congestion somewhere, either across the Rockies, where I am, or on line 15, the north-south——

Mr. KUCINICH. The net effect of one of those self-created congestions is that a company would get paid for moving energy to relieve congestion without actually moving any energy or relieving congestion?

Dr. BACKUS. That is something I had not actually thought about trying to think——

Mr. KUCINICH. Think about it right now. What do you think?

Dr. BACKUS. The answer to that is, that is correct, but again that is not the problem. I would argue with the ISO rules—that if the ISO had the ability to dictate how that congestion would be re-

lieved, that the ISO was actually part of the market, those problems could not have occurred.

Mr. KUCINICH. Isn't it also a possibility when you are talking about creating congestion, self-created congestion, that one effect of such an action would be to create the appearance of congestion through overstating loads?

Dr. BACKUS. The answer to that is, yes, but I also have to—I can go back to the idea that I simply reported that all these things existed, reported it to everybody that it existed.

For my own work in simulation, I do not have transmission lines, so I can't really simulate that other than in a broad sense to think about it. It was merely me trying to tell everybody that this is a problem that needs to be solved within the marketplace.

It also is a rather obvious problem, that the prices change across transmission. So, again, it is not in any way informing people, especially traders, who know much more about this than I do, about how this process would work.

Mr. KUCINICH. But your awareness of this self-created congestion—are you aware now that there is a symmetry between information, according to your testimony, that you presented and the memorandum that Enron's lawyers wrote about Enron's gaming activities with respect to their Death Star strategy, which was where Enron would get paid for moving energy to relieve congestion without actually moving any energy or relieving congestion, which you've said can occur, and their load shift strategy, which is an action to create the appearance of congestion?

Dr. BACKUS. Yes. I would say roughly about 40 percent, maybe more, of the Enron games and memoranda were included in my presentations. Again, those presentations were presented to everybody very early on, long before the markets opened, in fact, and certainly everybody knew about those. They could get them from the United Kingdom, and therefore the idea was to make sure that everybody was aware that those problems could be resolved in the sense that the ISO could certainly develop rules to prevent those things from happening.

[Clarification of testimony follows:]

Policy Assessment Corporation
14604 West 62nd Place
Arvada, Colorado 80004
Office: (303) 467-3566 Fax: (303) 467-3576
e-mail: George_Backus@ENERGY2020.com

Energy, Environmental, Economic Planning

August 23, 2002

Subcommittee on Energy Policy,
Natural Resources and Regulatory Affairs
2157 Rayburn House Office Building, B-377
Washington, DC 20515
Attention: Miss Allison Freeman

Re: "California's Electricity Market: The Case of Perot Systems"

Dear Miss Freeman:

In my presentations before those to Enron and including the Enron presentations, **none** of the games noted in the "Enron Gaming Memorandum" where known, included, or discussed. It is only in later presentations, not ever presented to Enron, that discussions that may have related to those games were included, as published news articles indicated their potential existence.

Sincerely,

George Backus

Mr. KUCINICH. So, in your view, you were marketing knowledge or informing people of knowledge of legal gaming, as opposed to illegal gaming?

Dr. BACKUS. I never made that distinction. I was simply reporting all the things that happened.

Mr. KUCINICH. Thank you. Right, that is important to state. Because in a way, retrospectively, questions, Mr. Chairman, have been raised about whether or not Enron's activities have, in fact, constituted a violation of law.

That doesn't mean that you were coaching them to break the law, but it also represents the possibility that you were giving them information that they may have taken to create strategies that ran contrary to the law.

Dr. BACKUS. I suppose anybody could pick up any textbook on economics and read the Cournot's duopoly and come up with the same conclusion.

Mr. KUCINICH. It is always helpful to find people who carry the textbook along and meet with individuals who then break the law.

Dr. BACKUS. Which is why we try to talk to all the commissions and to all the customers, so that everybody knew that they needed to deal with this problem.

Mr. OSE. I thank the gentleman. Let me ask a couple of questions here.

Dr. Gribik, it is obvious, if you have possession of the algorithms and the code that ISO and PX used in their systems, it would be a competitive advantage in terms of being able to draw the algorithm out and replicate it accordingly.

Now, my question of you is did you know that CAISO had computer codes or algorithms?

Dr. GRIBIK. I did not have any access to the ISO's computer codes or algorithms, but what I had access to was the public protocols, the public tariffs, the public problem formulations that came out of the WPEX process.

Mr. KUCINICH. WPEX?

Dr. GRIBIK. The Western Power Exchange.

Mr. OSE. I just wanted to make sure we got that on the record.

Dr. GRIBIK. It was the process that was set up to develop the initial set of protocols for the ISO and the PX. So I knew the problem formulations, which were in the public domain.

I had no access to the ISO's computer codes. I didn't know the algorithms. I believe those were considered proprietary by ABB and their subcontractors.

Mr. OSE. All right.

Did you have access to any proprietary information? If so, did you share it with other Perot Systems employees or other market participants?

Dr. GRIBIK. During the time we were engaged in these marketing efforts, I know of no proprietary information that I had ever received, and I certainly didn't share any with people outside, since I don't know of any that I would have had.

Mr. OSE. So your analyses and proposals were based entirely on public information?

Dr. GRIBIK. Yes. I was reading the public protocols and trying to decide how people would operate with them, see if I could find any potential problems that I would alert the ISO and PX to.

Mr. OSE. So, for instance, if I or any of my colleagues in Congress had been schooled in this type of analysis, we could have gone and read the public protocols?

Dr. GRIBIK. Yes. I think you could have gotten the public protocols, the documents exchanged in the WPEX process, freely. You could have seen how the problems were formulated, read it through; and you would, if you were schooled in the various fields of mathematics, you would know as much as I would.

Mr. OSE. So you got probability analysis, you have algorithms, you have all sorts of things. I want to make sure I understand this very carefully. That is, you are telling me your analysis was based entirely upon public information?

Dr. GRIBIK. Yes, it was.

Mr. OSE. All right.

Dr. Backus, the input that you provided, your analysis provided to whomever your consultants were, was it based on public information in its entirety, or was there proprietary information included in your proposals and presentations?

Dr. BACKUS. There was absolutely no proprietary information. It was all publicly available, well-known information.

Mr. OSE. Were there other people who have been schooled in this particular mathematical skill, that you are aware of, who are doing similar analyses to what you were doing?

Dr. BACKUS. No, there was not. Everybody was assuming everything was perfect, whereas I started off with the position that things were maybe not so perfect.

Mr. OSE. Dr. Gribik, how about you?

Dr. GRIBIK. I know at least on one of the problems I identified and brought to the ISO, there was a problem with how the real-time market was structured. I went to the ABB programmers who were developing the software for the real-time market—and I believe there was an ISO person there at the time—and outlined the problem I saw in the protocols.

I was told by them that this process—let's see, I think I notified them around May 1, 1997. I was told by them that this problem had been identified in the WPEX process, that it had been discussed, and a solution had been developed for the problem, but that somehow it fell through the cracks.

It was kind of surprising that whenever—they told me that they would take care of it, it would be fixed, it was not my concern. I was surprised in October, October 31, 1997, the ISO published a new set of protocols. I read them and saw the same problem was still there.

So I would say, yes, people knew about the problems, but one of the big problems that was faced was that sometimes they would fall through the cracks and they would not be addressed.

Mr. OSE. Mr. Winter, one of the things that would be critical to me as a Californian is whether or not CAISO has hired such skill to help them protect, prospectively, the interests of California consumers; in other words, to keep a constant look at how the market is evolving and how it interacts with the system that we have in

terms of the ability of people who have had this training either in the marketplace or in academia, to, in effect, calculate out this question: if this happens, if that happens?

Does CAISO have that kind of service available to it?

Mr. WINTER. Yes. Very clearly, our whole Department of Market Analysis is made up of Ph.D. economists who—that is their very role, to watch what is happening in real time, whether that has market impacts.

We further implemented a market surveillance committee that is made up of Dr. Wolack and a group of other academics who then review what is happening in the market, using the data that our market development or our market analysis people pull off of real time; so that they constantly monitor the market and identify any shortfalls that happen.

Now, do we have a computer model that we go into and do experimental things? No. We tried to develop one of those in conjunction with some people from Los Alamos, and it is my understanding that we have not been able to develop one that we felt was sufficient to actually look at the future.

Mr. OSE. So you have people on staff who are gaming the system in a protective sense?

Mr. WINTER. They certainly are looking at it.

Mr. OSE. In a protective sense, trying to anticipate from where the attacks are going to come?

Mr. WINTER. Right. And as some of the other witnesses have identified, the whole development was an open process. During those processes, we would come up and say, well, what about this? People could do this or could do that.

So we would look at it, and if it appeared to be a major flaw, then we would correct it. If it was something that would raise its level to, gee, you had better watch this the first couple of weeks in the market operation to make sure people are taking care of it, we looked at those. Some of them, we recognized very clearly that we did not have the knowledge or the ability to go outside the State and see what people were doing on circulating schedules, etc. So we pointed that out to FERC many times.

Mr. OSE. Now, FERC issued an order, I think in December 1999, regarding the manner in which ISO handled market congestion.

It asked ISO to implement this particular order, and in the content of that order, there were a number of things from a rulemaking standpoint that FERC wanted to see done. Now, this corresponded quite closely to the period of time during which the then-existing 26-member board of the CAISO was replaced with the five-member board of CAISO. It is my understanding that particular order never was implemented.

Do you have any recollection of that?

Mr. WINTER. You know, we have received like 40 orders from FERC, and I would have to go back and review which one it is.

Mr. OSE. We will followup on that in writing. That is fine.

Now, I just want to go back to the point: You have people on staff, what we call really smart guys, who sit and they look at the market and they try and anticipate where the imbalances might occur, and move the system accordingly to prevent those imbalances from occurring.

Mr. WINTER. Actually, what they are trying to do is look at market design and see whether or not people are "gaming the system," and then they look at the real data that is coming in and identify those areas where we think there is market power abuse, whether or not when a line goes out, people suddenly have upped the price, the bidding price, because they said congestion will be there. They are monitoring all of those activities.

Mr. OSE. All right. Just for simplicity's sake, I am going to thank you for putting people on staff to do the anti-game thing in favor of the California consumer. I do appreciate that.

Dr. Cicchetti, in your testimony, you state, "nothing remotely illegal, unethical, or even questionable about what Perot Systems did and/or offered to do in California's markets."

Following up on Mr. Winter's comments that they even have people on ISO's staff who look at this stuff, if this kind of marketing activity that did take place unsuccessfully, is that unusual? Does it take place in other commodity markets?

Again, if there is a smoking gun here, I am trying to find it.

Dr. CICCHETTI. I think that the idea of trying to teach utility types of employees about competitive markets and about how to be armed both offensively and defensively in commodity markets was an obvious place to try to attempt to offer services, as I think Dr. Backus and to some extent Perot Systems attempted to offer this training, because the culture of those industries was that they were cost-plus engineers; and there is nothing wrong with that, but that is what they were.

They were not economists or traders. They were not used to dealing with commodities.

Mr. OSE. You are referring to the type of structure that they had previously existed?

Dr. CICCHETTI. Correct.

Mr. OSE. All right.

Dr. CICCHETTI. What happened was, when the California system was going to go not just to a deregulation market but to virtually a 100 percent commodity market, some people thought that it would be a good business to go out and teach people from this old culture how to participate and be wary of what could go wrong in this new commodity market.

What happened was that essentially nobody who tried to do that training got hired because the industry went out and hired traders from other commodities, thinking that it was easier to teach people who knew how to trade corn and rice and wheat about electricity than it was to teach electrical engineers and people who knew about the electric business in a traditional sense about commodity markets.

Mr. OSE. Why didn't the investor-owned utilities like PG&E or Southern California Edison do the same thing?

Dr. CICCHETTI. They did. In fact, I think that both the utilities in California——

Mr. OSE. You say, they did do that?

Dr. CICCHETTI. They did do that. They understood trading needed outside experts.

Mr. OSE. So the investor-owned utilities had their own, so-to-speak, gaming department?

Dr. CICCHETTI. Correct. And, certainly they had a strategy. In fact, the problems in California, I think, began in terms of the gaming, if you will, by buyers underscheduling demand in the day-ahead market of the California Power Exchange to get a lower price there for buyers, or for consumers, knowing that they might be paying a higher price in the real-time market that the ISO ran.

What happened was, after the buyers started that process—this is something we discovered and reported in the State Audit Report—that is when the sellers adopted a similar strategy. What happened was, the real-time market which was supposed to have maybe 2 or 3 percent of the total energy in the State of California flow through it, by late 2000, some 35 percent of all the energy traded in California was going through the CAISO market. They were having to go out of market, buying power from other States in the region much beyond the levels that would normally have been the case. This is where the game of megawatt laundering was discovered.

None of this—the underscheduling, which was mostly started by buyers, and megawatt-hour laundering—was something that anybody would have imagined would have been the natural evolution of this market back when Perot Systems and Dr. Backus were offering their services to teach people about what happened in the U.K. These were purely California problems, and it was the strategic buying behavior of the utilities in California that first started both the so-called "underscheduling issue," and then second, the "megawatt-hour laundering issue," that came about as a result of people trying to avoid the price cap that emerged, quite foolishly, only in California, but not in the West.

Mr. OSE. So you are saying in a "regularly functioning market" you would have buyers and sellers taking or doing offensive and defensive tactics to protect themselves?

Dr. CICCHETTI. Correct. And, even the ISO takes offensive and defensive tactics. They are not quite doing what Mr. Winter suggested.

Mr. OSE. We just got that on the record.

Dr. CICCHETTI. Mr. Winter is suggesting they are playing a defensive game. I think the ISO even plays an offensive game. I think they attempted last week on a stage I emergency to get a lower price cap in effect. The Federal Energy Regulatory Commission saw that this was at least the result, whether it was a strategy or just simply a result, and said no, we are not going to let the price cap fall below the cap that has been working pretty well since last summer, and restored the cap to $92.

Mr. OSE. I actually think the problem was when they went to $57 the supply dried up, so they had to go back to the $92.

Dr. CICCHETTI. The fear was that would happen. But I even doubt whether or not, in my mind, that the $57 was a new result as opposed to at least the possibility that the CAISO was involved in gaming the system.

In fact, I was at discussions of the market advisory group that I serve on, where we discussed just that kind of strategy and just that kind of opportunity, where the ISO could either cause prices to go lower in an emergency or take actions to keep it from going higher in an emergency.

Mr. OSE. Let me just go back for a minute. You are on the Market Advisory Committee?

Dr. CICCHETTI. Of the CAISO, appointed by Governor Davis.

Mr. OSE. Appointed by Governor Davis?

Dr. CICCHETTI. Yes.

Mr. OSE. The Market Advisory Committee is discussing how to game the market?

Dr. CICCHETTI. Both how to game it and how to be protected from gaming the market, yes. This is not some kind of—you should know that gaming is not some kind of illegal process if you play within the rules. It is a process that is meant to understand the rules, play within the rules, and protect yourself when the rules are going to work against you; and take advantage when the rules, playing within them, will allow you to get a benefit.

Mr. OSE. Which brings me to my next question for Dr. Backus.

Dr. Backus, I am in possession of an e-mail dated May 9, 1997 in which you state that a game to overbook power in the PX—and again, this is before the market is up, so certainly it is prospective—you state that a game to overbook power in the PX could be worth over $50 million to Edison; and I believe you mean by that Southern California Edison.

Dr. BACKUS. That is correct.

Mr. OSE. Can you explain the game that you are suggesting here? You can read it on the screen if you would like.

Dr. BACKUS. With one eye. Thank you. Yes, that was an important consideration. We had already very clearly determined that Edison would go bankrupt, along with PG&E, already at this very early stage before the markets opened at all.

Mr. OSE. Who is "we?"

Dr. BACKUS. Edison and myself, because we had gone through and looked at what the proposed rules looked like. My analysis said there is no way this market is going to work, and you are going to lose a lot of money in a big hurry as soon as supply and demand get out of balance and prices go up, and you cannot pass on that price.

Mr. OSE. Edison had at least one consultant telling them that they were toast?

Dr. BACKUS. Yes. At least one, but I think multiple people were already saying that they were toast.

Mr. OSE. You may want to provide me with the names of the other consultants who were telling them that, too.

Dr. BACKUS. I will try to think of who those are.

Mr. OSE. Let's go back to my question. Explain this game.

Dr. BACKUS. The process here is to try to hold off the marketplace, and also cause a little volatility so everybody could see that there was a very, very big problem encroaching on the marketplace, which actually requires a lot of things to go on, so it actually goes one way and then the other.

So the first logic—and we will go through the sequence, we already went through some of those—is that we would first overbook the market dramatically.

Mr. OSE. Overbook it on the day ahead?

Dr. BACKUS. The day-ahead market. Instead of Edison bidding in their normal amount, we would bid in much higher than we would normally bid.

Mr. OSE. Multiples thereof?

Dr. BACKUS. Multiples? Just merely a fraction. If it was multiples, it would be the end of life as we know it; just a small percentage over the amount. So that would actually cause them to see higher prices in that process, but it would also scare the generators into feeling that there was now a shortage; that Edison knew about some load that they did not, so in all their cleverness they would raise their prices in the hour ahead and in the imbalance market.

When the time actually came in the imbalance market for Edison to buy the energy—which would now be very, very expensive—it actually would sell the energy, and in so doing, its net average price would be lower than it otherwise would have been.

This would upset the suppliers.

Mr. OSE. Just a minute. Let us say you have 1,000 megawatts. Southern California said we are going to generate 1,100; and then some private generator over there says, whoa, what do they know that we don't? So they ramp up——

Dr. BACKUS. The price to a very large value. I mean, it might be 100——

Mr. OSE. Then they bid into the hour-ahead market. Accordingly on the next day, in anticipation of the tight supply, then all of a sudden, 100 megawatts worth of scheduled demand goes poof?

Dr. BACKUS. Actually, it is different than that. In those days you could sell the demand back into the ISO as if it was generation, because you essentially own that generation from the day-ahead market. So you were——

Mr. OSE. So Southern California Edison then puts money in its pocket for that increment that it sells into the hour-ahead market?

Dr. BACKUS. Yes. On that, it only needed the 10,000 megawatts. So therefore the net average price they had to pay was much less, so it could survive a little bit longer.

Now, this would certainly upset the suppliers. So the next day, if you would think they were not too clever, you would grossly underbid and all the suppliers would say, oh, my gosh, Edison must know there is a storm coming and the market is useless, we have to keep our plants running, so bid your minimum cost into the hour-ahead market and into the imbalance market just to keep our plants running, because we cannot stand to shut down nukes and coal plants.

So now Edison, when it finally comes to be the day ahead, really does demand a lot of energy, but the price is low so they are still better off.

Mr. OSE. So the rules of the marketplace allowed this phantom demand to be entered into the market?

Dr. BACKUS. There was the hope that was the case. It was on the books. To my understanding, Edison then went to the general counsel who then went to the CPUC, and the answer was no, they would not allow that.

Mr. OSE. You went to whom?

Dr. BACKUS. The general counsel of Southern California Edison.

Mr. OSE. Whose name is?

Dr. BACKUS. I think it was Mr. Forney at that time, I don't remember his first name, or somebody in his group.

They went to the CPUC to ask whether this would be a legitimate process, or do we have to actually bid in, as Dr. Gribik pointed out, the 90 percent into the PX market and another 3 into the day-ahead, and the rest of the imbalance or whatever the numbers are, whether they could actually make this a variable number to try to prevent prices from going up. They would not go bankrupt and not see these huge prices on the marketplace.

My understanding is that the answer came back that no, the CPUC would look disfavorably at that. So Edison—and actually I had managers who were ready to cry, saying it really is hopeless for us.

Mr. OSE. So this request of the CPUC was made between May 9, 1997 and March 31, 1998?

Dr. BACKUS. Yes.

Mr. OSE. Do you know to whom the request was made at the CPUC?

Dr. BACKUS. No. When I brought up the process they said we will check on it, and several months later I heard back to say they would not go forward.

Mr. OSE. How many months later?

Dr. BACKUS. It could have been after the markets started. I simply don't remember the concept of what the timing was. I just know they said that they would check it out. They came back later at a visit I had taken there and said, by the way, it was not allowed, so therefore we are in bad shape.

Mr. OSE. At that point, the Edison people with whom you were working——

Dr. BACKUS. Their strategy then became—which is the strategy I believe they pursued—they said, our only hope is to become the perfect victim; that is, we will do nothing to defend ourselves, we will do nothing on offense, we will just simply ride this through and hope that California bails us out when all this is said and done.

Mr. OSE. If I understand you correctly, Edison took the precaution of hiring consultants who would help them, from a financially defensive standpoint, game the system for protective purposes; and then the California Public Utility Commission said, that is all great, but you can't do that?

Dr. BACKUS. That is correct. In fact, I understand—and maybe Dr. Gribik has more examples of this, of many other cases where perfectly legitimate gaming processes were proposed—and the statement was, no, you will follow the rules this way.

Mr. OSE. The CPUC not only prevented investor-owned utilities from entering into the forward contract market after August 1999, but then they also basically emasculated them in terms of defending themselves financially by reversing the game on the guys who were just hammering them?

Dr. BACKUS. Yes. In fact, I always called it the wolf, because you always knew every day—the generator always knew exactly how much demand was going to go on the day-ahead market and can do whatever they wanted to stop them.

Mr. OSE. This was a function of the rules and regulations under which the ISO market operated, or the PX market operated?

Dr. BACKUS. Now it gets to be a little more complicated, because you could have designed different rules, like allow a forward market——

Mr. OSE. My next question was, was anything ever done to fix that? I may direct that to Mr. Winter.

Dr. BACKUS. To my knowledge, nothing. Certainly, again, starting very early, we were showing all sorts of problems. Dr. Gribik was trying to show problems. Many of those problems were already obvious almost immediately when the market opened.

To my knowledge, nobody was fixing the problem. I mean, that my yelling and screaming when I went everywhere to commissions, hundreds of presentations, to try to wave the flag to say these are big problems, you should fix them. It is all right to make mistakes, but the bigger problem is when you don't fix them. That is what was going on in California.

Mr. OSE. It is your testimony between May 9, 1997 and March 31, 1998, Edison knew they were going to get hammered? They had figured it out?

Dr. BACKUS. Yes. So did PG&E. My closing remark to PG&E was, "In 4 years you will be bankrupt," which was not a very good selling pitch, but nevertheless that was the truth.

Mr. OSE. Mr. Winter, your perspective, please.

Mr. WINTER. Well, certainly I am not aware of any activities between Edison and PG&E and the PUC. I would not be privy do that.

I guess I am a little curious. The first 2 years we very clearly saw a market that was extremely beneficial to the investor-owned utilities. They certainly made back a large portion of their stranded costs during that timeframe. So in the beginning, even though we were monitoring the market and were aware of some of these programs or games, if you will, they obviously were not being played to any extent.

As other people pointed out, clearly when we started getting into the demand and supply preliminaries is when things took off and became very unstable.

I guess beyond that, I am not too clear on exactly what was being proposed and what was not being proposed.

Mr. OSE. Dr. Cicchetti.

Dr. CICCHETTI. Dr. Backus talked about one of the things that the CPUC said could not be done, which was the game that was a complicated game, where you would overschedule in the day-ahead market so as to create conditions of instability in the real-time energy imbalance, or CAISO market, and to be able to make money as a utility trading.

The CPUC—and it is my understanding that it agrees with Dr. Backus—said, "no, you can't do this." But the CPUC didn't stop the utilities in California from underscheduling, as opposed to overscheduling, in the day-ahead market.

And, in fact, it was the underscheduling of the utilities in terms of saying they wanted to buy less than they really needed in the day-ahead market that caused this incredible shift of the energy supply in California onto the backs of the CAISO, which had the

responsibility in real time to make certain that there would be sufficient power that caused them to go out of State, out of market, out of sequence, and to do literally anything that it took to keep the lights on.

It was when that happened, in conjunction with the supply demand imbalance or gap, if you will, that things literally in November or December 2000 went absolutely into these chaotic prices that we are all aware of, when the price of electricity jumped from the level it had been in 1999 of $25, I think Congressman Waxman said, to over $1,000.

It was this strategy of gaming on behalf of the buyers, followed then by a matched strategy on the part of the sellers, that shifted the burden onto the California Independent System Operator. And I think the numbers were in December 2000 for the CAISO to have to meet 35 percent of the total energy requirements of California, when it was designed to be about maybe 2 or 3 percent on the extreme, and certainly not anything like the 35 percent the CAISO had to find the ability to go out and acquire the electricity for California.

This, of course, also set up—because of price caps put into effect in that same period in the CAISO market only for California market participants—this caused the so-called megawatt hour laundering practices to begin where either the municipal utilities in California or out-of-State entities could either buy power or take their power that they would have otherwise sold to the CAISO, but to sell it roundabout back into the State at a much higher price and avoid those price caps.

Both of these problems are things that in the State Audit Report we pointed to: the underscheduling and the megawatt hour laundering. Eventually the Federal Energy Regulatory Commission went ahead and took steps to prevent those kinds of things from happening.

They continue to take steps, as recently as this week at the Federal Energy Regulatory Commission, to modify the rules, now having a restriction on a single bid price, which the CAISO proposed as to get around the kind of gaming between markets that we saw back in 2000.

So it is like a train wreck that occurred in 2000 in the California energy market. Many things have been fixed. It is not safe to say there will never be another train wreck, but many of the things that were done in 2000 and in 2001 are now prohibited by the actions of the Federal Energy Regulatory Commission; after the fact, to be sure. But this is preventative in terms of keeping things that happened as they occurred back then from happening again. You can't megawatt hour launder, you can't game the system through bidding between markets or different prices between markets. There are penalties for underscheduling that have some bite in them, and there are prohibitions against the so-called overloading congestion lines that are associated with Enron.

These are fixes that have been made, but the fundamental problems are still potentially present, except for the fact that now the market is mostly a long-term market and less volatile, because so much of the energy is under a long-term contract.

Mr. OSE. Dr. Cicchetti, in your opinion, had the California Public Utilities Commission allowed the investor-owned utilities to enter into long-term contracts, pursuant to their requests in August 1999, would our difficulties ever have arisen?

Dr. CICCHETTI. There would have been high prices because of supply and demand conditions, just as there was in the Midwest in 1999. But the Midwest, when they had the high prices in 1999, had about 85 percent or so of the energy that was under long-term contract, or owned by the midwestern utilities. Therefore the high prices, when they flew up, only affected 10 to 15 percent of the market. They got the same headlines as California, but they did not cause the same damage in terms of bankrupting the utilities or causing the States in the Midwest to have to come in and buy the power.

Mr. OSE. Your point is not only the ability of the long-term contract, but that portion of the total portfolio that had to be purchased in the day ahead market?

Dr. CICCHETTI. Exactly. That is the thing that eventually caused California as a State to step up and sign both the purchase contracts as well as enter into its own long-term contracts. Because unlike the utilities, California as a State was able to enter into long-term contracts beginning, as they did, in February or March or so of 2001.

Mr. OSE. I want to be clear; Mr. Winter, neither of those decisions or rules are jurisdictional to ISO? Those are both PUC regulations?

Mr. WINTER. That is correct.

Mr. OSE. All right.

Dr. Gribik, in your opening statement you mentioned that on several occasions you brought market design flaws to the attention of the ISO and the PX. According to what you have given us, you alerted ABB of a design flaw in the real-time market in early May 1997. I have a document, document No. 11.

And then, when you noticed the problem had not yet been fixed, you made a November 7, 1997 presentation to the ISO explaining the flaw, and that is document No. 12.

[The information referred to follows:]

Memorandum

From: Paul Gribik
To: File
Date: May 6, 1997
Subject: Gaming Issues and BEEP (Revised and Extended Version)

1.0 INTRODUCTION

The method of defining ex-post prices in the balancing energy market can lead to unstable or wildly fluctuating prices. It can also provide the parties playing in the markets with opportunities to "game" the system. The Trustee has had consultants looking at gaming and efficiency issues in the forward energy markets run by the PX and the forward transmission markets run by the ISO. To date, I am not aware of anyone looking at such issues in the real-time balancing energy market. However, it is likely that someone will look at this area.

In this note, I will briefly sketch one possibility for gaming the real-time market. This is not meant to be a detailed description of an actual scenario. It is only meant to illustrate a potential problem area. The problem I will illustrate arises from a discontinuity between the sets of players and bids in the forward energy markets and the set in the real-time balancing energy market. To simplify, I will only consider the hour-ahead market and the real-time market.

In the hour-ahead time frame, each SC essentially runs its own energy market according to its own rules. We will assume that there is no transmission congestion to simplify the example. Each SC schedules its generation according to its rules in its own hour-ahead market. In the real-time balancing energy market, the ISO runs a single market to balance the real-time energy in the entire system. Many different parties converge in this market. The SCs can bid adjustments to energy from sources that were scheduled in their individual hour-ahead markets. They can also bid energy from resources that were selected to provide ancillary services but which were not scheduled to generate in their hour-ahead markets. The bids may come from:

- supplemental energy bids (positive or negative adjustments) from sources scheduled in the SCs' forward markets
- supplemental energy bids (positive adjustments) from sources **not** scheduled in the SCs' forward markets
- energy from AGC sources (positive or negative adjustments) that were scheduled to produce energy in the SCs'forward markets
- energy from spinning reserves (positive adjustments only) that were **not** scheduled to produce energy in the SCs'forward markets
- energy from nonspinning reserves (positive adjustments only) that were **not** scheduled to produce energy in the SCs'forward markets
- energy from replacement reserves (positive adjustments only) that were **not** scheduled to produce energy in the SCs'forward markets

The combined set of these real-time energy resources are not to be dispatched to the point at which total energy costs are minimized in real-time. Instead, we are to work from the SCs' schedules from their forward markets. If more energy is needed in real-time than was scheduled in the forward markets, the cheapest additional energy available from the combined set of all real-time sources is to be used. If less energy is needed in real-time than was scheduled in the forward markets, the most expensive energy scheduled from the combined set of all real-time sources is to be backed down. Marginal costs are not clearly defined in such cases. The approach that BEEP follows can lead to gaming.

2.0 GAMING EXAMPLE

Consider an example with the PX and one SC. Suppose that the PX schedules loads of 10,000 MWh in its hour-ahead market and an equal amount of generation. Suppose that the SC forecasts its load as 5,000 MWh in its hour ahead market. I will look at two cases and the strategy that SC could follow in each to increase its profits at the expense of the PX.

2.1 CASE 1

Let's assume that SC has detected a pattern in the PX's operations. The PX tends to **under-forecast** its loads in situations similar to the current conditions. Assume that SC can forecast with a fair degree of accuracy that the PX will under-forecast its load by 1,000 MWh.

In its hour-ahead market, SC schedules an additional 1,100 MWh of load. Suppose that SC schedules:

Load = 6,100 MWh
Gen1_SC = 5,000 MWh
Gen2_SC = 1,100 MWh

The PX schedules:

Load = 10,000 MWh
Gen1_PX = 5,000 MWh
Gen2_PX = 5,000 MWh

In the real-time balancing energy market, SC submits the following strangely priced supplemental energy bid:

$0 \leq$ Gen2_SC $\leq$ 1,100 MWh @ \$1/kWh

In the real-time balancing energy market, the PX submits the following more realistically priced supplemental energy bids:

$0 \leq$ Gen1_PX $\leq$ 5,000 MWh @ \$0.05/kWh
$0 \leq$ Gen2_PX $\leq$ 10,000 MWh @ \$0.06/kWh

In real-time:

PX's load is 11,000 MWh which exceeds its scheduled load in its hour-ahead market by 1,000 MWh.
SC's load is 5,000 MWh which falls below its scheduled load in its hour-ahead market by 1,100 MWh.

2.1.1 BEEP Dispatch

The total system load in real-time is 100 MWh less than the load (and generation) which was scheduled by PX and SC combined in their hour-ahead markets. The ISO will call on the supplemental energy bids to reduce generation. BEEP will call on the most expensive resource to back down. This is Gen2_SC. Gen2_SC will be backed down by 100 MWh to 1000 MWh. It sets the price for balancing energy equal to $1/kWh.

Settlements for Balancing Energy in the BEEP Dispatch and Pricing

PX Generation:
PX generates 10,000 MWh in real -time and had scheduled generation of 10,000 MWh in its hour-ahead market. Its scheduled generation equals its real-time generation. PX's payments to the balancing market due to mismatch between scheduled and real-time generation = $0.

PX Load:
PX load is 11,000 MWh in real-time and had scheduled load of 10,000 MWh of load in its hour-ahead market. The PX consumes 1,000 MWh of balancing energy for which it pays the ISO $1/kWh * 1,000 MWh * 1,000 kWh/MWh = $1,000,000.

PX Net:
PX pays $1,000,000 to ISO for net 1,000 MWh of balancing energy it consumes.

SC Generation:
SC generates 6,000 MWh in real time and had scheduled generation of 6,100 MWh in its hour-ahead market. Its real-time generation falls short of its scheduled generation by 100 MWh. It buys replacement power to cover this shortfall from the ISO for $1/kWh * 100 MWh * 1,000 kWh/MWh = $100,000.

SC Load:
SC's load is 5,000 MWh in real time and it had scheduled load of 6,100 MWh in the hour-ahead market. Real-time load falls short of scheduled load by 1,100 MWh. SC sells this excess through the ISO's real-time balancing energy market. The ISO pays SC $1/kWh * 1,100 MWh * 1,000 kWh/MWh = $1,100,000 for this energy.

SC Net:
SC receives $1,000,000 from ISO for net 1,000 MWh of balancing energy sold in the real time balancing market.

Effect of SC's Strategy if BEEP Dispatch and Pricing were Used by ISO:

SC was able to game the system to sell very high priced energy to the PX (1,000 MWh at $1/kWh). The SC is able to set the price to an arbitrarily high level.

2.1.2 Real-Time Market Clearing Dispatch

To see that SC was able to game the system to sell high priced power to the PX, look at the prices and dispatch that would have occurred if the ISO were to clear the real-time energy market. To clear the real-time balancing energy market, the ISO would make the following changes to the dispatch:

Gen1_SC = 5,000 MWh
Gen2_SC = 0 MWh
Gen1_PX = 5,000 MWh
Gen2_PX = 6,000 MWh

Gen2_PX is now the marginal unit in the real-time dispatch. It sets the market price to $0.06/kWh.

Settlements for Balancing Energy in Real-Time Market Clearing Dispatch

PX Generation:
PX generates 11,000 MWh in real -time and had scheduled generation of 10,000 MWh in its hour-ahead market. Its real-time generation exceeds its scheduled generation by 1,000 MWh. The PX sells this energy to the ISO's real-time balancing energy market. The ISO pays the PX $0.06/kWh * 1,000 MWh * 1000 kWh/MWh = $60,000.

PX Load:
PX load is 11,000 MWh in real-time and had scheduled load of 10,000 MWh of load in its hour-ahead market. The PX consumes 1,000 MWh of balancing energy for which it pays the ISO $0.06/kWh * 1,000 MWh * 1,000 kWh/MWh = $60,000.

PX Net:
PX pays $0 to ISO for net 0 MWh of balancing energy.

SC Generation:
SC generates 5,000 MWh in real time and had scheduled generation of 6,100 MWh in its hour-ahead market. Its real-time generation falls short of its

scheduled generation by 1,100 MWh. It buys replacement power to cover this shortfall from the ISO for $0.06/kWh * 1,100 MWh * 1,000 kWh/MWh = $66,000.

SC Load:
SC's load is 5,000 MWh in real time and it had scheduled load of 6,100 MWh in the hour-ahead market. Real-time load falls short of scheduled load by 1,100 MWh. SC sells this excess through the ISO's real-time balancing energy market. The ISO pays SC $0.06/kWh * 1,100 MWh * 1,000 kWh/MWh = $66,000 for this energy.

SC Net:
SC pays $0 to ISO for net 0 MWh of balancing energy.

2.2 CASE 2

Again, assume that SC has detected a pattern in the PX's operations. The PX tends to **over-forecast** its loads in situations similar current conditions. Assume that SC can forecast with a fair degree of accuracy that the PX is over-forecasting its load by 1,000 MWh.

In its hour-ahead market, SC schedules 1,100 MWh of load less than it [illegible] serve. Suppose that SC schedule in its hour-ahead market is:

3,900 MWh of load
Gen1_SC = 3,900 MWh
Gen2_SC = 0 MWh

The PX schedule in its hour-ahead market is:

10,000 MWh of load
Gen1_PX = 5,000 MWh
Gen2_PX = 5,000 MWh

In the real-time balancing energy market, the SC submits the following strangely priced supplemental energy bid:

$0 \le$ Gen2_SC $\le$ 1,000 @ $0/kWh

In the real-time balancing energy market, the PX submits the following more realistically priced supplemental energy bids:

$0 \le$ Gen1_PX $\le$ 5,000 @ $0.05/kWh
$0 \le$ Gen2_PX $\le$ 10,000 @ $0.06/kWh

In real-time:

PX's load is 9,000 MWh which falls below its scheduled load in its hour-ahead market by 1,000 MWh.
SC's load is 5,000 MWh which exceeds its scheduled load in its hour-ahead market by 1100 MWh.

2.2.1 BEEP Dispatch

The total system load in real-time is 100 MWh more than the total load (and generation) which was scheduled by PX and SC combined in their hour-ahead markets. The ISO will call on the supplemental energy bids to increase generation. BEEP will call on the cheapest resource to increase. This is Gen2_SC. Gen2_SC will be increased by 100 MWh to 100 MWh. It sets the price for balancing energy equal to $0/kWh.

Settlements for Balancing Energy under BEEP Dispatch and Pricing:

PX Generation:
PX generates 10,000 MWh in real -time and had scheduled generation of 10,000 MWh in the hour-ahead market. Its scheduled generation equals its real time generation. Payments to balancing market due to mismatch between scheduled and real-time generation = $0.

PX Load:
PX's load in real-time is 9000 MWh and it had scheduled a load of 10,000 MW in its hour-ahead market. The PX's real-time load falls short of its scheduled load by 1,000 MWh. The PX sells this energy through the ISO's real-time balancing energy market. The ISO pays the PX $0/kWh * 1,000 MWh * 1,000 kWh/MWh = $0 for this 1,000 MWh of energy.

PX Total:
The PX receives $0 from ISO for net 1000 MWh of balancing energy the PX sells.

SC Generation:
SC generates 4,000 MWh in real time and it had scheduled generation of 3,900 MWh in its hour-ahead market. Its real-time generation exceeds its scheduled generation by 100 MWh. It sells this excess 100 MWh on the ISO's balancing market for $0/kWh * 100 MWh * 1,000 kWh/MWh = $0.

SC Load:
SC's real-time load is 5,000 MWh and it had scheduled a load of 3,900 MWh in its hour-ahead market. SC's real-time load exceeds its scheduled load by 1,100 MWh. SC buys this 1,100 MWh through the ISO's real-time balancing energy market. It pays the ISO $0/kWh * 1,100 MWh * 1,000 kWh/MWh = $0.

SC Total:
Pays $0 to ISO for net 1,000 MWh of balancing energy it consumes.

Effect of SC's Strategy if BEEP Dispatch and Pricing were Used by ISO:

SC is able to game the system to obtain 1,000 MWh of free energy from the PX.

2.2.2 Real-Time Market Clearing Dispatch

To see that SC was able to game the system to obtain 1,000 MWh of free energy, look at the prices and generation levels that would have occurred if the ISO were to clear the real-time energy market. To clear the real-time balancing energy market, the ISO would make the following changes to the dispatch:

Gen1_SC = 3,900 MWh
Gen2_SC = 1,000 MWh
Gen1_PX = 5,000 MWh
Gen2_PX = 4,100 MWh

Gen2_PX is now the marginal unit in the real time dispatch. It sets the market price to $0.06/kWh.

Settlements for Balancing Energy under Market Clearing Dispatch and Pricing:

PX Generation:
PX generates 9,100 MWh in real -time and had scheduled generation of 10,000 MWh in the hour-ahead market. Its real-times generation falls short of its scheduled generation by 900 MWh. The PX buys this as replacement energy on the ISO's balancing energy market and pays the ISO $0.06/kWh * 900 MWh * 1000 kWh/MWh = $54,000.

PX Load:
PX's load in real-time is 9000 MWh and it had scheduled a load of 10,000 MW in its hour-ahead market. The PX's real-time load falls short of its scheduled load by 1,000 MWh. The PX sells this energy through the ISO's real-time balancing energy market. The ISO pays the PX $0.06/kWh * 1,000 MWh * 1,000 kWh/MWh = $60,000 for this 1,000 MWh of energy.

PX Total:
The PX receives $6,000 from ISO for net 100 MWh of balancing energy the PX sells on the ISO's balancing energy market.

SC Generation:
SC generates 4,900 MWh in real time and it had scheduled generation of 3,900 MWh in its hour-ahead market. Its real-time generation exceeds its scheduled generation by 1,000 MWh. It sells this excess 1,000 MWh on the ISO's balancing market for $0.06/kWh * 1,000 MWh * 1,000 kWh/MWh = $60,000.

SC Load:
SC's real-time load is 5,000 MWh and it had scheduled a load of 3,900 MWh in its hour-ahead market. SC's real-time load exceeds its scheduled load by 1,100

MWh. SC buys this 1,100 MWh through the ISO's real-time balancing energy market. It pays the ISO $0.06/kWh * 1,100 MWh * 1,000 kWh/MWh = $66,000.

SC Total:
Pays $6,000 to ISO for net 100 MWh of balancing energy it consumes.

2.3 POSTSCRIPT TO EXAMPLE

There may be ways for an SC to cause the PX to over or under schedule load in its forward markets. There is nothing to prevent a large consumer/generator from buying some of its energy from a UDC and self-providing the rest. Such a party could act as an SC for part of its load. The UDC would have to forecast the portion of that party's load that the UDC must serve and include it in its bid to the PX. Such a consumer could easily induce forecasting errors in the UDC's forecast by shifting demand [illegible] between

- that which it self-provides, and
- that which the UDC provides.

It would need two meters and the ability to direct load to be served from its "SC" meter to its UDC meter and *vice versa*.

3.0 POSSIBLE FIX

[illegible] problem may be a bit [illegible] gaming opportunities. After all, [illegible] maximize their profits. Developing strategies to maximize profits may be viewed [illegible] positive. What we want to eliminate are incentives that induce [illegible] revising the protocols to eliminate one problem, we must be sure that the fix does not open even worse gaming opportunities.

The real time dispatch problem is not a static optimization problem. That is, we are not looking at a single "snap-shot" or point in time. We actually have a control problem in which time is an important variable. For example, we may minimize costs over an hour period. Within the hour, want to find:

- The dispatch of each resource in each five minute interval in the hour
- Take into account dynamic characteristics that limit changes in operating point from one five minute period to another (e.g. ramp rates)
- Meet changing loads over the hour
- Take into account dispatch of each resource at the start of the hour and the desired dispatch of each resource at the end of the hour (targets).

Solving an optimization problem that treats coupled time periods (e.g. 5 minute periods in an hour) is theoretically and practically possible. However, we most likely could not have such a system in place in 1998. As such, we should look for simpler problems that will give us reasonable performance but which are closer to currently available software. Today's economic dispatch software only looks at a single point in time. We will restrict ourselves to looking at similar formulations.

Our goal is to develop rational market prices for energy purchased and sold on the ISO's real-time balancing energy market. The goal is to use marginal cost based pricing for this market. As in congestion management in the forward markets, we can not define stable and appropriate marginal costs unless we dispatch the ISO's balancing energy market to minimize costs subject to appropriate constraints.

In the real-time balancing energy market, we cannot impose market separation constraints between the different scheduling coordinators. The ISO will not have the metering and telemetry that would be needed for such an approach. Consequently, the ISO's real-time balancing energy market must operate as a pool.

This is not to say that the entire California market structure is a pool. There will be separate forward energy markets for the different SCs and the PX. These [illegible] in their forward markets according to there own rules. They compete for transmission in the ISO's transmission forward markets to support these energy (and ancillary services) schedules. The SCs and the PX may voluntarily bid some of their resources to the ISO's real-time balancing energy market. Once these resources are bid to the ISO, the ISO will adjust their dispatch as in a pool. Only the real-time balancing energy market is a pool.

To start, we will ignore interzonal congestion.

We will [illegible] t_{12}, where t_0 is the start of the hour and t_{12} is [illegible] period, we will know the dispatch [illegible] t_{s-1}.

For the revised real-time dispatch, we must have forecasts of load plus losses at the end of the hour. This forecast may be updated at the start of each five minute period:

$Hour\_Req^{t_s}_{forecast}$ the forecast at t_s of requirements (load plus losses) at the end of **hour**.

We must also have a measure of the load plus losses **at the start of a five minute period**:

$Req^{t_{s-1}}_{actual}$ the load plus losses at t_{s-1}.

The ISO will calculate a forecast of the load plus losses that it will be serving by the end of a five minute period:

$$Req^{t_s}_{forecast} = Req^{t_{s-1}}_{actual} + \left(\frac{Hour\_Req^{t_s}_{forecast} - Req^{t_{s-1}}_{actual}}{(12 - s + 1) \cdot 5\,\text{min}} \right) \cdot 5\,\text{min}$$ = the forecast made at t_{s-1} of the requirements (load plus losses) that will exist **at the end of period s**.

