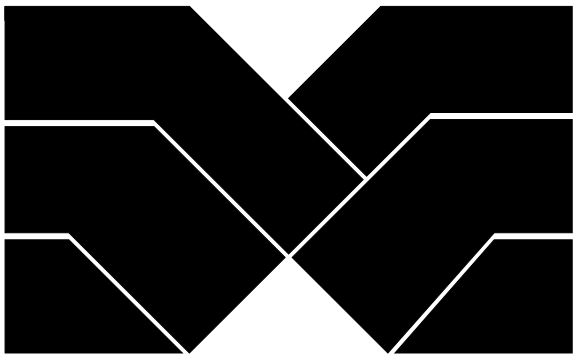

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MEMORANDUM

Date: May 28, 2003

To: McCullough Research Clients

From: Robert McCullough

Subject: Regional Economic Losses From Enron's Fat Boy Scheme

"By overscheduling load, the marketers are inflating the day ahead price."[1]

On April 26, 2003, the Federal Energy Regulatory Commission released its Final Report on Price Manipulation FERC's Final Report in Western Markets.[2] The report was a far reaching review of a number of abuses during the California energy crisis. One section characterized the Fat Boy debate as

> Although the fat boy strategy included submitting false load schedules, it did not adversely affect the market outcomes, if the generation is simply bidding as a "price taker." To the extent the generator submitted strategic bids that affected the market outcomes, this would constitute market behavior prohibited under the Cal ISO tariff.[3]

FERC staff's caveat is well taken. As with each of the Yoder/Hall schemes, the impact on the market

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[1]The first draft of the Yoder/Hall memo on Enron Trading Strategies left little doubt on the intention of the Fat Boy scheme. Trading Strategies, Stephen Hall, October 4, 2000.

[2]Final Report on Price Manipulation in Western Markets Fact-finding Investigation of Potential Manipulation of Electric and Natural Gas Prices Docket No. PA02-2-000, Staff of the Federal Energy Regulatory Commission, March 2003.

[3]Docket No. PA02-2-000, Price Manipulation in Western Markets, VI-42.

is not obvious. In this one case, however, it can be shown in a straightforward manner that the Fat Boy scheme significantly inflated the California Power Exchange prices. Since PX prices directly affected prices throughout the West Coast of the U.S. and Canada, Fat Boys had an impact on consumers from one end of the WECC to the other, in total, more than $3.5 billion.[4,5]

	Cost To Consumers		
	ISO	Total California	Total Region
January-00	$ 14,132,985	$ 15,168,434	$ 49,550,776
February-00	$ 11,276,160	$ 11,908,874	$ 32,363,716
March-00	$ 14,025,863	$ 14,673,102	$ 38,991,450
April-00	$ 15,611,488	$ 16,509,581	$ 44,777,443
May-00	$ 44,126,787	$ 46,946,580	$ 127,210,824
June-00	$ 93,853,727	$ 99,764,791	$ 257,535,261
July-00	$ 126,233,447	$ 133,638,769	$ 370,432,558
August-00	$ 266,609,529	$ 278,168,405	$ 703,661,871
September-00	$ 219,570,410	$ 228,683,011	$ 557,329,432
October-00	$ 246,145,393	$ 257,002,513	$ 579,775,121
November-00	$ 191,313,970	$ 199,389,072	$ 522,043,744
December-00	$ 103,385,405	$ 108,359,615	$ 301,241,631
Total	$ 1,346,285,165	$ 1,410,212,747	$ 3,584,913,827

It can easily be shown that Fat Boys did have a significant impact on the market. Firm energy that would have been available to meet loads at the Power Exchange was withdrawn and applied to imaginary or exacerbated loads (in the words of Enron's Service Desk "fake or increase" loads.) The additional supply received the price calculated by the ISO's real time market without any impact on the supply and demand of energy in that market.[6]

Data on Fat Boys has been difficult to procure from the California ISO. After initially refusing to answer data requests filed by Northwest parties in the FERC proceedings this spring, the ISO finally agreed to allow use of scheduling data after California State Senator Dunn's staff intervened in the discussions. Unfortunately, the ISO's permission was given only two working days before testimony was due – clearly insufficient for the millions of calculations required to simulate a shift of the hourly supply and demand curves for each hour of calendar 2000.

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[4]Western Electric Coordinating Council. The WECC is also frequently referred to as the WSCC, the organization's name until April, 2002.

[5]The California PX market was an option for utilities and marketers throughout the WECC. Higher prices at the PX attracted supplies available to other markets, for example, Mid-Columbia. Before a Capacity Benefit Margin was instituted by the California ISO in late December of 2000, prices at other market hubs closely tracked prices at the California PX.

[6]The ISO real time market (often referred to as the "ex-post" market) is a computer program that applies real time adjustment bids to load following requirements on a ten minute basis. The additional Fat Boy supplies did not appear as a supply bid into the ex-post market. The price from that market was applied to Fat Boy schedules.