PSC 0074

For scheduling coordinator k (SC k), we will have resources (generation and load reductions) that were scheduled in the forward markets. These are assumed to operate as scheduled in the forward markets:

$SP_{k,i}^{t_s}$ is the scheduled effective real power generation from resource i ($i \in \mathbf{SG}_k$) at t_s. This should be constant across all t_s in the hour.

$SR_{k,j}^{t_s}$ is the scheduled reduction of demand for load j ($j \in \mathbf{SL}_k$) at t_s. This should be constant across all t_s in the hour.

Scheduling coordinator k (SC k) may bid resources (generation and load) that the ISO can adjust to meet real-time balancing market needs. We will model these as additional logical resources that are separate from the resources that SC k scheduled in the forward markets:

$P_{k,i}^{t_s}$ is the effective real power generation from resource i ($i \in \mathbf{AG}_k$) at t_s.

$P_{k,i}^{\min} \le P_{k,i}^{t_s} \le P_{k,i}^{\max}$ for $i \in \mathbf{AG}_k$ is the adjustment range bid by SC k

$Ramp_{k,i}$ is the ramp rate for real power generation from resource i ($i \in \mathbf{AG}_k$).

$c_{k,i}^{G}(P_{k,i})$ is the convex price function for effective generation from resource i

$R_{k,j}^{t_s}$ is the reduction of demand for load j ($j \in \mathbf{AL}_k$) at t_s.

$R_{k,j}^{\min} \le R_{k,j}^{t_s} \le R_{k,j}^{\max}$ for $j \in \mathbf{AL}_k$ is the adjustment range bid by SC k

$Ramp_{k,j}$ is the ramp rate for load adjustment from load j ($j \in \mathbf{AL}_k$).

$c_{k,j}^{D}(R_{k,j})$ is the convex price function for reducing load j.

The ISO solves a small extension of the standard economic dispatch optimization problem to dispatch and price real-time balancing energy:

$$\min \sum_{k=1}^{K}\left(\sum_{i \in \mathbf{AG}_k} c_{k,i}^{G}\left(P_{k,i}^{t_s}\right) + \sum_{j \in \mathbf{AL}_k} c_{k,j}^{D}\left(R_{k,j}^{t_s}\right)\right)$$

subject to

$$\sum_{k=1}^{K}\left(\sum_{i \in \mathbf{AG}_k} P_{k,i}^{t_s} + \sum_{j \in \mathbf{AL}_k} R_{k,j}^{t_s}\right) = \mathrm{Re}\, q_{forecast}^{t_s} - \sum_{k=1}^{K}\left(\sum_{i \in \mathbf{SG}_k} SP_{k,i}^{t_s} + \sum_{j \in \mathbf{SL}_k} SR_{k,j}^{t_s}\right)$$

$$\max\left\{P_{k,i}^{\min}, \left(P_{k,i}^{t_{s-1}} - Ramp_{k,i} \cdot 5\min\right)\right\} \le P_{k,i}^{t_s} \le \min\left\{P_{k,i}^{\max}, \left(P_{k,i}^{t_{s-1}} + Ramp_{k,i} \cdot 5\min\right)\right\}$$
$$\text{for } i \in \mathbf{AG}_k; k = 1,2,\ldots,K$$

$$\max\left\{R_{k,j}^{\min}, \left(R_{k,j}^{t_{s-1}} - Ramp_{k,j} \cdot 5\min\right)\right\} \le R_{k,j}^{t_s} \le \min\left\{R_{k,j}^{\max}, \left(R_{k,j}^{t_{s-1}} + Ramp_{k,j} \cdot 5\min\right)\right\}$$
$$\text{for } j \in \mathbf{AL}_k; k = 1,2,\ldots,K$$

Since this is essentially the standard economic dispatch problem, this formulation should greatly simplify the development of systems for 1/1/98.

To price balancing energy, we can simply find the resource that is on the margin in the real-time balancing energy market.

This pool formulation of the real-time balancing energy market should simplify the treatment of real-time congestion management. We could merge these constraints into the DC OPF used for interzonal congestion management in the forward markets. We would also remove the market separation constraints. The result would be a transmission constrained economic dispatch problem. This problem could be solved to dispatch the balancing energy market and develop locational marginal costs. The same software that is being developed for interzonal congestion management could be used to solve this problem.

The size of the DC-OPF formulation could possibly pose problems in solving it every five minutes. In this case, we could shrink the formulation to [illegible] replace the DC power flow formulation by a network flow formulation [illegible] adequate (particularly if the interzonal network is radial). We would then solve the much smaller problem using highly efficient network flow software.

Consequences of the Imbalance Energy Market Protocols

Paul Gribik

Impact of the Structure of the Imbalance Energy Market

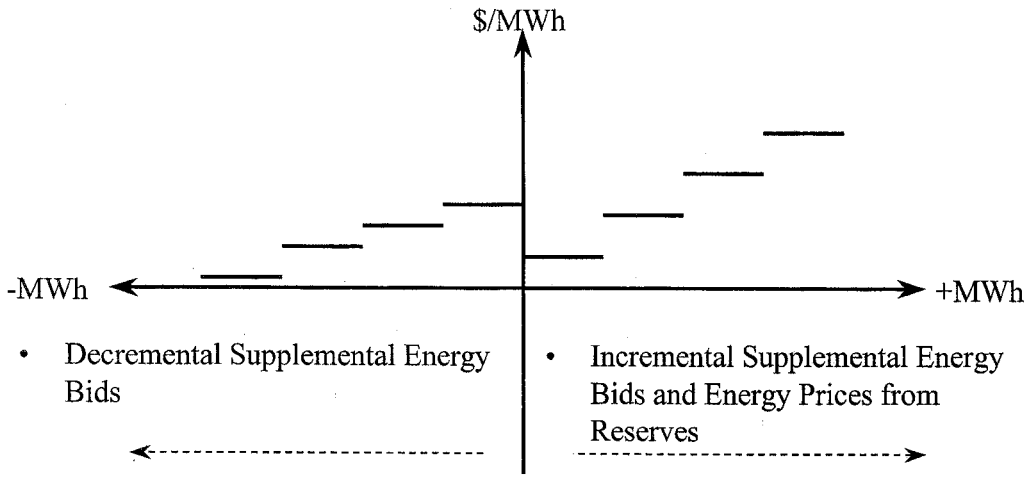
- The ISO's protocols for buying, selling, and pricing imbalance energy may invite strategies that could destabilize the market
- Points covered in this presentation
  - The operation of the market
  - A simple example of a strategy to take advantage of the structure
  - The effects on participants, the PX and the ISO
  - Possible foundation for a fix

ISO Real Time Dispatch

- To minimize the cost of providing imbalance energy:
  - If additional energy output … is needed, the ISO shall dispatch additional output or reduce demand from generating units, loads or system resource in ascending order of their incremental … bids.
  - If the ISO is required to reduce energy output … the ISO shall dispatch down generating units and system resource in descending order of their decremental … bids.
  - In the event that the ISO subsequently needs to decrement output, it will initially decrement the generating units or systems resources incremented previously, and then continue down the merit order of the decremental bids.

    (ISO Tariff 2.5.22.6)

Merit Order Stack

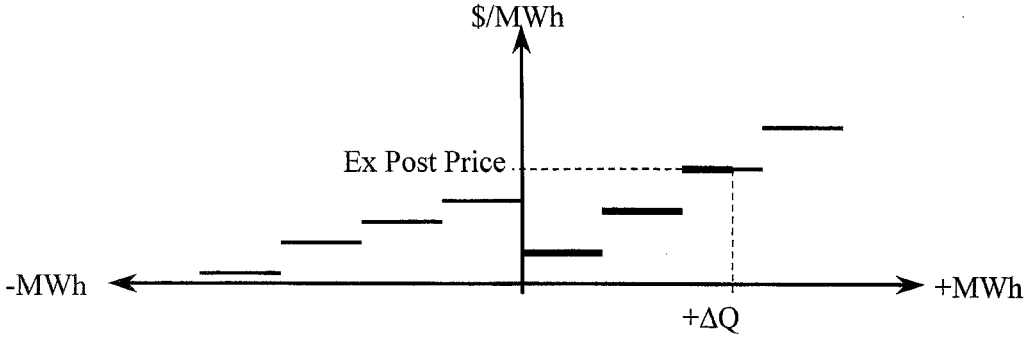


Pricing Imbalance Energy

- The five minute ex post price shall be based on the bid of the marginal generating units, loads and system resources dispatched by the ISO … in each five minute period.
- The marginal generating unit, load or system resource dispatched in the five minute period is:
  - if generation output is increased, or demand reduced, the generating unit, load or system resource with the highest bid that is accepted by the ISO for incremental generation or demand reduction;
  - if generation output is decreased, the generating unit or system resource with the lowest bid that is accepted by the ISO for decremental generation.

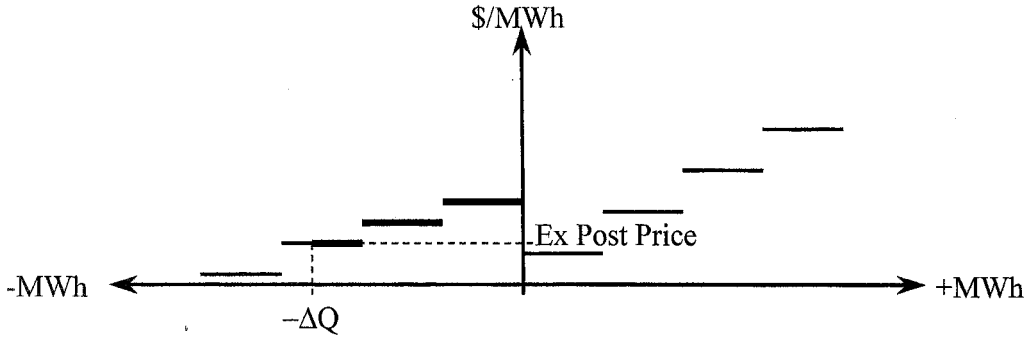
  (ISO Tariff 2.5.23.1)

Ex Post Price when Output is Increased



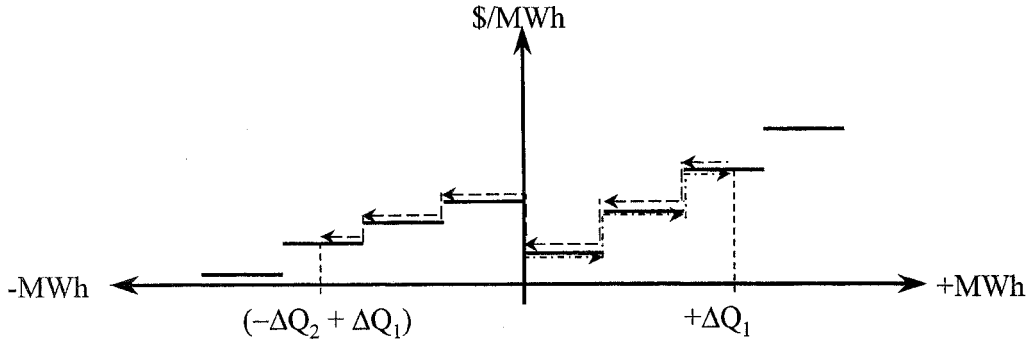
- Additional energy of ΔQ is needed
  - ISO dispatches the incremental resources with available energy in order of increasing bid price
  - Ex Post price is price of most expensive resource dispatched

Ex Post Price when Output is Decreased



- Reduction of energy (−ΔQ) is needed
  - ISO dispatches the decremental resources with available reduction in order of decreasing bid price
  - Ex Post price is price of least expensive resource dispatched downward

Output Increases then Decreases in Hour



- Increased output of $+\Delta Q_1$ followed by decrease of $-\Delta Q_2$ within the hour with $\Delta Q_1 < \Delta Q_2$

Controlling the Real-Time Market

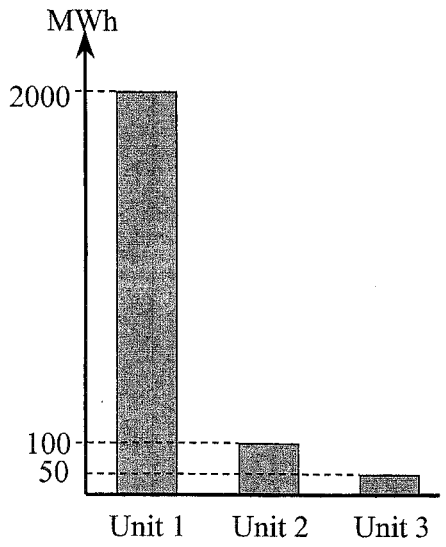
- The structure of the real-time imbalance energy market permits strategies by which a participant
  - can control the ex post price
  - dump power on the real time market
  - cause wild swings in the ex post price

Simplified Example

- Participant P1 has three generation units
  - Unit 1 with operating limits of [100 MW, 2000 MW]
  - Unit 2 with operating limits of [100 MW, 2000 MW]
  - Unit 3 with operating limits of [50 MW, 100 MW]
- P1 bids to sell 2150 MWh in the forward market (for 1 hour)
  - P1 intentionally forgoes the chance to sell an additional 1950 MWh in the forward market
  - P1 will use this capacity to control the ex post price and sell high-priced imbalance energy

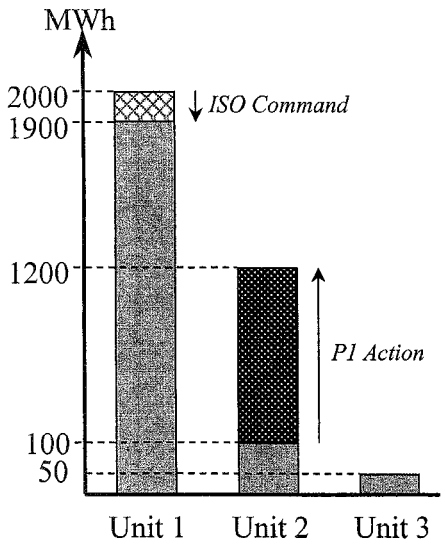
Schedule and Supplemental Bids

Schedules from Forward Market



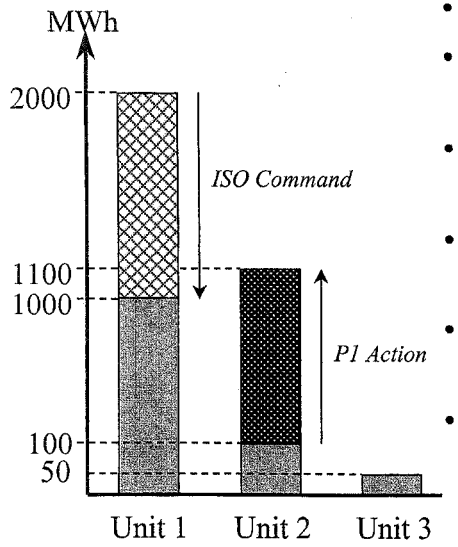
- Supplemental Energy Bids
  - Unit 1: Decremental only
    $10,000/MWh for $100 \leq x \leq 2000$
  - Unit 2: No Bid
  - Unit 3: Incremental Micro Bids
    \$ 0/MWh for $50 \leq x \leq 55$
    \$10/MWh for $55 \leq x \leq 60$
    - •
    - •
    - •
- Suppose that Unit 1 submits highest priced decremental bid to ISO

Case 1: ISO Needs Additional Energy



- Suppose ISO needs 1,000 MW more
- ISO will use incremental bids (including Unit 3 which gives P1 information)
- P1 starts to increment Unit 2 on its own
- ISO first backs down previously incremented units
- Unit 2 reaches a point at which ISO will have decremented all previously incremented units and starts reducing the highest priced decremental bid (Unit 1)
- P1 sells 1,000 MWh in imbalance energy market
- Ex post price set by last unit decremented ($10,000/MWh)
- P1 is paid $10,000,000.

Case 2: ISO Must Reduce Output



- Suppose ISO must reduce by 1,000 MW
- ISO will use decremental bids and back Unit 1 down by 1000 MW
- P1 would have to pay the ISO $10,000,000 to replace Unit 1's output
- P1 eliminates this risk by simultaneously increasing Unit 2 by 1000 MW
- P1's total real-time output is at scheduled value, so P1's net payment to ISO is $0
- ISO has problems
  - Imbalance persists
  - ISO leans more on AGC
  - ACG capacity requirements increase so ISO must buy more
  - Ancillary Service costs increase

Disguising the Strategy

- P1 can disguise this strategy in different ways, e.g.
  - Schedule more load in the forward market than it expects to serve in real-time
  - Schedule increased generation in the forward market to serve the increased load
  - If P1 wants to dump energy on the real-time imbalance energy market, it can do so from its unrealized load
  - If P1 does not want to dump energy on the real-time imbalance energy market, it can have an unscheduled outage of generation in real-time to offset its unrealized load

Effects on Market Participants

- Suppose that a participant usually experiences appreciable error in forecasting its real-time load
  - The participant may have to buy and sell energy on the imbalance energy market due to forecasting errors
  - If ex post price can rise to very high levels, the participant may experience extreme peaks in its payments for imbalance energy
  - Participant can insure against these peaks (or reduce their size)
    - Participant always schedules more energy in the forward market than it expects that it will need in real-time
      - Usually sell energy on imbalance energy market (or at least reduce the size of its purchases)
      - Additional costs if forward price > ex post price but eliminates or reduces payment peaks for imbalance energy

Effects on PX

- PX participants exposed to swings in ex post price
  - PX participants can insure themselves against effects but at a cost
  - By grouping participants (some of whom will likely over-forecast and some under-forecast), amount of extra energy scheduled in forward market to insure the group can be reduced
  - PX cannot take such a position in the forward market to insure a group of participants at lower cost
- Power Marketer (PM) acting as an SC can take a position in the forward markets to insure its participants at a lower cost than they could insure themselves as individuals
  - PM can use the strategy to cause wide ex post price swings
  - PM takes position in market to sell insurance that PX cannot sell
  - Attracts participants from the PX

Effects on ISO

- Parties may at times try to dump considerable energy on the ISO's imbalance energy market
  - ISO will need to decrement energy production more than anticipated
  - Decremental supplemental energy bids are voluntary
    - No concept of the ISO buying "negative reserves" to insure that it will have enough units that it can decrement
    - ISO may have to lean more on AGC
    - ISO may have to administratively reduce some generation
      - Real-time imbalance energy market may "fail" to set an ex post price based on decremental energy bids

Possible Basis for a Fix

- Clear the real-time imbalance energy market
  - Schedule all supplemental energy bids and reserves to minimize costs
    - Replace BEEP by an economic dispatch or a transmission constrained economic dispatch
  - Insure that the ISO will have sufficient decremental supplemental energy bids to provide "negative reserves"
    - Require that all SCs who have scheduled resources in the forward market to bid a certain percentage of their scheduled energy as decremental supplemental energy bids in the imbalance energy market.

Mr. OSE. Can you explain the nature of this problem and the steps that led to it being fixed?

Dr. GRIBIK. OK. The problem was a flaw in the ISO's real-time market protocol. At a high level, the flaw, a generator to place unscheduled power on—into the ISO's real-time market, it would start dumping power in. And, it could submit some bids to buy back power, which would in effect cause the real-time market price to go to whatever level that participant desired. So it could pump power into the ISO's real-time market and simultaneously set the price that would be paid for that power to any level.

As I said in the testimony, I alerted the ISO and ABB programmers to this in the beginning of May 1997. They told me that this process was known or this problem was known. They had discussed it in the WEPEX process. They had a way to fix it; that somehow it just fell through the cracks, they would take care of it.

At the end of October 1997, I was at that time providing consulting services to PX, and I read the ISO's protocols and saw that the problem still was there. I alerted Jim Kritikson, who was then director of scheduling at the Power Exchange, about this problem and devised an example to show how serious this flaw could be. In essence, I showed him a strategy a market player could use to dump power and simultaneously set the price.

He had me explain it to the CEO and the president of the Power Exchange, and they instructed us to go to the ISO and inform him of the Power Exchange's concern. We went up, gave them a presentation where we outlined the problem, outlined the strategy. I believe the ISO recognized the seriousness of the problem, and I believe they took it to their market participant process, because I received calls afterwards from several market participants asking me to explain the problem. And, the ISO fixed the problem by, in essence, adjusting the bid prices that people would submit to prevent the problem from occurring before the market opened. So it was patched well before the market opened.

Mr. OSE. OK. And the market opened, again, on?

Dr. GRIBIK. April 1, 1998.

Mr. OSE. April 1, 1998. And, you had this fixed roughly by the end of December 1997.

Dr. GRIBIK. I believe they had it fixed by December 1997.

Mr. OSE. Mr. Winter, my compliments.

Mr. WINTER. Thank you.

Mr. OSE. Now, Dr. Gribik, you also noticed a problem with transmission congestion pricing. And, on—according to my information, on January 30, 1998, you brought that problem to the attention of Jim Kritikson at the PX, who instructed you again to contact the ISO. That's document No. 13 on the screen right now.

[The information referred to follows:]

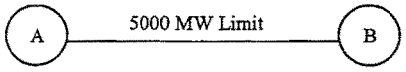
To: Jim Kritikson
From: Paul Gribik
Date: 1/30/98
Subject: Gaming Possibility Due to Limitations in CM Process -- **CONFIDENTIAL**

There are two shortcomings in the ISO's plans for congestion management:

- The ISO plans to administratively set congestion usage charges when it receives insufficient adjustment bids to relieve congestion
- The ISO will only accept adjustment bids on demands scheduled at individual take-out points (not on demand scheduled at load group or zonal levels).

The ISO plans to set "reference zonal prices" administratively when there are insufficient adjustment bids in a zone to manage congestion. This could work as long as the zonal prices are determined by CONG (the ISO's congestion management program) based on the penalty prices that CONG uses whenever it must schedule a resource outside the range specified in its adjustment bid. However, the ISO plans to set congestion usage charges that are unrelated to the penalty costs. This can lead to gaming strategies.

Let's consider a simple example with one hour, one zone (B) and one tie point (A) with an import limit of 5000 MW.



First, let's look at the PX energy auction. Suppose that the PX receives demand bids whose composite curve is piecewise linear with the following break points:

20,000 MWh @ $0/MWh,
15,000 MWh @ $90/MWh,
5,000 MWh @ $150/MWh,
0 MWh @ $500/MWh.

A PX participant (Gamer) submits a supply bid that he believes will exceed the total potential demand of the PX. He also wants to submit a supply bid that will exceed the total import capacity into zone B from tie point A. He bids 80,000 MWh @ $0/MWh. All of the other PX participants bid energy at some positive cost.

The PX auction for the hour will result in Gamer selling 20,000 MWh to the PX at a MCP of $0/MWh. No other producer wins the right to sell any energy in the auction.

Let's assume that all 20,000 MWh of demand is in zone B and that most of the 20,000 MWh is scheduled at load group or zone level take-out. This is a reasonable assumption since the UDCs will bid most of the demand, and they will be assigned the zone or load group take-outs. The demand at the load group or zone level will not be able to submit

adjustment bids for purposes of congestion management due to limitations in the ISO software. For simplicity, let's assume that there are only two demands scheduled in the PX:

- $D_{PXB,1}$ in zone B for 18,000 MWh scheduled at the load group level.
  - No adjustment bid by $D_{PXB,1}$ for CM
- $D_{PXB,2}$ in zone B for 2,000 MWh scheduled at a specific take-out point
  - Adjustment bid by $D_{PXB,2}$ for CM
    - 0 MWh to 1999 MWh @ $100/MWh
    - 1999 MWh to 2000 MWh @ $0/MWh

Gamer schedules his sale as an import at tie point A. He also submits one adjustment bid in zone B:

- $S_{PXA,Gamer}$ at tie point A for 20,000 MWh.
  - No adjustment bid by Gamer on $S_{PXA,Gamer}$ for CM
- $S_{PXB,Gamer}$ in zone B for 0 MWh.
  - Adjustment bid by Gamer on $S_{PXB,Gamer}$ for CM
    - 0 MWh to 1 MWh @ $0/MWh
    - 1 MWh to 2 MWh @ $50/MWh
    - 2 MWh to 3 MWh @ $100/MWh
    - 3 MWh to 4 MWh @ $150/MWh
    - 4 MWh to 5 MWh @ $200/MWh
    - 5 MWh to 6 MWh @ $250/MWh
    - 6 MWh to 7 MWh @ $300/MWh
    - 7 MWh to 8 MWh @ $350/MWh
    - 8 MWh to 9 MWh @ $400/MWh
    - 9 MWh to 10 MWh @ $500/MWh

Gamer wants to submit a very a bid to supply small amounts of energy at prices that range very high in zone B. This is done so that the ISO may schedule at least a small amount of high priced energy for the PX in zone B

Because no one else won any energy sales in the PX auction, Gamer anticipates that most other PX participants will decomit their units and not participate in the congestion management process. This is a reasonable assumption since the CM process may very likely develop schedules for such parties that are infeasible due to operational constraints.

Suppose that Gamer is correct and that only 3,000 MW of other PX supplies participate in zone B in the CM process. Let's lump these into a single participant (Rest) for the example:

- $S_{PXB, Rest}$ in zone B for 0 MWh.
  - Adjustment bid by Rest on $S_{PXB,Rest}$ for CM
    - 0 MWh to 300 MWh @ $0/MWh
    - 300 MWh to 600 MWh @ $50/MWh
    - 1200 MWh to 1800 MWh @ $100/MWh
    - 2100 MWh to 2400 MWh @ $150/MWh
    - 2400 MWh to 2700 MWh @ $200/MWh
    - 2700 MWh to 3000 MWh @ $250/MWh

For the example, let's assume that there is only one other SC. Further assume that the SC has one import at the tie point (S_{SCA}), one generator in zone B (S_{SCB}) and one demand in zone B (D_{SCB}). The SC submits the following preferred schedules and adjustment bids:

- D_{SCB} in zone B for 2,000 MWh
  - No adjustment bid on D_{SCB} for CM

- S_{SCA} at tie point A for 2,000 MWh.
  - Adjustment bid on S_{SCA} for CM
    - 0 MWh to 2,100 MWh @ $20/MWh
- S_{SCB} in zone B for 0 MWh.
  - Adjustment bid on S_{SCB} for CM
    - 0 MWh to 2,100 MWh @ $200/MWh

The ISO finds that the PX and SC want to send 22,000 MWh from A to B. This exceeds the line's 5,000 MWh limit so the ISO must adjust the parties' schedules to reduce the flow form A to B in the preferred schedules by 17,000 MWh

- SC's adjustment bids indicate a willingness to pay up to $180/MWh for transmission to move its energy from A to B.

- The adjustment bids that the PX submits indicates a willingness to pay any amount for transmission from A to B.

The PX will be assigned all of the transmission capacity from A to B.

The ISO will use SC's adjustment bids to move S_{SCA} to 0 MWh and S_{SCB} to 2,000 MWh. This removes any flow by SC from A to B. Even this will not be enough to support the PX's preferred schedule. The ISO must reduce imports at tie point A by an additional 15,000 MWh. However, it has run out of adjustment bid range at tie point A. Consequently, it curtails $S_{PXA, Garner}$ and set it to 5,000 MWh.

Now the ISO must also use adjustment bids in Zone B. It will use the adjustment bids available to:

- $MCP_{PXB} \geq$ \$500/MWh (the price of last bit of energy that the PX purchased from $S_{PXB, Gamer}$).

The PX zonal prices are set to:

- MCP_{PXA} = \$500/MWh
- MCP_{PXB} = -\$500/MWh.

Gamer must now pay the PX \$500/MWh to take its 5000 MWh of energy. This destroys the strategy.

The PX demands are still subject to high prices. This would be alleviated by letting all demands submit adjustment bids. That is, demands specified at load group and zone level must be allowed to submit adjustment bids for CM.

Dr. GRIBIK. Yes, sir.

Mr. OSE. Now, who is Jim Kritikson?

Dr. GRIBIK. Jim Kritikson was director of scheduling for the Power Exchange, and he was the Power Exchange person responsible for—basically, did oversight of the work that the Perot Systems was doing for the Power Exchange.

And, see, the problem in this case was the way that the ISO was going to set what they call default usage charges. The problem could have caused high prices and adversely affected reliability in the ISO's system.

In essence, to explain this in detail would take several hours, but I will try to give you a very highlighted——

Mr. OSE. Abbreviated, please.

Dr. GRIBIK. Yes. Unfortunately, this stuff gets very convoluted.

Roughly, the ISO allocates—or scheduling coordinators submit schedules to the ISO. The ISO checks to see if it can accommodate those schedules without overloading any of the transmission elements. If any transmission elements are overloaded, it allocates transmission to the scheduling coordinators who place the highest value on using the transmission as indicated by bids that they submit. The ISO allocates the transmission to the highest volume use first, the next highest, and so on, and at the end it sets the price for using the transmission to the value set by the last person that gets on.

The problem is that people do not have to submit bids for using the transmission. They could say, "I'm willing to pay anything to use them." Now, if the ISO runs out of bids to manage the transmission based on economics, it will allocate pro rata the transmission to those who did not submit bids, who in essence said, "I will pay anything to use it." It still has to, however, charge them for using the transmission. The ISO protocols as of October 31, 1997, said that they were going to pick the usage charge, in this case the default usage charge, when they ran out of economic bids by looking at the price for power in yesterday's real-time market, and they would set the usage charge equal to yesterday real-time market price.

What I pointed out to Mr. Kriticzen is if yesterday real-time market price was very low, say, $1 per megawatt—which could happen; in fact, sometimes it was zero—you have destroyed any incentive for people who value the path more than $1 to submit a bid, because why would I bid to use the path at $10 whenever I may be taken off and it is given to somebody else for $1? In essence, it becomes a free-for-all. Everyone comes rushing in to submit the schedules to use transmission. They will not give you adjustment bids, because why should they bid to use it when they say, "I'll pay anything; I only pay $1?"

Mr. OSE. You're saying that drove the price to zero? Whatever the situation, it would drive the price to zero because the guys who needed the transmission figured it out.

Dr. GRIBIK. Yeah. They'd figure it out and say, "Hey, I'm looking at yesterday's price; it's only $1. I will just overload this transmission line, knowing that I will only be charged $1."

Mr. OSE. Right.

Dr. GRIBIK. And, because it was pro rata allocation, they would even have incentive to bid to use more.

Mr. OSE. Now, if I understand what you did, working with Kritikson first and then the ISO, you were able to fix this problem?

Dr. GRIBIK. Yes. Jim Kritikson told me to take it to the ISO stakeholder process. There were a series of conference calls and meetings, I believe, that the ISO was holding on the congestion management process, and at those meetings and conference calls I raised this issue and said that you cannot set the price for using transmission today using yesterday's energy price. It was a hard sell to people, because, in essence, I was trying to tell them——

Mr. OSE. They had to pay.

Dr. GRIBIK [continuing]. You should be willing to pay more.

Mr. OSE. Right.

Dr. GRIBIK. No one wants to hear that.

Mr. OSE. But, in effect, at the end of the day prior to the March 31 operational date, this issue got fixed.

Dr. GRIBIK. Yes. The ISO submitted two amendments to its tariff, I think amendments 4 and 6, which alleviated the problem.

Mr. OSE. All right. Now, on April 9, 1998—first of all, let me go back and say, Mr. Winter, my compliments on fixing it, again.

In the April 9, 1998, memo from you to Fred Mobasheri, you discussed the need for market surveillance capabilities at the PX. Now, we have talked about market surveillance capabilities that exist at the ISO. Document 14 is on the screen, I believe. Who is Fred Mobasheri?

[The information referred to follows:]

To: Fred Mobasheri
CC: Dariush Shirmohammadi
From: Paul Gribik
Re: Market Surveillance
Date: April 9, 1998

The PX must ensure that its markets are stable and efficient. A participant may be able to employ strategies that increase its profits at the expense of the stability and efficiency of the PX and ISO markets. Such strategies can be developed t take inappropriate advantage of a number of areas including flaws in the PX and ISO Tariffs and Protocols.

The PX must be able to identify when a participant may be using an inappropriate strategy in a timely fashion. To achieve this, the PX must have identified and studied a range of potentially inappropriate strategies that a participant may use. It must have identified "markers" or behavior patterns associated with these strategies so that it can quickly decide whether in-depth study is warranted. The markers can be associated with the bids submitted by a participant or with the behavior of the overall market.

As the first step, the PX must undertake a detailed investigation of the ISO and PX Tariffs and Protocols. The PX should set-up a team to:

1. Review the PX and ISO tariffs and Protocols to define clearly and precisely the operations of the markets. In particular, identify bidding, selection and pricing processes in detail.
2. Investigate the interaction of the various markets. For example:
   2.1. Does bidding in one market may restrict a participant's ability to bid in another?
   2.2. May capacity be sold inappropriately more than once in different markets?
   2.3. Do related markets use consistent bid prices and quantities in (*e.g.* PX energy and ISO transmission markets)?
3. Identify flaw in the various markets or inconsistencies between markets.
4. Devise strategies that a participant could use to take advantage of the flaws discovered.
5. Investigate the properties of the strategies and rank them in importance to study further.
   5.1. How detrimental is the strategy to market stability and efficiency?
   5.2. How profitable is the strategy to the participant
6. Identify characteristic behavior that indicates that a participant is using an identified inappropriate strategy:
   6.1. Bidding behavior of the participant
   6.2. Behavior of the markets.

The team should be staffed with personnel with a variety of experiences. It should include people with experience in electric utility operations, market operations and surveillance, economics, game theory.

Dr. GRIBIK. Fred Mobasheri was the manager of the market moderating unit at the Power Exchange; in essence, the sister organization to the market surveillance unit at the ISO.

Mr. OSE. Was the PX vulnerable to being gamed by market participants?

Dr. GRIBIK. Well, I would say that anyone out there was going to start developing strategies to try to defend themselves, and also to take advantage of the rules where possible. What I was concerned about, because I had found these flaws sitting on the surface of the ISO and PX protocols whereby a single participant could have destabilized the markets, I was concerned that there might be more of these floating around out there, and I was recommending to Dr. Mobasheri that the PX should set up a team that would proactively seek out those types of flaws, identify them, identify the types of strategies people might make, figure out what the markers were that you could detect when somebody was using them, and either, if they could, change their protocol so those things could not be employed, or at the very least start looking for the markers whenever inappropriate behavior was being done so that they could take action.

Mr. OSE. So you gamed the system on behalf of the PX, purely in a theoretical manner.

Dr. GRIBIK. I was recommending——

Mr. OSE. Actually, at that point it would not have been theoretical; it was post-April 1st.

Dr. GRIBIK. Yes.

Mr. OSE. So you gamed the system, sent a memo to Mobasheri. Did the PX take your advice?

Dr. GRIBIK. Nothing came of it. They did have a market moderating unit. My estimation was that they were more in a reactive mode than a proactive mode; that they were reacting to what they saw in the market rather than trying to get ahead of the participants to patch holes before people used them.

Mr. OSE. Let me move on in the interest of time here. I do appreciate your attempts at trying to fix these holes.

Mr. Winter, I have to admit to some serious concern about the revelations laid out in the Enron memos, you know, about Fat Boy and Ricochet and all this other stuff, and yet I am trying to determine whether or not those practices were illegal at the time they were done. Were they illegal at the time they were done?

Mr. WINTER. Well, this is going to sound evasive. I'm not an attorney and really can't determine the legality, but having said that, certainly if you come in and tell someone that you are providing firm power, and then you are not providing firm power, I would call that somewhat illegal and violates WSCC criteria. I think if you say that you have got a unit that is available to run, and I am going to provide you 1,000 megawatts, and then you find out the unit's been broken and was never able to run, I think that is totally—I wouldn't—I don't know that I would say illegal, but certainly not—not something that you could do.

I think as far as arbitraging between markets, that is something that clearly was permitted, and if you have sufficient infrastructure, transmission, and generation, that is exactly what you want

the market to do, because it will then find its equilibrium, and the markets will then become very efficient as you use those.

But I think to say whether or not they were illegal, I would refer you to my appendix 2 of my testimony where we went through each of them and explained, you know, what the practice was, what we had done about it, and whether or not it was prohibited by our market monitoring rules.

Mr. OSE. Do the rules prevent it now? Let me rephrase the question.

Can California's consumers be comfortable with the nature of the market now being such as to prevent such gaming?

Mr. WINTER. Well, clearly we came out with five points, five of the practices, and sent out a market notice saying that these were illegal and people should not practice. And, again, you can read those in my testimony.

As far as the others, we have been very concerned about activities that happen outside the State because we don't have visibility to that. I think FERC's recent decision has gone a long ways to correct that.

Mr. OSE. They must offer.

Mr. WINTER. Must offer the maximum bid cap at 250. They are on an automated program that kicks in if you suddenly spike your bid prices. I think these go a long ways to protect it.

Now, if I have learned anything in the last 4 years, it's no matter what kind of rule you come up with, there are very clever people who try to find ways around that and often do. So I can't stand here and just absolutely give you assurance that it would never happen again, but I think there has been enough attention on it that if we saw something in the marketplace that was clearly out of line, we would get the action of FERC and those others very quickly.

Mr. OSE. Gentlemen, I need to confer with my counsel here for a couple minutes. We are going to take a 2-minute recess.

[Recess.]

Mr. OSE. When Dr. Backus comes in, we will just go ahead and proceed accordingly.

Mr. Winter, one of the things I keep coming back to is the confidence that the California consumer can have as to whether or not market participants are, in effect, unethically or illegally gaming the system, what measures are being taken by the appropriate government entity to protect the California consumers from that, and then the range of who is participating in this. I do want to ask you for an update on the issue having to do with, I believe, one of ISO's people on the floor.

Let me just state my question here. In July 2001, a conversation took place between one of ISO's employees and an Enron trader in which the employee asked the Enron trader to submit a specific bid. This employee was fired, and an investigation was ordered. I would like to know the status of that investigation.

Mr. WINTER. OK. When we learned through documents that Senator Dunn had gathered, we found reference to a person who was on the floor that had had a conversation with an Enron employee. We reviewed that. First, I think we got that information on a Friday. We hired an independent law firm to come in and do an inves-

tigation for us. In the meantime, we talked to the employee. He admitted that he had done it. It was clearly in violation of our code of conduct, and so we terminated him.

The investigation then went on, and the law firm had reviewed both vertically and horizontally different members of the corporation, different schedulers, the chain of command, and found out that this did appear. And that is the finding of the report, that this was one individual's action, and it was not widespread throughout the corporation.

That report has been completed and given to our board, and that's the status of it. And, Senator Dunn has also been informed.

Mr. OSE. Two questions. Can I get a copy of the report at the conclusion of the investigation?

Mr. WINTER. Yes. It was a confidential report since it dealt with personnel but I don't see why you could not get it.

Mr. OSE. I do appreciate that.

The second question: You used the phrase that these were not widespread practices. I mean, there is just one person?

Mr. WINTER. Just one person.

Mr. OSE. So they are very unique to this person?

Mr. WINTER. Yes, it was.

Mr. OSE. According to the investigation. OK. So it is not widespread.

Mr. WINTER. Not at all.

Mr. OSE. All right.

Dr. Cicchetti, the new rules on trading practices that the ISO has adopted, do you believe these will be successful?

Dr. CICCHETTI. I think that they will be successful in terms of eliminating the pricing gaming between markets. But two other things that the Federal Energy Regulatory Commission has started were also necessary. The first is the Federal Energy Regulatory Commission has effectively ordered the ISO to develop nodal pricing so that the kind of congestion gaming that has received so much attention today and as part of the Enron memo wouldn't be one of the games that could be played, because nodal pricing would effectively replace the kind of congestion path pricing or valuation that's in the current tariff.

And, the second thing that the Federal Energy Regulatory Commission has ordered is to change the CAISO board to make it an independent board. The current board is a political board. There is no other way around it. I don't think that's particularly a problem or has been a particular problem that's caused gaming. But the old stakeholder boards, both of the CAISO and the CPX, in the work I did for the State Audit Bureau as well as the Federal Energy Regulatory Commission's own review, we both found that the market monitoring committees and staff of both the CAISO and the California Power Exchange reported problems, and the process of getting those problems reported and then out to Federal Energy Regulatory Commission, so as to fix the problems, was stalled by the stakeholder board process.

And so, the independent boards are an important part of restoring faith, which is an important part of any commodity market; that is, policing markets is an important function—that those policing activities of the staffs of both in the case of the CPX, which no

longer really exists, but in the case of the CAISO, very excellent staff, so that material gets out and in the hands of the Federal Energy Regulatory Commission sooner rather than later.

And now, to complete the process I think the Federal Energy Regulatory Commission this past week has ordered California to develop a purely independent board, not a stakeholder board, not a Governor appointee board, but one that is purely independent, and that will help restore some of the market confidence along with the new locational nodal pricing that will be put into effect.

Mr. OSE. Thank you, Doctor.

Let me follow on, if I may. We have had a large debate about a regional transmission organization, whether California should or should not participate. What is your opinion on that issue?

Dr. CICCHETTI. Personally I think that a regional transmission organization for the West makes a great deal of sense. In fact, we saw problems that occurred through megawatt-hour laundering, Ricochet, whatever you want to call it, because we had essentially a two-tier market. That's been fixed to some extent by the fact that the Federal Energy Regulatory Commission came up with a Western States price cap. But, fundamentally, I think we have to do more than that because we have to deal with the congestion problem for transmission that exists throughout the entire West, not just in California.

The problem is that, given California's terrible crisis in 2000 and 2001, not very many other Western States want to partner or participate in a regional transmission organization with California. So, while I think it is the right way to go, it is the right model, it is ultimately going to be necessary; I think that it is probably more likely that the Southwest and then the Pacific Northwest will form their own RTOs eventually to be merged together, as well as to be merged with California.

But for the short term I think California has to continue to do what it has been doing, which is to regain stability and see the return of competition and lower prices, as we have been seeing in the past 12 months or so. But we need probably a bit more time to convince the neighboring States to go along with an RTO that would include California, unless somehow or another Congress orders such a thing to happen, which I don't see happening.

Mr. OSE. Thank you. I have a couple more very specific questions.

Mr. Winter, down in the San Diego area, there is some debate as to whether or not to build a transmission line north/south linking the San Diego market to Southern California Edison. Are you positive toward that, ambivalent? Are you negative toward it? What is your perspective?

Mr. WINTER. I'm extremely positive toward it, but it is just first a small link in what we need to do. It is called the Valley Rainbow 500 Interconnection from northern San Diego up to a valley substation in the Los Angeles area. Now—but what we need to do is then complete the next link of that, which is Rainbow to Miguel, which brings us next to the Mexican border. Right now we are seeing about 1,000 megawatts plus being developed in Mexico, and the way that is going to get into the entire grid is up through San Diego. So we have got to add to the infrastructure in that area as

well as Path 15 to allow the north/south transfer of large blocks of energy out of the Southwest and Northwest.

Mr. OSE. I will tell you for a fact that most of the California delegation is very supportive of Path 15, working through the Bureau and others. Can you give us some sense of the status of the negotiations on that, given the different stakeholders?

Mr. WINTER. It is my understanding that there are actually two proposals, one before the Public Utility Commission that would have PG&E build the entire line. In the other one, the Western Area Power Authority would be the Federal agency that would build it, and an independent transmission company would provide about 85 percent of the money, with the remainder coming from PG&E. And, both of those proposals are moving ahead. As to which one is going to win, I don't know at this time.

Mr. OSE. But both are integral to solving the transmission problem?

Mr. WINTER. Yes, sir.

Mr. OSE. All right.

Mr. WINTER. Either one of them would do it.

Mr. OSE. All right. I want to summarize here. I just want to be clear. I heard all four of you say you don't know of any nonpublic information that Perot or—some of you actually testified you had not used it. Do any of you know of any nonpublic information that was used in the presentations to various parties about the structure of the ISO market?

Mr. Winter.

Mr. WINTER. I certainly am not aware of any. However, all I saw was what I had been provided at this point.

Mr. OSE. All right. Dr. Cicchetti.

Dr. CICCHETTI. No. And I will only add to what Mr. Winter said by pointing out that I found some of the identical material being used in the Perot Systems that the CAISO, or the California Independent System Operator, uses in its own training materials.

Mr. OSE. All right.

Dr. Backus, you've testified that you didn't have any nonpublic information that you used in your presentation.

Dr. BACKUS. All I knew is the public information. That's all that could be contained within the presentations.

Mr. OSE. And, Dr. Gribik, your testimony was consistent with that?

Dr. GRIBIK. Yes. Used absolutely no proprietary information.

Mr. OSE. All right, gentlemen. First of all, I want to thank you all for coming. One of the things we struggle with back here is, frankly, getting to the bottom of it without a lot of hue and cry. We have a continuing problem in our State about supply of energy and the ability to obtain energy at reasonable prices. Frankly, I can understand why Mr. Winter and his colleagues at the ISO were upset when they learned what possibly Perot System was doing. I have to applaud your logical means of resolving that, where you actually sat down and communicated to each other your concerns, worked it out. Frankly, based on the testimony today and the documents we have received to date, I am at a bit of a loss to explain all the allegations I am familiar with.

The other aspect of this that I think is germane is that, No. 1, the work that Perot Systems did took place prior to the market opening, and then that which they tried to do with what is alleged to be nonpublic information, nobody bought. I mean, I just don't understand this. Maybe I'm missing something. Based on the information we have today, I just am afraid we have used 2½ hours for little purpose.

Now, the other things I want you to understand is that to the extent, Mr. Winter, that you or, Dr. Cicchetti, your colleagues on the market committee can continue to use gaming theory to protect California's consumers, I want to encourage you to do that. I just think it's great for California's consumers to have that as a defensive effort. I don't know how you massage this thing with the CPUC who says, well, you can have some tools, but you can't have others, even though you know your competitors have them to stick it to you.

This market design issue is going to stay with us. I know it is going to evolve over time. I look forward to working with all four of you as we try and address these things in an evolutionary fashion.

Again, I thank you for coming today. I appreciate your testimony. We are adjourned.

[Whereupon, at 4:32 p.m., the subcommittee was adjourned.]

[Additional information submitted for the hearing record follows:]

INDUSTRY FOCUS

California May Face Renewed Energy Crisis

Signs of Trouble in State's Power Market Include Canceled Plants, Conservation Drop-Off

By Scott Thurm
And Mitchel Benson

THE BLACKOUTS ARE gone for now, but California's power market remains deeply troubled and there are signs the state could soon be facing a renewed energy crisis.

Consider:

• The two biggest utilities still aren't creditworthy, and state government continues to buy the bulk of California's power.

• State and federal regulators can't agree on how to fix the flawed system. Yesterday, frustrated federal regulators ordered the state's grid operator to replace its board, increased the price cap on regional power sales and established a new system to detect price-gouging. But a ranking state official said the new price cap "could cost consumers billions of dollars," and called the board restructuring "nonsense."

• The state is renegotiating long-term contracts with power suppliers that it thinks took unfair advantage of the crisis by locking in high prices.

• Voluntary conservation efforts are easing as blackout memories recede, and important new conservation programs remain stalled.

• Energy-generating companies, unsure of the state's plans and facing a credit squeeze fueled by questionable business practices in California and elsewhere, are canceling and delaying planned power plants.

The problems became apparent last week, when the operator of the state's power grid declared a "Stage 2" emergency for the first time in a year and asked big industrial users to curtail energy use. The state averted rolling blackouts, but may not be so lucky next time.

In a June 14 report to federal regulators, the grid operator, formally known as the California Independent System Operator, warned of an "alarming trend" of power-plant delays and cancellations. Even as some new plants come on line, the report said, some older plants are being retired.

"We ain't seen the end of this yet," says Allan Vallow, director of the electric utility for the central California city of Lodi. The spate of plant delays and cancellations mean California is "probably worse off than when this started," he says.

State officials and some experts disagree. Claudia Chandler, a spokeswoman for the California Energy Commission, the state's energy policy and planning agency, says new power plants and continued conservation helped the state cope with near-record demand amid triple-digit temperatures and an unexpected plant outage last week. "It was a pretty phenomenal test of the system and everything worked together," she says.

By the end of July, energy companies will have opened power plants capable of generating 4,600 megawatts of electricity—enough for roughly 4.6 million homes—over the previous 14 months. Officials estimate that continuing conservation efforts saved an additional 2,000 megawatts. But conservation is slipping: Peak energy use rose 3.3% in June from a year earlier, eroding some of the 14% savings from conservation at the height of the energy crisis.

California will likely need to import as much as 15% of its power at peak demand. The energy commission, in a February report, said that by 2005 growing demand would likely force California back to "tight supplies, price volatility, reliability concerns, and consumer dissatisfaction." The commission expects plants capable of generating more than 6,000 megawatts of power to open in the next three years, but Ms. Chandler says little progress is being made at some sites. In June alone, 1,441 megawatts of planned generating capacity were put on hold, according to the ISO.

Mirant Corp., for example, has cut its planned spending on big projects this year by roughly $2 billion. The opening of its 530-megawatt power plant in Contra Costa County, east of San Francisco, has been delayed almost two years to June 2005.

Energy-company executives complain that the state is sending confusing signals on its willingness to pay for new power plants. Closely held **Delta Power**, Morristown, N.J., spent more than $65 million last year preparing to build a 180-megawatt power plant in Chico. But Delta scrapped the project in December after the state Department of Water Resources, which is buying most of California's electricity, balked at signing a long-term contract.

Some energy experts say the plant cancellations aren't cause for alarm. Severin Borenstein, director of the University of California Energy Institute in Berkeley, says there is no evidence that the state is suffering from "underinvestment," but the state needs to quickly establish its restructured market and implement conservation programs.

The Federal Energy Regulatory Commission set some new rules yesterday, raising to $250 per megawatt hour, from $91.87 previously, the price cap for power sales across the West beginning Oct. 1. The agency also created a new day-ahead electricity market, and established a new computerized modeling system to detect and reject excessively high power bids.

Even so, FERC Chairman Pat Wood III said "the long-term fixes" to California's market "are not here. ... I don't think we're out of the woods here yet."

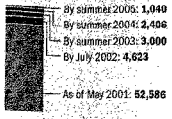
FERC also ordered the ISO to scrap its governing body—all appointees of Gov. Gray Davis—in favor of a two-tier structure with an independent board and an advisory panel of stakeholders. But ISO Chairman Michael Kahn said, "The truth is FERC wants to control the ISO and they don't like that California controls the ISO."

Enough Power?

During its energy crisis, California planned to add new power plants to meet growing demand. Some of those new plants are now operating, but many others, enough to generate over 20,000 megawatts, are being delayed or canceled.

Generating electricity...

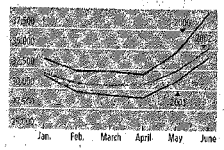
Current and additional future plant production, in total megawatts



Note: One megawatt is roughly enough power to supply 1,000 homes.

As demand creeps back

Monthly peak demand for electricity in California in megawatts*



*Figures are adjusted for economic growth and weather, and exclude some municipal systems, accounting for about 10,000 megawatts of demand at peak use

Sources: California Energy Commission, Federal Energy Regulatory Commission

Chronology:
Correspondence between the California System Operator (CAISO) and Perot Systems Corporation (PSC) regarding CAISO's charge of PSC's Conflict-of-Interest

10/21/97 –	first telephone discussion between CAISO and PSC of reported solicitations by PSC energy market participants
10/22/97 –	CAISO sent a letter to PSC expressing concern over attempts by PSC to market inside knowledge of the CAISO energy market and alleging conflict-of-interest
10/24/97 –	PSC sent a letter replying to CAISO's 10/22/97 letter, reputing allegations and discussing the terms of the CAISO and PSC contract
11/18/97 –	CAISO and PSC met to discuss the conflict
11/24/97 -	CAISO sent a letter to PSC with a list of actions for PSC to perform in order to reach a "conflict solution" and assure CAISO that the "project" did not disclose "insider information" to prospective clients
11/26/97 -	PSC sent a letter to CAISO's outside counsel (Skadden, Arps, Slate, Meagher, and Flom LLP) with a list of documents for review and actions to be performed by PSC in compliance with the requests made in CAISO's 11/24/97 letter
11/97 -	to comply with CAISO's demands, PSC sent CAISO for its approval a draft memo to all of PSC's associates and independent contractors engaged in the CAISO account, including a disclaimer, letter, and ethics wall
2/9/98[1] -	PSC sent a follow-up letter to CAISO's outside counsel (Skadden, Arps, Slate, Meagher, and Flom LLP) noting that CAISO had not responded to the 11/26/97 letter, and that PSC would use a disclaimer in its sales and marketing presentations

[1] This was the last correspondence between CAISO and PSC on this matter.

CALIFORNIA INDEPENDENT SYSTEM OPERATOR

October 22, 1997

Mr. H. Ronald Nash
Vice President
Perot Systems Corporation
Suite 1100
12377 Merit Drive
Dallas, Texas 75251

Re: ISO Alliance and Perot Systems Corporation Conflicts of Interest

Dear Mr. Nash:

This is to follow up on our telephone conversation of October 21, 1997 regarding reported solicitations by Perot Systems Corporation ("*Perot Systems*") of parties expected to market energy in California.

As we discussed, such solicitations are inconsistent with the ISO's Alliance's and Perot Systems' conflict of interest obligations under the Scheduling Applications, Scheduling Infrastructure and Business Systems Contract between the ISO Alliance and the ISO Restructuring Trust dated as of March 14, 1997 (the "Contract") which you executed on behalf of the ISO Alliance and Perot Systems.

Specifically, it was reported to me that representatives of Perot Systems contacted Gary Cotton of San Diego Gas & Electric (SDG&E), and perhaps other potential market participants, and offered the services of Perot Systems in helping SDG&E to exploit the new California energy market by exploiting potential weaknesses and shortcomings in the ISO's system to their commercial advantage.

It was further reported that Perot Systems' representatives at these solicitations included Ed Smith and Paul Gribik, both of whom have been significantly involved in ISO Alliance's and Perot Systems' activities in negotiating and performing the Contract, and that Perot Systems' involvement in developing the ISO's system was cited as evidence of Perot Systems' knowledge of the potential weaknesses and shortcomings in that system.

Perot Systems' marketing of its inside knowledge of the ISO's system to third parties so that they may economically exploit the new California energy market, in addition to being a flagrant violation of basic norms of business ethics and indicative of bad faith dealing, would seriously erode the integrity of the new California energy market and materially compromise the work being performed and the system being produced by the ISO Alliance and Perot Systems for the ISO. Article 31 of the Contract expressly prohibits the ISO Alliance, including Perot

151 BLUE RAVINE ROAD • SACRAMENTO, CALIFORNIA • 95630
PHONE: 916.351.2222 • FAX: 916.351.2181

Systems, ABB and Ernst & Young, from performing services for others which may create a material conflict of interest with the ISO or in any way otherwise materially compromise the work being performed by the ISO Alliance and Perot Systems on behalf of the ISO.

Perot Systems' behavior as described above is contrary to Perot Systems' contractual obligations and is expressly prohibited under the Contract. While reserving all rights and remedies available to the ISO, including but not limited to those concerning breach and termination, under the Contract and applicable law, the ISO will require that Perot Systems immediately:

(i) cease the solicitation and marketing as described above;

(ii) contact those parties previously solicited in this regard in writing, retracting it's offer of such consulting services and stating that such consulting services will not be offered by Perot Systems or the ISO Alliance;

(iii) provide the ISO with a list of names of the market participants actually contacted by Perot Systems;

(iv) describe what specifically was being marketed by Perot Systems and the basis for such solicitations with such itemization to be renewed at the end of Stage I and Stage II of the Contract;

(v) certify that neither Perot Systems nor the ISO Alliance has introduced any changes or modifications other than those specified by the ISO Contract, the Detailed Statement of Work (DSOW), or documented change orders, with such certificates to be renewed at the end of Stage I and Stage II of the contract; and

(vi) pursuant to Article 31.7 of the Contract provide all accounts and records relating to any program of solicitation activity in this regard.

Finally, as I emphasized in our telephone conversation, prompt cessation of the offending solicitation activities and prompt retraction of all express offers of such consulting services is essential to any ultimate resolution of this matter. I look forward to hearing your response and the status of any additional activities you may propose for Perot Systems and the ISO Alliance to remedy this situation.

Sincerely,

Jeffrey D. Tranen
President and Chief Executive Officer

cc: Ake Almgren, President, ABB T&D Inc.
William Hunter, Operations Partner, Ernst & Young

BOWNE INTEGRATED TYPESETTING SYSTEM Site: (BOD) BOWNE OF DALLAS, INC Phone: (214) 651-1001 Operator: BOD31026 Date: 6-JUN-2002 18:11:20.07
Name: PEROT SYSTEMS Validation: Y Lines: 50 [E/O] CRC: 1447 JB: D97558 PN: 799.03.01.00 SN: 0 Ed#: 4
Queue: BOD_CPS
Description: EXHIBIT 99.3

EXHIBIT 99.3

DRAFT

October 24, 1997

California Independent System Operator Inc.
Attn. Mr. Jeffrey D. Tranen
President and Chief Executive Officer
151 Blue Ravine Road
Sacramento, California 95630

Re: Allegation of Conflict of Interest

Dear Mr. Tranen:

This letter is in response to your letter dated October 22, 1997, and our earlier telephone discussion regarding your allegations that associates of Perot Systems Corporation discussed "inside information" with a third party in purported breach of the Scheduling Applications, Scheduling Infrastructure and Business Systems Contract between the ISO Alliance and the ISO Restructuring Trust dated as of March 14, 1997 (the "Contract"), or that we may have a conflict of interest in pursuing certain sales and marketing activities.

First, I'd like to assure you unequivocally that no "inside information" of the ISO has been, or will be, disclosed by Perot Systems or any of its associates to anyone, except as permitted by the Contract. The confidentiality of our client's affairs is a cornerstone of our business, and we will not tolerate any such breach of client's trust.

I have spoken to Ed Smith, Paul Gribik and other members of our team about your letter and have satisfied myself that no inappropriate disclosures of "inside information" have occurred. At no time has Perot Systems offered to assist anyone to exploit "potential weaknesses and shortcomings in the ISO's system," or suggested that our involvement in developing the ISO's system would allow us to exploit any knowledge we have about the ISO's system. Without discussing this matter further with you, we can only speculate that someone has not distinguished between the ISO's business protocols and the systems that implement these protocols.

I can also assure you that neither Perot Systems nor, to our knowledge, the ISO Alliance has introduced any changes or modifications other than those specified by the ISO Contract, the Detailed Statement of Work (DSOW), or documented change orders. The introduction of surreptitious code into the ISO System, or the unauthorized disclosure or use of any legitimate functionality of the ISO System, by

any Perot Systems associate or subcontractor would violate our Standards of Ethical Practices that would result in immediate, unequivocal disciplinary action.

As you know, Perot Systems has long been involved in the public process leading to the deregulation of California's electricity markets. In particular, Paul advised the group that developed the business protocols under which the ISO will allocate and price congested transmission - long before the ISO Alliance and Perot Systems were engaged by the ISO. In addition, Paul and many others have publicly suggested strategies for participants to optimize their operations and maximize their profitability under these protocols. In response to your question about the use of the term "gaming", I found that it was used in context as a mathematical process for business optimization, not in context as a gambling term or manipulative process. Perot Systems markets consulting services based on our collective understanding of these new business protocols and the related markets. I have enclosed a white paper that sets forth the essence of our sales presentation and a copy of the slides recently used by Paul in his sales presentations for your information. At your convenience, Ed, Paul, Ken Scott and I will make ourselves available to meet with you to discuss in detail our marketing activities with respect to the California electricity markets. However, we will be able to discuss the details of any discussions we may have had with a specific client or potential client only with their prior consent.

Second, I would like to address your concerns about a potential conflict of interest under Article 31 of the Contract. After reviewing your letter and discussing the matter with Ed, Paul, and other associates, I am convinced that no material conflict of interest exists between our activities for third parties and our obligations to the ISO under the Contract.

Section 31.2 of the Contract (in conjunction with the subcontract between the ISO Alliance and Perot Systems) requires Perot Systems to use "reasonable care and diligence to prevent any actions or conditions which could result in a conflict of interest." Section 31.1 describes two basic scenarios in which a conflict could arise: (i) a relationship, contract or employment which could result in a material conflict with the best interests of ISO, or (ii) a relationship, contract or employment which could in any way materially compromise the Work to be performed under the Contract.

The existence of a conflict of interest in violation of the Contract is refutable under either scenario. With respect to the first, the Contract contemplates the ability of Perot Systems to perform services for third persons. Section 31.3 of the Contract requires only that Perot Systems "will not accept any employment or engage in any work which creates a material conflict of interest with (ISO) or in any way materially compromises the Work to be performed under the Contract, within the context of (Perot Systems') policies and rules relating to business ethics." Perot Systems is in full compliance with its policies and rules relating to business ethics, and, therefore, the Contract. With respect to the second scenario, no conflict that could compromise the Work exists because, in part, neither Ed Smith nor Paul Gribik are currently engaged on a day-to-day basis with the Work to be performed under the

Contract. In fact, the Work is progressing substantially in accordance with the terms of the Contract.

With respect to your request that Perot Systems cease offering its consulting services to potential ISO market participants, we have concluded that the Contract contains no such requirement and that doing so could harm our business prospects.

We hope that this letter satisfactorily resolves your concerns in this matter. Accordingly, we are declining to provide you with additional information you have requested at this time.

I hope that you will take the opportunity to meet with Ed, Paul, Ken Scott and me to develop a more thorough understanding of our service offerings and our approach to this new market. Perhaps, this will allow our companies to avoid any disagreements based on incomplete or erroneous information and will allow the good relationship that we have established to date with the ISO to continue to develop.

Perot Systems and each of the individuals named in your letter would appreciate receiving a retraction of your allegations, since your publication of these allegations to the participants in the ISO Alliance, your law firm and possibly other, could cause considerable damage to our and their reputations. We would appreciate your attention to this task and would be glad to assist you in any way to facilitate this.

Thank you for calling me when you had concerns about our performance. Only by such direct and clear communication can we keep on track and provide the best service level to the ISO. As always, all of us on the Perot Systems team stand ready to help you whenever we can.

Sincerely,

H. Ronald Nash
Vice President

CALIFORNIA INDEPENDENT SYSTEM OPERATOR

November 24, 1997

Mr. H. Ronald Nash
Vice President, Perot Systems Corporation
12377 Merit Drive
Suite 1100
Dallas, Texas 75251

Dear Ron:

Many thanks for your and Chuck Bell's trip to Folsom last week to help work out the conflict of interest matter involving Perot's contemplated consulting services ("the Services") in conjunction with Policy Analysis Corporation ("PAC"). I believe that we are in agreement on the need to move forward quickly to remedy the situation.

Your recognition that the appearance of conflict weighs as heavily as actual conflict was most welcome. Public confidence in the fairness of the ISO and PX Systems must be one of its salient characteristics; it is a major and substantial interest of ours - and the FERC's - in the design and procurement of the system and the market. That the ISO is a quasi-public if not a public entity and the procurement funds for the system are quasi-public if not public funds, are important elements of the environment in which we are operating.

Achievement of the December 5 deadline for having our conflict solution in place will be important, as I outlined. By way of summary, the elements that need to be available or in place are as follows:

- The form of a disclaimer which will be issued to past and future prospects for the Services. We are to have the total number of prospects approached and "pitched"; you will approach all past and future prospects and secure permission to disclose their identity, if possible.
- Provide a set of Ethics Assurance Procedures to assure appropriate isolation of the ISO/Alliance Project from the offering and providing of the Services. We need to identify the Project personnel in their varying capacities and their exposure or access to protected or non-public information relating to the Project, and identify as well the appropriate applicatory time periods .
- Provide a control process to assure the continuing implementation of the above.
- Provide certification in appropriate form that no protected or non-public information has been released, either to PAC or to prospective clients in the course of soliciting clients for the services or actually providing the services, as well as that the above described activities are being implemented.

151 BLUE RAVINE ROAD • FOLSOM, CALIFORNIA • 95630
TELEPHONE: 916.351.2222 • FACSIMILE: 916.351.2350

I appreciate your looking into the form of the "teaming" arrangements between Perot and PAC for provision of the services so that we can be aware of their circumstances. Also of importance is your continuing assessment regarding how the ISO can receive assurance that the system is free of any gratuitous insertions or "hooks" designed to enable some feature of the Services, both past and future.

Again, Ron, thank you for your positive response to our concerns. We look forward to responding rapidly to the items set forth above, after we receive your draft proposal.

Sincerely,

Jeffrey Tranen
President and Chief Executive Officer

Charles N. Bell
Associate General Counsel
Direct Dial: (972) 383-5615
Facsimile: (972) 383-5735
Email: chuck.bell@ps.net

perotsystems

26 November 1997

VIA FAX: 202/ 393-5760

Skadden, Arps, Slate, Meagher & Flom LLP
Attn: Martin R. Hoffman
1440 New York Avenue, N.W.
Washington, D.C. 20005-2111

Re: California Independent System Operator

Dear Marty:

As we discussed during our recent meeting with Mr. Jeffrey Tranen of the California Independent System Operator, Inc. (ISO) and Mr. Ronald Nash of Perot Systems Corporation ("Perot Systems"), I am enclosing for your review the following documents:

1. A "Disclaimer" proposed to be used in Perot Systems' sales and marketing presentations involving the California energy market deregulation.

2. A "Letter" proposed to be sent to potential participants in the California energy market to whom Perot Systems has made sales and marketing presentations.

3. An "Ethics Wall" proposed to be invoked formally for Perot Systems associates working with the ISO.

In response to Mr. Tranen's inquiry, Perot Systems has made presentations regarding our consulting capabilities with respect to California market restructuring to three potential market participants (in addition to related presentations made to the ISO and the California Power Exchange). Of these three companies, two decline to reveal their identities under the terms of our non-disclosure agreements. The remaining company is San Diego Gas and Electric, and its parent, Energy Pacific, which has informed the ISO of our confidential discussion.

In response to Mr. Tranen's inquiry regarding our relationship with Policy Assessment Corporation (PAC), I have reviewed our contracts database and made appropriate inquiries regarding any such relationship. Perot Systems has no

Perot Systems Corporation 12377 Merit Drive Suite 1100 Dallas, TX 75251-3233 972.383.5600 tel

contractual relationship with PAC, except for mutual non-disclosure agreements. Perot Systems and PAC make periodic joint sales presentations in situations where we have mutual business interests, and we have discussed various potential joint projects. However, we have not yet engaged in any joint projects and none are currently pending. Perot Systems has not provided any services to PAC, but has received consulting services from PAC. In addition, PAC does not employ any current or former associates of Perot Systems.

Upon your approval of the forms of these documents, Perot Systems will promptly (i) formally communicate the content of the Ethics Wall to the appropriate associates, (ii) send the Letter to each of potential participants to whom Perot Systems has made sales and marketing presentations regarding our consulting capabilities with respect to California market restructuring, and (iii) ensure that the Disclaimer appears as part of our sales and marketing presentations regarding our consulting capabilities with respect to California market restructuring.

Based on our discussions of November 18th, and following our compliance with Mr. Tranen's requests in this matter, it is our understanding that the ISO will make similar requests to each of the ISO's vendors who offer consulting services relating to California market restructuring and that Mr. Tranen will formally withdraw the allegations made in his letter dated October 22, 1997.

If you have any questions regarding these matters, please call me at 972/383-5615 at your earliest convenience. Best wishes for the holidays.

Sincerely,

Charles N. Bell

cc: Jeffrey D. Tranen (w/ attachments)
California Independent System Operator, Inc.

Andy Goletz (w/ attachments)
Ron Nash (w/ attachments)
Ken Scott (w/ attachments)
Ed Smith (w/ attachments)

DRAFT

PROPOSED DISCLAIMER SLIDE

Perot Systems' services addressing the restructuring of California's power markets and development of supporting infrastructure and services are based on our understanding of the California ISO's and PX's business protocols; NOT the use of, or knowledge of, any proprietary client systems.

DRAFT

Proposed Letter to Contacts:

The California Independent Service Operator (ISO) has retained Perot Systems Corporation (Perot Systems) as a member of the ISO Alliance, LLC to provide professional services to the ISO in the design, development, integration and roll-out of the information technology applications supporting the ISO's business operations.

Recently, the ISO expressed concerns over the potential insights which Perot Systems and the ISO's other service providers may possess into its proprietary systems or operations.

To address these concerns and avoid any suggestion, whether real or perceived, of Perot Systems using information not in the public domain in performing services to other clients, Perot Systems agreed to initiate several actions, including contacting its present clients and those prospects with whom we have been discussing matters of California market restructuring to reinforce our position in matters of this nature.

I am writing to you in support of these agreements.

Perot Systems' offering of our services addressing the restructuring of California's power markets and development of supporting infrastructure and services, are based on our understanding of the ISO's and the California Power Exchange's business protocols; not the use of, or knowledge of, any proprietary client systems.

We are fortunate to count amongst the members of our team, subject matter experts in such issues as congestion theory and in other equally critical aspects of the business rules governing these markets. It is through these Associates' comprehension of the business rules and their applications to the market that our strategic service offerings are shaped.

Perot Systems' Standards and Ethical Principals embody the highest concepts and standards of honesty and integrity. Our values require that we operate with absolute integrity and that each of our associates conduct themselves in a manner that will bring credit to themselves, their families and the company at all times. Each and every associate pledges his or her personal and professional commitment to these principals and values. There are no exceptions.

It is understandable that the major changes all of us are facing in deregulating this industry should be accompanied by states of anxiousness. Perot Systems feels it important that our clients can be assured that one constant they can expect is the measure of integrity with which we will approach their business dealings. We welcome the opportunity to discuss these matters if you have any concerns or questions whatsoever. We will be contacting each of you directly to review any concerns which you may have.

These are exciting times. We look forward to working with you to shape the future.

Sincerely,

DRAFT

MEMORANDUM

To: All Perot Systems Associates and Independent Contractors Engaged on the California ISO Account

From: Andy Goletz

Date: [DRAFT]

Re: California ISO Ethics Wall

Please review the attached document and return the attached Affirmation to me as soon as possible. It is essential that you review this document carefully and comply with its requirements.

If you have any questions, please give me a call.

DRAFT

CALIFORNIA INDEPENDENT SYSTEM OPERATOR
ETHICS WALL

November 17, 1997

THIS DOCUMENT REQUIRES YOUR IMMEDIATE CAREFUL REVIEW

The core concepts of Perot Systems Corporation's ("Perot Systems") Standards and Ethical Principals are the highest standards of honesty and integrity. Our values require that we operate with integrity and that each of our associates conduct themselves in a manner that will bring credit to themselves, their families and the company at all times.

California Independent System Operator, Inc. (the "Client") has engaged the ISO Alliance, LLC (the "Alliance") to provide certain project management, system development, system integration, system testing and training services in connection with electric utility deregulation and the new competitive environment in the California electric industry. Perot Systems is a member of, and a subcontactor to, the Alliance and has certain contractual obligations to the Alliance and our Client with respect to (1) the disclosure and use of the Alliance's and our Client's confidential information and (2) the acceptance of certain third party client engagements.

Perot Systems' Standards and Ethical Principals, as well as your Associate Agreement, Independent Contractor Agreement, or Confidentiality and Proprietary Rights Agreement, as the case may be, prohibit the disclosure or use of our Client's confidential or proprietary business and technical information without Perot Systems' and our Client's approval.

From time to time, you may be called upon to participate in discussions with the California Power Exchange (the "PX"), one or more investor owned utilities, one or more scheduling coordinators (including the PX when acting in such capacity), vendors or other persons who may use or have another interest in the computer systems of our Client. In addition, you should be aware than certain Perot Systems associates may be engaged in marketing consulting or technology services to these parties.

In order to ensure compliance with Perot Systems' Standards and Ethical Practices and our contractual obligations to our Client and to avoid the appearance of a conflict of interest, Perot Systems is formally establishing a so-called "Ethics Wall" with respect to all associates who perform services for our Client. This Ethics Wall will serve to reinforce, to the greatest extent practicable, the care to be exercised by all associates involved in Perot Systems' work for our Client, particularly when talking to persons who are involved in Perot Systems' work for third parties who may have an interest in our Client's confidential or proprietary information.

ALL PEROT SYSTEMS ASSOCIATES AND CONTRACT PERSONNEL MUST CAREFULLY REVIEW AND COMPLY WITH THE FOLLOWING RESTRICTIONS WHICH COMPRISE THE ETHICS WALL

DRAFT

CALIFORNIA INDEPENDENT SYSTEM OPERATOR
ETHICS WALL

November 17, 1997

Definitions

1. Except for persons designated as members of the Marketing Team or the Joint Team, all Perot Systems associates and independent contractors who are currently providing, services for this Client are designated members of the "Client Team."

2. Except for persons designated as members of the Joint Team, all Perot Systems associates who are actively involved in the marketing and sale of Perot Systems' services to competitors or customers of this Client are designated part of the "Marketing Team." Third parties with whom Perot Systems is making joint marketing presentations will also be designated members of the Marketing Team.

3. All Perot Systems associates who (a) provide services after the date of this document or during the six months prior to the date of this document have provided services for this Client, and (b) are actively involved in the marketing and sale of Perot Systems' services to competitors, customers or suppliers of this Client are designated part of the "Joint Team." The Client will be notified of the assignment of associates to the Joint Team.

4. All written and oral information disclosed by Client or its agents to the Client Team will be considered by all members of the Client Team to be confidential ("Confidential Information") and will be held in strict confidence except to the extent (a) reasonably necessary for the Client Team to perform Perot Systems' contractual obligations to Client, as such obligations and reasonable necessity are determined by the Account Manager, or (b) disclosure of such Confidential Information is authorized by Client or Perot Systems' legal department. Unless otherwise required by Perot Systems' contractual obligations to Client, Confidential Information will not include information that is (1) publicly available without fault of Perot Systems or the Alliance, (2) or was known to Perot Systems prior to its disclosure by Client or members of the Alliance, or (3) received from a third party without restriction as to confidentiality. This paragraph is intended to define a standard of conduct for Perot Systems' associates and independent contracts, and will not be deemed to modify any term or condition of any agreement between Perot Systems and Client, any associate, any independent contractor or any other person, as the case may be.

Requirements

5. So long as Perot Systems is providing services for this Client, and for 90 days thereafter, Perot Systems' will:

(a) maintain accurate and complete lists of the Client Team, the Marketing Team and the Joint Team and post such lists in locations accessible to all members of the Client Team, the Marketing Team and the Joint Team;

DRAFT

CALIFORNIA INDEPENDENT SYSTEM OPERATOR
ETHICS WALL

November 17, 1997

(b) notify all members of the Client Team each time a new associate or independent contractor joins or leaves the Client Team;

(c) distribute this document to each associate and independent contractor who performs services for the Client and each other Perot Systems associate who is reasonably expected to be a member of the Marketing Team; and

(d) maintain a file containing the Affirmations of this Ethics Wall executed by all members of the Client Team, Marketing Team and Joint Team.

6. Members of the Client Team are absolutely barred from disclosing any of Client's Confidential Information to any person other than (1) members of the Client Team and, except where such person is a member of the Marketing Team or Joint Team, their supervisors, or (2) persons authorized by Client or a Perot Systems attorney to receive such Confidential Information; provided, in each case, that such person has entered into a confidentiality agreement with Perot Systems or Client.

7. Members of the Joint Team may actively participate in Perot Systems' marketing activities and may provide consulting services for third parties other than Client, provided that such person does not disclose any Confidential Information to any third party.

8. Each member of the Client Team, Marketing Team and Joint Team will execute the Affirmation attached to this document.

Perot Systems associates and independent contractors who have concerns about perceived violations of the requirements set forth in this document will immediately report such information to Perot Systems' legal department at 972/383-5600.

If you are not designated as a member of the Client Project Team, the Marketing Team, or the Joint Team, but believe that you should be included on one of those lists, please contact the Account Manager or the Perot Systems legal department immediately.

If you have any questions concerning the requirements of this Ethics Wall, please contact the Account Manager or the Perot Systems legal department.

DRAFT

CALIFORNIA INDEPENDENT SYSTEM OPERATOR
ETHICS WALL

November 17, 1997

AFFIRMATION

By signing this Affirmation, I represent to Perot Systems that:

A. I have read Perot Systems' Standards and Ethical Principles, and agree to abide by its requirements; and

B. I have read this CALIFORNIA INDEPENDENT SYSTEM OPERATOR ETHICS WALL, and agree to abide by its requirements.

Signature: _____

Name: _____

Date: _____

EXHIBIT 99.6

[PEROTSYSTEMS(TM) LETTERHEAD]

9 February 1998

VIA FAX: 202/393-5760

Skadden, Arps, Slate, Meagher & Flom LLP
Attn: Martin R. Hoffman
1440 New York Avenue, N.W.
Washington, D.C. 20005-2111

Re: California Independent System Operator

Dear Marty:

On November 26, 1997, Perot Systems Corporation proposed to take certain steps to address concerns raised by Mr. Jeffrey Tranen of the California independent System Operator Corporation with respect to our consulting services. We have not received a response to our letter, but wish to assure Mr. Tranen of our continued commitment to act in an ethically responsible manner.

Accordingly, pending a complete resolution of the issues raised by Mr. Tranen, Perot Systems will continue to use a disclaimer in its sales and marketing presentations involving the California energy market deregulation that is substantially similar to that proposed in our November 26, letter.

If you have any questions regarding this matter, please call me at 972/385-5615 at your earliest convenience.

Sincerely,

Charles N. Bell

cc: Jeffrey D. Tranen
California Independent System Operator Corporation

Andy Goletz
Ron Nash
Ken Scott
Ed Smith

August 8, 2002

BY FACSIMILE
Dr. Charles J. Cicchetti
Jeffrey Miller Chair in Government,
Business and the Economy
University of Southern California
1341 Hillcrest Avenue
Pasadena, CA 91106

Dear Dr. Cichetti:

On July 22, 2002, the Subcommittee on Energy Policy, Natural Resources and Regulatory Affairs held a hearing on "California Electricity Markets: The Case of Enron and Perot Systems." During the course of this hearing at which you testified, full Committee Ranking Member Henry Waxman asked to pose follow-up questions for the record.

On behalf of Rep. Waxman and Subcommittee Ranking Member John Tierney and pursuant to the Constitution and Rules X and XI of the United States House of Representatives, I ask that you respond to the questions in the enclosure. Please forward your responses by August 30, 2002 to the majority and minority staffs of the Government Reform Subcommittee on Energy Policy, Natural Resources and Regulatory Affairs. The offices are located in B-377 and B-350A, respectively, in the Rayburn House Office Building.

If you have any questions about this request, please contact Subcommittee Staff Director Dan Skopec at (202) 225-4407. Thank you in advance for your attention to this request.

Sincerely,

Doug Ose
Chairman
Subcommittee on Energy Policy, Natural
Resources and Regulatory Affairs

Enclosure

cc: The Honorable Dan Burton
The Honorable Henry Waxman
The Honorable John Tierney

Questions to Dr. Cicchetti from Congressman Waxman

1) You testified about the propriety of Perot Systems' marketing presentations.

a) Did you attend these marketing presentations?

b) Please list all of the sources you used to determine what was discussed at those meetings. If you discussed the meetings with any individual meeting attendees, please provide the name of the individuals and the length of time you spent talking to each of them about the substance of the meetings.

2) The Cal ISO tariff defines gaming as taking "unfair advantage of the rules and procedures set forth in the CPX or CAISO tariffs, or of transmission constraints in periods where there is substantial congestion, to the detriment of efficiency and consumers." Gaming includes taking advantage of transmission and generation capacity, e.g., plant outages, which is called "physical withholding."

a) In your view, are the gaming strategies described in the December 8, 2000, Enron memo on gaming strategies examples of a company "taking unfair advantage of the rules?"

b) In your view, if a gaming strategy is allowed under the tariff is it legal?

USC
UNIVERSITY
OF SOUTHERN
CALIFORNIA

August 29, 2002

School of Policy, Planning, and Development

Charles J. Cicchetti

The Jeffrey J. Miller Professor of Government, Business and the Economy

The Honorable Doug Ose
Chairman
Subcommittee on Energy Policy, Natural Resources, and Regulatory Affairs
2157 Rayburn House Office Building
Office B-377
Washington, DC 20515-6143

Dear Chairman Ose:

Enclosed please find my responses to Rep. Waxman's questions to my testimony on July 22, 2002 in the Subcommittee hearing on "California Electricity Markets: The Case of Enron and Perot Systems."

Sincerely,

Charles J. Cicchetti
CJC:nb

Enclosure

cc: The Honorable Henry Waxman

University of
Southern California
Los Angeles,
California 90089-1211
Tel: 213 740 5728
Fax: 213 740 7795

Responses of Dr. Cicchetti to Questions from Congressman Waxman

August 30, 2002

Question 1

1) You testified about the propriety of Perot Systems' marketing presentations.

a) Did you attend these marketing presentations?

b) Please list all of the sources you used to determine what was discussed at those meetings. If you discussed the meetings with any individual meeting attendees, please provide the name of the individuals and the length of time you spent talking to each of them about the substance of the meetings.

Response

1(a) No.

1(b) I did not speak with any individual meeting attendees prior to preparing my written testimony. I did however review in detail the material identified in my July 9, 2002 Statement to the California Senate Select Committee to Investigate Price Manipulation in the Wholesale Electricity Market:

(1) Presentation entitled "Profit Maximization Under U.K. and U.S. Deregulation" dated January 13, 1998;
(2) Draft Proposal to Enron dated February 16, 1998;
(3) Undated Proposal to Enron;
(4) Correspondence to Rich Davis dated April 8, 1998;
(5) Undated draft correspondence to Rich Davis; and
(6) Project Tasks and Deliverable dated February 2, 1998.

Question 2

2) The Cal ISO tariff defines gaming as taking "unfair advantage of the rules and procedures set forth in the CPX or CAISO tariffs, or of transmission constraints in periods where there is substantial congestion, to the detriment of efficiency and consumers." Gaming includes taking advantage of transmission and generation capacity, *e.g.*, plant outages, which is called "physical withholding."

a) In your view, are the gaming strategies described in the December 8, 2000, Enron memo on gaming strategies examples of a company "taking unfair advantage of the rules?"

b) In your view, if a gaming strategy is allowed under the tariff is it legal?

Response

2(a) This question, as drafted, cannot be answered in the affirmative or negative. Each strategy described in Enron's December 8, 2000 memo must be analyzed within the context it was actually used -- if it was actually used -- in order to ascertain whether the strategy constitutes an example of a company "taking unfair advantage of the rules." On August 13, 2002, FERC Staff issued its Initial Report in FERC Docket No. PA02-2-000 ("Initial Report"). In the Initial Report, FERC Staff analyzes Enron's trading strategies in the context of the CAISO and CPX rules and market supply and demand fundamentals that occurred during the year 2000. FERC also ordered formal investigations into Enron's actual trading activity. These investigations are likely to take several months before the FERC reach any conclusions. Until the FERC completes its investigations, I can only speculate about Enron's strategic thinking versus its actual practices. Therefore, in fairness, I reserve judgment about what Enron did or did not do until FERC completes its formal investigation.

Finally, FERC may analyze this problem using the following three broad categories to describe competitive behavior: (1) games; (2) gaming; and (3) cheating. For example, two people can make a bet based on who will draw the highest card when a deck of cards is cut. Each has a fixed expectation based on the odds of drawing any particular card. This is a "game." If the same two people are playing poker, other strategies, include bluffing and betting, come into play. These strategies are within the rules of the game and are expected by the participants and encouraged. The players each have a rational expectation based on the rules. This is "gaming." In the third scenario, the same two players are again playing poker, but one player has secreted an ace up a sleeve, to be used advantageously should the opportunity arise. This is "cheating" and it is outside the rules of the game.

2(b) First, I am an economist, not an attorney. With that qualification, I understand there may be other laws that apply to energy transactions, and those laws may prohibit conduct that would be otherwise allowed under the CAISO tariff at issue. As a general matter, an action that violated a statute, even if allowed under the tariff, apparently would be prohibited by that statute. As an economist, I cannot comment further on the legal hypothetical posed in the question. In its investigation, FERC likely will attempt to define what it means to take "unfair advantage" of the CAISO's rules, bearing in mind that the CAISO tariff recognizes the difficulties in characterizing a particular practice as improper gaming or legitimate aggressive competition.

ONE HUNDRED SEVENTH CONGRESS

Congress of the United States

House of Representatives

COMMITTEE ON GOVERNMENT REFORM

2157 RAYBURN HOUSE OFFICE BUILDING

WASHINGTON, DC 20515–6143

MAJORITY (202) 225–5074
FACSIMILE (202) 225–3974
MINORITY (202) 225–5051
TTY (202) 225–6852

www.house.gov/reform

August 8, 2002

BY FACSIMILE
Dr. George Backus
President
Policy Assessment Corporation
c/o Tim Beyer, Esq.
Brownstein, Hyatt, Faber PC
410 17th Street - 22nd Floor
Denver, CO 80202

Dear Dr. Backus:

On July 22, 2002, the Subcommittee on Energy Policy, Natural Resources and Regulatory Affairs held a hearing on "California Electricity Markets: The Case of Enron and Perot Systems." During the course of this hearing at which you testified, full Committee Ranking Member Henry Waxman asked to pose follow-up questions for the record.

On behalf of Rep. Waxman and Subcommittee Ranking Member John Tierney and pursuant to the Constitution and Rules X and XI of the United States House of Representatives, I ask that you respond to the questions in the enclosure. Please forward your responses by August 30, 2002 to the majority and minority staffs of the Government Reform Subcommittee on Energy Policy, Natural Resources and Regulatory Affairs. The offices are located in B-377 and B-350A, respectively, in the Rayburn House Office Building.

If you have any questions about this request, please contact Subcommittee Staff Director Dan Skopec at (202) 225-4407. Thank you in advance for your attention to this request.

Sincerely,

Doug Ose
Chairman
Subcommittee on Energy Policy, Natural Resources and Regulatory Affairs

Enclosure

cc: The Honorable Dan Burton
The Honorable Henry Waxman
The Honorable John Tierney

Questions to Dr. Backus from Congressman Waxman

1) Please provide the following information for each meeting regarding joint services offered by Policy Assessment Corp. and Perot Systems:

a) The date of the meeting;

b) The companies represented at the meeting;

c) The location of the meeting;

d) The primary purpose of the meeting;

e) Any additional purposes of the meeting;

f) The number of individuals attending the meeting;

g) The names of individuals that attended the meeting (if you do not have a list, please list all individuals that you recall attending);

h) The occupation (e.g. trader, general manager, government relations expert) of each of these individual attendees;

i) Please provide all documents you or Perot Systems used at the meeting;

j) Please provide all documents you or Perot Systems provided to any attendee;

k) Describe in detail any discussions about consultation services;

l) Describe each gaming strategy that was discussed;

o) Do you believe any gaming strategies that you discussed were illegal;

p) A detailed accounting of your expenses for that meeting; and

q) Whether you were paid by another entity for the meeting (including expenses) and, if so, how much.

2) You explained that your meeting with Enron could not have led to consultation services because Perot Systems was no longer interested in your joint venture. If you had no services to market, what was the purpose of this meeting?

3) Have you ever been paid a sum as great as $7000 in order to make a presentation soliciting future consultation work? If so, please describe those solicitations and the amount you were paid.

4) Have you ever made a presentation soliciting future consultation work without receiving compensation? If so, please describe those solicitations.

Policy Assessment Corporation
14604 West 62nd Place
Arvada, Colorado 80004
Office: (303) 467-3566 Fax: (303) 467-3576
e-mail: George_Backus@ENERGY2020.com

Energy, Environmental, Economic Planning

August 23, 2002

Majority Staff
Government Reform Subcommittee on Energy Policy,
Natural Resources and Regulatory Affairs
2157 Rayburn House Office Building, B-377
Washington, DC 20515

Minority Staff
Government Reform Subcommittee on Energy Policy,
Natural Resources and Regulatory Affairs
2157 Rayburn House Office Building, B-350 A
Washington, DC 20515

Re: "California's Electricity Market: The Case of Perot Systems"

Dear Sirs and Madams:

The following are my responses to the questions received on August 8, 2002 from Rep. Waxman and Subcommittee Ranking Member John Tierney:

1) Please provide the following information for each meeting regarding joint services offered by Policy Assessment Corp. and Perot Systems:

a) The date of the meeting;

There were three joint meetings involving the joint services offered by Perot Systems. There was to be a fourth to Enron in Portland, but Perot Systems ceased those discussions because they felt they had finally receiving the new ISO contract. I made a standard presentation on deregulation dynamics to Enron alone, but included an overview of the Perot Systems' IT proposal with the understanding that it could no longer be pursued without Perot involvement.

I only have the dates listed on my presentations to reflect the meeting dates. I presume these are the dates or very close to it. The joint-service meetings were:
Southern California Edison (SCE): Best guess is May 15, 1997 Perot Systems may have an exact date.
San Diego Gas & Electric (SDG&E): October 7, 1997
Pacific Gas & Electric (PGE): August 18, 1997

These latter two are based on the date listed on the presentation and are consistent with the time frame I remember (within possibly a week on either side.)

The meeting with Enron customers was October 21, 1997 (No association with Perot Systems and solely prompted by my WSCC presentation.) The meeting in the Enron Portland Office was near the first week of February, 1998. The original meeting in January was cancelled due to a snowstorm. My records do not show the date of the rescheduled meeting but the invoice (attached) was February 6 and I usually invoiced presentations the next day.

b) The companies represented at the meeting;

The Enron customer presentation is only included for completeness (These two are my only presentations and only significant contact with Enron). I do not remember the names of any customer companies and I was simply a speaker with the time slot to make the presentation on the "dynamics of deregulation." For the SCE, PG&E, and SDG&E presentations, only staff from the host company and Perot Systems were also present. For the second Enron presentation, only Enron staff (Portland-office only) and myself were present.

c) The location of the meeting;

Southern California Edison: Rosemead HQ
San Diego Gas & Electric: San Diego HQ
Pacific Gas & Electric: San Francisco secondary staff-office. I followed Perot Systems staff to the office building so did not know or learn the address.
Enron: Portland General HQ

d) The primary purpose of the meeting;

In all cases, I presented my standard "Dynamics of Deregulation" presentation. For SCE, SDG&E, and PG&E, the proposal originally developed for SCE (SCE proposal) was also overviewed (attached) primarily by Perot Systems for SDG&E and PG&E and with my assistance for SCE. For Enron, the primary focus was the dynamics of deregulation presentation with me indicating that the Perot option was most probably now non-existent and that my work could only consider generic strategy issues. The SCE proposal was discussed with Enron to the extent that it was no longer applicable. This fact only became clear between the time of the rescheduling and the actual meeting. To my memory, the only specific issue discussed was the idea of Perot Systems still having IT capabilities that could automate some of their operational processes as noted in the SCE proposal. This discussion was truncated because Perot Systems was not present.

e) Any additional purposes of the meeting;

See D above. Only "variation" is that PG&E was not interested at all in considering work for California, but only possibly for its activities in New England.

f) The number of individuals attending the meeting;

For all the meetings, I am guessing six to eight attended, in addition to Perot Systems staff and myself.

g) The names of individuals that attended the meeting (if you do not have a list, please list all individuals that you recall attending);

I only remember Lewis Hashimoto from the SCE meeting (He was my project manager for the market review work). From Perot Systems, I believe Paul Gribik and Hemant Lall were both there. Also possibly, Ed Smith of Perot Systems.