Moreover, evidence concerning the reliability practices (and emergency declarations) of the California ISO still needs to be reviewed before a final decision can be rendered on the impact on reliability at the ISO and the rest of the WECC. Obviously, the massive redirection of firm prescheduled energy to non-firm, real time energy posed a cost to consumers. More importantly, the shift from firm energy to non-firm energy should have had an impact on the California ISO's emergency declarations. This, in turn, would have affected prices in the market.[7]

Background on Fat Boy

On May 6, 2002, Enron turned over three memos to the Federal Energy Regulatory Commission's PA2-02-000 investigation. The memos described a number of different schemes designed to take advantage of the California Power Exchange and the California Independent System Operator. The first scheme was named "Fat Boy" and "inc-ing load."

> 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. 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 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

[7]This point is addressed below. In theory, inadvertent flows would not be counted as a capacity resource any more than a bank error in your favor would be entered onto a loan application. In practice, the California ISO has never articulated a clear methodology behind its emergency declarations during the California crisis and various ISO officials hold different opinions on the effects of Fat Boys on the ISO's operations.

Services ("EES") . The ISO receives the schedule, which says "1000 M W 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.[8]

The first draft of the exotic strategies memo was even more direct:

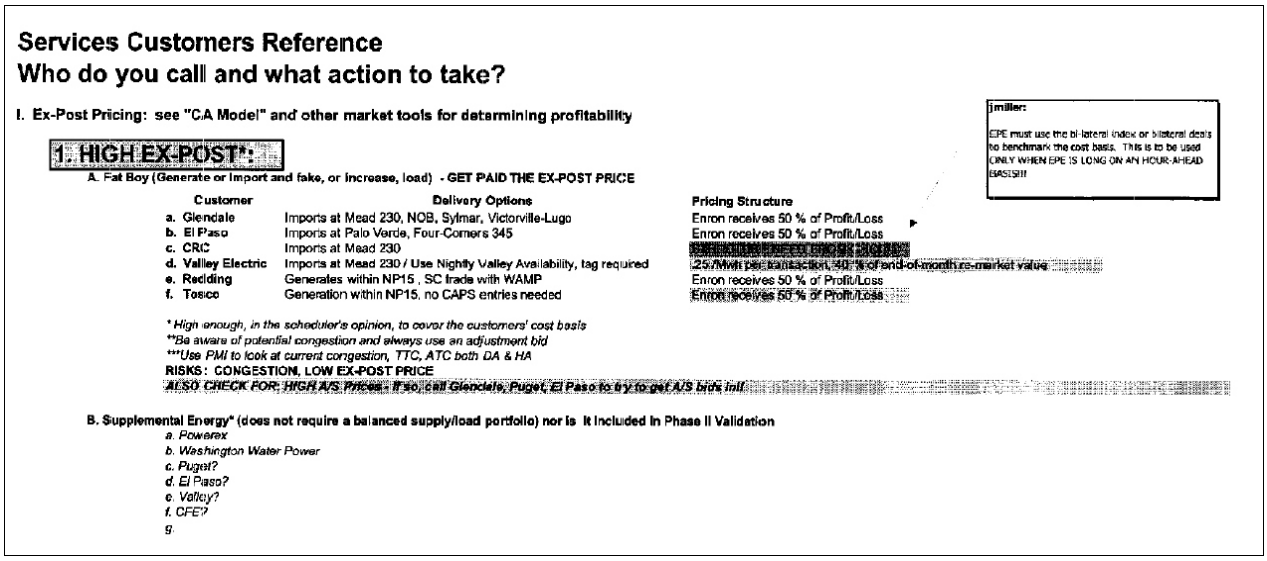
"Fat Boy"

- This strategy takes advantage of the fact that the real-time price is often higher than the day-ahead price.
- The traders therefore buy energy in the PX day-ahead market and sell into the ISO's real-time market as an uninstructed (?) deviation, for which we receive the ex post decremental (" dec") price.
- Here is an example. Assume that we needed to schedule 500 MW of generation and 500 MW of load in zone NP-15. We would schedule 1000 MW of generation and load in NP-15 in the day-ahead market. We would then purchase 500 MW in the PX day-ahead market. Because we only need 500 MW to satisfy our load, we then have 500 MW available to be diverted into the ISO's real-time market.
- By sending the excess energy to the real-time market as an uninstructed deviation, we are a price-taker and are paid the dec price.
- "Our big strategy is to find those with market power and follow their lead."
- Conclusion: By overscheduling load, the marketers are inflating the day ahead price. Of course, the IOUs try to lower the market-clearing price by underscheduling their load.[9]

[8]Traders' Strategies in the California Wholesale Power Markets/ ISO Sanctions, Christian Yoder and Stephen Hall, December 6, 2000, pages 1-2.

[9]Trading Strategies, Stephen Hall, October 4, 2000.

A third source, Enron's Services Handbook, also made clear Enron's role in this process:[10]



Services Customers Reference
Who do you call and what action to take?