For the PG&E meeting, I believe Paul Gribik and Ed Smith were there and possibly Hemant Lall. From PG&E, I only remember Michael Katz and Mark Melgin, because I have their cards.

For the SDG&E meeting, I believe Paul Gribik, Ed Smith, and Hemant Lall were present. I only remember Eric Nelson from SDG&E.

For all three of these meetings I was a technical presenter (albeit also a joint beneficiary of any success) and let the marketing issues remain fully with Hemant Lall and Ed Smith. I did not take notes or attempt to learn names.

For Enron in Portland, I only remember Rich Davis and Tim Belden by name. No Perot Systems staff attended.

h) The occupation (e.g. trader, general manager, government relations expert) of each of these individual attendees;

For the SCE, PG&E, and SDG&E meetings, I think there were only managers present. For the Portland Enron meeting, there were only traders present.

i) Please provide all documents you or Perot Systems used at the meeting;

The SCE proposal is attached as are the presentations in the last draft I had. (I only needed to worry about my "dynamics of deregulation" part and did not need the finalized slides.) Perot Systems may have final presentations. Some form of all of these, I believe, are on the Pert System website and were reviewed by Dr. Charles Cicchetti prior to the

Congressional hearing of July 22, 2002 to verify they do not contain questionable material. I believe I only used the initial Enron-customer presentation in Portland, but they or I may have had a copy of the attached draft presentation for the cancelled January meeting.

j) Please provide all documents you or Perot Systems provided to any attendee;

I do not remember whether the attendees were provided copies of attached presentations (my only documents). I do not know if Perot Systems provided anyone other than SCE with a copy or version of the "SCE proposal." It appears that Enron did later re-contact Perot Systems to ask if Paul Gribik could just make a presentation on the ISO/PX markets (Task 0) to keep the "proposal" alive in case Perot lost the ISO contract. This draft document is attached, but I do not know if it was ever delivered to Enron. I also do not remember if I participated in any of this later discussion – due to the low probability of business for me. In all cases, no work developed and nothing occurred beyond the efforts noted here.

k) Describe in detail any discussions about consultation services;

My focus was the "dynamics of deregulation" presentation. I probably provided technical input, as asked, to clarify a task effort per the proposal, but did not discuss the consultation services, per se. That marketing effort was left to Perot Systems for SCE, SDG&E and PG&E. As noted above for Enron, I did have discussions indicating that I did believe Perot Systems had the IT capability to automate trading operations, but I could not carry the conversation further. I did discuss the ability to use my model for generic strategy, but that was rejected as not being useful to the trading operation before the discussion even got started.

I think the marketing effort and its relation to gaming needs to be placed in context. We were selling a process embodied in a computer system to allow potential clients to simulate market dynamics. Perot Systems is an IT organization and I am a computer simulationist. We were not proposing to teach potential clients how to game the market. The computer system could be used to allow them to learn how develop a game plan for operating in the new competitive markets, but we could only teach them how to use the software and the concepts.

Further, the "dynamics of deregulation" include 6 phases, of which only one considers market gaming. This market gaming is no different than that used for any other commodity to help firms maximize their profits against competitors. Only a few slides of the presentation focus on market gaming. Later presentations included more gaming news because gaming had then become the dominant phase as predicted years earlier – consistent with historical deregulation transitions in other industries. As was routine practice, the presentations usually explicitly stated in a slide line-item that that gaming

must occur within the bounds of the market rules. My interests focus on mergers and acquisitions, capacity expansion, and the impact of market rules on ensuring a workable market. My model did not and does not have the temporal, generation plant, or transmission detail to simulate games. It is not useful to traders – who consider these details as being paramount. The model can only simulate gaming concepts to show their impact on competitors. As Dr. Gribik pointed out in his testimony, the tools we proposed are not directly valuable to traders. Enron also verified this to me at my presentation in Portland. The generic nature is useful to strategic planning and to generic tactical planning but not to operation implementation. At best, even the proposed detailed Perot Systems' IT system could simply show the possibilities of what would happen next in the markets. That is useful information, but not of adequate detail to specify actual trading operations.

The computer system was to conceptually test possibilities (Dr. Gribik's red team – blue team exercises), to possibly automate the processing of information flow to make them most useful for making market decisions, and to develop long-term strategies to succeed against competitors given the market rules.

To operate in a previously protective, regulated environment, market participants needed to understand how to operate and survive in the transitional chaos produced by moving to competition. Mergers, acquisitions, market focus, market expansion, and legitimate market gaming are part of that new environment. We simply offered a capability to learn the required lessons safely on a computer rather than by actual market experimentation. It is no different from a pilot using a flight simulator and Perot Systems involvement is no different from a turn-of-the-century automotive employee teaching the public how to drive.

1) Describe each gaming strategy that was discussed;

In the sense I think is meant here, I do not remember any games being discussed. I did present the publicly known games as stated in bullets from my slides (attached). In most, if not all, instances, I just read the slide and the audience understood the concept. There would be questions to clarify the terms or the activities (such as the British use of the term "LOLP,") but there was never any discussion of how to actually apply the games. As noted in other documents, none of us claimed knowledge of trading practices. Therefore, we would not even know how to discuss specific implementations of any games. For PG&E, there was a discussion of whether any of our work would be applicable to New England, but again no discussion of specific games took place (other than to clarify the game definition during the presentation). These were marketing or generic deregulation presentations. All parties, therefore, would make sure they said nothing with specificity until after any contractual arrangements were completed. Thus, only generic, publicly known concepts were discussed.

For Enron, all the attendees (except Rich Davis) appeared to be freshly graduated traders, new to energy. This was my first ever experience with traders. They asked if I could describe the market gaming of the deregulation presentation in their terms (calls, puts, condors, butterflies, etc.). My complete knowledge of trading was reading two chapters in an options book (for personal stock trading) on the plane prior to arrival in preparation for the presentation. I only made a fool of myself and the traders politely left the room as soon as they could, thereafter. I don't believe Tim Belden or Rich Davis asked any questions and only commented that traders spend years learning what they do and what I showed was nothing new or interesting -- as verified by them not asking me back. As an additional point brought out as an addendum to the Congressional testimony, the presentation and materials provided to Enron (as can be verified via the attachments) contain none of the games later noted in the "Enron gaming memorandum." I did not know any of these "games" at the time. None of these games, to my memory, was ever broached to me.

o) Do you believe any gaming strategies that you discussed were illegal;

I simply presented games that the public literature said existed or could exist. They were not "discussed" in the sense of future implementation. The legality of a game depends on the rules in place. I was unaware of any final rules yet in place for California at this time. Further, most of the games (all of those that seem to be concern to investigators) described the UK, not the US markets. It was routine practice in all presentations to explicitly state that gaming must be within the bounds of the rules.

p) A detailed accounting of your expenses for that meeting; and

I have attached the invoices for the SDG&E and Enron presentations. I was already on-site for the SCE presentation, so there were no incremental expenses. I believed I used frequent-flier miles for PG&E, so I only had two taxi charges for which I can no longer find the specific receipts.

q) Whether you were paid by another entity for the meeting (including expenses) and, if so, how much.

See "p" above. Perot System paid my expenses for SDG&E and Enron paid the standard expenses for a "dynamics of deregulation" presentation.

2) You explained that your meeting with Enron could not have led to consultation services because Perot Systems was no longer interested in your joint venture. If you had no services to market, what was the purpose of this meeting?

I was paid to make the WSCC "dynamics of deregulation" presentation for the "new hire" traders just as I had for the Enron customers months earlier (and for a multitude of

other organizations). During this time, a large fraction of my income was from simply repeating the WSCC presentation (and updates thereof) for commissions, industry groups, consumer groups, regional planners, utilities, etc. That is why I wrongly assumed such interest could be turned into a real consulting business.

3) Have you ever been paid a sum as great as $7000 in order to make a presentation soliciting future consultation work? If so, please describe those solicitations and the amount you were paid.

No.

4) Have you ever made a presentation soliciting future consultation work without receiving compensation? If so, please describe those solicitations.

Only the proposed joint efforts with Perot System consulting-services include explicit consideration of market gaming. As a one-person company, I cannot afford to make presentations on potential consulting work – as indicative of Perot Systems paying my expenses for the SDG&E presentation. I almost exclusively receive new work via word of mouth, long-term clients (via previous government work), and responding to RFP's. My motivation for the Perot Systems joint effort was that if they were successful, Perot Systems could provide me stable software development work without me having to do marketing. Other than a few times a year for project-milestone presentations, whenever possible, all my presentations are via telephone with the client showing the slides on the screen on-site, while I talk on speaker-phone from my home office. I do not like to and seldom do travel for work. I find meetings a waste of time. I do and did accept limited on-site presentations if it was just in and out on the same day. I work alone, unaffiliated with a company for that reason.

I believe that the last time I made an "un-funded" solicitation presentation was to the ISO New England due to their requirement that short-listed respondents to their RFP on market-rule-review had to make a presentation without-cost at the ISO NE offices. Prior to that, I think the last solicitation presentation was to the Ohio Consumers Council in about 1991. Both "marketing" presentations were unsuccessful. Therefore, as a critical practice to minimize (non-productive) costs, I take great lengths to avoid making presentations for soliciting work. Therefore, questions 3 and 4 do not really apply to me.

Sincerely,

George Backus

Enclosures

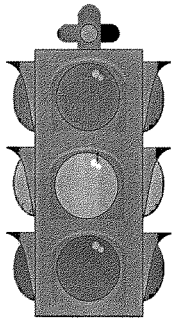
Deregulation Dynamics Overview

Dr. George Backus
Policy Assessment Corporation
Denver, CO, Cambridge, UK
Telephone: 303-467-3566

Pacific Gas & Electric Corporation
August 18, 1997

Agenda

- System Overview
- A Different View of Deregulation
- Protecting PG&E from California Gaming



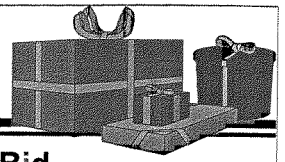
Policy Assessment Corporation

CIGMOD AND PG&E

- Focus on California/WSCC Dynamics
- 50 State Plus Canadian Provinces
- All North American Electric and Gas Suppliers & Markets (Utility, Marketing, Transmission)
- Full Strategic, Tactical and Real-Time Operational Analysis
- Detect/Stealth Activities of/to Competitors
- HYPERSENS, Electric and Gas Utility System Was Developed at PG&E

Policy Assessment Corporation

The California Focus

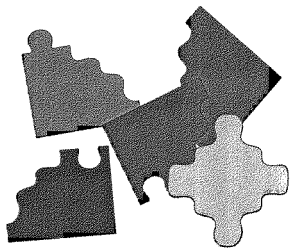


- Determine Protocol Areas That Benefit the Bid, Availability, Over/Under-Booking and Congestion Opportunities.
- Determine Portfolio of (Long-term,) Daily, Hourly, Spot and Ancillary-Service Actions to Maximize Profitability.
- Determine Monetary Value of Changing The Rules (PX/ISO, FERC, and CPUC).
- Coordinate Generation, Marketing And UDC Operations for Maximum Company Profitability (Without Collusion).
- Determine (New and Old) Competitor Threats and Strategies.
- Complete Loss Avoidance and Profit Risk Control.
- Demand, Financial, Generation Simulation for All Players.

Policy Assessment Corporation

System Components

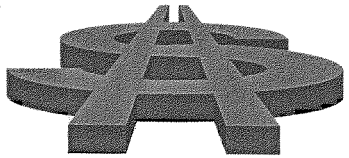
- Comprehensive Response System
  - » Determine Gaming Issues
  - » Protocol/Grandfather-Rule Dynamics
  - » Loop-Holes and Fringe Games
  - » Game Verification Testing
- PX/ISO/Settlement Simulation
- Strategy Search System
- ST-Forecasting System
- Data Mining of Short-Term Tactical Gaming (Generation and Demand)
- Mid/Long-Term Capabilities (M&A, Alliance, Assets)
- Competitor-Aware, Real-Time Tactical/-Operational Response (Conditional Latin Hypercube)



Policy Assessment Corporation

Macroeconomy Design

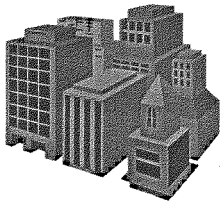
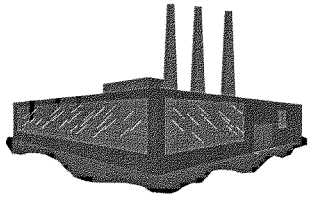
- Dynamics of Local (State or Sub-State) Economies Due to Deregulation and Retail Wheeling Activity
- Individual Dynamics for Residential and 49 Industry/Business/Government Sectors
- Impacts of Prices, Marketing and Utility Investment on Local Economy
- Market Size Dynamics
- Market Segment Analysis
- Data for All 50 States plus CN Provinces



Policy Assessment Corporation

Demand Design

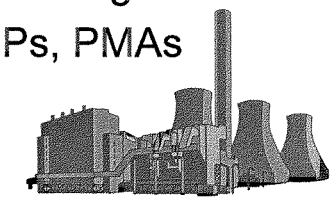
- Residential, Commercial, 2-Digit SIC Markets at State Level
- Inter-Fuel Competition, Cogeneration
- Loads From End-Use Demands by Season
- Retail Wheeling, Distributed Generation
- Utility Marketing Outside of Region


Policy Assessment Corporation

Utility Design

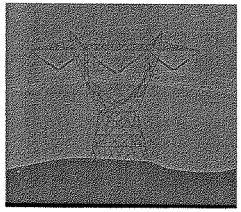
- RDI, DOE and CANSIM Data
- Financial, Capacity, Dispatch, Rates
- M&A, Take-Over And Bankruptcy Dynamics
- Gas and Electric Utility Dynamics/Hedging
- Spot, Contract, Direct Access Markets
- Generation Bid and Availability Gaming
- Includes Municipals, Co-Ops, IPPs, PMAs
- Pollution Legislation Impacts



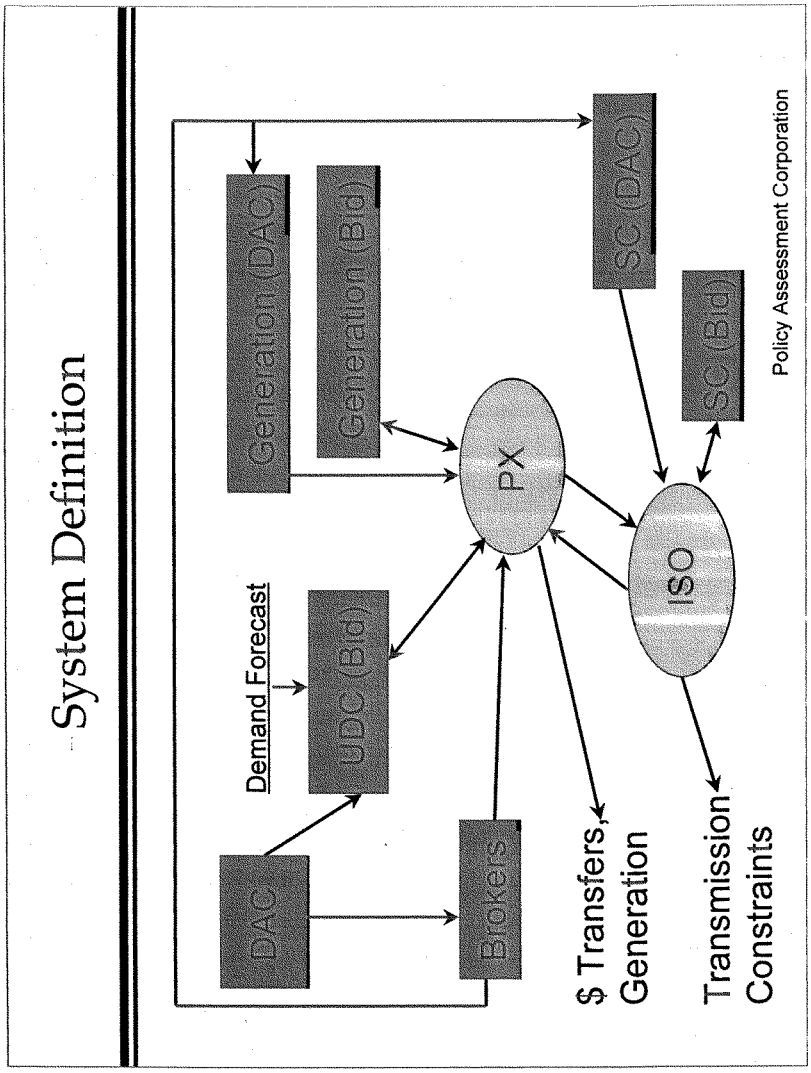
Policy Assessment Corporation

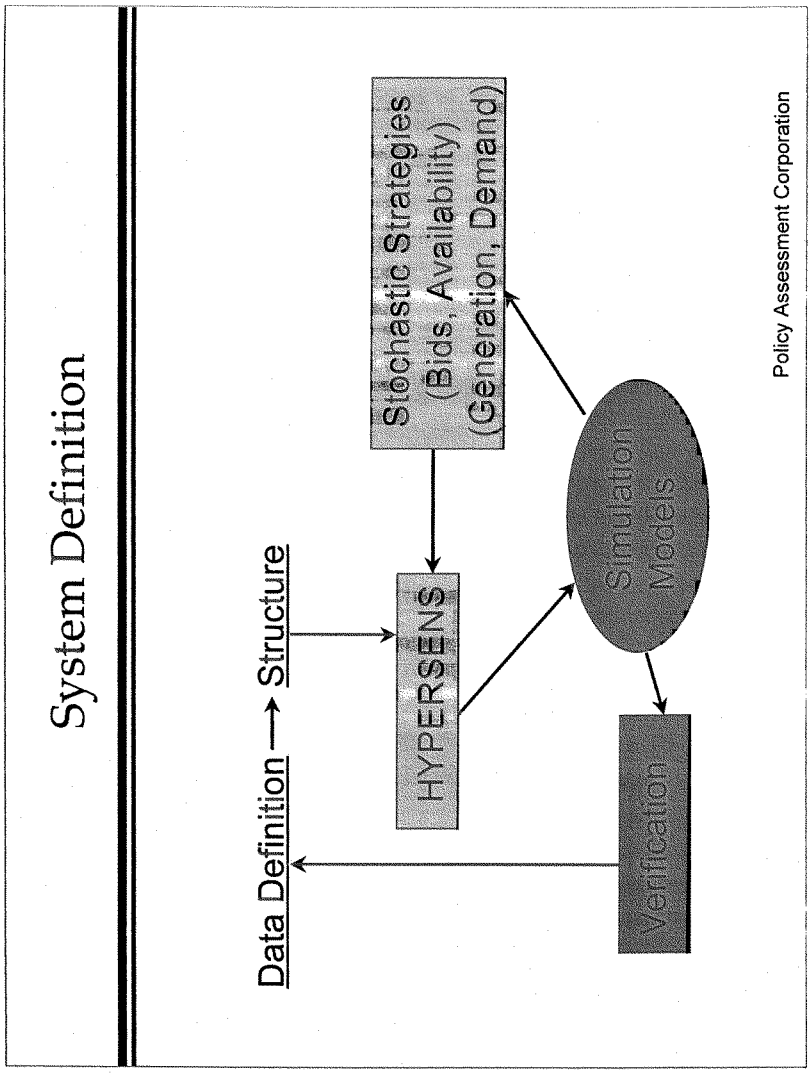
Transmission Design

- Major Intra/Inter-Regional Transmission Constraints
- Transmission Pricing From Cost Recovery, and Constrained-on and Constrained-off Plant.
- Gas Transmission Constraints for Generation.
- Poolco with ISO and Spot or Direct Access Scenarios



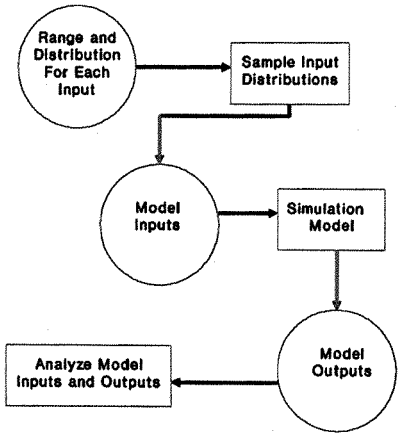
Policy Assessment Corporation


System Definition
Generation (DAC)
Generation (Bid)
SC (DAC)
SC (Bid)
PX
ISO
UDC (Bid)
Demand Forecast
DAC
Brokers
$ Transfers, Generation
Transmission Constraints
Policy Assessment Corporation


System Definition
Data Definition → Structure
HYPERSENS
Stochastic Strategies
(Bids, Availability)
(Generation, Demand)
Simulation
Models
Verification
Policy Assessment Corporation

HYPERSENS

- Provides confidence intervals & validity values.
- Quantifies uncertainty of response impacts.
- Identifies source and importance of uncertainty.
- Minimizes data requirements.
- Determines strategy-portfolio optimization.

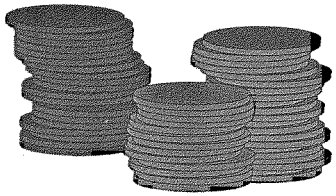


Sensitivity Analysis

Policy Assessment Corporation

Summary Benefits

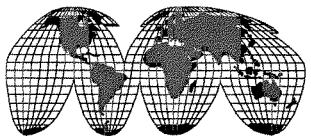
- Detailed North American Demand, Utility and Economic Databases.
- Market/Financial Analysis of Strategy Impacts
- Competitive Information on M&A Options
- In-House Competitor Gaming-Analysis Capability
- Financial As Well As Market, Generation and Transmission Dynamics/Options



Policy Assessment Corporation

A Perspective

- Living the UK Experience (Customer and Industry/Government/Academic Consultant)
- Flight-Simulation With Commissions/Utilities
- Day-to-Day Canadian and European Views
- Deregulation of US Oil & Gas in the Carter Administration
- Only Regional Planning Models: New England States; Hawaii-Pacific Region
- Canadian and US EPA GHG Analysis
- 1986 US Electric Deregulation Analysis of UK

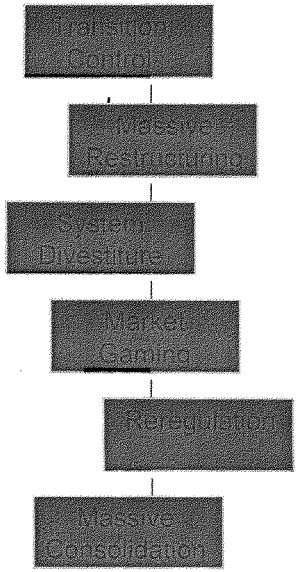


Policy Assessment Corporation

Dynamic Phases of Deregulation

- Transition Control
- Massive Market Deregulation
- System Divestiture
- Market Gaming
- Reregulation
- Massive Consolidation

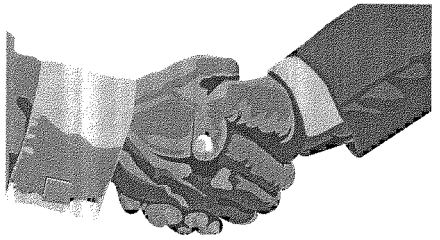
(5-6 Years: Start to Finish)



Policy Assessment Corporation

Phase 1 - Transitional Market

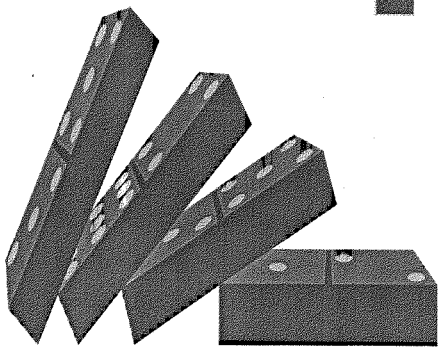
- Characteristics
  - » Regulated Market to Structured Market
    - – Poolco, Contracts
    - – Investment Recovery
    - – Regulator Role
- Indicated Keys to Success
  - » Allocentric Perspective
  - » Advocate Favorable Terms
  - » Over-book System
- Transition Signals
  - » Actual Vs. Contract Path
  - » Initial Market Gaming
  - » Increasing Volatility
  - » Abnormal Returns



Policy Assessment Corporation

Phase 2 - Massive Deregulation

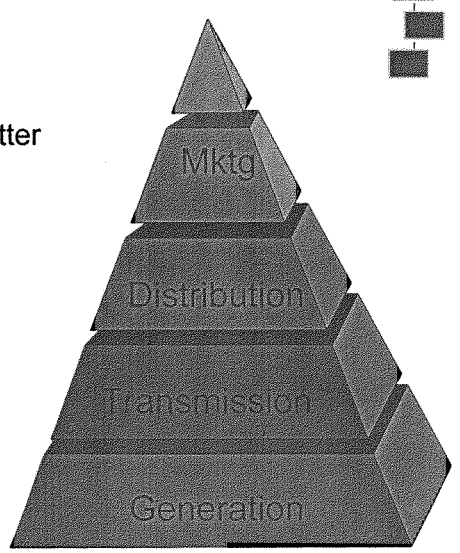
- Characteristics
  - » States make unilateral changes
  - » Asymmetry causes "Chain Reaction"
    - – Economic, Political Pressure
- Indicated Keys to Success
  - » Cash Position to Survive Price War
  - » Conserve Cash not Market Segment
  - » Plan Exit if Necessary
- Transition Signals
  - » Necessary Expansion is not Made
  - » Initial Reregulation



Policy Assessment Corporation

Phase 3 - System Divestiture

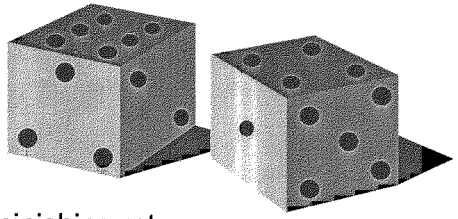
- Characteristics
  - » New Market Structure Changes System Loading
  - » Certain Customers & Markets Better
  - » Conflicts Erupt Across Segments
    - – Strategy / Marketing
    - – Cost Structure / Risk Levels
- Indicated Keys to Success
  - » Match Capabilities to Market
  - » Can't Win/Survive on Defense
- Transition Signals
  - » Transmission Gaming
  - » Survival Mentality



Policy Assessment Corporation

Phase 4 - Market Gaming

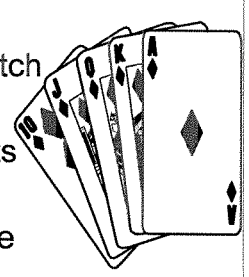
- Characteristics
  - » "Low Cost" Suppliers face "Unfair" Tactics
  - » Perverse Pricing
  - » Orthodox (Optimization) Strategies don't Work
- Indicated Keys to Success
  - » Surprise - it works once
  - » Continuous new ideas
  - » Strategic litigation
- Transition Signals
  - » Litigation reaches point of diminishing returns
  - » Huge disjoint profitability among competitors
  - » Legislative activity



Policy Assessment Corporation

Phase 4 - Market Gaming

- Overbuild Despite Excess Capacity (Increases Reliability But Ends IRP/DSM Rules)
- Put Big Generation Online Early So Other Generators Can't Get on Degraded Transmission System.
- Double Book Transmission & Generation Capacity Firm & Spot With Options; Over Contract for Distribution
- Put on Plant at Below Marginal Costs to Distort Dispatch and Make Later Costly Plant Profitable
- Have "Sudden" Outage of Plant So Spot Market Plants More Profitable (ISO Needs Autonomy Power)
- Give Capacity Zero-Rating So LOLP Price to Available "High Costs" Plants Soars (Rules Hurt)
- Prices Vary by Factor of 1000 but Average Is Low.



Policy Assessment Corporation

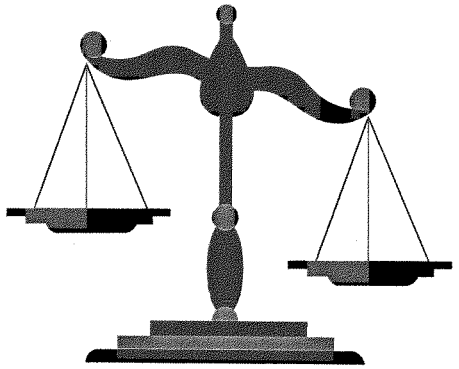
The World and CIGMOD

- Divestiture Insures Transmission Expansion Is Limited, But to Minimal Effect
- Disjoint Profitability Among Competitors; Survival Mentality
- Perverse Pricing: Orthodox Strategies Don't Work
- Utilities Hoard Cash for Volatile Market Ride
- Surprise - It Works Once: Continuously New Ideas
- Rules Not Physics Limiting: Strategic Litigation
- Limited-Time Stranded Investment/Costs Recovery
- More Rules Signal New Loop-Holes and Market Volatility
- No Level Playing Field Regulators Must React Under Pressure

Policy Assessment Corporation

Phase 5 - Reregulation

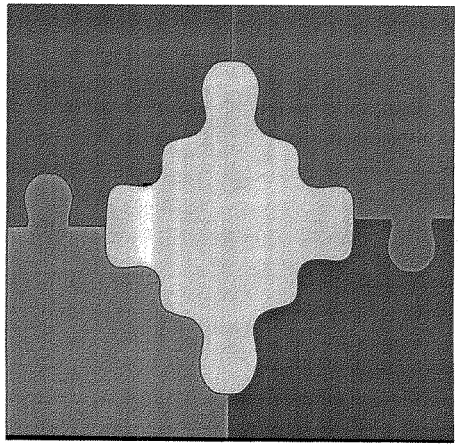
- Characteristics
  - » Gaps between expectations & reality due to "ups" & "downs"
  - » Political & Economic Pressure
- Indicated Keys to Success
  - » Match Load to Capabilities
  - » Advocate Regulatory Approach
  - » Strategically Reintegrate
- Transition Signals
  - » Formation of National Utilities
  - » Formation of Niche Utilities



Policy Assessment Corporation

Phase 6 - Industry Consolidation

- Characteristics
  - » Mergers to recapture market
  - » Assets are re-priced
  - » Overall rising prices
  - » Less volatility
  - » Rediscover vertical integration
  - » Results in 5-7competitors
- Indicated Keys to Success
  - » Wars allow one victor unless treaties stop it
  - » Play end-game
- Transition Signals
  - » Price Rise
  - » END STATE



Policy Assessment Corporation

California Gaming

- Abundant Complex Rules Cause Abundant Complex Gaming
- Movement in Day-Ahead, Hour-Ahead, and Real-Time Markets for Generation and Ancillary Services Provides Gaming Options
- Large Domain Between Genteel and Illegal
- Supply, Demand and Combination Gaming
- Rules Change and Change (This is as of August and considers PX limitations.)

Demand Gaming

- DAC who owns generation or flexible production does what it wants for most of month, has "hidden" hourly meter, bids or contracts perfect profile, can match end-of-month MWh, and leaves all imbalance-energy charges with UDC, independent of profile.
- UDC loss is estimated in-flow less hourly-metered and estimated profile. UDC (as residual without other players) realizes all uncertainty as imbalance charges.

UDC Gaming

- Over-Book Day-Ahead and Sell on Hour-Ahead or Real-Time (or Vice-Versa Depending on Price Gradient). Over-Booking Could Force Other Prices up for Profit.

- Under-Book Day-Ahead to Force Hour-Ahead Down; Take Hour-Ahead Rates.

Supply Gaming

- Ancillary and generation markets are mixed. Generation bid often contains start-up and no- load costs. Ancillary may not include these costs, especially if generation and ancillary bids come from same plant. Price can ***drop*** or rise on real-time market.
- Generator over books DAC load (with possible help from DAC), has unit output "frozen." At end of day ISO has to pay generator real-time price for the excess capacity.
- If price can drop on real-time market, then under-book/generate for DACs.
- Use inconsistencies of new rules with old contracts/rules.

Interim Games

- With No Iteration: No Price Discovery; Mis-information "Undetectable."
- With Only Day-Ahead, SC have advantage over PX via Hour-Ahead: Old Contracts can be used to move Power via SC.
- With Both Limitations: Congestion Opportunities Arise: Must Run Logic Limits Counter-Strategies
- El Niño Allows Conditional Expectations

Policy Assessment Corporation

Future Games

- North-to-south generation can cause congestion that increases revenue for south-generation despite congestion costs.
- Force inter-zonal constraint that hurts competitor worse than you, such as a small schedule-coordinated producer.
- Build plant at interconnect to cause congestion problems.

Policy Assessment Corporation

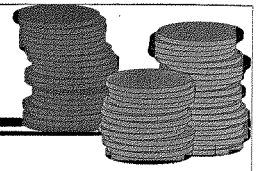
Combative Moves

- Congestion iteration makes and relieves constraint at cost to competitor.
- If real-time price drops due to ancillary-service bidding convolution, then have outage.
- In intra-zonal market, occasionally high-bid constrained-on unit. If hit for LT. contract, make money by never running plant - change internal dispatch.

<u>Every Gaming Move Has Counter Move</u>

Policy Assessment Corporation

Other "Games"



- Micro-Bids As Probes.
- If You Are Marginal Plant, Have (Multiple) Outage(s) and Have Other Plants in Queue.
- Use Model to Determine (Without Signals) That Generation, Marketing, or UDC Should Take Strategy Lead to Avoid "Conflict" of Financial Interests.
- Combined Generation/UDC Over/Under-Book Strategies.
- External 3rd Party Alliance (Collaborator) on Bids and Generation Ownership.

Policy Assessment Corporation

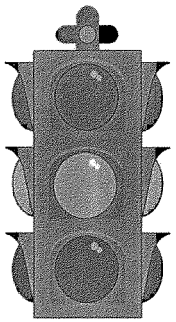
Deregulation Dynamics Overview

Dr. George Backus
Policy Assessment Corporation
Denver, CO, Cambridge, UK
Telephone: 303-467-3566

ENOVA,Pacific Enerprises, SDG&E
October 7, 1997

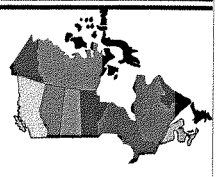
Agenda

- System Overview
- A Different View of Deregulation
- Protection/Benefits from California Gaming



Policy Assessment Corporation

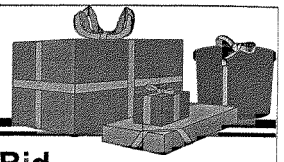
CIGMOD AND PE



- Focus on California/WSCC Dynamics
- 50 State Plus Canadian Provinces
- All North American Electric and Gas Suppliers & Markets (Utility, Marketing, Transmission)
- Full Strategic, Tactical and Real-Time Operational Analysis
- Detect/Stealth Activities of/to Competitors
- Eastern Europe, South America Canada

Policy Assessment Corporation

The California Focus

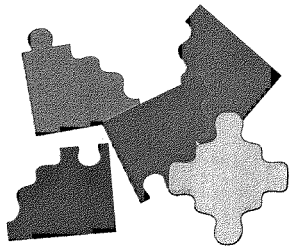


- Determine Protocol Areas That Benefit the Bid, Availability, Over/Under-Booking and Congestion Opportunities.
- Determine Portfolio of (Long-term,) Daily, Hourly, Spot and Ancillary-Service Actions to Maximize Profitability.
- Determine Monetary Value of Changing The Rules (PX/ISO, FERC, and CPUC).
- Coordinate Generation, Marketing And UDC Operations for Maximum Company Profitability (Without Collusion).
- Determine (New and Old) Competitor Threats and Strategies.
- Complete Loss Avoidance and Profit Risk Control.
- Demand, Financial, Generation Simulation for All Players.

Policy Assessment Corporation

System Components

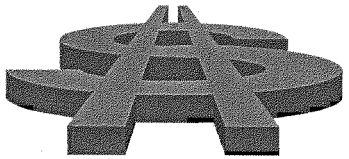
- Comprehensive Response System
  - » Determine Gaming Issues
  - » Protocol/Grandfather-Rule Dynamics
  - » Loop-Holes and Fringe Games
  - » Game Verification Testing
- PX/ISO/Settlement Simulation
- Strategy Search System
- ST-Forecasting System
- Data Mining of Short-Term Tactical Gaming (Generation and Demand)
- Mid/Long-Term Capabilities (M&A, Alliance, Assets)
- Competitor-Aware, Real-Time Tactical/-Operational Response (Conditional Latin Hypercube)



Policy Assessment Corporation

Macroeconomy Design

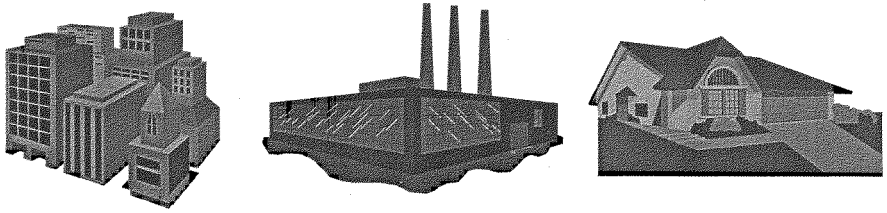
- Dynamics of Local (State or Sub-State) Economies Due to Deregulation and Retail Wheeling Activity
- Individual Dynamics for Residential and 49 Industry/Business/Government Sectors
- Impacts of Prices, Marketing and Utility Investment on Local Economy
- Market Size Dynamics
- Market Segment Analysis
- Data for All 50 States plus CN Provinces



Policy Assessment Corporation

Demand Design

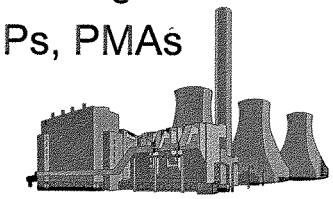
- Residential, Commercial, 2-Digit SIC Markets at State Level
- Inter-Fuel Competition, Cogeneration
- Loads From End-Use Demands by Season
- Retail Wheeling, Distributed Generation
- Utility Marketing Outside of Region



Policy Assessment Corporation

Utility Design

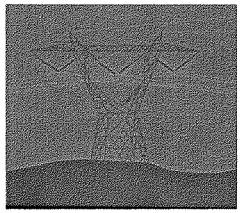
- RDI, DOE and CANSIM Data
- Financial, Capacity, Dispatch, Rates
- M&A, Take-Over And Bankruptcy Dynamics
- Gas and Electric Utility Dynamics/Hedging
- Spot, Contract, Direct Access Markets
- Generation Bid and Availability Gaming
- Includes Municipals, Co-Ops, IPPs, PMAs
- Pollution Legislation Impacts



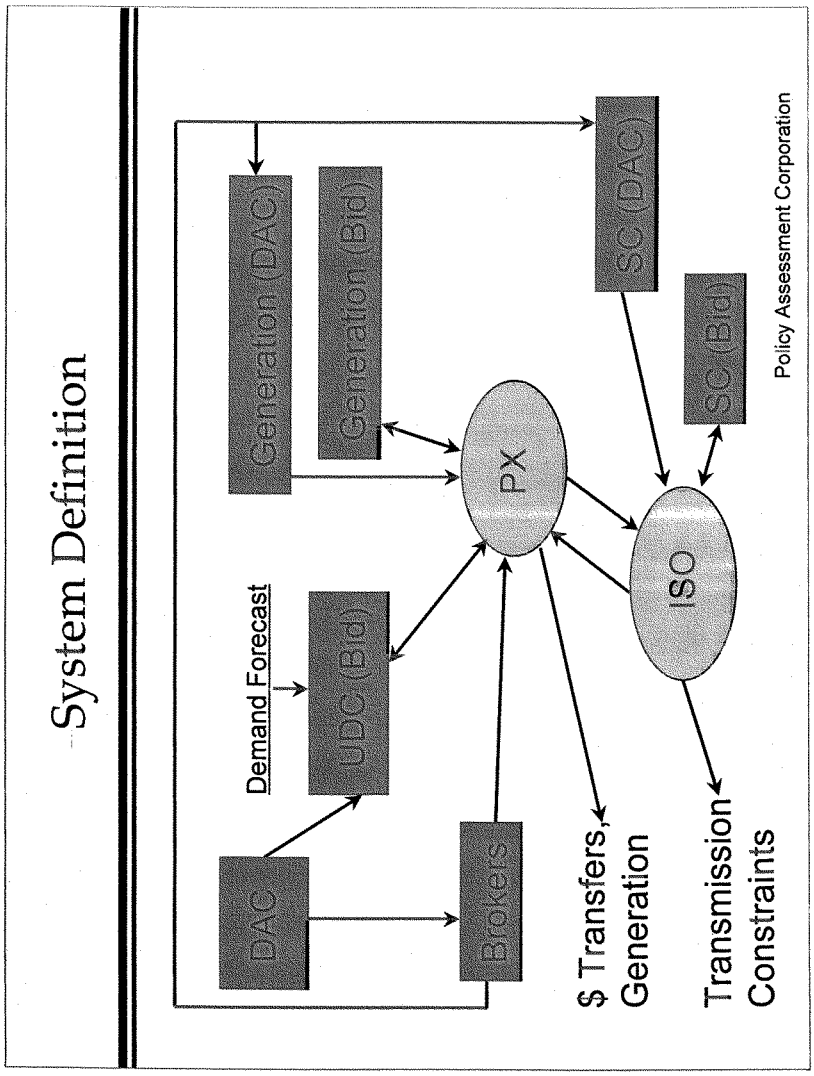
Policy Assessment Corporation

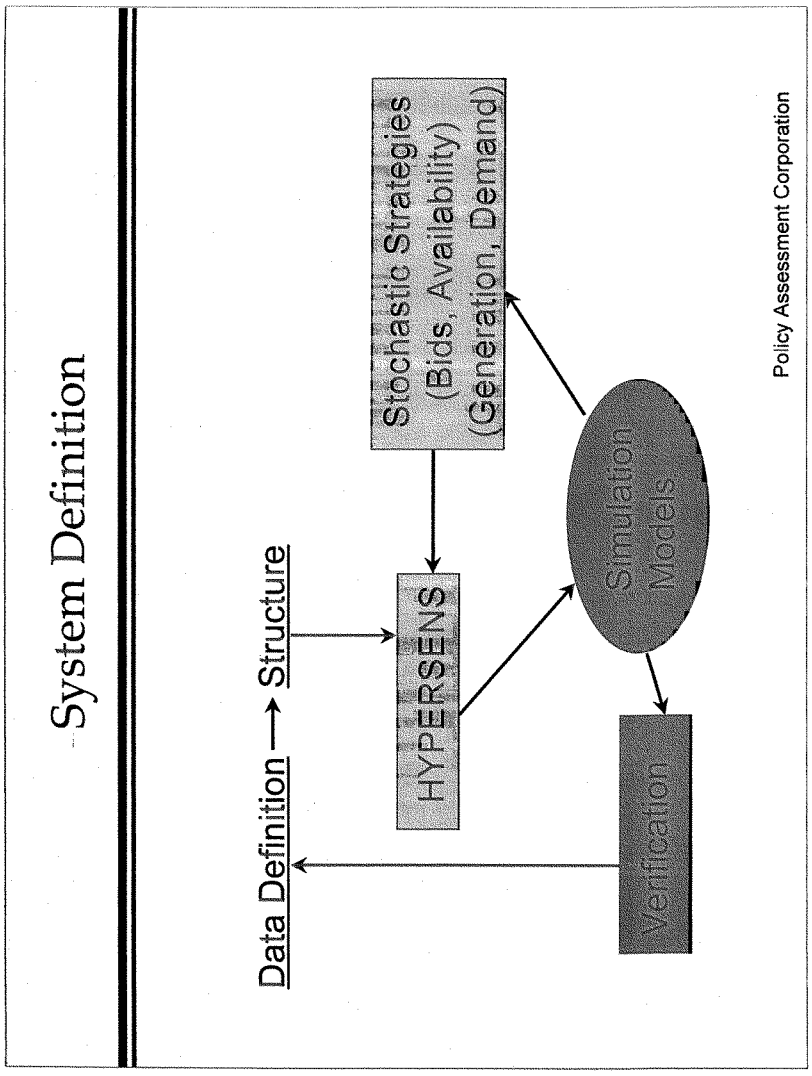
Transmission Design

- Major Intra/Inter-Regional Transmission Constraints
- Transmission Pricing From Cost Recovery, and Constrained-on and Constrained-off Plant.
- Gas Transmission Constraints for Generation.
- Poolco with ISO and Spot or Direct Access Scenarios



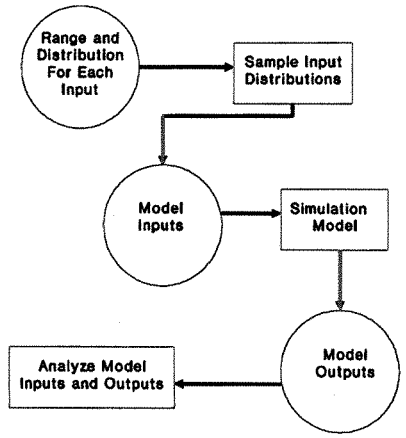
Policy Assessment Corporation


System Definition
Generation (DAC)
Generation (Bid)
SC (DAC)
SC (Bid)
PX
ISO
Demand Forecast
UDC (Bid)
DAC
Brokers
$ Transfers, Generation
Transmission Constraints
Policy Assessment Corporation


System Definition
Data Definition → Structure
HYPERSENS
Stochastic Strategies
(Bids, Availability)
(Generation, Demand)
Simulation
Models
Verification
Policy Assessment Corporation

HYPERSENS

- Provides confidence intervals & validity values.
- Quantifies uncertainty of response impacts.
- Identifies source and importance of uncertainty.
- Minimizes data requirements.
- Determines strategy-portfolio optimization.

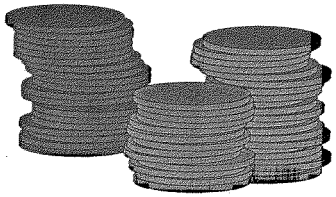


Sensitivity Analysis

Policy Assessment Corporation

Summary Benefits

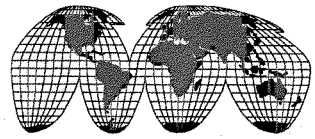
- Detailed North American Demand, Utility and Economic Databases.
- Market/Financial Analysis of Strategy Impacts
- Competitive Information on M&A Options
- In-House Competitor Gaming-Analysis Capability
- Financial As Well As Market, Generation and Transmission Dynamics/Options



Policy Assessment Corporation

A Perspective

- Living the UK Experience (Customer and Industry/Government/Academic Consultant)
- Flight-Simulation With Commissions/Utilities
- Day-to-Day Canadian and European Views
- Deregulation of US Oil & Gas in the Carter Administration
- Only Regional Planning Models: New England States; Hawaii-Pacific Region
- Canadian and US EPA GHG Analysis
- 1986 US Electric Deregulation Analysis of UK

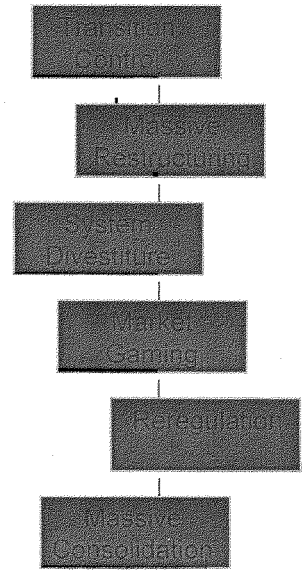


Policy Assessment Corporation

Dynamic Phases of Deregulation

- Transition Control
- Massive Market Deregulation
- System Divestiture
- Market Gaming
- Reregulation
- Massive Consolidation

(5-6 Years: Start to Finish)



Policy Assessment Corporation

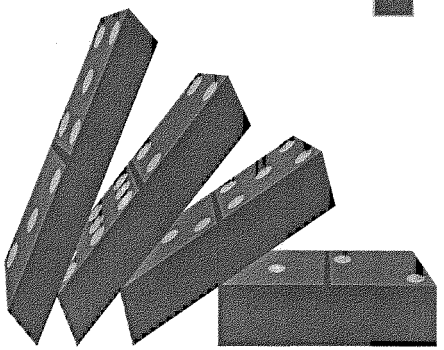
Phase 1 - Transitional Market

- Characteristics
  - » Regulated Market to Structured Market
    - – Poolco, Contracts
    - – Investment Recovery
    - – Regulator Role
- Indicated Keys to Success
  - » Allocentric Perspective
  - » Advocate Favorable Terms
  - » Over-book System
- Transition Signals
  - » Actual Vs. Contract Path
  - » Initial Market Gaming
  - » Increasing Volatility
  - » Abnormal Returns

Policy Assessment Corporation

Phase 2 - Massive Deregulation

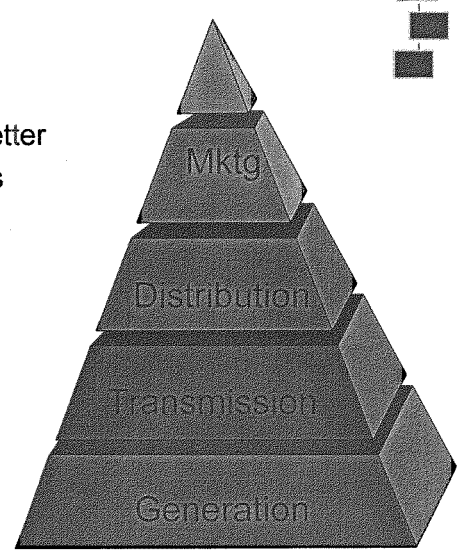
- Characteristics
  - » States make unilateral changes
  - » Asymmetry causes "Chain Reaction"
    - – Economic, Political Pressure
- Indicated Keys to Success
  - » Cash Position to Survive Price War
  - » Conserve Cash not Market Segment
  - » Plan Exit if Necessary
- Transition Signals
  - » Necessary Expansion is not Made
  - » Initial Reregulation



Policy Assessment Corporation

Phase 3 - System Divestiture

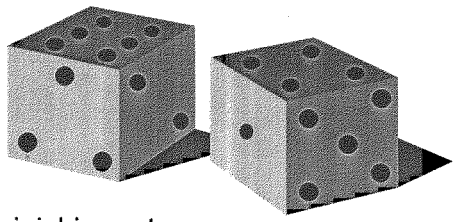
- Characteristics
  - » New Market Structure Changes System Loading
  - » Certain Customers & Markets Better
  - » Conflicts Erupt Across Segments
    - – Strategy / Marketing
    - – Cost Structure / Risk Levels
- Indicated Keys to Success
  - » Match Capabilities to Market
  - » Can't Win/Survive on Defense
- Transition Signals
  - » Transmission Gaming
  - » Survival Mentality



Policy Assessment Corporation

Phase 4 - Market Gaming

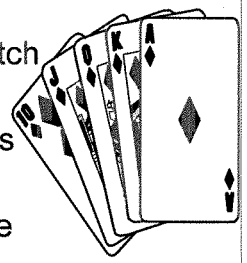
- Characteristics
  - » "Low Cost" Suppliers face "Unfair" Tactics
  - » Perverse Pricing
  - » Orthodox (Optimization) Strategies don't Work
- Indicated Keys to Success
  - » Surprise - it works once
  - » Continuous new ideas
  - » Strategic litigation
- Transition Signals
  - » Litigation reaches point of diminishing returns
  - » Huge disjoint profitability among competitors
  - » Legislative activity



Policy Assessment Corporation

Phase 4 - Market Gaming

- Overbuild Despite Excess Capacity (Increases Reliability But Ends IRP/DSM Rules)
- Put Big Generation Online Early So Other Generators Can't Get on Degraded Transmission System.
- Double Book Transmission & Generation Capacity Firm & Spot With Options; Over Contract for Distribution
- Put on Plant at Below Marginal Costs to Distort Dispatch and Make Later Costly Plant Profitable
- Have "Sudden" Outage of Plant So Spot Market Plants More Profitable (ISO Needs Autonomy Power)
- Give Capacity Zero-Rating So LOLP Price to Available "High Costs" Plants Soars (Rules Hurt)
- Prices Vary by Factor of 1000 but Average Is Low.



Policy Assessment Corporation

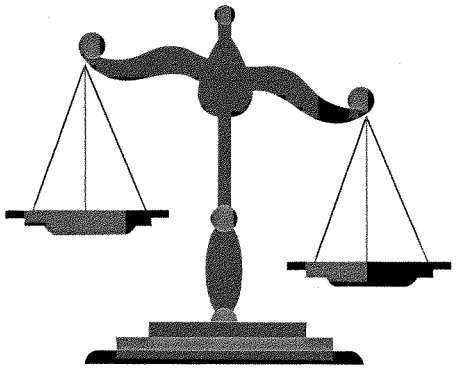
The World and CIGMOD

- Divestiture Insures Transmission Expansion Is Limited, But to Minimal Effect
- Disjoint Profitability Among Competitors; Survival Mentality
- Perverse Pricing: Orthodox Strategies Don't Work
- Utilities Hoard Cash for Volatile Market Ride
- Surprise - It Works Once: Continuously New Ideas
- Rules Not Physics Limiting: Strategic Litigation
- Limited-Time Stranded Investment/Costs Recovery
- More Rules Signal New Loop-Holes and Market Volatility
- No Level Playing Field Regulators Must React Under Pressure

Policy Assessment Corporation

Phase 5 - Reregulation

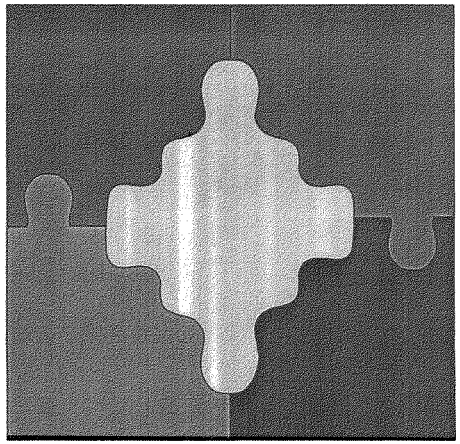
- Characteristics
  - » Gaps between expectations & reality due to "ups" & "downs"
  - » Political & Economic Pressure
- Indicated Keys to Success
  - » Match Load to Capabilities
  - » Advocate Regulatory Approach
  - » Strategically Reintegrate
- Transition Signals
  - » Formation of National Utilities
  - » Formation of Niche Utilities



Policy Assessment Corporation

Phase 6 - Industry Consolidation

- Characteristics
  - » Mergers to recapture market
  - » Assets are re-priced
  - » Overall rising prices
  - » Less volatility
  - » Rediscover vertical integration
  - » Results in 5-7competitors
- Indicated Keys to Success
  - » Wars allow one victor unless treaties stop it
  - » Play end-game
- Transition Signals
  - » Price Rise
  - » END STATE



Policy Assessment Corporation

California Gaming

- Abundant Complex Rules Cause Abundant Complex Gaming
- Movement in Day-Ahead, Hour-Ahead, and Real-Time Markets for Generation and Ancillary Services Provides Gaming Options
- Large Domain Between Genteel and Illegal
- Supply, Demand and Combination Gaming
- Rules Change and Change (This is as of September 18th, 1997 and considers PX/ISO and Ancillary-Service limitations.)

Policy Assessment Corporation

Demand Gaming

- DAC who owns generation or flexible production does what it wants for most of month, has "hidden" hourly meter, bids or contracts perfect profile, can match end-of-month MWh, and leaves all imbalance-energy charges with UDC, independent of profile.
- UDC loss is estimated in-flow less hourly-metered and estimated profile. UDC (as residual without other players) realizes all uncertainty as imbalance charges.

UDC Gaming

- Over-Book Day-Ahead and Sell on Hour-Ahead or Real-Time (or Vice-Versa Depending on Price Gradient). Over-Booking Could Force Other Prices up for Profit.

- Under-Book Day-Ahead to Force Hour-Ahead Down; Take Hour-Ahead Rates.

Policy Assessment Corporation

Supply Gaming

- Ancillary and generation markets are mixed. Generation bid often contains start-up and no- load costs. Ancillary may not include these costs, especially if generation and ancillary bids come from same plant. Price can ***drop*** or rise on real-time market.
- Generator over books DAC load (with possible help from DAC), has unit output "frozen." At end of day ISO has to pay generator real-time price for the excess capacity.
- If price can drop on real-time market, then under-book/generate for DACs.
- Use inconsistencies of new rules with old contracts/rules.

Policy Assessment Corporation

Interim Games

- With No Iteration: No Price Discovery; Mis-information "Undetectable."
- With Only Day-Ahead, SC have advantage over PX via Hour-Ahead: Old Contracts can be used to move Power via SC.
- With Both Limitations: Congestion Opportunities Arise: Must Run Logic Limits Counter-Strategies
- El Niño Allows Conditional Expectations

Policy Assessment Corporation

Future Games

- North-to-south generation can cause congestion that increases revenue for south-generation despite congestion costs.
- Force inter-zonal constraint that hurts competitor worse than you, such as a small schedule-coordinated producer.
- Build plant at interconnect to cause congestion problems.

Policy Assessment Corporation

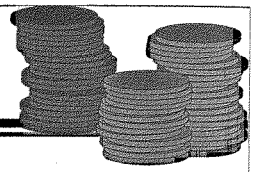
Combative Moves

- Congestion iteration makes and relieves constraint at cost to competitor.
- If real-time price drops due to ancillary-service bidding convolution, then have outage.
- In intra-zonal market, occasionally high-bid constrained-on unit. If hit for LT. contract, make money by never running plant - change internal dispatch.

<u>Every Gaming Move Has Counter Move</u>

Policy Assessment Corporation

Other "Games"



- Micro-Bids As Probes.
- If You Are Marginal Plant, Have (Multiple) Outage(s) and Have Other Plants in Queue.
- Use Model to Determine (Without Signals) That Generation, Marketing, or UDC Should Take Strategy Lead to Avoid "Conflict" of Financial Interests.
- Combined Generation/UDC Over/Under-Book Strategies.
- External 3rd Party Alliance (Collaborator) on Bids and Generation Ownership.

Policy Assessment Corporation

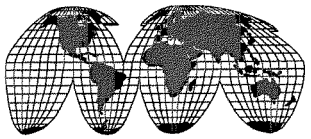
The Dynamics of The Deregulation Transition

Dr. George Backus
Policy Assessment Corporation
Denver, CO, Cambridge, UK
Telephone: 303-467-3566

ENRON
October 21, 1997

A Perspective

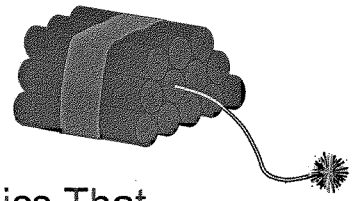
- Living the UK Experience (Customer and Industry/Government/Academic Consultant)
- Flight Simulation of Deregulation With Commissions and Utilities in 50 States and Provinces
- Deregulation of US Oil & Gas, US GHG Policy
- 1986 Vintage US Simulation of UK
- Eastern Europe, Canada, All North America



Policy Assessment Corporation

Some Twists

- Enron Staff Played CIGMOD in Portland Six Months Prior to Announcement.
- $1 Billion/Year CA Loop-Hole at PG&E and SCE Expense.

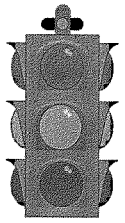


- CIGMOD Presaged PECO Dynamics That Ultimately Vaporize Any Stranded Investment.
- Enron Can Legally Shut-Down ISO & Destroy CTC.
- PJM and Midwest ISO Loop-Holes As Bad As CA.
- Over 1000 Ways to Game CA. (Interim and Full).
- Electricity Plus Gas Provide Added Gaming Power.

Policy Assessment Corporation

Insights from Deregulation

- Comparing Fears of "What" Is Not the Same As Asking the Understanding of "Why?"
- Delineate Improbable From Probable
- Deregulation Is Opposite of Regulation
- All Humans Hate Change
- The Impacts Take Time and Rules Re-Change With Changing Economic Pressures
- Relevance or Irrelevance of UK, South America, Australia, Canada

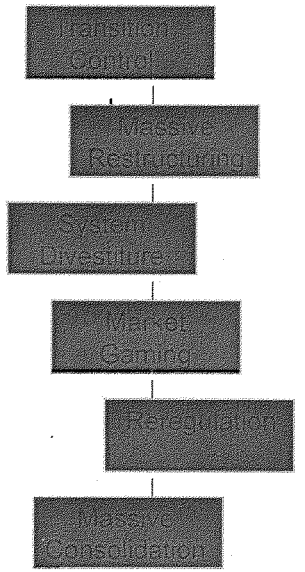


Policy Assessment Corporation

Dynamic Phases of Deregulation

- Transition Control
- Massive Market Deregulation
- System Divestiture
- Market Gaming
- Reregulation
- Massive Consolidation

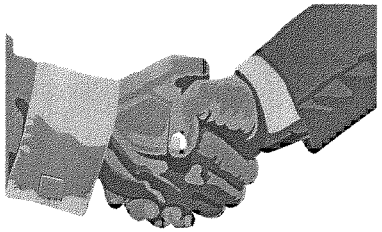
(5-6 Years: Start to Finish)



Policy Assessment Corporation

Phase 1 - Transitional Market

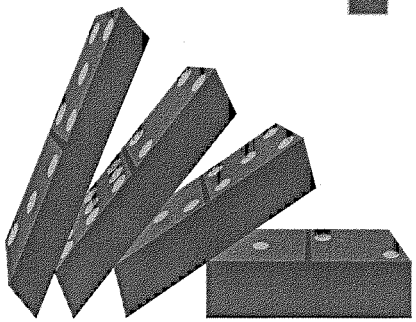
- Timing and Cause
  - » 1974 Oil Crisis - Customer and Utility Backlash
  - » Declines One Year After Initiation
- Customer
  - » Rumors but No Noticeable Change
  - » Protect or Improve Own Status-Quo
- Regulator
  - » New Letter of Law to Protect Both Status-Quo and New Claims
  - » Physically Impossible Rules
  - » Not Seen As Standing in Way of Progress
- Utility
  - » Protect Assets And Own Status-Quo
  - » ISO Formation
  - » Weak Mergers



Policy Assessment Corporation

Phase 2 - Massive Deregulation

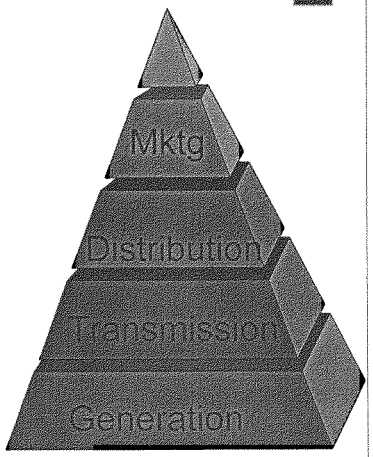
- Cause and Timing
  - » Asymmetry Causes "Chain Reaction" of Economic, Political Pressure
  - » Starts As Phase 1 Peaks; Full Swing in 6 Months; Completed in 2 Years
- Customer
  - » Sees Options; Forms Expectations
  - » Gas Impact on Economy, Not Electric
- Regulator
  - » Sees Work As Transient of Inevitable
  - » Legislative Activity To Reverse Rules
- Utility
  - » Reevaluates Business Focus
  - » Stranded Asset Scramble



Policy Assessment Corporation

Phase 3 - Electric Utility Divestiture

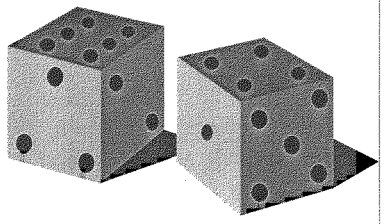
- Cause and Timing
  - » Conflicts Erupt Across Segments (Marketing Options / Risk Levels)
  - » As Soon As Phase 2 Is Recognized, US Peaks in 2 Years; UK in 45 Minutes
- Customer
  - » The Break Between Old Way and New
  - » Marketer/Broker Options
- Regulator
  - » Overwhelmed by ISO and Break-up Details
- Utility
  - » (Electric/Gas) Merges For "Market Security" or Passively Breaks-Up
  - » Electric Utility Consolidation Gaming Begins



Policy Assessment Corporation

Phase 4 - Market Gaming

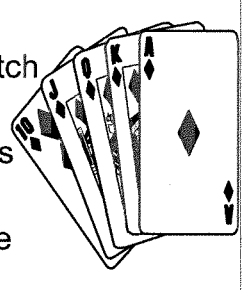
- Cause and Timing
  - » Rules and "Fair Players" Provide Great Opportunities
  - » As Soon As Phase 1 Falters.
- Customer
  - » Initial Price Drops; Acquires Averaged Bills
- Regulator
  - » Actual Vs. Contract Path Melt-Down
  - » Minimal Rules to Localize Impact Within Generation
- Utility (Generation)
  - » Can't Win/Survive on Defense
  - » Increasing Revenue Volatility
  - » "Low Cost" Suppliers Face "Unfair" Tactics



Policy Assessment Corporation

Phase 4 - Market Gaming

- Overbuild Despite Excess Capacity (Increases Reliability But Ends IRP/DSM Rules)
- Put Big Generation Online Early So Other Generators Can't Get on Degraded Transmission System.
- Double Book Transmission & Generation Capacity Firm & Spot With Options; Over Contract for Distribution
- Put on Plant at Below Marginal Costs to Distort Dispatch and Make Later Costly Plant Profitable
- Have "Sudden" Outage of Plant So Spot Market Plants More Profitable (ISO Needs Autonomy Power)
- Give Capacity Zero-Rating So LOLP Price to Available "High Costs" Plants Soars (Rules Hurt)
- Prices Vary by Factor of 1000 but Average Is Low.



Policy Assessment Corporation

California Gaming

- Abundant Complex Rules Cause Abundant Complex Gaming
- Movement in Day-Ahead, Hour-Ahead, and Real-Time Markets for Generation and Ancillary Services Provides Gaming Options
- Large Domain Between Genteel and Illegal
- Supply, Demand and Combination Gaming
- Rules Change and Change (This is as of September 18th, 1997 and considers PX/ISO and Ancillary-Service limitations.)

Policy Assessment Corporation

Customer Gaming

- DAC who owns generation or flexible production does what it wants for most of month, has "hidden" hourly meter, bids or contracts perfect profile, can match end-of-month MWh, and leaves all imbalance-energy charges with UDC, independent of profile.
- UDC loss is estimated in-flow less hourly-metered and estimated profile. UDC (as residual without other players) realizes all uncertainty as imbalance charges.

Policy Assessment Corporation

Non-UDC Supplier Games

- For interim rules, non-UDC (marketer/broker) goes in with Public Power for SC. No price limits/rules apply. SC consistently over-states demand. ISO revises "estimate" downward via rules. SC then correctly states demand and causes pseudo-shortage but backs up demand with spot supply at prices in $10+/kWh range (1000X normal price)! UDC loses company? Non-UDC customer protected by Non-UDC (marketer/broker) agreement. (Full rules reverse the game.)

Policy Assessment Corporation

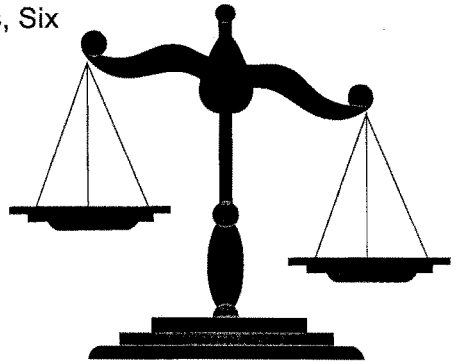
The World and CIGMOD

- Divestiture Insures Transmission Expansion Is Limited, But to Minimal Effect
- Disjoint Profitability Among Competitors; Survival Mentality
- Perverse Pricing: Orthodox Strategies Don't Work
- Utilities Hoard Cash for Volatile Market Ride
- Surprise - It Works Once: Continuously New Ideas
- Rules Not Physics Limiting: Strategic Litigation
- Limited-Time Stranded Investment/Costs Recovery
- More Rules Act a New Signals to Go Around Them

Policy Assessment Corporation

Phase 5 - Reregulation

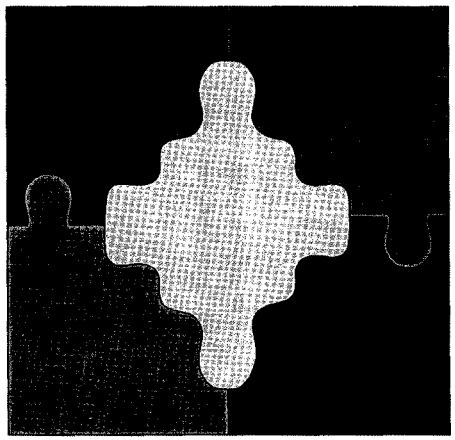
- Cause and Timing
  - » Damaged Utilities & Customers Revolt
  - » As Gaming Takes "Big "Casualties, Six Months to Peak
- Customer
  - » Options Restricted
- Regulator (Financial)
  - » Small Number of "Bank" Rules
  - » Old Regime Rules Gone
- Utility
  - » Assets Are Re-Priced
  - » National ISO/Grid, Nuclear Dumping



Policy Assessment Corporation

Phase 6 - Industry Consolidation

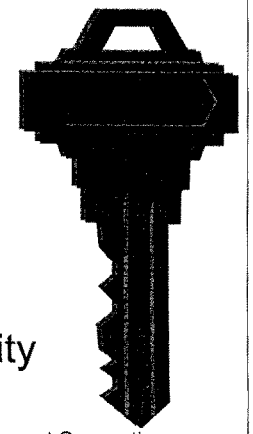
- Cause and Timing
  - » Phase 5 Locks in Advantages
  - » Starts in Phase 2
- Customer
  - » Prices Rise, Few Real Choices
  - » Industry Cost Still Improved
  - » Aggregation Imperative
- Regulator
  - » Only Abusive Anti-Trust Issues
- Utility
  - » Industry Reintegration
  - » Less Price Volatility
  - » 5 National "Companies," Many Small Niche Players



Policy Assessment Corporation

Summary Indications From Simulation and Experience

- Only Five Companies in Any Commodity; Go with Winner
- Like Airlines & Telecommunications, Roughly Five Year Transition
- Regulation Loop-Holes Create Market Volatility
- Regulators Must React Under Pressure
- No Leveling Playing Field Is Possible: Rules Change With Conditions
- UK Investments Will Soon Play at a Utility Near You



Policy Assessment Corporation

California Gaming

- Abundant Complex Rules Cause Abundant Complex Gaming
- Movement in Day-Ahead, Hour-Ahead, and Real-Time Markets for Generation and Ancillary Services Provides Gaming Options
- Large Domain Between Genteel and Illegal
- Supply, Demand and Combination Gaming
- Rules Change and Change (This is as of April 9th, 1997 and considers new Ancillary-Service rules.)

Policy Assessment Corporation

Demand Gaming

- DAC who owns generation or flexible production does what it wants for most of month, has "hidden" hourly meter, bids or contracts perfect profile, can match end-of-month MWh, and leaves all imbalance-energy charges with UDC, independent of profile.
- UDC loss is estimated in-flow less hourly-metered and estimated profile. UDC (as residual without other players) realizes all uncertainty as imbalance charges.

UDC Gaming

- Over-Book Day-Ahead and Sell on Hour-Ahead or Real-Time (or Vice-Versa Depending on Price Gradient). Over-Booking Could Force Other Prices up for Profit.

- Under-Book Day-Ahead to Force Hour-Ahead Down; Take Hour-Ahead Rates.

Supply Gaming

- Ancillary and generation markets are mixed. Generation bid often contains start-up and no-load costs. Ancillary may not include these costs, especially if generation and ancillary bids come from same plant. Price can ***drop*** or rise on real-time market.
- Generator over books DAC load (with possible help from DAC), has unit output "frozen." At end of day ISO has to pay generator real-time price for the excess capacity.
- If price can drop on real-time market, then

Future Games

- North-to-south generation can cause congestion that increases revenue for south-generation despite congestion costs.
- Force inter-zonal constraint that hurts competitor worse than you, such as a small schedule-coordinated producer.
- Build plant at interconnect to cause congestion problems.

<u>After 5-X Years, Social Efficiency Issues Will Demand Poolco-Like System.</u>

Policy Assessment Corporation

Combative Moves

- Congestion iteration makes and relieves constraint at cost to competitor.
- If real-time price drops due to ancillary-service bidding convolution, then have outage.
- In intra-zonal market, occasionally high-bid constrained-on unit. If hit for LT. contract, make money by never running plant - change internal dispatch.

<u>Every Gaming Move Has Counter Move</u>

Policy Assessment Corporation

October 25, 1997

Ms. Laura Houston
Enron Capital And Trade Resources
1400 Smith, Suite 33528
Houston, Texas 77002-7361

Dear Laura:

Thank you again for inviting me to your conference. I hope that the talk was considered useful. I have attached a copy of the airfare ($855.00) and airport parking ($10.00) receipts. These total to $865.00. With the daily labor fee of $2000.00, the total value of this invoice is $2865.00

Please make the check payable to Policy Assessment Corporation. The employee identification number for Policy Assessment Corporation is 41- 1516395

Thank you for all your help.

Sincerely,

George Backus
President

Policy Assessment Corporation
14604 West 62nd Place
Arvada, Colorado 80004
Office: (303) 467-3566 Fax: (303) 467-3576
e-mail gbackus@boulder.earthnet.net

Energy, Environment and Economic Planning

October 28, 1997

Dr. Hemant Lall
Perot Systems Corporation
12377 Merrit Drive
Suite 1100
Dallas, Texas 75251

Dear Hemant;

Attached is a copy of the receipts for the marketing trip to San Diego to visit Pacific Enterprises on October 10, 1997. The direct travel costs for airfare ($370.30), taxi ($10.00), hotel ($175.85) and airport parking ($16.00) sum to $572.15. Please make the check payable to Policy Assessment Corporation. The employee identification number for Policy Assessment Corporation is 41- 1516395.

Sincerely,

George A. Backus
President

WYNDHAM EMERALD PLAZA
SAN DIEGO

Thank You!
Driver: Am 362 Cab #
Amount: 10.00 Date: 10/6/97
U.S.A. CAB LTD. From: Airport To: Wyndham Plaza
231-1144

At Emerald Plaza
Broadway, San Diego, California 92101
(619) 239-4500 Facsimile (619) 239-3274

DENVER
INT'L AIRPORT
Entrance: 16:35 10/05/97
Exit: 19:26 10/07/97
License Plate
Cashier
Length of stay
Amount Paid $0016.00
Thank You

GEORGE BACHUS
12377 MERIT DRIVE
SUITE 1100
DALLAS TX 75251

10-07-97
Folio (Room) Number
63554 PAGE 1
CO:0522 JJG

ROSEN!

Activity Date	Transaction	Description	Charges	Credits
10-06-97	LD232B	LONG DISTANCE CALLS 303-467-3506	.00	
10-06-97	Z40522	ROOM CHARGE-PKG (+T)	149.00	
10-06-97	RT0522	ROOM TAX	15.65	
10-07-97	LD106A	LONG DISTANCE CALLS 303-467-3506	.00	
10-07-97	LC191A	LOCAL CALLS 888-327-8468	.00	
10-07-97	TG09398	THE GRILL	11.20	
10-07-97	AX1110	AMERICAN EXPRESS		175.85

PASSENGER TICKET AND BAGGAGE CHECK
SUBJECT TO CONDITIONS OF CONTRACT
NOT TRANSFERABLE
IN/11597
PASSENGER RECEIPT
BOARDING PASS XX
ARC XX

UNITED AIR LINES INC XXXXX A06535082 BACKUS/GEORGE MR
ARVADA WEST TRAVEL AND CRUARVADA COUS30SEP97 DENSANUA1607H 060C
BACKUS/GEORGE MR GIOIT8/1S MULTI 0055/ OSANDENUA 424H 070C
NOT VALID FOR THIS IS YOUR RECEIPT
**TRANSPORTATION* JG-JG

FP AX3781 197228 52003 EXP 0499 000032 /FC 060C19
7 DEN UA SAN184.40HA3 UA DEN146.79HA7 USD331.19END
XF DEN3SAN3

USD 331.19
US 33.11
XF 6.00
USD 370.30

272[illegible]124 0 016 1549234895 5

NOT VALID FOR TRAVEL

THANK YOU FOR VISITING THE WYNDHAM EMERALD PLAZA HOTEL. PLEASE COME AGAIN.

Balance Due .00

Signature ________ Date ________

Profit Maximization Under UK and US Deregulation

Dr. George Backus
Policy Assessment Corporation

Dr. Paul Gribik, Dr. Hemant Lall
Ed Smith, Vice President
Perot Systems Corporation

Enron
January 13, 1998

Agenda

- Background on Companies, Capabilities and Offerings
- Strategic, Tactical, and Operational Gaming in the UK
- Using California PX/ISO and FERC Rules to the Best Advantage
- A Real-Time System for CA, WSCC, US, UK & Elsewhere
- What We Can Propose

Policy Assessment Corporation

- US for DOE Oil and Gas Deregulation
- 1986 US Electric Deregulation Analysis
- 1995/1995 UK Deregulation and Prognosis
- Australian, South American, & US Deregulation Validation
- 50+ State and Province Energy Suppliers and Regulators
- CIGMOD Training for Utilities and Commission
- North American Deregulation Analysis
- Eastern Europe Deregulation & Planning
- US EPA and Canadian Kyoto Support (Regional Macroeconomic, Energy, and Environment Policy Impacts)
- Brazil Deregulation

Perot Systems Corporation

- Capabilities, Experience and Offerings

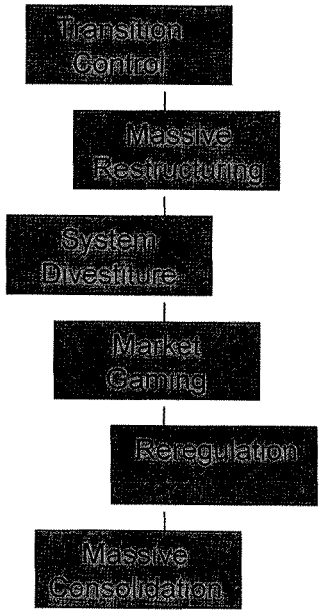
Overall Need

- Long Term:
  - Alliances & Acquisitions
  - Generation Plant Inventory
- Mid Term:
  - Financial Instruments
  - Rule modification
- Short term: Hourly, Day-Ahead, Bid Resources
  - Bidding strategies
  - Supply and demand decisions
  - Deal with noise, uncertainty, and possible hidden behavior of competitors

Dynamic Phases of Deregulation

- Transition Control
- Massive Market Deregulation
- System Divestiture
- Market Gaming
- Reregulation
- Massive Consolidation

(5-6 Years: Start to Finish)

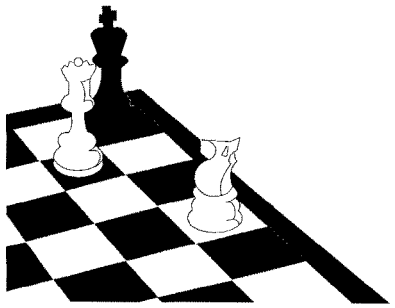


PAC UK Experience

- All the RECs
- OFFER
- PowerGen, National Power
- Cambridge Econometrics, Ltd.
- Scottish Power Deregulation Training
- 500 -1000 Recorded "Game Moves" As of DOE Report Release
- Applied US System to UK Then UK to AU, SA and US
- HYPERSENS Portfolio Analysis
- Neural Network Forecasting and Data Mining (Also PSC)

UK Gaming (As of 1995)

- Outage Games
- Availability Games
- Full-Load Only Games
- Full or No Generation - Transmission Games
- Constrained-off/Constrained-on Games
- Re-Order Generation Games
- Down and Up Games (Now Illegal)
- Over-Build Games (Fossil and Nuclear)
- LOLP Withholding Games
- "Own" Your Competitors Capacity Games
- Hedge Your Own Forward Market Game
- Change Market Niche Games
- Double Booking Games
- Over-Generation Games (Now Illegal)
- Collusion Forced by Regulation (a Universal Truth)
- Ancillary Service Games (Now Sort of Illegal)



Points of Interest

- Market clearing analysis not even used
- The world's largest coal plant is used for peaking
- A fossil-fuel tax pays for nuclear plants (CTC?)
- Three months until know revenues
- High rates of return lead to price caps & wind-fall tax
- 60% to 80% of assets are in CDs and cash
- "Stranded Investments" not even part of English language

Other Examples

Australia

- Capacity Availability
- Price Volatility
- Transmission Constraint (PSC)

South America

- Zero Bids
- Hydro Over-Generation
- Weekend Unavailability

Perot in UK

- Experience and Capabilities

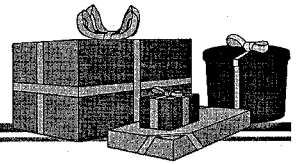
What We Will Do

- Features
  - Customization of existing model
  - Incorporation of real-time market data
  - Expert analysis of opportunities in rules and protocols
- Benefits
  - Advisory insights on proposed strategies through computer simulation
  - Maximize Enron profitability despite action of competitors and regulators
- Initial Deliverables
  - Executable model of UK or California system
  - Real time data interfaces
  - Training and support of Enron staff in real-time market strategies
- Later Efforts
  - WSCC, PJM, Brazil, ??

What We Have

- CIGMOD Model
  - Deregulation dynamics
  - Competitive behavior
  - Changing regulatory conditions
  - Computer simulation of choices over time
- Understanding The Details
  - CA PX/ISO
  - Protocols
  - Operations
  - U.K. deregulation experiences
  - Utility industry restructuring
  - Deregulated market IT experience

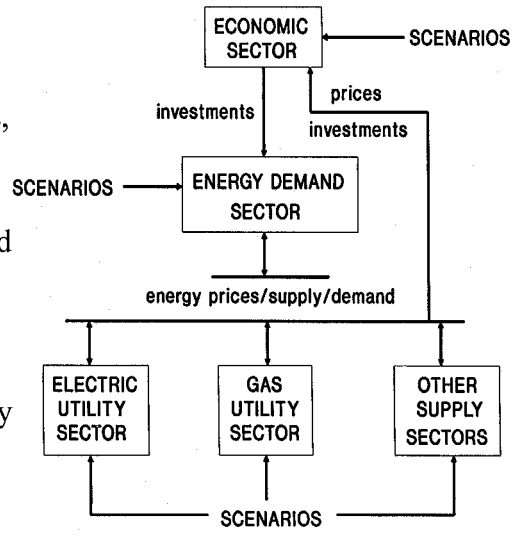
Features



- **Determine Portfolio of (Weekly) Daily, Hourly, Spot and Ancillary-Service Actions to Maximize Profitability.**
- **Determine Protocol/Rule Areas That Benefit the Bid, Availability, Over/Under-Booking and Congestion Gaming.**
- **Determine Monetary Value of Changing Game Rules (OFFER, E-POOL, PX/ISO, FERC, and CPUC).**
- **Coordinate Generation, Trading, and Retail Gaming for Maximum Company Profitability.**
- **Determine (New and Old) Competitor Threats and Strategies.**
- **Complete Loss Avoidance and Profit Risk Control.**
- **Demand, Financial, Trading, Generation Simulation for All Players.**

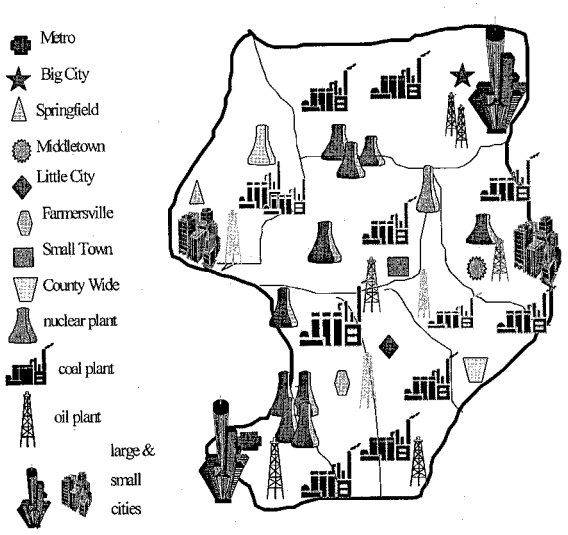
Introduction to CIGMOD

- Rigorous & Automatic Calibration to Local Conditions
- Describes All Sectors, End-Uses, Fuels, All Utility Departments
- Captures The Feedback Dynamics Among Utility, Demand, Economy, and Regulation
- Profitability Analysis of Any Market Segment Scenario
- Automatic Confidence And Uncertainty Analysis Capabilities:
- Real Versus Optimal Behavior
- User Has All Code and Rights



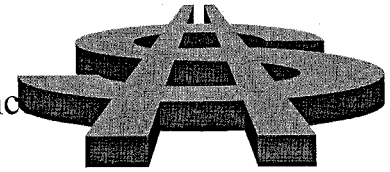
CIGMOD Perspective

- Play to Prove Future Cannot Be As Assumed. (Human/Computer)
- Evaluate Value of Mergers, Acquisitions, Disaggregation.
- Test Buy, Build, Bid Games.
- Quantify Retail/Wholesale Wheeling Strategies/Impacts.
- Simulate Full Spectrum of Regulatory Options/Dynamics.
- Model Inter-regional Competitor Interactions.
- Find Robust Strategy for Uncertain Business Climate.
- Simulate Transmission and Market Pricing.

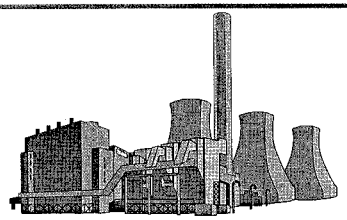


Macroeconomy Design

- Dynamics of Local (State or Sub-State) Economies Due to Deregulation and Retail Wheeling Activity
- Individual Dynamics for Residential and 49 Industry/Business/Government Sectors
- Impacts of Prices, Marketing and Utility Investment on Local Economy
- Market Size Dynamics
- Market Segment Analysis
- Data for All 50 States plus CN Provinc



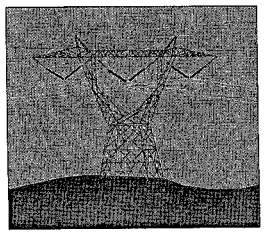
Utility Design



- 2-7 Utility Companies/Aggregates Per State/Province
- Gaming Impacts
- Financial, Capacity, Dispatch, Rates
- M&A, Take-Over And Bankruptcy Dynamics Are Shut Off for Study but Fully Available
- Gas and Electric Utility Dynamics/Hedging
- Spot, Contract, Direct Access Markets
- Generation Bid and Availability Gaming
- Includes Municipal, Co-Ops, PMA Players

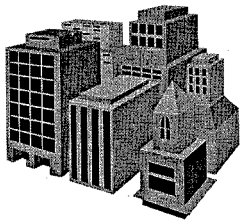
Transmission Design

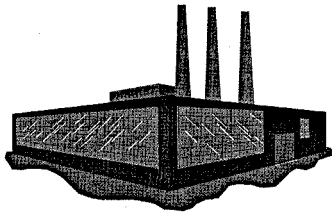
- Major Intra/Inter-Regional Transmission Constraints
- Transmission Pricing From Cost Recovery, and Constrained-on and Constrained-off Plant.
- Gas Transmission Constraints for Generation.
- Poolco with ISO and Spot or Direct Access Scenarios

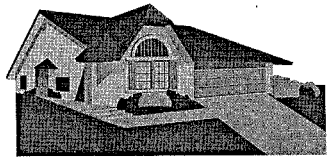


Demand Design

- Residential, Commercial, 2-Digit SIC Markets at State Level
- Inter-Fuel Competition
- Loads From End-Use Demands by Season
- Buy From Retailco That May Be Part of Generator
- Utility Marketing Outside of Region

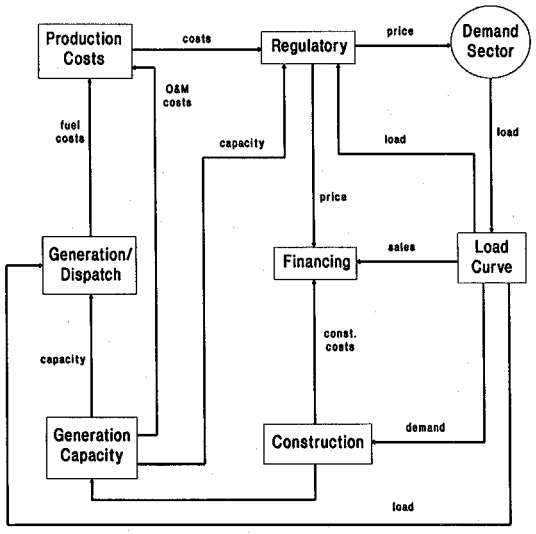






Utility Structure

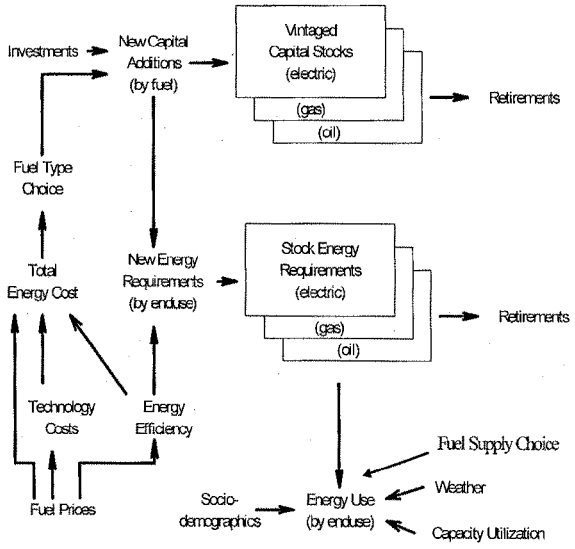
- RDI data plus DOE Plus CANSIM
- Provides complete detailed description of all utility departments (Gas/Electric).
- Dynamic, detailed load duration curves
- Simulates capacity expansion, forecasting, construction, and financing.
- Reconciles environmental constraints. allowance markets, GHG legislation.
- Dispatches generation dynamically, provides production costing
- Simulates complete utility accounting and financing
- Allows arbitrary pricing policies for distribution and transmission (gas and electric), generation
- Provides IPP dynamics.



perotsystems™

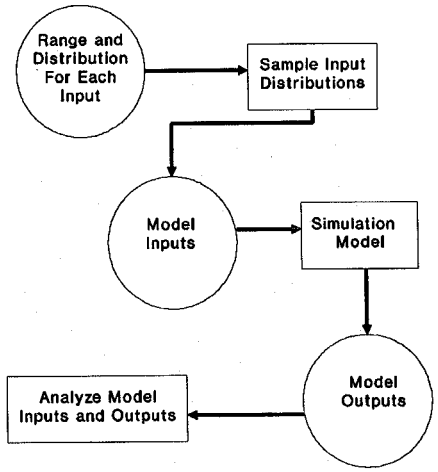
Demand Analysis

- Allows arbitrary number of end-uses, fuels, technologies, suppliers, market segments
- Simulates cogeneration investment, construction, and usage.
- Simulates short-term effects such as retail wheeling, budget constraints and temperature sensitive loads.
- Macroeconomic model simulates prices, wages, inflation, costs, and output by sector.
- Incorporates inflation impact on financial markets.
- Captures energy feedback on capital investments, capacity utilization, and inflation.



HYPERSENS

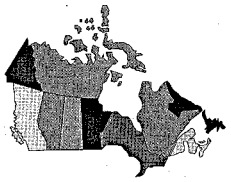
- Provides confidence intervals.
- Quantifies uncertainty of scenario impacts.
- Identifies source and importance of uncertainty.
- Minimizes data requirements.
- Determines strategy optimization.

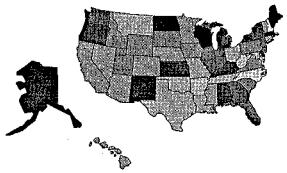


Sensitivity Analysis

CIGMOD AND ENRON

- 50 State Plus Canadian Provinces
- Full Tactical and Strategic Capability
  (can expand to operational)
- CIGMOD Gaming Capability
- HYPERSENS Capability
- Electric and Gas Utilities/Markets
- Use Model for in-House Gaming/Analysis





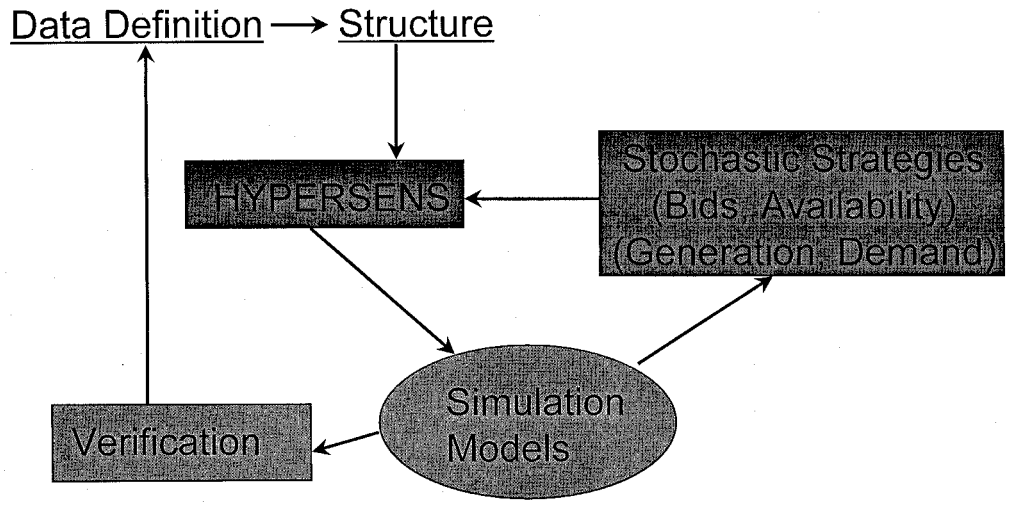
Policy Assessment Corporation

perotsystems™

Efforts

- Gaming Issues
- National Market Expansion Strategies
- Loop-Holes and Fringe Games
- Game Verification Testing
- Stochastic ISO/PX/Settlement
- Protocol/Grandfather Dynamics
- Competitor-Aware, Real-Time Tactical/Operational Gaming (Conditional Latin Hypercube)
- Can Do for All Parts of US, Europe and World.

System Definition



Multiple Markets and Regions

- System can handle multiple regions and markets to allow better hedging, arbitrage and options to minimize risk.
- Shows how to create own financial instruments.
- System simulates all fuels (particularly) gas and electric competition supply, pricing and finances.
- Simulates gas and electric transmission and storage
- Simulates cogeneration and distributed generation

California and the West and ...

- All markets, by definition, undergo a transition from regulated to deregulated
- Market distortions are inevitable
- Distortions "force" gaming to "clear" the market
- CA is only different because of rule complexity
- The more "rules," the more distortions
- Transition markets change due to pressures and normal "equilibrium" games take over (as in all commodity markets).
- The details change but the underlying mechanisms are global and temporally universal.

PX and ISO Issues

- Price Discovery
- Market Power in Many Markets
- Short Day Ahead Market
- Real-Time Market
- Repetitive Biding
- Over and Under Booking
- Over Generation
- Congestion
- Ancillary Services
- Distributed Generation Dating

Real Examples and Problems

- Perot (Consequences of the Imbalance Energy Market Protocols, Operations in a Tight Pool)

California Gaming

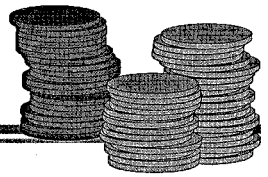
Abundant Complex Rules Cause Abundant Complex Gaming: Large Domain Between Genteel and Illegal

- Leave imbalance energy with the UDC
- UDC under and over booking
- WSCC redefinition of single contingency
- N/S generation can cause congestion that increases revenue for south-generation despite congestion costs.
- Force inter-zonal constraint that hurts competitor worse
- Build plant at interconnect to cause congestion problems

Other Example Gaming

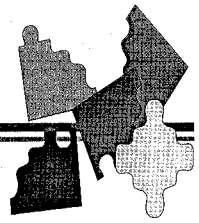
- Ancillary and generation markets are mixed. Generation bid often contains start-up and no-load costs. Ancillary may not include these costs, especially if generation and ancillary bids come from same plant. Price can ***drop*** or rise on real-time market.
- Marketer over books DAC load (with possible help from DAC), has unit output "frozen." At end of day ISO has to pay generator real-time price for the excess capacity.
- If price can drop on real-time market, then under-book/generate for DACs.
- If real-time price drops due to ancillary-service bidding convolution, then have outage.

Other "Games"



- Micro-Bids As Probes.
- If You Are Marginal Plant, Have (Multiple) Outage(s) and Have Other Plants in Queue (via multiple SCs).
- Use Model to Determine (Without Signals) That Generation, Trading, or Retail Should Take Strategy Lead to Avoid "Conflict" of Financial Interests.
- Combined Generation/Trading/Retail Over/Under-Book Strategies.
- External 3rd Party Alliance (Collaborator) on Bids and Generation Ownership.

Project Overview



- Need: Comprehensive Gaming System, Physical System Simulation, Strategy Search System, ST-Forecasting System, and Data Mining for Short-Term Tactical Gaming (With Mid/Long-Term Capabilities).
- Will Update System for UK/California Details, Add ST Timing, Add E-POOL/PX-ISO Rules, Add Data Gathering/Mining.
- Have Gaming Model (Generation, Trading and Demand), Strategy Search System, ST-Forecasting.
- Will Build E-POOL/PX-ISO Simulation; Implement UK/California Specific Strategies, Add Real-Time Accounting, Augment Search System With Data Gathering/Mining.

What Would Be Delivered

- Phase I
  - Functional Model
  - Strategy Options
  - Identify relevant protocols and rules
  - Company learns the modeling system
- Phase II
  - Real-time market data availability
  - Analysis capabilities to take advantage of the data
  - Synthetic production of data to train for Phase III
- Phase III
  - Real-time implementation
  - "Fail-safe" positions to limit exposure
  - Benchmark

Optional Follow-on Phases

- Phase IV
  - Impacts of others entering market
  - Impacts of mergers, acquisitions, and takeovers
  - Impact of consolidation of market
- Phase V
  - Increased transfer capabilities within Region
  - Add AC considerations to the model

Perot Wrap-Up

- A Modest Proposal

February 6, 1998

Richard G. Davis
Vice President, West Power Trading
Enron Capital and Trade Resources Corp.
121 SW Salmon Street
Portland, Oregon, 97204

Dear Richard:

Thank you again for inviting me to your offices. I enjoyed seeing and understanding your trading floor and hope that you found the information I provided useful. This is an invoice for the visit. Per our agreement, the labor fee is for one-half day or $1000. The direct travel expenses were $533.00 ($388.00 for airfare, $75.00 airline fee to reschedule tickets after the ice-storm cancellation, $60.00 for Portland taxi, and $10.0 for Denver airport parking). A copy of the receipts except the reschedule fee are attached,

The total value of this invoice is then $1533.00. Please make the check payable to Policy Assessment Corporation. The employee identification number for Policy Assessment Corporation is 41- 1516395.

Sincerely,

George A. Backus, D.Eng.
President

DRAFT

(February 16, 1998)

PROPOSAL TO ENRON

Prepared by
Perot Systems Corporation (PSC)
In partnership with
Policy Assessment Corporation (PAC)

Objective:

Deregulation of the electric & gas industries combined with opening of the power markets to competition have created an opportunity for skilled market participants to optimize their bidding and asset positions for profit maximization. The California market is in the early days of these changes.

Enron Capital & Trade Corporation have expressed an interest in exploring and developing with PSC and PAC appropriate strategies and tools for seizing these market opportunities.

Approach

It is proposed that Enron's optimization strategies be developed through a multi-phased effort. This approach offers maximum opportunity to explore concepts; refine the market scenarios; test the validity of supporting systems & tools; and, to develop related performance metrics. Decisions to progress from phase to phase will be determined on a valuation of benefits achieved and an estimation of expected future return on investments. Each successive phase is designed to build upon the other and, independently produce value to Enron. This approach limits Enron's financial risk while affording a foundation for refining design requirements as work is progressed.

Phase 0: Initial Seminar

Phase 0 is designed to test the concepts employed in developing optimization strategies. The framework is a 1 1/2 day seminar used for identifying "gaps" in the market protocols; designing scenarios and optimization strategies; and, then framing these scenarios for testing within Enron's trading environment.

Employees of Enron, PSC and PAC will use specific examples of gaps in California market protocols seen to offer opportunities for market optimization. This joint team effort led by Paul Gribik, Hemant Lall and Ed Smith of PSC, and George Backus of PAC, will closely examine 3 concrete California market examples previously verified by PSC with the California Power Exchange/Independent Service Operator as valid illustrations of market "gaps".

The seminar will design detailed strategies and plans around these "gaps" to reach agreement on the range of market opportunities they pose; develop appropriate strategies for optimization and, prove the reality and soundness of such tactics. The approach will also illustrate how existing rules can be re-evaluated to produce new market

opportunities. One of the on-going benefits to be derived by Enron's staff is education in the process used for examining these situations

Enron employees will share insights on existing capabilities and asset portfolios for the purpose of plotting positions against which these scenarios will be tested. Testing will also include analysis of any trading floor procedural constraints that may be seen to exist. . The success of this phase in validating the existence of "gaps" against which optimization strategies can be mapped, as well as the realistic ability to act on such opportunities, will form the basis for moving to Phase 1.

Phase 1

Phase 1 will be split into two parts.

Phase 1a greatly expands on Phase 0 by conducting a detailed review of the PX and ISO business and operational protocols for the purpose of cataloging the perceived "gaps" within and between these two entities. These findings will then be prioritized in terms of their relevant impact and, once compared with Enron's capabilities and trading portfolio, corresponding electric and gas tactics/strategies will be designed/developed. The range of game/tactic categories will be extensive enough to consider games associated with generation, trading, transmission, and customers. Moves that are made independently or in combination with other market players (across function and across companies) will also be considered. This consideration is essential, as moves limited to trading only may not take adequate advantage of market opportunities. Combined moves, across market functions, provide more flexibility and higher pay-offs. Countermoves will also be addressed to examine plans for protecting Enron from competitor actions.

Enron staff will decide on areas where Enron

- would like to focus on immediate trading-function efforts,
- would like to focus on building up alliances for combined functional or non-Enron company efforts, and
- does not want to become involved.

Dependent upon the level of interest expressed, Phase 1a can also include interactive team "war" efforts using PAC's CIGMOD software simulation models to formally test and review the generic gaming options within the simulated frame work of the California market place and Enron environment.

Because the rules and the market are evolving, this phase will continue to see changes. However, the development of an exhaustive list of categories, along with a selection of those key areas of most interest to Enron, will constitute the completion and success of this phase.

Phase 1b takes the prioritized list of opportunities converting them into detailed concrete moves. Each tactic is formally defined in terms of specific plant, transmission line, load, and system conditions for both gas and electricity. The formal definition not only allows

for the actual execution of the strategies but also provides the analytical formalization to operationally use the strategies in Phase 2. Market and operational information input requirements will also be identified and sources for obtaining this information will be investigated.

Phase 2

Phase 2 will also be split into two parts.

This phase will convert the detailed and formalized listing of strategies into computerized simulations of game moves in the real world. This phase will have two sub-phases.

Phase 2a involves the creation of "study mode" computer models simulating the California PX and ISO systems. Actual protocols and rules are carefully detailed. Simulations will include the PX's energy auction model, the ISO congestion management model and, define their interaction. Transmission simulation will allow accurate constraint analysis. The HYPERSENS software is activated as an umbrella overarching the energy-system simulation to capture the uncertainty and impacts of competitor counter moves. Data for each company and plant in the region will be incorporated in the model to be available for determining bidding strategies. It can also determine those moves seen to bring Enron the most advantage under noted operating conditions and a "pay-off matrix" examining values for the moves, or portfolio of moves.

Phase 2b develops "real time" optimization versions of the "study mode" models to test the system against real world, real-time data. Real PX, ISO and trading floor, OASIS, and SC data will be used in the model to compare modeled to actual positions. The value of transactions/positions from the simulation will also be compared to those that actually occurred. Performance benchmarks for evaluating future transactions will be established. This effort validates the model capabilities to test or recommend moves in real time. Most importantly, the list of strategies from Phase 1b can be tested for value and potency within the real marketplace. The resolution of the model would minimally be hour-by-hour. Required interfaces for inputs of market and operational data will either be established, or alternative arrangements made at this point.

As part of Phase 3, these models will then be fully integrated with Enron's computer infrastructure and linked to real-time data systems. This linkage of real time data is a task in and of itself. Data collection, transfer, reconciliation, timing and use must be operationalized, coordinated and verified.

Phase 3

This phase will integrate the tools and knowledge developed during the previous phases into Enron's normal trading processes, systems and, operations. It is expected that the early use of these tools with real-time data will find areas where the system must be tuned or modified to capture unforeseen opportunities, cope with human or data-stream errors, recognize divergence of idealized from real operations, and prevent inappropriate responses in ambiguous conditions. The "fine tuning" of the system and the modification

of the system and its user interface to maximize profits/usability is a critical focus. Training of Enron staff will be integral to this transition. This phase will include a benchmark sub-system to compare the system-recommended performance to a "reference" baseline performance.
The changing market rules and data streams will require continued maintenance and refinement of the system. This ongoing maintenance, consulting and technical/software support could be considered as Phase 4 or as a separate project.

The design of the project allows for future extension of the system (for example, to include all of WSCC in detail) or cloned (for example, to maximize Enron profits in the UK, Brazil, US East Coast or US Midwest markets). Efforts along these lines are considered outside the scope of this project. (Note that the system possesses the inherent capabilities to simulate the financial and strategic impacts of mergers, acquisitions, purchasing of facilities/generation and the building of generation, gas-storage or transmission.)

Professional Fees
The PSC/PAC professional fees for Phase 0's "Proof-of-Concept" Seminar will be $40,000 plus all reasonable expenses. PSC will be the prime contractor to Enron, and PAC will sub-contract to PSC. It is proposed that Phase 0 be held on Feb 28 and March 1, 1998 at a location of Enron's choice.

Estimates and an approach to calculation of professional fees for future Phases will be provided after conclusion of Phase 0.

Other mutually agreeable contractual or partnering relationships are not precluded and could become part of this overall proposal.

Policy Assessment Corporation

A Proposal for a Real-time Competitive Response System

INTRODUCTION

The transition from a regulated to a deregulated market presents a tumultuous time for all the companies that prospered under the "old" rules. Regulators attempt to provide an orderly transition from the past to the future that protects existing rights and commitments while simultaneously clearing the way for new free-market activities. These two demands are in economic opposition and new rules necessarily contain ambiguities and market distortions. Physical constraints to the system insure that any definition or rule will become ambiguous under some operating condition[1] (Hunt 1996, p. 61) and thereby allow competitors to respond in way that dramatically changes the expected character of the future market place[2] (Newbery 1996, p. 64). In California, significant efforts were made to ensure the market acted as the regulators deemed appropriate. This not only causes market distortions that can be advantageous to some and detrimental to others, it also means that the rules probably will have effects contrary to the desired effect. As Richard Tabors of MIT notes:"...the market rules cannot be gotten right on the first try if the goal is a pre-designed supervised market. The regulatory interference has prevented the types of market mechanism ... normally seen in a commodity type market"[3] (Tabors 1996, p. 47). From electricity deregulation experience in other parts of the world, "the message .. is clear. It was incorrectly assumed that the new commercial entities would continue to operate by the intent of the rules, even if not formally stated, when the new structure began. But commercial markets are commercial markets, profits are profits and any commercial advantage will be taken" (Tabors 1996,

[1] Sally Hunt and Graham Shuttleworth, *Competition and Choice in Electricity*, John Wiley and Sons, 1996, p. 61.
[2] David M. Newbery, "Regulation, Public Ownership and Privatisation of the English Electricity Industry" in *International Comparison of Electricity Regulation*, Richard Gilbert, and Edward Kahn, ed., Cambridge University Press, 1996.
[3] "Lessons from the UK and Norway," Richard D. Tabors, *IEEE Spectrum*, New York, pp. 45-49.

p. 49). The dynamics of deregulation as they relate to how competitors may act toward each other are documented further by Wolak[4] and Backus.[5]

This proposal specifies tasks that adds the California ISO/PX simulation to and modifies the structure of the deregulation dynamics model developed by Systematic Solutions, Inc., to faithfully reflect the specific rules and protocols associated with the California market of January 1, 1998. The purpose of the effort is to ensure that competitors cannot take advantage of opportunities that the rules provide to the undue detriment of Edison International. The modeling system would be a tool equally applicable to all energy-market divisions of Edison International, such as generation and the UDC.

This proposal brings together the talents of Perot System Consultants (PSC), Systematic Solutions, Inc. (SSI), and Policy Assessment Corporation (PAC) experts on deregulation and PX/ISO operation. To our knowledge, no other individual or group of organizations is capable of providing the type of system proposed.

[4] Frank A Wolak and R.H. Patrick, "The Impacts of Market Rules and Market Structure on the Price Determination in the England and Wales Electricity Market, Stanford University Department of Economics Working Paper," April 1997. Available on www-path.eecs.berkeley.edu/UCENERGY.

[5] George A. Backus, *The Dynamics of U.S. Electric Utility Deregulation*, U.S. Department of Energy, Office of Utility Technology, Washington D.C., August 1996.

THE PROJECT

This project is divided into three or more phases to verify that each current phase indicates the success of the next phase. Careful consideration of the project goals strongly indicates minimal technical risk under all hypothesized conditions. The changing ground of the California deregulation process, however, indicates that certain tasks may not be needed, that some tasks may need to be redefined and that other tasks may need to be added in Phases II and III. For example, last minute (December) modifications to the ISO protocols would require that our ISO simulation model be modified accordingly. This proposal provides for the testing of the complete system in Phase I, followed by two other phases contingent on a best guess expectation of the PX/ISO release of specifications, an exhaustive model testing regimen, and Edison International staff training needs.

Phase I

The first phase, called the "functional model phase," reviews all the information of the California ISO and PX as well as any other relevant commission rulings to determine any areas where competitors could find opportunities. These are translated to strategies and incorporated into the existing strategy options within the current deregulation model framework. The simulation of the way that the actual PX/ISO operates is also incorporated into the model. Perot Systems Consulting (PSC) has help designed these tools for the actual PX/ISO and are thus the most capable to make sure this project provides valid simulations of actual PX/ISO operations. Further, PSC's intimate knowledge of PX/ISO protocols has a particular advantage for this project.

The deregulation framework contains detailed demand, energy, financial and physical representations of all the known potential players in the California market. (Unanticipated entities can be added as needed.) The short-term forecasts for California and local competitors demands are determined endogenously so that the generation available to serve the California market can be correctly ascertained. Phase I provides the integration and testing of all critical components as well as determines what protocols and rules have relevancy to future market conditions. Edison International staff will use this framework to learn the modeling system plus gain confidence in its usage as an operational tool. The human interface will also be modified as needed to maximize the efficacy of using the model for bidding and other strategies. The real-time data available from the PX/ISO will not have been determined during Phase but will be the focus when it becomes available for Phase II. Nonetheless, the ability of the model to simulate basic competitive strategies against human players will be tested in Phase I to ensure that the model performs as expected.

Phase II

The second phase is the "operational model phase." In this phase the project team determines the available and actual real-time data from the ISO/PX and adds the analysis capabilities to take advantage of that data stream within the model. Advanced statistical methods (primarily associated with the technical analysis of commodity time series and cointegration) will be added to the model. These sub-systems determine the statistical qualities of the prices, supplies and demands in order to understand the underlying direction of their variance and averages. The software should be able to detect any pattern in a competitor's actions that may be detrimental to Edison International operations or whether competitors are somehow directly tracing any Edison International efforts.

In Phase III below, neural networks may be advantageous for the short-term forecasting of price and demand. Neural nets, however, do require specific data structures that would not yet be understood in the early days of the deregulation.

Both Phase II and Phase III use a sophisticated confidence/validity package called HYPERSENS. It can search essentially all the possible options to find those real-time strategies that ensure Edison International is not disadvantaged by the behaviors of competitors. HYPERSENS cannot only accommodate the uncertainty in competitor behavior, generator availability, and hourly demands, it can determine the set of options available that best meet Edison International goals.

Because the modeling system of Phase II will have the capabilities to analyze hourly data, test data sets will be generated for Edison International staff to use as a means of learning and gaining confidence in the system. Any uncovered limitations will be mitigated as appropriate. Model testing with Edison International Staff is a significant part of the project to insure that the model does well under anticipated and unanticipated conditions. Synthetically produced data streams that approximate what is actually expected during the first quarter of 1997 will be used in the testing.

Phase III

The third phase is the "real-time implementation phase." Only after January 1, 1998 will real data be available for both analysis and real-time decision-making purposes. The modeling system described here will need to be monitored to insure that it produces the information Edison International expects. The system will contain software that notifies staff of any anomalies that may jeopardize the result's validity. Further, fail-safe" positions will be included that limit any financial exposure during the time interval before adequate data have become available to fully validate the system's operation. The algorithms will be "tuned" as appropriate and enhanced features are added as required. The model will also be benchmarked against "reference" assumption to determine its success rate compared to equilibrium conditions. The model methodology will, by default, certainly have the ability to determine the best bidding strategy given market information. The only area where added care and testing must be taken is in those strategies that respond directly to the aggressive actions of a competitor.

Optional Follow-on Phases

As an intrinsic part of the system, the CIGMOD deregulation dynamics model will allow Edison International to test the impacts of others entering the California market (generation or marketing) or the impacts of (gas and electric) mergers, acquisitions, and takeovers among competitors or by Edison International. This could represent a Phase IV consulting effort. The consolidation (or dilution) of the market changes the strategies that a company must use to insure profitability. This effort would extend the short term (hour-to-hour to monthly) analyses to longer time frames, thereby providing company-wide analyses of the impacts of such longer-term strategies on day-to-day as well annual operations and profitability. This Phase can also test competitors' financial strategies which could impact Edison International's operations/profitability.

The ISO/PX system in California is premised on the assumption that DC analysis is adequate to determine system requirements and behaviors. Efforts of the project staff indicate that the AC considerations lead to significant additional opportunities for competitors to disadvantage Edison International operations. Some of the advanced technical efforts to increase the transfer capabilities within WSCC may make this area the most crucial to insuring the real-time availability of Edison International generating units. Adding AC considerations to the proposed modeling system could represent a Phase V

The specifics of these potential Phases IV and V are not pursued further in this proposal.

PROJECT TASKS AND DELIVERABLES

The project phases are designed as self-contained tasks whose completion verifies that step of the project. Phase I tasks use existing tools and convert them to reflect the detailed California PX/ISO specifications and protocols. Phase II tasks incorporate the data stream that will be available from the PX/ISO as soon as it is known and verifies that that system performs well under the expected and unexpected operational conditions of the PX/ISO. Phase III tasks fine tune the model parameters as soon as actual PX/ISO data support such adjustments. Further, Phase III provides support to Edison International staff as needed to insure maximum profitability from the system. For all phases, great effort will be made to keep Edison International staff fully cognizant of the model's technology and the model's operation.

Phase I Tasks

Tasks
1.) Review PX and ISO protocols and business opportunities: This task involves a detailed review of PX and ISO business and operational protocols and particularly the interactions between these two entities. The main goal is to become well versed with the ongoing changes in PX and ISO business and operational protocols, and to become aware of which strategies are available to competitiors in the California market. **Deliverable:** The strategies will be documented.
2.) Implement the reduced scale PX/ISO operational model (CPXISO): This tasks implements a reduced scale model that would closely approximate the operation of California's PX and ISO systems. This task starts with existing full scale models available to PAC and PSC. Included in this model will be the PX's energy auction model, the ISO Congestion Management model, and the interaction between these models. The full 6000 bus ISO linear programming model will be simulated using a much smaller set of buses and nodes (approximately 100 buses). This ISO model, even though it will be much smaller and much faster, will effectively simulate the results of the actual ISO simulation and dispatch. Data interfaces between PX, ISO, and deregulation model (CIGMOD) will also be developed. Data models for external systems will also be developed in this task. **Deliverable:** A working version of the CPXISO system.
3.) Incorporate strategies into system: Based on Task 1, the full spectrum of strategies will be developed for each of the participants in the market. This task will emphasize getting the "levers" into the model to allow for the development of ever more sophisticated strategies. The full range of strategies will be linked to the HYPERSENS subsystem and thereby allow the exhaustive testing and selection of strategies under uncertain future conditions. **Deliverable:** Working HYPERSENS subsystem with implemented strategy levers.
4.) Adapt PAC's short-term load forecast (SLF) model to work for California's

energy market: This task involves integrating and fine tuning the SLF model for California competitors and developing interfaces with the PX/ISO operational model. The system will forecast hourly demands for all players in and out of California. The SLF model produces hourly load forecasts for the next 7 days based on the historical loads, the historical weather, and the weather forecast. It re-estimates the relevant coefficients on a daily or hourly basis by live links to the weather service and existing conditions. **Deliverable:** Existing system with SLF integration.
5.) Develop interfaces between CIGMOD and CPXISO: The system interface includes system-control, Edison International data-entry, and Edison International bidding strategy output. The interface between the model and the operators will automate the input of hourly data, will produce timely reports and charts which effectively communicate the relevant information, and will facilitate the operator's decision making process. **Deliverable:** Existing System site tested interface.
6.) Add Edison International Proprietary Data: Any proprietary data that Edison International would like included can be added at this time. From this point forward, the databases of the model cannot be removed from Edison International offices without written permission.
7.) Calibrate CIGMOD/CPXISO model to California and Edison International behavior: Data for each company and plant in the region will be incorporated into the model. This data will be available for use in determining bidding strategies (prices and quantities) and will be used to determine the operating income of Edison International and each of the competitors. The data will include capacities, heat rates, fuel prices, variable and fixed O&M, and embedded capital costs. The CIGMOD model will be calibrated to competitor and Edison International data. The calibration process will test the model and will estimate critical operating and financial parameters. **Deliverable:** Existing model with tested simulation of all relevant companies.
8.) Test model with Edison International staff and update algorithms/interface: This task will test the operation on the model to insure that the simulation of the ISO, PX, and company financials are accurate and that the interface is informative and easy to use. Strategies will be tested to insure that they are simulated correctly and that the results are reasonable. The algorithms and interface will be revised and enhanced as necessary. **Deliverable:** Staff training and system with enhanced interface
9.) Test model and strategies against realistic conditions: The system will be used to test the basic strategies to determine the realistic impact of these strategies. The growing list of strategies will be tested in several sets of simulations. These simulations will test human strategy against human strategy and human strategy against machine strategy to determine the effectiveness of the strategies and to develop alternative strategies. As good strategies are developed, counter strategies will be developed, incorporated and tested for their robustness. The creativity of the human players will be very important in developing new strategies. After a new strategy is developed it will be automated and utilized by computer players. **Deliverable:** Fully functional system except for real-time PX/ISO analysis.
CIGMOD and associated software: Deliverable: At the beginning of the project, the

CIGMOD system will be implemented on the Edison International computer system used for this project.

Phase II Tasks

Tasks
Integration of California's market data into CIGMOD/CPXISO model: This task will determine the availability of the data from the PX and the ISO. The assessment will include the timing of the data, the company and node detail of the data, and the form and source of the data. Any expected or possible problems or inconsistencies of the data will be noted and solutions proposed.
Implement AI/statistical code into CIGMOD/CPXISO model:. The data stream will be analyzed to determine the use of the data stream in the forecasting of competitor actions, spot market prices, and other system values. The system will be modified to automatically analyze the data using accepted statistical and artificial intelligence methods.
Interface to real-time systems: . A real-time data retrieval system will be developed to bring in the data from the PX, the ISO, and other relevant data sources. Because Perot intimately knows the system, this task will provide Edison International with the best understanding of the data available.
Develop portfolio rules: Portfolio rules for real-time and over-all strategies will be developed by testing each strategy under a variety of market conditions and competitor strategies. Portfolios as used here are defined as the time-dependent packages of bids and demands/supply that maximize Edison International goals.
Initial testing and training of Edison International staff: This task will test the operation of the system by creating a synthetic hour-by-hour data stream. Edison International staff will conduct the test after being trained on the use of the system. The results of the test will be used to revise and enhance the system.
Market dry runs: The proposed strategies and portfolio rules will be tested in real-time to determine realistic use of strategies and the operation of the system. Multiple sample data streams will be developed to test all aspects of the system. The decision making process of the competitors will be split between human players and computerized decision rules. This test will be used to further enhance the strategies and counter strategies for Edison International in the California market.

Phase III Tasks

Tasks
Monitor early use and fine tuning of market strategies and addition of new AI based strategies: During the first days of the deregulation, large amounts of new information will become available. This information will be used to immediately improve the performance of the system. The task will determine and update any simulation sub-systems needing tuning or enhancement. This task will also test and refine the fail-safe algorithm for bidding under the unlikely condition that the system warns users of an ambiguous situation.
Develop benchmark saving protocols and models: To determine the efficacy of the system, it needs to be benchmarked against "reference" conditions. This task will provide a secondary simulation that has the market acting according to assumed economic considerations such as marginal costs pricing or the existing trends in the market. A continuous accounting record of wins and losses will be maintained in the system.
Ongoing support Edison International staff: The PX/ISO protocols and rules will probably change regularly in the early period of deregulation. Further, new commission rulings must be expected. This task provides Edison International staff assistance in updating the systems and its data bases to reflect new conditions. Further, it provides assistance in strategy development when the new rules change the nature of the market operation.

Edison International will be provided all software associated with the proposed modeling system, its documentation and all required training on use, operation, and modification. The specific strategies developed with Edison International and the associated proprietary Edison information will be for the exclusive use of Edison. The pre-existing software and generic algorithms and model it contains is a general purpose tool, as such it is not subject to exclusive use terms.

PROJECT TEAM

The project team is composed of experts from Policy Assessment Corporation (PAC), Systematic Solutions, Inc. (SSI), and Perot System Consulting (PSC). Information on PAC, SSI and their products are provided in Section 2 of this document. Information on PSC is provided in Section 3. For the purposes of Phase I, Perot Systems Consulting and Systematic Solutions, Inc. are subcontractors to Policy Assessment Corporation. Because the later Phases may change slightly in scope due to changes in PX/ISO protocols or California commission rulings, the relationship among the staff may change for later Phases.

The primary staff for this project include:

Dr. George Backus (PAC): 20+ years of experience in electric utility planning and simulation, including direct electric deregulation experience in the U.K., knowledge of S. America and Australian deregulation, and direct experience in U.S. oil and gas deregulation.

Jeff Amlin (SSI): 20+ years of experience in electric utility planing and simulation including over 10 years of experience in simulating electric utility deregulation, decision making under dynamics uncertainty and accurate short- and long term forecasting.

Dr. Paul Gribik (PSC): 20 years of experience in utility operations and planning within California. He is a key player in the development of the ISO protocols for California fully cognizant of transmission congestion issues. He has assisted the California utilities and WEPEX in developing a methodology to manage and price transmission congestion that will maximize the economic use of transmission while providing nondiscriminatory access.

Dr. Dariush Shirmohammadi (PSC): 20+ years of experience in electric utility planning and operations including extensive experience in electric restructuring and power flow issues. He is also fully cognizant of the California PX/ISO design and operation.

Dr. Hemant Lall (PSC): 20 years of experience in mathematical programming and modeling, including real-time data flow and neural network issues.

Dr. David Azoff (PSC): Extensive experience using neural networks to forecast prices and dynamics in the UK generation markets.

Other experts within the respective companies of the primary staff are also available for this project. The resumes of the primary staff are provided in Section 4 of this document.

PROJECT COST ESTIMATES

The purpose of this project is to develop a real-time software system that maximizes Edison International profitability after January 1, 1998, despite the action of existing and new competitors in the California marketplace. Edison International-specific transactions could exceed $50,000,000 per day. Positive variations in supply and demand, price, and costs conditions could have significant benefits to overall profitability in the deregulated environment.

Phase I would extend from June 1 to September 15, 1997. Phase II would extend from September 15th or earlier until December, 31, 1997. Phase III would extend from January 1, 1998 to June 30th 1998 or longer.

Policy Assessment Corporation proposes a price not to exceed $850,000 for Phase I as defined (including travel expenses). The work for Phase I is to be completed by September 15th, 1997 providing work begins on June 1st, 1997. This price will remain valid until Midnight, June 20th, 1997.

Invoicing is to be done in 3 parts based on these milestones:

1) Completion of Tasks 1-3 of Phase 1
2) Completion of Tasks 4-6 of Phase 1
3) Completion of Tasks 7-9 of Phase 1

Each invoice will represent one-third of the project cost.

Phases II and III are herein estimated for budgetary purposes only. Depending on protocol and rule changes, Phase II would require $500,000 to $750,000 of effort; Phase III would require $500,000 to $950,000 of effort (including travel expenses). Please note again that Phase III assumes six months of part-time technical support to Edison International staff on system use and operation. The total project then has a cost range of $1,850,000 to $2,550,000.

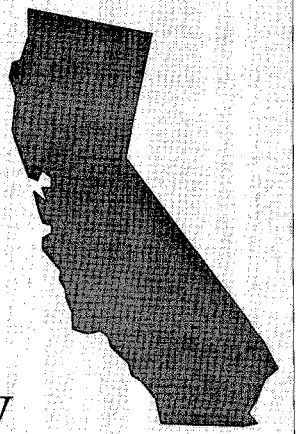
A Proposal For a Real-Time Competitive Response System

Dr. George Backus

Policy Assessment Corporation

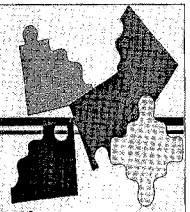
Agenda

- Project Overview
- Proposal Overview
- System Definition
- PX/ISO Definition
- Contractual Overview



Policy Assessment Corporation

Project Overview



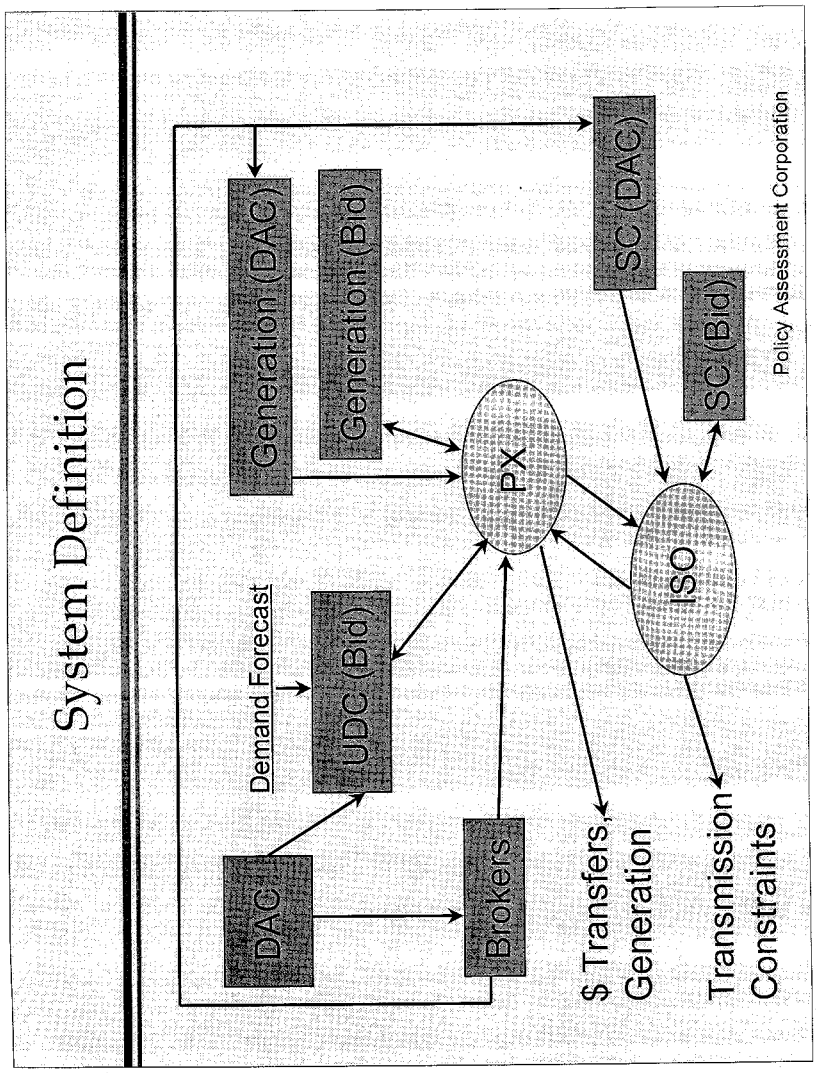
- Need: Comprehensive Gaming System, PX/ISO Simulation, Strategy Search System, ST-Forecasting System, and Data Mining for Short-Term Tactical Gaming (With Mid/Long-Term Capabilities).
- Will Update System for California Details, Add ST Timing, Add PX/ISO, Add Data Gathering/Mining.
- Have Gaming Model (Generation and Demand), Strategy Search System, ST-Forecasting.
- Will Build PX/ISO Simulation Using Staff Would Worked on Actual System; Implement California Specific Strategies, Add Real-Time Accounting, Augment Search System With Data Gathering/Mining.

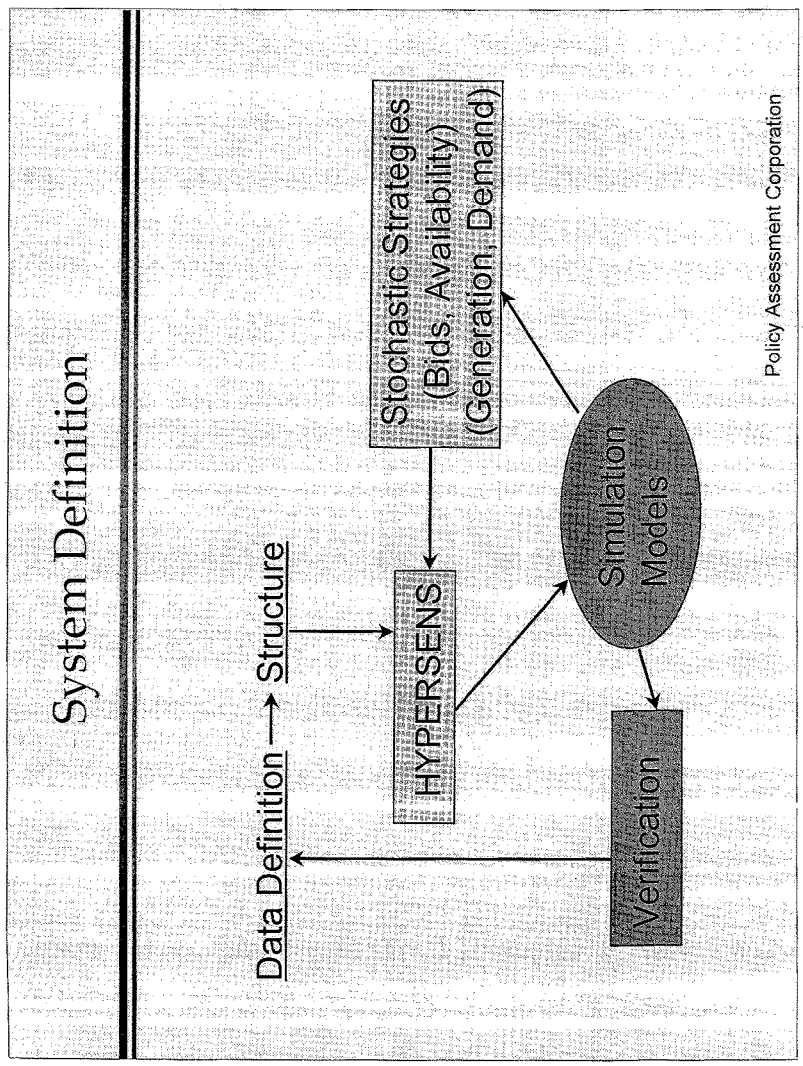
Policy Assessment Corporation

Proposal Overview

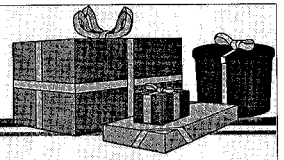
- Hemant (Phases, project importance to SCE, Perot and Pac,+ ?)

Policy Assessment Corporation


System Definition
Generation (DAC)
Generation (Bid)
SC (DAC)
SC (Bid)
PX
ISO
Demand Forecast
UDC (Bid)
DAC
Brokers
$ Transfers, Generation
Transmission Constraints
Policy Assessment Corporation


System Definition
Data Definition → Structure
HYPERSENS
Stochastic Strategies
(Bids, Availability)
(Generation, Demand)
Simulation
Models
Verification
Policy Assessment Corporation

Features



- Determine Portfolio of (Weekly) Daily, Hourly, Spot and Ancillary-Service Actions to Maximize Profitability.
- Determine Protocol Areas That Benefit the Bid, Availability, Over/Under-Booking and Congestion Gaming.
- Determine Monetary Value of Changing Game Rules (PX/ISO, FERC, and CPUC).
- Coordinate Generation And UDC Gaming for Maximum Company Profitability.
- Determine (New and Old) Competitor Threats and Strategies.
- Complete Loss Avoidance and Profit Risk Control.
- Demand, Financial, Generation Simulation for All Players.

Policy Assessment Corporation

California Gaming

- Abundant Complex Rules Cause Abundant Complex Gaming
- Movement in Day-Ahead, Hour-Ahead, and Real-Time Markets for Generation and Ancillary Services Provides Gaming Options
- Large Domain Between Genteel and Illegal
- Supply, Demand and Combination Gaming
- Rules Change and Change (This is as of April 9th, 1997 and considers new Ancillary-Service rules.)

Policy Assessment Corporation

Demand Gaming

- DAC who owns generation or flexible production does what it wants for most of month, has "hidden" hourly meter, bids or contracts perfect profile, can match end-of-month MWh, and leaves all imbalance-energy charges with UDC, independent of profile.
- UDC loss is estimated in-flow less hourly-metered and estimated profile. UDC (as residual without other players) realizes all uncertainty as imbalance charges.

Policy Assessment Corporation

UDC Gaming

- Over-Book Day-Ahead and Sell on Hour-Ahead or Real-Time (or Vice-Versa Depending on Price Gradient). Over-Booking Could Force Other Prices up for Profit.

- Under-Book Day-Ahead to Force Hour-Ahead Down; Take Hour-Ahead Rates.

Policy Assessment Corporation

Supply Gaming

- Ancillary and generation markets are mixed. Generation bid often contains start-up and no-load costs. Ancillary may not include these costs, especially if generation and ancillary bids come from same plant. Price can ***drop*** or rise on real-time market.
- Generator over books DAC load (with possible help from DAC), has unit output "frozen." At end of day ISO has to pay generator real-time price for the excess capacity.
- If price can drop on real-time market, then

Future Games

- North-to-south generation can cause congestion that increases revenue for south-generation despite congestion costs.
- Force inter-zonal constraint that hurts competitor worse than you, such as a small schedule-coordinated producer.
- Build plant at interconnect to cause congestion problems.

<u>After 5-X Years, Social Efficiency Issues Will Demand Poolco-Like System.</u>

Policy Assessment Corporation

Combative Moves

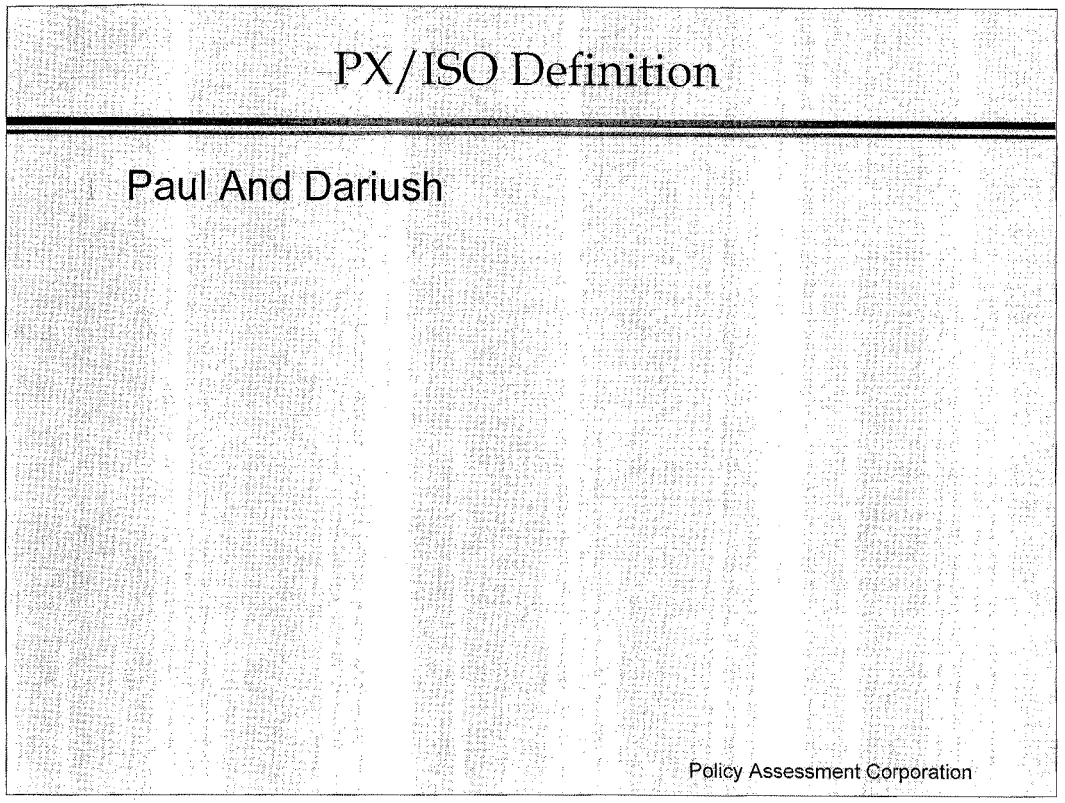
- Congestion iteration makes and relieves constraint at cost to competitor.
- If real-time price drops due to ancillary-service bidding convolution, then have outage.
- In intra-zonal market, occasionally high-bid constrained-on unit. If hit for LT. contract, make money by never running plant - change internal dispatch.

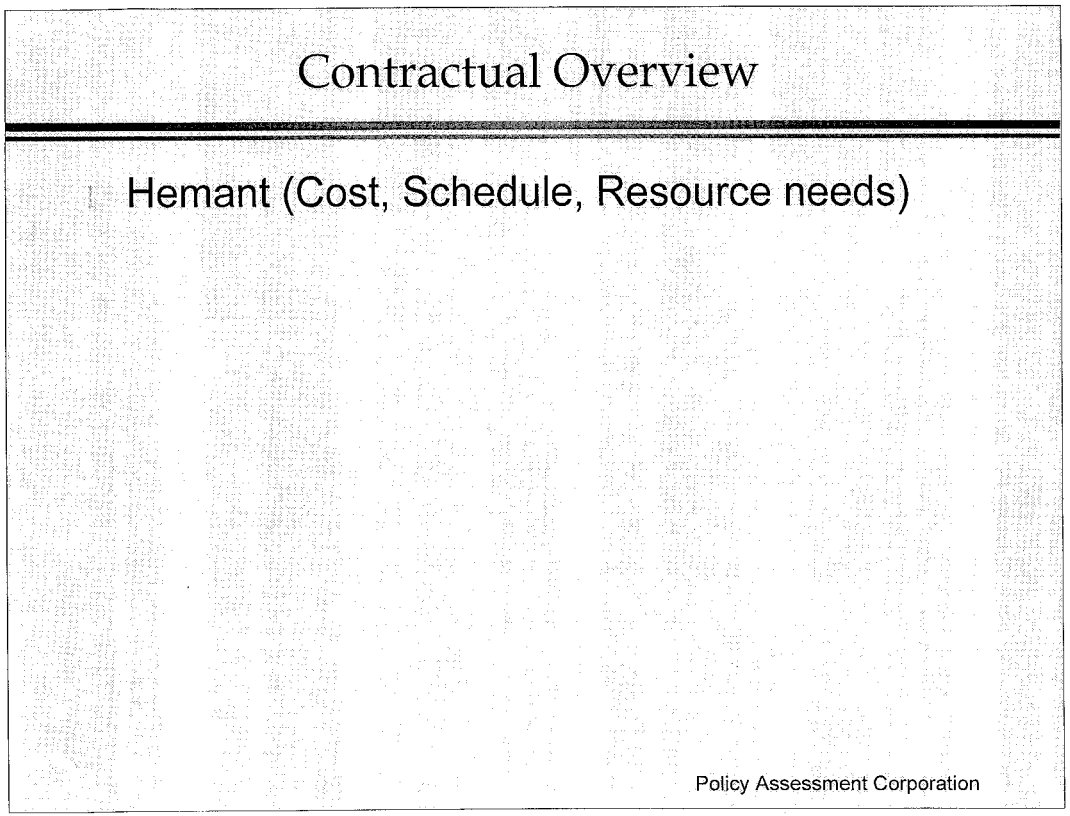
<u>Every Gaming Move Has Counter Move</u>

Policy Assessment Corporation

Other "Games"

- Micro-Bids As Probes.
- If You Are Marginal Plant, Have (Multiple) Outage(s) and Have Other Plants in Queue.
- Use Model to Determine (Without Signals) That Generation or UDC Should Take Strategy Lead to Avoid "Conflict" of Financial Interests.
- Combined Generation/UDC Over/Under-Book Strategies.
- External 3rd Party Alliance (Collaborator) on Bids and Generation Ownership.


PX/ISO Definition
Paul And Dariush
Policy Assessment Corporation


Contractual Overview
Hemant (Cost, Schedule, Resource needs)
Policy Assessment Corporation

July 21, 1997

Jonathan Jacobs
Manager of Market Evaluation
Pacific Gas and Electric
77 Beale Street
San Francisco, CA 94177

Dear John:

I am sending this to you via the fax because it may contain information that would require you to destroy it or to black out selected sections after you have read it. (I can edit it as you may request and then send an email version.) As is noted in the report I sent you, we have "verified" the inevitable dynamics of deregulation by using our models to correctly predict the evolution of events in the UK (where I spent the year in Cambridge developing the European energy analysis capabilities for the European Commission), South America, Australia, and the US (were we have not only compared the results to published events, we have modified the model to take out the computer's decision algorithms so that humans - utility executives and commissioners - can make the decisions and change the rules – only to show the resulting same set of events). This note indicates that we know how to take advantage of those events over the full spectrum of subtle to extreme gaming tactics. We have a methodology that directly considers the uncertainty in competitor and regulatory actions/responses. It determines any underlying patterns and can automatically produce an certain-to-win but continuously changing portfolio of tactics based on the actual market conditions it sees and analyses.

To put this proposal in perspective, the transition from a regulated to a deregulated market presents a tumultuous time for all the companies that prospered under the "old" rules. Regulators attempt to provide an orderly transition from the past to the future that protects existing rights and commitments while simultaneously clearing the way for new free-market activities. These two demands are in economic opposition and new rules necessarily contain ambiguities and market distortions. Physical constraints to the system insure that any definition or rule will become ambiguous under some operating condition[1] (Hunt 1996, p. 61) and thereby allow competitors to respond in way that dramatically changes the expected character of the future market place[2] (Newbery 1996, p. 64). In

[1] Sally Hunt and Graham Shuttleworth, *Competition and Choice in Electricity*, John Wiley and Sons, 1996, p. 61.
[2] David M. Newbery, "Regulation, Public Ownership and Privatisation of the English Electricity Industry" in *International Comparison of Electricity Regulation*, Richard Gilbert, and Edward Kahn, ed., Cambridge University Press, 1996.

California, significant efforts were made to ensure the market acted as the regulators deemed appropriate. This not only causes market distortions that can be advantageous to some and detrimental to others, it also means that the rules probably will have effects contrary to the desired effect. As Richard Tabors of MIT notes:"...the market rules cannot be gotten right on the first try if the goal is a pre-designed supervised market. The regulatory interference has prevented the types of market mechanism ... normally seen in a commodity type market"[3] (Tabors 1996, p. 47). From electricity deregulation experience in other parts of the world, "the message .. is clear. It was incorrectly assumed that the new commercial entities would continue to operate by the intent of the rules, even if not formally stated, when the new structure began. But commercial markets are commercial markets, profits are profits and any commercial advantage will be taken" (Tabors 1996, p. 49). The dynamics of deregulation as they relate to how competitors may act toward each other are documented further by Wolak[4] and Backus.[5]

My work has focused on the games people play during the transition from the regulated to the deregulated environment. During this period, the optimization tools typically used by utilities cannot provide adequate answers. Not only do the uncertainty in rules and competitor responses invalidate the assumptions of the analysis, I can show that an optimal "player" is the one that is easiest to defeat in a readily-producible "gaming" situation. The comprehensive gaming we address necessarily includes strategic, tactical, operational, real time components. Wars are not won with a singe one-shot battle using a single tactic and a single weapon.

We simulate (with the needed validation and confidence bounds): dynamically changing own and competitor financial strength, tactical sequencing, repetitive and non-repetitive tactics, portfolios of tactics, misinformation efforts, gambits, bidding, diversions, third-party tacit cooperation, counter-responses, counter-measures, over/under booking, availability strategies, protocol ambiguity/rule conflicts, congestion tactics, must-run/take tactics, market separation effects (e.g., day versus hour versus ancillary), market isolation (region and segment), combined customer/suppler distortions, signaling, financial instruments/hedging, financial restructuring/asset placement, divestiture re-direction, affiliated marketers, affiliated generators, exacerbating weather effects, new rule "guidance," legal restraining orders/law suits or any other categories that become recognized. If required, we can keep the gaming below regulatory thresholds or hide it in the noise of the market.

Some "desirable" tactics could be blatant to cause a rule to be changed to hurt a competitor more than PG&E, or to help PG&E more than it helps the competitor. We also show the advantage of both the regulated and unregulated segments of the company

---

[3] "Lessons from the UK and Norway," Richard D. Tabors, *IEEE Spectrum*, New York, pp. 45-49.
[4] Frank A Wolak and R.H. Patrick, "The Impacts of Market Rules and Market Structure on the Price Determination in the England and Wales Electricity Market, Stanford University Department of Economics Working Paper," April 1997. Available on www-path.eecs.berkeley.edu/UCENERGY.
[5] George A. Backus, *The Dynamics of U.S. Electric Utility Deregulation*, U.S. Department of Energy, Office of Utility Technology, Washington D.C., August 1996.

having the tool so that efforts are coordinated - but without direct communication. "Perversities" in the market dynamics exist such that the unregulated marketing arm can, under an orchestrated game plan, be most useful helping adversaries take away UDC market share. Similarly, generation may want to over-sell to old grandfather contracts even if the power "goes" to an out-of state supplier. We can determine and coordinate the comprehensive set of moves, from real-time to long-term end-game, that maximize income or any other measure of company success. The highly convoluted rules of the California system, by nature, produce abundant but highly convoluted gaming moves.

We call what we are proposing a "Real-time Competitive Response System." The system, however, does and must include the financials simulation of all California market players as well as the full simulation of all the North American gas and electric energy suppliers. This allows both short-term and the long-term analysis of merger, acquisition, take-over, bankruptcy and market entry activities. In additional to the financial simulation capabilities, the model contains the plant, electric transmission, and gas transmission physical detail. The detailed aspects of the PX and ISO will be included as they change AND are expected OR preferred to change. It also includes the all-fuel, end-use simulation of demands. Very realistic (and accurate) retail-wheeling and marketing dynamics/impacts are intrinsic to the model.

Gaming may be a dirty word to FERC and the California commission, but the sooner the market clears out the distortions, the better it works for everyone. The "gaming" defeats the flaws in the system and ultimately removes the players or features that lead to market distortions. There may be ethical issues related to "the end justifying the means" but there is a large region of opportunities between what is ethically viable (profitable) and ethically dangerous (illegal). It is prudent to understand the full spectrum of possibilities, and through the understanding of market dynamics that it provides, to select that appropriate subset of strategies which best serve the long-term interests of PG&E.

In 1986 (not 1996), Policy Assessment Corporation (PAC)and Systematic Solutions Incorporated (SSI) developed the Competitive Industry Gaming Model (CIGMOD) to analyze the dynamics of deregulation for the State of Illinois. The model was based on the ENERGY 2020 model used in 40 states and provinces in North America by the energy industry and regulators. Versions of ENERGY 2020 are the US National Energy Policy Model (FOSSIL2/IDEAS) and the Canadian government's National Energy Planning Model (ETPM). ENERGY 2020 was selected to analyze the energy and environmental evolution of Western Europe. The model is extensively used in Eastern and Central Europe to address the severe dynamics of both economic and energy deregulation there. We are currently initiating the invited efforts to assist Brazil in its deregulation process. The model is also being used by the US and Canadian governments to provide analytical support for the international greenhouse gas negotiations.

When the conventional models used in the UK to analyze deregulation failed to reproduce the unfolding events, it was the re-parameterized US CIGMOD model that reproduced the gaming dynamics, the re-regulation activities and the merger processes within the UK.

Most observers would argue that the UK experience has little to do with the US. The CIGMOD "experience" turns this view on its head and goes so far as to say a "market is a market" in all languages and countries. The work of Sally Hunt as referenced above, later corroborated that conclusion.

Our combined efforts with the Perot System's (PSC) staff working on the ISO (primarily those familiar to PG&E: Paul Gribik, Ali Vojdani and Dariush Shirmohammadi) have shown a large number of additional gaming opportunities that their unique experience with the PX, ISO and the PX/ISO interface allow. These opportunities are not only in the design of the PX and ISO itself, but also in the data transfer, settlement, and physical response issues.

Thus, my associated organizations (PAC and SSI) along with PSC provide a capability that is not even remotely available elsewhere. What we would propose to PG&E would be specific tasks that adds the California ISO/PX simulation to and modifies the structure of the deregulation dynamics model developed by Systematic Solutions, Inc., to faithfully reflect the specific rules and protocols associated with the California market as they change from now until the end of the transition.

The Project

The proposed effort could tentatively be divided into three or more phases to verify that each current phase indicates the success of the next phase. **This hypothetical proposal is provided for exemplary purposes only. An entirely different effort, more or less ambitious, could be readily accommodate.** Careful consideration of the system's design strongly indicates minimal technical risk under all hypothesized conditions. We have all the tested parts to the system except the real-time PX/ISO data acquisition software. The parts do need to be modified to reflect the specific and continuously changing, California regulatory conditions, PG&E priorities, and the calculation times needed to provide real-time response. The changing ground of the California deregulation process, however, also indicates that certain tasks may not be needed, that some tasks may need to be redefined and that other tasks may need to be added in Phases II and III. For example, recent (June) modifications to the PX protocols would require that our PX simulation model be modified accordingly for the interim PX operations. This **example** proposal provides for the testing of the complete system in Phase I, followed by two other phases contingent on the expectations of the PX/ISO release of specifications, an exhaustive model testing regimen, and PG&E staff training needs. This phasing also allows PG&E to gain confidence in the system and approach prior to using it in the actual market place to help facilitate up to $12 million in transactions per day.

Phase I

The first phase, called the "functional model phase," reviews all the information of the California ISO and PX as well as any other relevant commission rulings to determine any areas where PG&E or competitors could find opportunities. These are translated to

strategies and incorporated into the existing strategy options within the current deregulation model framework. The simulation of the way that the actual PX/ISO operates is also incorporated into the model. Perot Systems Consulting (PSC) has help designed these tools for the actual PX/ISO and are thus the most capable to make sure this project provides valid simulations of actual PX/ISO operations. Further, PSC's intimate knowledge of PX/ISO protocols has a particular advantage for this project.

The deregulation framework contains detailed demand, energy, financial and physical representations of all the known potential players in the California market. (Unanticipated entities can be added as needed.) The short-term forecasts for California and local competitors' demands are determined endogenously so that the generation available to serve the California market can be correctly ascertained. Phase I provides the integration and testing of all critical components as well as determines what protocols and rules have relevancy to future market conditions. PG&E staff will use this framework to learn the modeling system plus gain confidence in its usage as an operational tool. The human interface will also be modified as needed to maximize the efficacy of using the model for bidding and other strategies. The real-time data available from the PX/ISO will not have been determined during Phase but will be the focus when it becomes available for Phase II. Nonetheless, the ability of the model to simulate basic competitive strategies against human players will be tested in Phase I to ensure that the model performs as expected.

Phase II

The second phase is the "operational model phase." In this phase the project team determines the available and actual real-time data from the ISO/PX and adds the analysis capabilities to take advantage of that data stream within the model. Advanced statistical methods (primarily associated with the technical analysis of commodity time series and cointegration) will be added to the model. These sub-systems will determine the statistical qualities of the prices, supplies and demands in order to understand the underlying direction of their variance and averages. Depending on the intelligence data available PG&E pursues, the software will be able to detect any pattern in a competitor's actions that may be detrimental to PG&E operations or whether competitors are somehow directly tracing any PG&E efforts.

In Phase III below, neural networks may be advantageous for the short-term forecasting of price and demand. Neural nets, however, do require specific data structures that would not yet be understood in the early days of the deregulation.

Both Phase II and Phase III use a sophisticated confidence/validity package called HYPERSENS. It can search essentially all the possible options to find those real-time strategies that ensure PG&E is not disadvantaged by the behaviors of competitors. HYPERSENS cannot only accommodate the uncertainty in competitor behavior, generator availability, and hourly demands, it can determine the set of options available that best meet PG&E goals.

Because the modeling system of Phase II will have the capabilities to analyze hourly data, test data sets will be generated for PG&E staff to use as a means of learning and gaining confidence in the system. Any uncovered limitations will be mitigated as appropriate. Model testing with PG&E Staff is a significant part of the project to insure that the model does well under anticipated and unanticipated conditions. Synthetically produced data streams that approximate what is actually expected during the first quarter of 1997 will be used in the testing.

Phase III

The third phase is the "real-time implementation phase." Only after January 1, 1998 will real data be available for both analysis and real-time decision-making purposes. The modeling system described here will need to be monitored to insure that it produces the information PG&E expects. The system will contain software that notifies staff of any anomalies that may jeopardize the result's validity. Further, fail-safe" positions will be included that limit any financial exposure during the time interval before adequate data have become available to fully validate the system's operation. The algorithms will be "tuned" as appropriate and enhanced features are added as required. The model will also be benchmarked against "reference" assumption to determine its success rate compared to equilibrium conditions. The model methodology will, by default, certainly have the ability to determine the best bidding strategy given market information. The only area where added care and testing must be taken is in those strategies that respond directly to the aggressive actions of a competitor.

Optional Follow-on Phases

The data flows during the transition may be overwhelming to PG&E operations. We also have the ability to provide the data-visualization (GIS) that clearly delineates for PG&E staff the options and recommended actions. This activity could constitute a Phase IV

As an intrinsic part of the system, the CIGMOD deregulation dynamics model will allow PG&E to test the impacts of others entering the California market (generation or marketing) or the impacts of (gas and electric) mergers, acquisitions, and takeovers among competitors or by PG&E. This could represent a Phase V consulting effort. The consolidation (or dilution) of the market changes the strategies that a company must use to insure profitability. This effort would extend the short term (hour-to-hour to monthly) analyses to longer time frames, thereby providing company-wide analyses of the impacts of such longer-term strategies on day-to-day as well annual operations and profitability. This Phase can also test competitors' financial strategies which could impact PG&E's operations/profitability.

The ISO/PX system in California is premised on the assumption that DC analysis is adequate to determine system requirements and behaviors. Efforts of the project staff indicate that the AC considerations lead to significant additional opportunities for competitors to disadvantage PG&E operations. Some of the advanced technical efforts to

001080

increase the transfer capabilities within WSCC may make this area the most crucial to insuring the real-time availability of PG&E generating units. Adding AC considerations to the proposed modeling system could represent a Phase VI.

The specifics of these potential Phases IV through VI are not pursued further here.

Attached is an example of what the tasks of a "real" proposal might look like. I want to make this as concrete for you as possible so that your evaluation is as easy as possible. Please contact me with any questions or concerns you may have.

Sincerely,

Dr. George Backus
President

om: George Backus [gbackus@boulder.earthnet.net]
Sent: Sunday, August 03, 1997 11:29 PM
To: Jacobs, Jonathan
Cc: Paul Gribik; Hemant Lall
Subject: Re: Interest?

John,

I think I need your help on the best choice here. I can come out to make a general presentation but would do so under the expectation that if I "proved myself, then both Perot and I would come out to make a presentation to senior management. Without such an assurance, there would be little value to my efforts. Secondly, the subject matter I was intending to present and discuss would not be looked upon favorably if it were to get back to the commission. Therefore, I would only be able to give the "general talk" to the staff. I would include the overall proposal concepts in the talk and a few examples to show that what I am saying is real and has been done in the UK, Australia and South America despite the "best intentions" of the "deregulation rules" (and occurred as and when our work predicted). I also do have examples of some pretty "neat" games already played in the US at the expense of the "big guys.". Finally, as you know, the British are buying US assets and will bring their "games" with them. My work shows that doesn't really matter, however. The "games" are inevitable and the more convoluted the rules become to prevent them, the worse it gets. California leads, by far, in producing convoluted rules.

The proposal discussions to assist PG&E play the game and win the war would probably only be appropriate to senior management. In that discussion, I would present how easy it is for other entities to perform a "few acts" that would be detrimental to PG&E. In other words, if PG&E plays by the 'spirit of the law' instead of the "letter of the law," it will surely lose against those who can not resist the 10's if not 100's of millions of dollars that can be easily had at the expense of the "naive." (Think of tax laws. You and I would feel really dumb if we did not take all the deductions the law allowed because it wasn't in the "spirit" of ensuring the government received all the taxes it anticipated.) The temptation to go to the limits of the law is great to those who would lose under the "spirit of the law," and, as such, the P.T. Barnum truism play well. In the converse, aggressive play and counter-moves by PG&E would be hard to stop.

I still have the 18, 19 and 20th of August open. Can we get a meeting with Sr. Mgmt. on the first round with the implication to skip the staff presentation unless mgmt. feels that their presence would be useful? Or can you set up the process whereby a presentation to the staff would act as the "test" to determine the follow-on presentation to senior mgmt? You know the capabilities of the Perot folks and I think what I sent you about my work affirms that what we are proposing is a serious and significant capability. I would hope there is a means for you and I to produce a level of interest consistent with the proposed effort. Any ideas?

Thanks

George

> From: Jacobs, Jonathan <jmj6@pge.com>
> To: 'George Backus' <gbackus@boulder.earthnet.net>
> Subject: RE: Interest?
> Date: Wednesday, July 30, 1997 6:07 PM
>
> The lack of response was, as you suspected, due to latency. I have

8th April 1998

Rich Davis
Vice President
Enron Capital and Trade Resources Corp.

RE: Real-Time Market Modeling and Optimization

Dear Rich:

My apologies for the delay in producing this document. George and I wanted to engage Paul's thoughts in the illustrations we've included. Given his involvement with both the California Power Exchange and ISO in opening the market, his time has not been his own.

We have thought extensively about the questions you posed and, we think we can provide a positive response to all of them --- but as you may have guessed the answers all have a twist to them that leaves an amount of uncertainty. Our focus has been to approach these questions from a perspective of; can you reasonably expect the Workshop discussed to either produce an answer or, satisfy that an answer is possible? We would not advise spending any measure of time or money for this meeting unless some certainty of outcome can be established.

Below you'll find a cursory response to your questions. A more complete response probably requires a face-to-face discussion. Clarifications could be provided in a telephone call should this prove of interest once you have had the chance to review.

Question 1: **What is the nature of the strategies ECT and PGE can play in the market?**

A. The "good news" & the "less than good news" is that an overabundance of strategy categories exist; ranging from just playing the "gaps" in the protocols, to taking advantage of self-created congestion, to using customer loads and ECT energy to control market revenue flows, and yet on still to possibly using allies to create market control of market niches. While the trading floor can unilaterally take advantages of market "opportunities" as they arise, a broader strategy involving other parts of Enron (or PGE) along with possibly allies in other energy supply or delivery organizations may actually serve to create opportunities rather than wait for them. The trick is having a view of "where and how" these opportunities should be targeted. Focusing only on actual CA protocol gaps, a few examples may assist in illustrating these points.

- Under its old protocols, when the ISO received insufficient adjustment bids, the ISO would have set the default usage charge equal to the ex-post price in the hour on the previous day. When yesterday's ex-post price was very low, a large importer could attempt to increase the price at its intertie. For example, suppose that yesterday's ex-post price was $20/MWh in the hour. An importer could bid to sell 10,000 MWh in

000353

the PX auction at $0/MWh. It would likely be selected. It would then schedule the 10,000 MWh across an intertie whose limit is less than its scheduled flow, say a 2,000 MWh limit.

The importer would not give an adjustment bid on its import. It would schedule a small amount of energy in CA and give a high priced incremental bid on that resource. Many PX bidders would likely have lost in the PX auction under these conditions and will not schedule their resources nor submit adjustment bids. This will likely result in a thin adjustment bid market in CA. As a result, high priced adjustment bids will likely be used in CA and the zonal price in CA will rise to a high level. Suppose that the importer's incremental adjustment bid in CA were used. The price in CA would rise to $250/MWh. The price at the intertie would then have been set to $250/MWh - $20/MWh or $230/MWh.

We have alerted the ISO and PX to this particular gap and it has been "closed."

- Without going into details, other gaps do exist in the way that the ISO manages intrazonal congestion in the forward markets and rules of managing imbalances in the real-time market

We're confident of being able to jointly create a process for deciding those strategy categories that are most efficacious to ECT and PGE circumstances. Once that is determined, we can then refine the characteristics (with examples) of strategies and tactics that could be pursued.

Question 2: **Are ECT and PGE big enough to shape the market? e.g. do they have the right assets (transmission rights, generation, customer load schedules, etc.)? If not, can we identify what we see the hurdle points may be?**

A. The answer to this question lacks a straight forward response but, instead is of the "Yes, no, and none of the above" sort. Many strategies (tactics) can be played independent of size considerations. As an illustration, here is a real "gap" in the system – band-aided for the time being.

- The CA ISO will set a default usage charge on a congested path when it does not receive enough decremental bids in the exporting zone and incremental bids in the importing zone to alleviate congestion using economic signals. The ISO protocols would have permitted this default usage charge to rise to $250/MWh.

  The PX protocols require that the difference in energy prices in two zones must be equal to the ISO's transmission usage charge between the zones. The old PX protocols previously required that each zonal energy price be greater than or equal to zero.

A party with generation on both sides of a small interface could have devised a strategy to control the PX energy prices in CA under these protocols. For example, the Silverpeak interface has a limit of around 30 MW. Suppose that a party bid to sell 100 MWh in the PX auction at $0/MWh. It will likely win the right to sell 100 MWh. That party could schedule an import of 35 MWh at Silverpeak and 65 MWh of generation in CA. If it did not provide a decremental adjustment bid on its 35 MWh import, the ISO would reduce the import by 5 MWh and set a default usage charge of $250/MWh on the intertie. Under the old PX protocols, the energy price in CA would have been set at $250/MWh. In this way, the party could ensure that it received $250/MWh for its 65 MWh generated in CA.

There is already evidence that participants in the CA PX/ISO are delivering micro-probes (small, "unusual" bids) designed to find the weaknesses in the system and the software. It is clear that many holes in the system exist that could be used to deliver "unexpected" profits.

Nonetheless, size does determine the types of strategies that can be pursued. In a naive sense, the current "concept" of PGE and the Western ECT trading floor is both geographically in the wrong place to routinely "shape" the markets in WSCC/CA and, as stand alone entities, not large enough to "shape" the market. As we understand it, the bulk of ECT flexible transactions use NW power. To shape the market, loads and generation at a variety of geographical locations would maximize the number, size, and type of strategies that could be played. If ECT-associated energy supplies or loads in Northern California help create congestion, ECT-associated energy supplies in Southern California could take advantage of the price increases due to that congestion. Both loads and supplies can be strategically used to create local markets with added ECT profitability. As George described in his last visit, the rules for the schedule coordinators (SC), allow SCs to mix and match loads and generation after the fact without telling its clients. The SCs also have information and timing advantages over the PX that allow added profitability – if used wisely.

As part of the proposed seminars we can delineate the strategy types available as a function of size (MW/MWh of both loads and supply) and geographical diversity.

Question 3: **Can these strategies be realized and what is the size of the investment return to be captured?**

Some strategies can be executed in isolation with assurance that the conditions that warrant their use insure their profitable completion. Others strategies come in risk balanced groups. For example, if prices are high, company A selling energy on the imbalance market is probably winning, while company B buying from the imbalance market is probably losing. Thus, via asymmetric agreements with both parties, you win when either A or B win but, lose little if either loses. Conversely you can have a strategy that wins when either A or B loses but, loses little if A or B win. In this situation you are guaranteed to win. Matters can be made more advantageous if you can add market volatility that insures winners and losers -- your pay-off is limited in a stable market where no one remarkably wins or loses. With multiple market players, a portfolio of positions exists whereby one can guarantee no losses or conversely one can command

higher profits for a higher probability of loss -- that still averages to a high profitability over a specified number of transactions.

As part of the seminars, we can provide first pass estimates of the pay-off under typical conditions for simple protocol "gap" tactics. We can also demonstrate how to determine the expected pay-off and required conditions for more complex strategies.

Rich, I hope this response to you questions explains the probable value we see this session may bring to ECT. We are confident our expertise and the tools we have available can deliver increased profits.

Once you have a chance to review, let's set another time to talk and see if we reached the state of comfort needed to proceed with our plans together. I'll look for your comments on email and, will plan to call you next week.

Sincerely,

Ed Smith

STOEL RIVES LLP

MEMORANDUM

December 8, 2000

TO: RICHARD SANDERS

FROM: CHRISTIAN YODER AND STEPHEN HALL

RE: Traders' Strategies in the California Wholesale Power Markets/ ISO Sanctions

---

CONFIDENTIAL: ATTORNEY/CLIENT PRIVILEGE/ATTORNEY WORK PRODUCT

This memorandum analyzes certain trading strategies that Enron's traders are using in the California wholesale energy markets. Section A explains two popular strategies used by the traders, "inc-ing" load and relieving congestion. Section B describes and analyzes other strategies used by Enron's traders, some of which are variations on "inc-ing" load or relieving congestion. Section C discusses the sanction provisions of the California Independent System Operator ("ISO") tariff.

A. The Big Picture

1. "Inc-ing" Load Into The Real Time Market

One of the most fundamental strategies used by the traders is referred to as "'inc-ing' load into the real time market." According to one trader, this is the 'oldest trick in the book' and, according to several of the traders, it is now being used by other market participants.

To understand this strategy, it is important to understand a little about the ISO's real-time market.[1] One responsibility of the ISO is to balance generation (supply) and loads (demand) on the California transmission system. During its real-time energy balancing function the ISO pays/charges market participants for increasing/decreasing their generation. The ISO pays/charges market participants under two schemes: "instructed deviations" and "uninstructed deviations." Instructed deviations occur when the ISO selects supplemental energy bids from generators offering to supply energy to the market in real time in response to ISO instructions. Market participants that increase their generation in response to instructions ("instructed deviation") from the ISO are paid the "inc" price. Market participants that increase their

[1] The "real-time" energy market is also known as the imbalance energy market. The imbalance energy market can be further subdivided into the (1) supplemental energy or instructed deviation market and (2) the ex post market or uninstructed deviation market.

generation without an instruction from the ISO (an "uninstructed deviation") are paid the ex post "dec" price. In real-time, the ISO issues instructions and publishes ex post prices at ten-minute intervals.

"'Inc-ing load' into the real-time market" is a strategy that enables Enron to send excess generation to the imbalance energy market as an uninstructed deviation. To participate in the imbalance energy market it is necessary to have at least 1 MW of load. The reason for this is that a generator cannot schedule energy onto the grid without having a corresponding load. The ISO requires scheduling coordinators to submit balanced schedules; i.e., generation must equal load. So, if load must equal generation, how can Enron end up with excess generation in the real-time market?

The answer is to artificially increase ("inc") the load on the schedule submitted to the ISO. Then, in real-time, Enron sends the generation it scheduled, but does not take as much load as scheduled. The ISO's meters record that Enron did not draw as much load, leaving it with an excess amount of generation. The ISO gives Enron credit for the excess generation and pays Enron the dec price multiplied by the number of excess megawatts. An example will demonstrate this. Enron will submit a day-ahead schedule showing 1000 MW of generation scheduled for delivery to Enron Energy Services ("EES"). The ISO receives the schedule, which says "1000 MW of generation" and "1000 MW of load." The ISO sees that the schedule balances and, assuming there is no congestion, schedules transmission for this transaction. In real-time, Enron sends 1000 MW of generation, but Enron Energy Services only draws 500 MW. The ISO's meters show that Enron made a net contribution to the grid of 500 MW, and so the ISO pays Enron 500 times the dec price.

The traders are able to anticipate when the dec price will be favorable by comparing the ISO's forecasts with their own. When the traders believe that the ISO's forecast underestimates the expected load, they will inc load into the real time market because they know that the market will be short, causing a favorable movement in real-time ex post prices. Of course, the much-criticized strategy of California's investor-owned utilities ("IOUs") of underscheduling load in the day-ahead market has contributed to the real-time market being short. The traders have learned to build such underscheduling into their models, as well.

Two other points bear mentioning. Although Enron may have been the first to use this strategy, others have picked up on it, too. I am told this can be shown by looking at the ISO's real-time metering, which shows that an excess amount of generation, over and above Enron's contribution, is making it to the imbalance market as an uninstructed deviation. Second, Enron has performed this service for certain other customers for which it acts as scheduling coordinator. The customers using this service are companies such as Powerex and Puget Sound Energy ("PSE"), that have generation to sell, but no native California load. Because Enron has native California load through EES, it is able to submit a schedule incorporating the generation of a generator like Powerex or PSE and balance the schedule with "dummied-up" load from EES.

Interestingly, this strategy appears to benefit the reliability of the ISO's grid. It is well known the California IOUs have systematically underscheduled their load in the PX's Day-

Ahead market. By underscheduling their load into the Day-Ahead market, the IOUs have caused the ISO to have to call on energy in real time in order to keep the transmission system in balance. In other words, the transmission grid is short energy. By deliberately overscheduling load, Enron has been offsetting the ISO's real time energy deficit by supplying extra energy that the ISO needs. Also, it should be noted that in the ex post market Enron is a "price taker," meaning that they are not submitting bids or offers, but are just being paid the value of the energy that the ISO needs. If the ISO did not need the energy, the dec price would quickly drop to $0. So, the fact that Enron was getting paid for this energy shows that the ISO needed the energy to balance the transmission system and offset the IOU's underscheduling (if those parties own Firm Transmission Rights ("FTR") over the path).

2. Relieving Congestion

The second strategy used by Enron's traders is to relieve system-wide congestion in the real-time market, which congestion was created by Enron's traders in the PX's Day Ahead Market. In order to relieve transmission congestion (i.e., the energy scheduled for delivery exceeds the capacity of the transmission path), the ISO makes payments to parties that either schedule transmission in the opposite direction ("counterflow payments") or that simply reduce their generation/load schedule.

Many of the strategies used by the traders involve structuring trades so that Enron gets paid the congestion charge. Because the congestion charges have been as high as $750/MW, it can often be profitable to sell power at a loss simply to be able to collect the congestion payment.

B. Representative Trading Strategies

The strategies listed below are examples of actual strategies used by the traders, many of which utilize the two basic principles described above. In some cases, the strategies are identified by the nicknames that the traders have assigned to them. In some cases, i.e., "Fat Boy," Enron's traders have used these nicknames with traders from other companies to identify these strategies.

1. Export of California Power

   a. As a result of the price caps in the PX and ISO (currently $250), Enron has been able to take advantage of arbitrage opportunities by buying energy at the PX for export outside California. For example, yesterday (December 5, 2000), prices at Mid-C peaked at $1200, while California was capped at $250. Thus, traders could buy power at $250 and sell it for $1200.

   b. This strategy appears not to present any problems, other than a public relations risk arising from the fact that such exports may have contributed to California's declaration of a Stage 2 Emergency yesterday.

2. "Non-firm Export"

a. The goal is to get paid for sending energy in the opposite direction as the constrained path (counterflow congestion payment). Under the ISO's tariff, scheduling coordinators that schedule energy in the opposite direction of the congestion on a constrained path get paid the congestion charges, which are charged to scheduling coordinators scheduling energy in the direction of the constraint. At times, the value of the congestion payments can be greater than the value of the energy itself.

b. This strategy is accomplished by scheduling non-firm energy for delivery from SP-15 or NP-15 to a control area outside California. This energy must be scheduled three hours before delivery. After two hours, Enron gets paid the counterflow charges. A trader then cuts the non-firm power. Once the non-firm power is cut, the congestion resumes.

c. The ISO posted notice in early August prohibiting this practice. Enron's traders stopped this practice immediately following the ISO's posting.

d. The ISO objected to the fact that the generators were cutting the non-firm energy. The ISO would not object to this transaction if the energy was eventually exported.

Apparently, the ISO has heavily documented Enron's use of this strategy. Therefore, this strategy is the more likely than most to receive attention from the ISO.

2. "Death Star"

a. This strategy earns money by scheduling transmission in the opposite direction of congestion; i.e., schedule transmission north in the summertime and south in the winter, and then collecting the congestion payments. No energy, however, is actually put onto the grid or taken off.

b. For example, Enron would first import non-firm energy at Lake Mead for export to the California-Oregon border ("COB"). Because the energy is traveling in the opposite direction of a constrained line, Enron gets paid for the counterflow. Enron also avoids paying ancillary service charges for this export because the energy is non-firm, and the ISO tariff does not require the purchase of ancillary services for non-firm energy.

c. Second, Enron buys transmission from COB to Lake Mead at tariff rates to serve the import. The transmission line from COB to Lake Mead is outside of the ISO's control area, so the ISO is unaware that the same energy being exported from Lake Mead is simultaneously being imported into Lake Mead. Similarly, because the COB to Lake Mead line is outside the ISO's control area, Enron is not subject to payment of congestion charges because transmission charges for the COB to Lake Mead line are assessed based on imbedded costs.

d. The ISO probably cannot readily detect this practice because the ISO only sees what is happening inside its control area, so it only sees half of the picture.

e. The net effect of these transactions is that Enron gets paid for moving energy to relieve congestion without actually moving any energy or relieving any congestion.

3. "Load Shift"

a. This strategy is applied to the Day-Ahead and the real-time markets.

b. Enron shifts load from a congested zone to a less congested zone, thereby earning payments for reducing congestion, i.e., not using our FTRs on a constrained path.

c. This strategy requires that Enron have FTRs connecting the two zones.

d. A trader will overschedule load in one zone, i.e., SP-15, and underschedule load in another zone, i.e., NP-15.

Such scheduling will often raise the congestion price in the zone where load was overscheduled.

The trader will then "shift" the overscheduled "load" to the other zone, and get paid for the unused FTRs. The ISO pays the congestion charge (if there is one) to market participants that do not use their FTRs. The effect of this action is to create the appearance of congestion through the deliberate overstatement of loads, which causes the ISO to charge congestion charges to supply scheduled for delivery in the congested zone. Then, by reverting back to its true load in the respective zones, Enron is deemed to have relieved congestion, and gets paid by the ISO for so doing.

e. One concern here is that by knowingly increasing the congestion costs, Enron is effectively increasing the costs to all market participants in the real time market.

f. Following this strategy has produced profits of approximately $30 million for FY 2000.

4. "Get Shorty"

a. Under this strategy, Enron sells ancillary services in the Day-ahead market.

b. Then, the next day, in the real-time market, a trader "zeroes out" the ancillary services, i.e., cancels the commitment and buys ancillary services in the real-time market to cover its position.

c. The profit is made by shorting the ancillary services, i.e., sell high and buy back at a lower price.

d. One concern here is that the traders are applying this strategy without having the ancillary services on standby. The traders are careful, however, to be sure to buy services right at 9:00 a.m. so that Enron is not actually called upon to provide ancillary services. However, once, by accident, a trader inadvertently failed to cover, and the ISO called on those ancillary services.

e. This strategy might be characterized as "paper trading," because the seller does not actually have the ancillary services to sell. FERC recently denied Morgan Stanley's request to paper trade on the New York ISO.

The ISO tariff does provide for situations where a scheduling coordinator sells ancillary services in the day ahead market, and then reduces them in the day-of market. Under these circumstances, the tariff simply requires that the scheduling coordinator replace the capacity in the hour-ahead market. ISO Tariff, SBP 5.3, *Buy Back of Ancillary Services.*

f. The ISO tariff requires that schedules and bids for ancillary services identify the specific generating unit or system unit, or in the case of external imports, the selling entity. As a consequence, in order to short the ancillary services it is necessary to submit false information that purports to identify the source of the ancillary services.

5. "Wheel Out"

a. This strategy is used when the interties are set to zero, i.e., completely constrained.

b. First, knowing that the intertie is completely constrained, Enron schedules a transmission flow through the system. By so doing, Enron earns the congestion charge. Second, because the line's capacity is set to "0," the traders know that any power scheduled to go through the inter-tie will, in fact be cut. Therefore, Enron earns the congestion counterflow payment without having to actually send energy through the intertie.

c. As a rule, the traders have learned that money can be made through congestion charges when a transmission line is out of service because the ISO will never schedule an energy delivery because the intertie is constrained.

6. "Fat Boy"

a. This strategy is described above in section A (1).

7. "Ricochet"

a. Enron buys energy from the PX in the Day Of market, and schedules it for export. The energy is sent out of California to another party, which charges a small fee per MW, and then Enron buys it back to sell the energy to the ISO real-time market.

b. The effect of this strategy on market prices and supply is complex. First, it is clear that Enron's intent under this strategy is solely to arbitrage the spread between the PX and the ISO, and not to serve load or meet contractual obligations. Second, Ricochet may increase the Market Clearing Price by increasing the demand for energy. (Increasing the MCP does not directly benefit Enron because it is *buying* energy from the PX, but it certainly affects other buyers, who must pay the same, higher price.) Third, Ricochet appears to have a neutral effect on supply, because it is returning the exported energy as an import. Fourth, the parties that pay Enron for supplying energy to the real time ex post market are the parties that underscheduled, or underestimated their load, i.e., the IOUs.

8. Selling Non-firm Energy as Firm Energy

a. The traders commonly sell non-firm energy to the PX as "firm." "Firm energy," in this context, means that the energy includes ancillary services. The result is that the ISO pays EPMI for ancillary services that Enron claims it is providing, but does not in fact provide.

b. The traders claim that "everybody does this," especially for imports from the Pacific Northwest into California.

c. At least one complaint was filed with the ISO regarding Enron's practice of doing this. Apparently, Arizona Public Service sold non-firm energy to Enron, which turned around and sold the energy to the ISO as firm. APS cut the energy flow, and then called the ISO and told the ISO what Enron had done.

9. Scheduling Energy To Collect the Congestion Charge II

a. In order to collect the congestion charges, the traders may schedule a counterflow even if they do not have any excess generation. In real time, the ISO will see that Enron did deliver the energy it promised, so it will charge Enron the inc price for each MW Enron was short. The ISO, however, still pays Enron the congestion charge. Obviously a loophole, which the ISO could close by simply failing to pay congestion charges to entities that failed to deliver the energy.

b. This strategy is profitable whenever the congestion charge is sufficiently greater than the price cap. In other words, since the ex post is capped at $250, whenever the congestion charge is greater than $250 it is profitable to schedule counterflows, collect the congestion charge, pay the ex post, and keep the difference.

C. ISO Tariff

The ISO tariff prohibits "gaming," which it defines as follows:

> "Gaming," or taking unfair advantage of the rules and procedures set forth in the PX or ISO Tariffs, Protocols or Activity Rules, or of transmission constraints in period in which exist substantial Congestion, to the detriment of the efficiency of, and of consumers in, the ISO Markets. "Gaming" may also include taking undue advantage of other conditions that may affect the availability of transmission and generation capacity, such as loop flow, facility outages, level of hydropower output or seasonal limits on energy imports from out-of-state, or actions or behaviors that may otherwise render the system and the ISO Markets vulnerable to price manipulation to the detriment of their efficiency." ISO Market Monitoring and Information Protocol ("MMIP"), Section 2.1.3.

The ISO tariff also prohibits "anomalous market behavior," which includes "unusual trades or transactions"; "pricing and bidding patterns that are inconsistent with prevailing supply and demand conditions"; and "unusual activity or circumstances relating to imports from or exports to other markets or exchanges." MMIP, Section 2.1.1 et seq.

Should it discover such activities, the ISO tariff provides that the ISO may take the following action:

1. Publicize such activities or behavior and its recommendations thereof, "*in whatever medium it believes most appropriate.*" MMIP, Section 2.3.2 (emphasis added).

2. The Market Surveillance Unit may recommend actions, including fines and suspensions, against specific entities in order to deter such activities or behavior. MMIP, Section 2.3.2.

3. With respect to allegations of gaming, the ISO may order ADR procedures to determine if a particular practice is better characterized as improper gaming or "legitimate aggressive competition." MMIP, Section 2.3.3.

4. In cases of "serious abuse requiring expeditious investigation or action" the Market Surveillance Unit shall refer a matter to the appropriate regulatory or antitrust enforcement agency. MMIP, Section 3.3.4.

5. Any Market Participant or interested entity may file a complaint with the Market Surveillance Unit. Following such complaint, the Market Surveillance Unit may "carry out any investigation that it considers appropriate as to the concern raised." MMIP, Section 3.3.5.

6. The ISO Governing Board may impose "such sanctions or penalties as it believes necessary and as are permitted under the ISO Tariff and related protocols approved by FERC; or it may refer the matter to such regulatory or antitrust agency as it sees fit to recommend the imposition of sanctions and penalties." MMIP, Section 7.3.

MEMORANDUM

Brobeck
ATTORNEYS AT LAW

TO: **Richard Sanders**

FROM: **Gary Fergus**
Jean Frizzell (Gibbs & Bruns LLP)

SUBJECT: Status Report on Further Investigation and Analysis of EPMI Trading Strategies

DATE:

CC: **Tim Belden**
Michael Kirby
Barrett Reasoner

DRAFT DRAFT DRAFT DRAFT

PRIVILEGED AND CONFIDENTIAL ATTORNEY CLIENT COMMUNICATION AND ATTORNEY WORK PRODUCT

As part of our preparation for the various investigations and litigation actually and potentially facing EPMI in connection with the California energy market, Jean Frizzell, Barrett Reasoner, Mike Kirby and Gary Fergus spent several full days over the past few months at EPMI for the purpose of learning and understanding more about the data, methodology, the various strategies used by the traders and the implementation of those strategies. This is a highly complicated subject matter and all of us are still learning.

We used as our starting point the Preliminary Memorandum dated December 8, 2000, which we understand was prepared as the first step in educating you and outside counsel about EPMI trading practices. The Preliminary Memorandum was written by Steve Hall, an associate on loan from the Stoel Rives law firm, and co-authored by Christian Yoder, the in-house counsel at EPMI. Over the course of the past month, we have spent a fair amount of time with a number of traders. In some instances, we met the same traders more than once to try and understand the various practices. On January 11th, we spent another full day with Tim Belden, chief trader for EPMI in Portland going over the strategies that have been identified. Here is our summary of the status of our further investigation and present analysis of the EPMI trading practices:

Overview

The California energy market during calendar year 2000 was an incredibly complex and dynamic environment. Weather, supply shortages, physical limits and market volatility contributed to this environment. During the past month, we have had several outside law firm lawyers, each with varying degrees of experience with California electricity market, work together with the EPMI traders to understand the market and the practices. From time to time, the understanding of and interpretation by the lawyers interviewing the same traders about the market and the trading practices were inconsistent. When that happened, we would go back to the traders to try and gain a common understanding of the particular market and trading strategy. At this point in the process, we realize that there are very few clearly defined trading strategies. Depending upon the particular circumstances of the day, trading strategies were modified and applied in response to EPMI's portfolio, market conditions, the individual trader's understanding of them, and the individual trader's preferences within a larger overall framework. In part, this is because trading is done 7 days a week for many different schedules (e.g. PX day ahead, PX day of, ISO hour ahead, ISO real time etc

EPMI is only one of many market participants. We do not have nearly enough information to gain a good understanding of all of the impacts other participants, and whatever their strategies might have been, had on the market. For these reasons, you should consider this a work in progress, rather than the definitive analysis of EPMI trading practices. We may learn that some of the conclusions we have reached will later turn out to be inaccurate. In fact, we learned during this process that some of the information contained in the Preliminary Memorandum, which resulted in some erroneous assumptions and conclusions, cannot be supported by the facts and evidence which are now known. In other instances, some statements in the Preliminary Memorandum understandably mixed trading strategies and schedules. In order to minimize the risk of confusing matters further, we have taken the additional step of having Tim Belden review this memorandum to see if we have accurately described the trading practices and to see whether he can spot any flaws in our analysis. We tried to follow the same format of the Preliminary Memorandum for easy cross reference.

"Incing" Load into the Real Time Market

"Incing" was a slang name (short for "increasing") for a trading strategy used in response to the independently owned utilities (IOU) well known and documented strategy of significantly underestimating their load in the PX day ahead market. This practice by the utilities apparently occurred almost daily. Because the IOU's purchased their power through the PX day ahead market, the PX thus became their scheduling coordinator; the ISO's resulting schedules understated the load for the next day. The IOU practice of underestimating load artificially lowered the PX day ahead market clearing price. Incing served to partially counteract the reliability issues caused by this practice and, from the California consumer's perspective, appears to have been preferable to the alternative of selling outside of California. In addition, incing may have increased the actual guaranteed available supply of power in the California market depending upon the shape of the demand curve. Incing reduced demand in the ISO market, therefore reduced the ex post price and potentially lowered the overall cost to California consumers. When incing, EPMI was a price taker in the ISO ex post market.

Death Star
Death Star was a slang name for a strategy that addressed congestion between northern and southern California. During certain periods, there are transmission limits between northern California and southern California on path 15 and path 26. It appears that the source of the congestion may have been the consistent underestimating of load by PG&E – the same underestimating referred to above. Because the demand was artificially lower in Northern California, it appears supply was trying to move to southern California. By using a combination of ISO approved scheduled counterflows and alternative non-ISO transmission lines, EPMI increased the transfer capability between the regions, reduced congestion, and utilized underused pathways to increase the overall supply of electricity in southern California. By virtue of using multiple transmission paths, EPMI took on financial risks, including having the transmission line derated, assessment of additional congestion charges, and liability for take or pay transmission charges on alternative transmission lines to execute the strategy.

Contrary to certain statements in the Preliminary Memorandum, congestion was relieved and energy did flow through otherwise underutilized paths.

Load Shift
Load shift is a general term used to describe a variety of scheduling practices and trading strategies in the day ahead and hour ahead markets. One variation of load shifting involved scheduling ISO approved counterflows in the ISO day ahead market, ISO hour ahead market or both. Generally speaking, as an alternative to purchasing power in the north, EPMI purchased power in the south and counterflowed that power to the north. Such transactions had the effect of providing congestion relief in the ISO day ahead market or the ISO hour ahead markets. These transactions placed EPMI at financial risk for the differences in price between the regions.

Another category of load shifting involves shifting the load on paths for which EPMI purchased firm transmission rights. This category was briefly discussed in the Preliminary Memorandum. We have learned more about this load shifting strategy since the Preliminary Memoranda was written. As the result of several in depth interviews with the traders and review of the public market surveillance reports available to the public and all market participants, it is apparent that the assumptions and conclusions contained in the Preliminary Memorandum were inaccurate. First, in hindsight, it now appears likely that the load shifting strategy, without knowing the impact of other market factors, sometimes may have reduced the prices in the north while leaving prices in the south unchanged or minimally impacted. Second, it appears that the estimate of profits from this load shifting strategy in the Preliminary Memorandum was vastly overstated and indeed confused. It would appear that the source of the confusion may have been that the Preliminary Memorandum reported the total profit attributable to the EPMI firm transmission rights on path 26, as reflected in ISO public documents, as opposed to any calculation of the profit of this particular strategy.

Get Shorty
"Get Shorty" was the slang name for a trading strategy involving the provision of ancillary services in the PX day ahead and ISO hour ahead markets. EPMI committed to providing the ancillary services in the PX day ahead market and covered its position by purchasing those services in the ISO hour ahead market. Accordingly, EPMI actually purchased the services

necessary to provide ancillary services if called upon to do so. In fact, the ISO regularly called upon EPMI for ancillary services that were provided. Based upon the information we have so far, there was only one incident where EPMI failed to cover its position. In that single instance, EPMI promptly offered to, and ultimately did, return the payment received for the ancillary services that were not provided. Accordingly, the strategy did not impact the reliability of the grid. This strategy, however, did place EPMI at financial risk. On a number of occasions, it appears the cost to cover exceeded the amount received in the day ahead market and EPMI provided services to the ISO at a loss.

The Preliminary Memorandum incorrectly assumed that the information provided to the ISO was inaccurate. It now appears that, consistent with daily ISO practices, that EPMI did not specify the source of the ancillary services at the time of sale.

Ricochet
"Ricochet" was the slang term for a trading strategy that existed because EPMI was not permitted to make adjustment bids in SC to SC (scheduling coordinator) trades due to limitations in the ISO software systems. Ricochet served the dual purpose of allowing for adjustment bids and opening up market options for EPMI including the supplemental and bilateral markets. By using this strategy, EPMI was at financial risk if the PX price exceeded either the supplemental or bilateral market price. Furthermore, the ISO software limitation forced EPMI to incur additional costs, export charges, ancillary services on exports and line losses on imports.

Ricochet appears not to have been a strategy that was used to a significant extent when compared to EPMI's overall portfolio. It appears that other market participants with control areas adjacent to California and access to extremely flexible generation resources may have relied more extensively on this strategy.

At the present time, EPMI faces its own software limitations in implementing ISO approved adjustment bids in SC to SC transactions.

Non-Firm Export
This was a trading practice that involved scheduling counterflows three hours ahead of the time energy would flow. The scheduled counterflow had the likely effect of reducing the congestion charge on the scheduled path. Under this strategy, EPMI qualified for the congestion relief payment two hours before the scheduled flow. Ultimately, EPMI did not flow the power. Based upon the information we have, this practice does not appear to have had any demonstrable impact on either the PX price or the ISO ex post price. However, in August 2000, the ISO directed that the practice be discontinued. The EPMI traders with whom we spoke confirmed that EPMI has complied with that mandate.

Selling Non Firm Energy as Firm Energy
This was a trading strategy that was occasionally used in southern California to allow for the import of power that would otherwise not be available. The net effect of this practice, in conjunction with other market factors, was to increase the overall supply with no apparent impact on PX price. EPMI was subjected to financial risk in that if the non-firm power was cut,

EPMI would have to cover the energy cut by purchasing that power in the ISO market at the ex post price.

At this time, it appears that the net result of this practice was to bring additional supply into California.

Scheduling Energy to Collect the Congestion Charge II
The net effect of this strategy was to schedule counterflow thereby reducing congestion in hour ahead market. This was a high risk strategy because EPMI was exposed to the ex post market price that could exceed the congestion price. This strategy could have potentially lowered the congestion charge depending upon a wide variety of other market factors.

CALIFORNIA INDEPENDENT SYSTEM OPERATOR

October 22, 1997

Mr. H. Ronald Nash
Vice President
Perot Systems Corporation
Suite 1100
12377 Merit Drive
Dallas, Texas 75251

Re: ISO Alliance and Perot Systems Corporation Conflicts of Interest

Dear Mr. Nash:

This is to follow up on our telephone conversation of October 21, 1997 regarding reported solicitations by Perot Systems Corporation ("*Perot Systems*") of parties expected to market energy in California.

As we discussed, such solicitations are inconsistent with the ISO's Alliance's and Perot Systems' conflict of interest obligations under the Scheduling Applications, Scheduling Infrastructure and Business Systems Contract between the ISO Alliance and the ISO Restructuring Trust dated as of March 14, 1997 (the "Contract") which you executed on behalf of the ISO Alliance and Perot Systems.

Specifically, it was reported to me that representatives of Perot Systems contacted Gary Cotton of San Diego Gas & Electric (SDG&E), and perhaps other potential market participants, and offered the services of Perot Systems in helping SDG&E to exploit the new California energy market by exploiting potential weaknesses and shortcomings in the ISO's system to their commercial advantage.

It was further reported that Perot Systems' representatives at these solicitations included Ed Smith and Paul Gribik, both of whom have been significantly involved in ISO Alliance's and Perot Systems' activities in negotiating and performing the Contract, and that Perot Systems' involvement in developing the ISO's system was cited as evidence of Perot Systems' knowledge of the potential weaknesses and shortcomings in that system.

Perot Systems' marketing of its inside knowledge of the ISO's system to third parties so that they may economically exploit the new California energy market, in addition to being a flagrant violation of basic norms of business ethics and indicative of bad faith dealing, would seriously erode the integrity of the new California energy market and materially compromise the work being performed and the system being produced by the ISO Alliance and Perot Systems for the ISO. Article 31 of the Contract expressly prohibits the ISO Alliance, including Perot

151 BLUE RAVINE ROAD • SACRAMENTO, CALIFORNIA • 95630
PHONE: 916.351.2222 • FAX: 916.351.2181

Systems, ABB and Ernst & Young, from performing services for others which may create a material conflict of interest with the ISO or in any way otherwise materially compromise the work being performed by the ISO Alliance and Perot Systems on behalf of the ISO.

Perot Systems' behavior as described above is contrary to Perot Systems' contractual obligations and is expressly prohibited under the Contract. While reserving all rights and remedies available to the ISO, including but not limited to those concerning breach and termination, under the Contract and applicable law, the ISO will require that Perot Systems immediately:

(i) cease the solicitation and marketing as described above;

(ii) contact those parties previously solicited in this regard in writing, retracting it's offer of such consulting services and stating that such consulting services will not be offered by Perot Systems or the ISO Alliance;

(iii) provide the ISO with a list of names of the market participants actually contacted by Perot Systems;

(iv) describe what specifically was being marketed by Perot Systems and the basis for such solicitations with such itemization to be renewed at the end of Stage I and Stage II of the Contract;

(v) certify that neither Perot Systems nor the ISO Alliance has introduced any changes or modifications other than those specified by the ISO Contract, the Detailed Statement of Work (DSOW), or documented change orders, with such certificates to be renewed at the end of Stage I and Stage II of the contract; and

(vi) pursuant to Article 31.7 of the Contract provide all accounts and records relating to any program of solicitation activity in this regard.

Finally, as I emphasized in our telephone conversation, prompt cessation of the offending solicitation activities and prompt retraction of all express offers of such consulting services is essential to any ultimate resolution of this matter. I look forward to hearing your response and the status of any additional activities you may propose for Perot Systems and the ISO Alliance to remedy this situation.

Sincerely,

Jeffrey D. Tranen
President and Chief Executive Officer

cc: Ake Almgren, President, ABB T&D Inc.
William Hunter, Operations Partner, Ernst & Young

perotsystems™

Perot Systems Corporation, US And Affiliated Entities

STANDARDS AND ETHICAL PRINCIPLES

The Standards and Ethical Principles document is divided into 11 sections, as follows:

1. General Statement
2. Anticompetition and Marketing Laws
3. Payments to Government Officials and Employees
4. Political Contributions
5. Confidential and Proprietary Data
6. Conflict of Interest
7. Equal Employment Opportunity
8. Harassment
9. Inside Information and Insider Trading
10. Electronic Mail
11. Questions Concerning the Standards and Ethical Principles

1. General Statement

The core concepts of the Perot Systems Standards and Ethical Principles are honesty and integrity. Business should be conducted in accordance with both the letter and the spirit of the applicable laws of each country, state, or other locality in which Perot Systems does business.

These basic principles concern every Perot Systems employee, Fellow, Director, and Advisory Board member (cumulatively "Associates"). Everyone in the company is asked to commit to these principles in the form of this pledge:

I will not give or receive anything that could be construed as a bribe or a kickback, make improper political contributions, abuse confidential information, or misuse Perot Systems or customer funds or assets.

I will not participate in the illegal use or sale of any controlled substance. Nor will I indulge in the excessive use of alcohol so as to in any way affect my performance as an Associate of Perot Systems at any time. I understand that this measure helps to ensure our Associates' and our customers' health and safety, protects against loss of productivity and reputation, and builds trustworthiness in the marketplace.

I accept the responsibility of assuring compliance with the Perot Systems Standards and Ethical Principles and of reporting immediately, without fear of retribution, any violations, intentional or otherwise.

I measure my conduct against this Golden Rule of Business Ethics: Would I do business in complete trust with someone who acts the way I do? The answer must be YES!

Anticompetition and Marketing Laws

We believe in the objectives of the anticompetition laws of all countries within which we operate: free markets in which the competitor offering the best product or service at the best price gets the business.

I will be alert to and should not engage in any kind of agreement or business practice that restricts free and fair competition.

Without the prior approval of the Chairman, I will not enter into any understanding - formal or informal - with any competitor regarding bids or proposals; prices or terms of sale; or service, territories, or customers.

In addition, without such approval, I will not exchange or discuss with a competitor any prices or terms of sale or service, or other non-public competitive information.

In general, it is illegal for a seller to compensate a representative of a purchaser or supplier. Where payments are made for brokerage services, the broker must be truly independent of the other party.

I will not attempt to improperly influence a customer or supplier.

3. Payments to Government Officials and Employees

I will not provide anything of value- directly or indirectly - to any government official, employee, or political party; or to any entity in which such individual or institution is known to have an interest (a) because of any official act to be performed by such individual or institution, or (b) for the purpose of obtaining, retaining, or directing business or affecting the conditions for doing business.

I will not pay, or allow someone else to pay, any bribe, payoff, gratuity, or kickback to any government official or employee (including political parties and their employees) to influence him or her in carrying out his or her duties. I will not do anything which may give the appearance of influencing the government official or employee in an unethical or unlawful way.

I understand that this rule applies at all times and in all places whether or not there is any applicable law which prohibits such action, since these activities are illegal in the U.S. and abroad under the U.S. Foreign Corrupt Practices Act.

4. Political Contributions

I will not use funds or assets of Perot Systems for, or in aid of, any candidate or nominee for political office or for any political parties or committees. I understand that this rule covers direct contributions and indirect assistance such as the furnishing of goods, services, or equipment to candidates, political parties, or committees, unless Perot Systems is paid the fair value of such assistance.

The rules of the countries within which we operate vary as to whether corporate contributions are legal in federal, state, and local elections (for example, United States law prohibits corporate contributions to federal election campaigns). Accordingly, contributions to any U.S. federal election campaigns are prohibited and any campaign contribution to any other federal, state or local election or to an election campaign in any jurisdiction must be approved in advance, in writing, by the Chief Financial Officer or equivalent officer or his/her designee.

I understand that, where it is legal, the company encourages me to make voluntary contributions to candidates of my choice and to participate actively in local, state, and federal political processes. I will not be reimbursed by the company for these contributions, and I will not be available to aid candidates on company time.

5. Confidential and Proprietary Data

I will not use or release to others - whether or not for personal benefit - any non-public data, plans, decisions, or other confidential business or technical information known as a result of employment by Perot Systems.

The proprietary information residing in the software and systems programs Perot Systems develops is a valuable asset.

I acknowledge that there are legal requirements that such proprietary information not be improperly taken from Perot Systems. I have also made an affirmative promise as part of my Employment Agreement to respect and safeguard such information and not to misuse such information.

I have access to trade secrets and proprietary information of our customers or other third parties. I will carefully honor the trust imposed by the knowledge of such information. Without proper approval, I will not disclose such information to non-Associates or even to other Associates who do not have a business need to know the information.

One form of proprietary information of third parties to which Associates often have access is third-party computer software.

Just as I expect our company's proprietary software rights to be honored, I will honor the rights of software vendors. I will not use any third-party software unless Perot Systems has a valid license or other right to do so. This applies to personal computer software as well as to software used to provide services to our customers.

6. Conflict of Interest

I will be alert to situations that may present conflicts of interest and will inform my supervisor of any circumstance which may create a conflict of interest or even the appearance of a conflict of interest.

It is impracticable to specify all circumstances that create conflicts of interest. But, as an example, a conflict of interest may arise where (a) an Associate has an interest or relationship with anyone who is a party to a transaction with Perot Systems, (b) the Associate is in a position to make, influence, or benefit from decisions pertaining to the transaction, and (c) the interest or relationship is sufficiently substantial to be reasonably thought by others to be a factor in the Associate's judgment or action concerning the transaction. A conflict of interest may similarly arise where the interest or relationship is held by a member of the Associate's family.

My family and I will not accept expensive gifts (e.g., gifts in excess of $50 or its equivalent); lavish or excessive entertainment, trips, accommodations, vacations; or other gratuities from those doing business or seeking to do business with Perot Systems. I will not provide these items to our customers or to those with whom we do business. I will not accept or offer even nominal gratuities if receipt of the gift might place the employee of the other company or me in an embarrassing position, or if acceptance of the

gratuity would interfere with the impartial discharge of my or of the other employee's duties.

Without the express consent of the Chairman, President, Director or equivalent executive, I will not receive compensation in any form from our customers, vendors, or competitors.

While gratuities may be offered or received innocently, they can effect the pure business evaluation of relationships, proposals, services, and products. Both the perception and the fact of this happening must be avoided.

I may accept in moderation meals, travel accommodations, and other expenses directly related to Perot Systems business, but I will never solicit them.

As a general rule:
- I will never accept anything that might require explanation or justification.
- I will graciously return such gifts and explain that company policy prevents acceptance.
- I will never offer anything that might require explanation or justification.
- I will immediately report any offers that I consider inappropriate to my supervisor.

Perot Systems will only do business with ethical parties.

7. Equal Employment Opportunity

There shall be no discrimination against any Associate or applicant on the grounds of race, color, religion, gender, sexual orientation, age, disability, or national origin.

This policy relates to all phases of employment, including recruitment, hiring, placement, promotion, transfer, compensation, benefits, training, educational, social, and recreational programs, as well as to the use of Perot Systems facilities. It covers all personnel actions in all job categories at all levels.

8. Harassment

I am responsible for maintaining a work environment that is free of harassment of any type, whether based on sex, race, religion, age, disability, or otherwise. I will not engage in such harassment or tolerate such harassment of other Associates by Associates (including supervisors), customers, or vendors. The following discussion concentrates on sexual harassment, but I understand that its principles apply to any harassment.

The work environment is for work, not for sexual conduct or language.

I will avoid any sexually-oriented conduct or language at work and will avoid any such conduct or language toward Associates outside of the work environment that could possibly be interpreted as sexual harassment. I understand that conduct or language that I may consider to be humorous, playful, inoffensive, or welcome may not be perceived that way by others.

Sexual harassment includes, but is not limited to, unwanted or unsolicited sexual advances by Associates (including supervisors), customers, or suppliers toward any individual working at Perot Systems. It also

cludes offensive touching, unwelcome vulgar or sexually-suggestive language, and improper requests for sexual favors.

The following conditions, among others, will be considered sexual harassment:

- one Associate seeks sexual favors from another Associate as a condition for employment, advancement, opportunities, benefits, or other privileges of employment
- employment-related decisions, such as bonuses, promotions, salary increases, or continued employment are based on the subordinate's acceptance or rejection of sexual advances by the supervisor
- supervisors knowingly allow or create a work environment where the sexual language or conduct is so severe, hostile, intimidating, or harassing that an Associate's ability to do his or her job is unduly affected

I understand that should I engage in such conduct, I will be disciplined up to and including termination. Perot Systems will promptly investigate any claim by an Associate of sexual harassment.

If I feel I have been subjected to, or have first-hand knowledge of, prohibited conduct, I will immediately notify my supervisor (if he or she is not a party to the prohibited conduct) as well as the Human Resources Manager or the Employee Relations contact in Human Resources of the incident; and I will cooperate fully in the investigation of the claim.

Associates alleging sexual harassment will be free of any retaliation as a result of making the claim.

9. Inside Information and Insider Trading

will treat in strictest confidence material information concerning Perot Systems and its business, including its customers, which has not received general publicity.

I will always comply with the insider trading laws of the particular country in which I work.

In general, the test of materiality (for purposes of United States insider trading laws) is whether there is a substantial likelihood that a reasonable investor would consider the information important in deciding how to act in regard to the company's securities.

One objective of these laws is to treat all shareholders and potential shareholders fairly by providing them with prompt and complete information about significant corporate developments. In addition, the laws are designed to ensure that insiders do not profit from advance knowledge of such information not available to the general public. Examples include, but are not limited to, information about forthcoming acquisitions and mergers, changes in earnings, significant new contracts, technological discoveries, major management changes, decisions to enter into or terminate lines of business operations, and other important corporate developments.

Electronic Mail

I acknowledge that electronic mail is Perot Systems' property. I will treat electronic mail in the same way that I treat other Perot Systems documents.

I will use Perot Systems' electronic mail system only for Perot Systems business purposes (although reasonable and limited incidental personal use is permitted).

Reasonable and limited incidental personal use will be treated no differently from other messages for purposes of this policy.

All messages are Perot Systems' records. However, some messages, especially those received from our customers or third parties, may contain trade secrets or proprietary business or technical information of others.

Without proper approval, I will not disclose such information outside Perot Systems or even to other Associates who do not have a business need to know the information.

I will change my computer passwords frequently, in accordance with company policy. I will not use the electronic mail system to obtain access to the files or communications of others without their consent, unless there is a good business purpose for such action.

Examples of good business purposes include access to retrieve business information after employment of an Associate has ended or if an Associate is unavailable. If a supervisor wants to review electronic mail communications to determine whether there have been any violations of Perot Systems' policy, or breaches of duty or law, the supervisor should first receive approval from the legal department.

Even with this limitation, Associates should be aware that once they send an electronic mail message, it is inherently insecure and may be accessed by persons other than those to whom it is addressed. Therefore, it is extremely important that all Associates who send electronic mail messages understand that there can be no assurance that they will be seen only by the intended addressees; and that all recipients act carefully, professionally, and responsibly with respect to electronic mail messages.

Perot Systems reserves the right to access and disclose all messages sent over its electronic mail system, for any purpose, including disclosure of any electronic mail message to law enforcement officials, with or without notice to any Associates who may have sent or received such messages. Perot Systems also reserves the right to destroy any and all messages at any time, subject to limitations required by law enforcement officials or other legal authorities.

11. Questions Concerning the Standards and Ethical Principles

Associates are encouraged to discuss issues concerning the Standards and Ethical Principles and its application with supervisors and any other Associates. Questions about company policy should be directed to the legal department, and in the case of the harassment policy, to Human Resources. More comprehensive statutory or contractual obligations shall remain unaffected by the provisions of this Standards and Ethical Principles document.

August 8, 2002

BY FACSIMILE
Dr. Paul Gribik
c/o Joseph J. Aronica
1919 Pennslyvania Ave, N.W.
Washington, DC 20006

Dear Dr. Gribik:

On July 22, 2002, the Subcommittee on Energy Policy, Natural Resources and Regulatory Affairs held a hearing on "California Electricity Markets: The Case of Enron and Perot Systems." During the course of this hearing at which you testified, full Committee Ranking Member Henry Waxman asked to pose follow-up questions for the record.

On behalf of Rep. Waxman and Subcommittee Ranking Member John Tierney and pursuant to the Constitution and Rules X and XI of the United States House of Representatives, I ask that you respond to the questions in the enclosure. Please forward your responses by August 30, 2002 to the majority and minority staffs of the Government Reform Subcommittee on Energy Policy, Natural Resources and Regulatory Affairs. The offices are located in B-377 and B-350A, respectively, in the Rayburn House Office Building.

If you have any questions about this request, please contact Subcommittee Staff Director Dan Skopec at (202) 225-4407. Thank you in advance for your attention to this request.

Sincerely,

Doug Ose
Chairman
Subcommittee on Energy Policy, Natural
Resources and Regulatory Affairs

Enclosure

cc: The Honorable Dan Burton
The Honorable Henry Waxman
The Honorable John Tierney

Questions to Dr. Gribik from Congressman Waxman

1) Please provide the following information for each meeting regarding joint services offered by Policy Assessment Corp. and Perot Systems:

a) The date of the meeting;

b) The companies represented at the meeting;

c) The location of the meeting;

d) The primary purpose of the meeting;

e) Any additional purposes of the meeting;

f) The number of individuals attending the meeting;

g) The names of individuals that attended the meeting (if you do not have a list, please list all individuals that you recall attending);

h) The occupation (e.g. trader, general manager, government relations expert) of each of these individual attendees;

i) Please provide all documents you or Perot Systems used at the meeting;

j) Please provide all documents you or Perot Systems provided to any attendee;

k) Describe in detail any discussions about consultation services;

l) Describe each gaming strategy that was discussed;

o) Do you believe any gaming strategies that you discussed were illegal;

p) A detailed accounting of your expenses for that meeting; and

q) Whether you were paid by another entity for the meeting (including expenses) and, if so, how much.

2) What was the purpose of the meeting between Enron and Dr. Backus?

3) Dr. Backus testified that Perot Systems was not involved in marketing consultation services to Enron. However, an April 8, 1998, memo from Ed Smith of Perot Systems to Rich Davis of Enron, Mr. Smith writes "The 'good news' & the 'less than good news' is that an overabundance of strategy categories exist; ranging from just playing the 'gaps' in the protocols, to taking advantage of self-created congestion, to using customer loads and ECT energy to

control market revenue flows, and yet on still to possibly using allies to create market control of market niches."

a) Did Perot Systems market its services to Enron?

i) If yes, please describe those marketing efforts in detail.

ii) If no, please explain the above quote.

4) Perot Systems was apparently soliciting consultation work in joint meetings with both the regulated utility arms and the unregulated trading arms of corporations. For instance, Perot Systems marketed to Edison International and Southern California Edison in the same meeting.

a) On what occasions did Perot Systems market simultaneously to both utilities and trading arms?

b) Was there any discussion about whether there was an ethical problem in marketing to the two entities simultaneously considering there is supposed to be a firewall between the regulated and unregulated entities?

PORTER WRIGHT MORRIS & ARTHUR LLP
Attorneys & Counselors at Law

Joseph J. Aronica
202-778-3040
jaronica@porterwright.com

1919 Pennsylvania Avenue N.W.
Suite 500
Washington, DC 20006-3434

Facsimile: 202-778-3063
Toll Free: 800-456-7962

August 30, 2002

The Honorable Doug Ose, Chairman
Subcommittee on Energy, Policy, Natural
Resources and Regulatory Affairs
Congress of the United States
Committee on Government Reform
2157 Rayburn House Office Building
Washington, D.C. 20515-6143

Dear Congressman Ose:

Attached are Dr. Paul Gribik's answers to Congressman Waxman's questions posed in your letter to Dr. Gribik dated August 8, 2002. Per your request, we have delivered two copies of his responses to the majority staff and the minority staff.

If you have any questions, please contact me.

Sincerely,

Joseph J. Aronica

JJA:jkr

Attachment

RESPONSES OF DR. PAUL GRIBIK TO
QUESTIONS FROM CONGRESSMAN WAXMAN

August 30, 2002

Question 1:

1) Please provide the following information for each meeting regarding joint services offered by Policy Assessment Corp. and Perot systems: (a) The date of the meeting; (b) The companies represented at the meeting; (c) The location of the meeting; (d) The primary purpose of the meeting; (e) Any additional purposes of the meeting; (f) The number of individuals that attended the meeting (if you do not have a list, please list all individuals that you recall attending; (h) The occupation (e.g. trader, general manager, government relations expert) of each of these individual attendees; (i) Please provide all documents you or Perot Systems used at the meeting; (j) Please provide all documents you or Perot Systems provided to any attendee; (k) Describe in detail any discussions about consultation services; (l) Describe each gaming strategy that was discussed; (o) Do you believe any gaming strategies that you discussed were illegal; (p) A detailed accounting of your expenses for that meeting; and (q) Whether you were paid by another entity for the meeting (including expenses) and, if so, how much.

Responses to Question 1:

1) I am aware of the following meetings regarding joint service offerings by Policy Assessment Corporation and Perot Systems Corporation:

I) Meeting between Perot Systems and Policy Assessment personnel

a) The meeting was sometime around May or June of 1997.
b) Perot Systems and Policy Assessment were present at the meeting.
c) The meeting was in Rosemead, CA.
d) The purpose of the meeting was to learn about each others capabilities.
e) There was no other purpose to the meeting.
f) I do not recall the number of people at the meeting.
g) Individuals that I recall being present:
Perot Systems: Paul Gribik (Associate)
Hemant Lall (Associate)
Policy Assessment: George Backus (President)
h) Titles given above
i) I do not recall Perot Systems using any documents.
j) I do not recall Perot Systems providing any documents.
k) I do not recall the details of the conversations. George Backus gave an overview of his company's capabilities, particularly the CIGMOD computer package for simulating market dynamics.
l) I do not recall any discussion of gaming strategies.
o) I do not believe the topics discussed were illegal.
p) I do not think that I incurred any expenses for the meeting.
q) I was not paid anything beyond my Perot Systems salary.

II) Meeting between Perot Systems, Policy Assessment Personnel and Pacific Gas and Electric

a) The meeting was sometime around August of 1997 – I do not recall attending this meeting.
b) I do not recall attending the meeting, but I believe Policy Assessment, Perot Systems and Pacific Gas and Electric were present. I do not know whether the staff from the regulated side or the unregulated side were present.
c) I believe the meeting was in San Francisco.
d) The primary purpose was to sell consulting services to assist PG&E in developing strategies for participating in energy markets.
e) There was no other purpose of which I am aware.
f) I do not recall attending the meeting so I do not know the number attending.
g) I do not recall attending the meeting so I do not know who attended.
h) I do not recall attending the meeting so I do not know the titles of those attending.
i) I do not recall attending the meeting so I do not know whether Perot Systems used any documents.
j) I do not recall attending the meeting so I do not know whether Perot Systems provided any documents.
k) I do not recall attending the meeting so I cannot give details about the discussion of consulting services.
l) I do not recall attending the meeting so I cannot describe what if any gaming strategies were discussed.
o) Refer to answer (l) above.
p) None.
q) No.

III) Meeting between Perot Systems and San Diego Gas and Electric

a) The meeting was held in October 1997.
b) Perot Systems and San Diego Gas and Electric were present. I do not recall whether the regulated or unregulated side of San Diego Gas and Electric were present. I do not believe that George Backus attended the meeting, but the meeting was on behalf of both PAC and Perot Systems.
c) The meeting was in San Diego, CA.
d) Primary purpose was to sell consulting services to assist SDG&E in developing strategies for participating in energy markets.
e) I do not recall any additional purpose of the meeting.
f) I do not recall the number of people attending. It was at least four.
g) Individuals that I recall being present:
   Perot Systems: Paul Gribik (Associate)
   Hemant Lall (Associate)
   Ed Smith (Vice President)
   SDG&E: I do not recall those attending.
h) Titles of individuals given above.
i) I am providing the document used by Perot Systems. (Attachment A).

j) We provided the same document as in (i).
k) I do not recall the details of our discussions beyond the material provided in (i).
l) The only gaming strategy that I recall discussing was that included in the presentation provided in (i) above. This strategy could not have been used in practice since we had alerted the ISO and the market rules were changed prior to the opening of the market to prevent such strategies.
o) No.
p) I do not have my expense information for that meeting, but whatever expenses I might have incurred would have been reimbursed by Perot Systems.
q) I was not paid to attend by any other entity.

Question 2:

2) What was the purpose of the meeting between Enron and Dr. Backus?

Response to Question 2:

2) I was not present at the meeting between Enron and Dr. Backus and do not know what was discussed.

Question 3:

3) Dr. Backus testified that Perot Systems was not involved in marketing consultation services to Enron. However, an April 8, 1998, memo from Ed Smith of Perot Systems to Rich Davis of Enron, Mr. Smith writes "The 'good news' & the 'less than good news' is that an overabundance of strategy categories exist; ranging from just playing the 'gaps' in the protocols, to taking advantage of self-created congestion, to using customer loads and ECT energy to control market revenue flows, and yet on still to possibly using allies to creat market control of market niches."

a) Did Perot Systems market its services to Enron?

i) If yes, please describe those marketing efforts in detail.

ii) If no, please explain the above quote.

Response to Question 3(i):

3i) I do not recall being present at any marketing presentation to Enron, so I cannot say whether any meeting occurred. Based on documents I have seen, I believe that someone from Perot Systems may have had phone conversations with Enron. Also, from documents I have seen, a proposal to provide consulting services to Enron was drafted, but I do not know whether it was ever presented.

Response to Question 3(ii):

3ii) I did not draft the quote, so I cannot explain the author's meaning.

Question 4:

4) Perot Systems was apparently soliciting consultation work in joint meetings with both the regulated utility arms and the unregulated trading arms of corporations. For instance, Perot Systems marketed to Edison International and Southern California Edison in the same meeting.

a) On what occasions did Perot Systems market simultaneously to both utilities and trading arms?

b) Was there any discussion about whether there was an ethical problem in marketing to the two entities simultaneously considering there is supposed to be a firewall between the regulated and unregulated entities?

Response to Question 4(a):

4a) I do not know whether Perot Systems marketed simultaneously to regulated utilities and unregulated trading arms.

Response to Question 4(b):

4b) Refer to answer 4a) above, and I was not involved any such discussions.

Exhibit 99.8

Perot Systems

Paul Gribik

perotsystems™

California Market Structure

- California energy "market" for 1/1/98 is complex
  - A progression of forward and spot markets
    - Day-ahead
    - Hour-ahead
    - Real-time
  - Separate markets for different commodities
    - Multiple forward energy markets (PX and SCs)
    - Forward transmission market (ISO)
    - Multiple ancillary services markets (ISO or self-provision)
    - Single real-time imbalance energy market (ISO)
  - The separate markets interact in complex ways

perotsystems

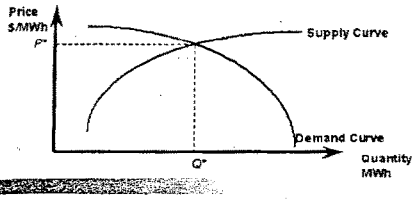
Winning in California Markets

- What strategies will help you prosper in the California market structure on 1/1/98?
- Often heard "folk" wisdom:
  - "Bid your true costs and you will maximize your profits"
  - How did this folk wisdom arise?
  - Is it true?

perotsystems

Underlying Economic Theory

- Each individual market is based on a simple supply/demand economic model
  - Operate at intersection of supply and demand curves
    - Socially optimal production and use
    - Market clearing price



Auction Theory

- Socially optimal production and efficient prices result if producers & consumers bid true supply and demand curves
  - How do you get parties to bid their true costs?
- Auction theory
  - Parties bid true supply and demand curves when
    - Each party is small compared to the market
    - Market is run once (or infrequently)

Reality vs. Economic Theory

- Supply and demand curves are not nice smooth functions
  - Start-up costs
  - Uncertainty
- Protocols governing several of the interacting California markets have holes
  - Some markets will not clear and may be unstable
    - The real-time imbalance energy market is poorly designed
  - Coupling from hour to hour ignored
- Prices can be "gamed"

Reality vs. Auction Theory

- Simple auction model ignores important features
  - Locational market power due to transmission
  - Frequently repeated markets
  - Interacting markets
    - Energy
    - Reserves
  - Cooperative behavior among participants
- Expect the parties to bid strategically to take advantage of deviations from theory

Strategic Decisions in California

- Decide which forward energy market to use
  - PX or another Scheduling Coordinator
- Decide how to use resources
  - Bid capacity in one market and withhold in others
    - Energy market vs. reserves markets
    - Hour-ahead vs. day-ahead vs. real-time
- Tactical decisions
  - Adjust bid prices
  - Negotiate side deals
    - Contracts for differences

perotsystems

Steps in Developing Strategies

- Expert analysis
  - Review of business protocols
  - Review of competitor characteristics
  - Identify potential strategies based on experience
- Analytical tools
  - Test possible strategies against computer
  - Test possible strategies against user specified counter strategies
- War gaming
  - Red team, blue team competition
  - Analytical tools provide playing field

perotsystems

Analysis of Protocols

- Gaps in the protocols provide
  - Opportunities for increased profits
  - Chance for other players to damage your position
- Analyze protocols
  - Find leverage points you can use
  - Find ways to protect against actions of others
  - Develop potential "raw" strategies
    - Prioritize for detailed investigation

Development of Practical Strategies

- Analysis provides the foundation
  - Analysis of protocols
  - Analysis of competitors
  - Gives start for the development of usable strategies
- Development of practical strategies requires detailed simulation of market operations
  - Impact of your actions
  - Impact of competitors' actions

Analytical Business Model

- Detailed computational business model of the California markets is required
  - Model protocols and market operation in detail
    - Strike a balance among
      - modeling detail
      - computational resources needed
      - available market information
  - Game theoretic model with multiple participants
- Must accept a wide range of possible strategies and evaluate the outcomes

Developing Strategies

- Develop strategies that allow you to operate within the protocols and increase its profits
- Workable strategies
  - Do not require unrealizable precision in forecasts
  - Position you to take advantage of opportunities to increase profits when they arise
  - Limit losses if conditions differ from expected
- Examine the range of strategies that others may use to increase their profits
  - Develop counter strategies that limit their detrimental impact on you

Changing Protocols

- ISO/PX will recognize holes as they operate
  - Revise protocols and systems to close the holes
  - Time lag between recognizing and closing holes
  - Window of opportunity in which you can increase profits or in which other players can damage you
  - Closing one hole may open others
- Market rules will be fluid for a while
  - ISO/PX will be pressured to provide new services and capabilities
    - Long-term tradable transmission rights

Ongoing Process

- Strategy development is not static
  - Protocols evolve
  - Competitors learn new strategies
- You must have an ongoing effort
  - Monitor operation of market
  - Monitor actions of competitors
  - Revise your strategies to keep pace

Our Capabilities

- Our qualifications are unique
  - We know the protocols
    - Assisted WEPEX in developing the protocols that govern forward transmission and energy markets
    - Assisting the PX in developing its protocols
  - We know the actual ISO systems
    - We are part of ISO Alliance building the ISO's systems
    - Know the "warts" as well as the theory
  - We have business experience
    - Aided East Midlands Electricity adapt to deregulation
    - People with wide range of utility and energy experience

Project Tasks & Deliverables

Phase I

- Review PX and ISO protocols and business opportunities
  - DELIVERABLE: Documented strategies
- Implement reduced scale PX/ISO operational model (CPXIO)
  - DELIVERABLE: Working version of CPXISO
- Incorporate strategies into system
  - DELIVERABLE: Working HYPERSENS subsystem
- Adapt PAC's short term load forecast (SLF) model for CA energy market
  - DELIVERABLE: Existing system with SLF integration
- Develop interfaces between CIGMOD and CPXISO
  - DELIVERABLE: Existing system site tested interface
- Add utility's proprietary data
- Calibrate CIGMOD/CPXISO model to California and utility's behavior
  - DELIVERABLE: Existing model with tested simulation of all relevant companies
- Test model with utility staff and update algorithms / interface
  - DELIVERABLE: Staff training and system with enhanced interface
- Test model & strategies in real conditions
  - DELIVERABLE: Fully functional system except for real-time PX/ISO analysis

Project Tasks and Deliverables
Phase II

- Integration of California's market data into CIGMOD/CPXISO model
- Implement AI/statistical code into CIGMOD/CPXISO model
- Interface to real-time systems
- Develop portfolio rules
- Initial testing and training of staff
- Market dry runs

Project Tasks and Deliverables
Phase III

- Monitor early use and fine tuning of market strategies and addition of new AI based strategies
- Develop benchmark saving protocols and models
- Ongoing support of staff

BOWNE INTEGRATED TYPESETTING SYSTEM Site: (BOD) BOWNE OF DALLAS, INC Phone: (214) 651-1001 Operator: BOD31028 Date: 6-JUN-2002 17:05:29.47
Name: PEROT SYSTEMS [E/O] CRC: 56519 JB: D97558 PN: 799.08.20.00 SN: 0 Ed#: 1
Queue: BOD_CPS EDGAR 2
Description: EXHIBIT 99.8

What We Can Offer

- Business requirements definition
- Program management
- Delivery accountability
- On-going service support
- Service delivery options
  - Joint project team
  - Turn-key project
  - Provide "as service"

Example of Gap in Protocols:
Real Time Balancing Energy

- Overview of real-time balancing operations
  - If additional energy is needed, increment least expensive available resources
  - Ex-post price set by most expensive unit incremented
  - If less energy is needed, decrement most expensive available resources
    - Ex-post price set by least expensive unit backed down
  - All available resources are not re-dispatched to minimize costs
    - Ex-post price is not the price that clears the market
- May affect bidding strategies

Simple Example...

- PX schedules in forward market
  - 10,000 MWh in an hour
- SC1 schedules in forward market
  - 6,100 MWh in an hour
    - However, expects its load will be only 5,000 MWh
    - Expects that PX under forecasts its load by 1,000 MWh
- Real-time balancing energy bids
  - PX: -5,000 MWh to 5,000 MWh @ $Y/kWh
  - SC1: -1,200 MWh to 0 MWh @ $X/kWh
    - X is a large number (X>>Y)

...Simple Example

- Suppose that SC1 was right
  - Actual loads in the hour in real time
    - PX: 11,000 MWh
    - SC1: 5,000 MWh
  - Scheduled generation exceeds load by 100 MWh
- ISO actions
  - Backs down SC1's generation by 100 MWh
  - Sets ex-post price to $X/MWh
- Results
  - SC1 sells 1,000 MWh to PX for $X million
  - SC1 can set X as large as it likes

Taking Advantage of the Gap

- The example shows a gap in the imbalance energy market
  - The strategy outlined is not practical
- Practical strategies can be developed to take advantage of the gap
  - Devise bids that allow you to take advantage of the gap when conditions are right
  - Other gaps in the protocols allow you to develop responses that protect your position if conditions deviate from forecast