I. Ex-Post Pricing: see "C.A Model" and other market tools for determining profitability

1. HIGH EX-POST*:

A. Fat Boy (Generate or Import and fake, or increase, load) - GET PAID THE EX-POST PRICE

	Customer	Delivery Options	Pricing Structure
a.	Glendale	Imports at Mead 230, NOB, Sylmar, Victorville-Lugo	Enron receives 50 % of Profit/Loss
b.	El Paso	Imports at Palo Verde, Four-Corners 345	Enron receives 50 % of Profit/Loss
c.	CRC	Imports at Mead 230	[redacted]
d.	Valley Electric	Imports at Mead 230 / Use Nightly Valley Availability, tag required	.25/Mwh per transaction, 40 % of end-of-month ice-market value
e.	Redding	Generates within NP15 , SC trade with WAMP	Enron receives 50 % of Profit/Loss
f.	Tosco	Generation within NP15, no CAPS entries needed	Enron receives 50 % of Profit/Loss

jmiller:
EPE must use the bi-lateral index or bilateral deals to benchmark the cost basis. This is to be used ONLY WHEN EPE IS LONG ON AN HOUR-AHEAD BASIS!!!

*High enough, in the scheduler's opinion, to cover the customers' cost basis
**Be aware of potential congestion and always use an adjustment bid
***Use PMI to look at current congestion, TTC, ATC both DA & HA
RISKS: CONGESTION, LOW EX-POST PRICE
ALSO CHECK FOR: HIGH A/S Prices: If so, call Glendale, Puget, El Paso to try to get A/S bids in!!

B. Supplemental Energy" (does not require a balanced supply/load portfolio) nor is it included in Phase II Validation

a. Powerex
b. Washington Water Power
c. Puget?
d. El Paso?
e. Valley?
f. CFE?
g.

A number of other market participants also facilitated Fat Boy schedules. Coral's Term Strategies document delineates a number of Enron schemes including Fat Boy:[11]

2) Decremental Price Plays in ISO: When pricing looks favorable, you can obtain power from Glendale via an SC to SC transfer in South Path and park it on a Coral Load ID in either SP, NP or Zone 26. Glendale will earn the difference between the cost of the power and the Decremental Price in the zone in which the power was scheduled.

The similarity between the Enron and Coral documents is not a coincidence. The Brobeck firm documented at least one trader who moved from Enron to Coral at the beginning of 2000.[12,13] The same trader shows up several times in FERC's ENPOWER Fat Boy database searches for facilitating Fat Boys with Glendale.

Powerex also described extensive Fat Boys in their PA02-2-000 affidavit. Powerex's affidavit clearly

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[10]Market Conditions Reference, Services Handbook RT,xls, Enron, no date, page 5.

[11]Coral Term Strategies, Attachment II.B PA02-2-000 Affidavit, page 2.

[12]California Electricity Market Preliminary Investigation Report EPMI, December 8, 2000, Exh. No. CA-79 in dockets EL00-95 and EL00-98, page 4.

[13]Carey Morris, the trader at Enron apparently indicated by the Brobeck firm as leaving Enron for Coral, is indicated as the responsible trader for several Fat Boy trades with Glendale in the listing of Fat Boy trades from Enpower.

states that they had pursued this scheme, but argued that such schemes were not forbidden by ISO rules.[14]

The basic Fat Boy scheme involved scheduling power to the California ISO to non-existent or exacerbated loads. The computer systems at the California ISO were apparently unable to recognize a systematic patter n of abuse. A number of market participants took this flaw as permission in spite of hundred years of industry practice. Powerex, for example, includes the following memo in their PA02-2-000 affidavit.[15]

From: Bechard, Thomas
Sent: 2000, May 04 3:47 PM
To: Powerex - RealTime Trader
Subject: Accounting for Under/Over scheduling to CISO load

I have discussed overscheduling to load with Francois. As suggested by Ralph and others, it would be easier for everyone involved if we show this as follows:

- if you overschedule to the load in the hour ahead market, in the BC/US sheet you should show a system sale to the CISO at the expost price. Show the Interchange id ie. PWX_HANOB_IN, and make a note that says "Load deviation" so that accounting knows that this is not a sup schedule or a mixed wheel through. In the arbitrage sheet you should show the PWRX/PWRX deal to account for the HA congestion. If the Hour ahead zonal reference prices are both 0 then you do not need to show this in the arb sheet at all. If they are both non-zero but the same, you still need to show it.

I will be available Tuesday at 10:00 for a workshop on how to account for over or under scheduling and cuts to CISO import schedules that are serving load. If you can make it, let me know.

Powerex viewed this as significant enough an opportunity that they contracted with a retail entity in California in order to overschedule:[16]

[14]PA02-2-000 Affidavit of Ken Peterson, May 22, 2000.

[15]Ibid., page 119.

[16]Ibid., page121.

From: Kurschner, Renata
Sent: 2000, April 26 8:55 AM
To: RTG, Powerex; Yazdi, Ali; Hiley, Michelle; Bechard, Thomas
Subject: Sale to Ancor

FYI:
Starting 1 May 2000, continuing till 15 May 2001, we have sold 1MW flat to an Energy Service Provider (Ancor) for delivery in SP15 (SCE1). We are the Scheduling Coordinator with CISO for this 1MW for Ancor. Similarly to our PGEES transaction, this deal gives us a **scheduling flexibility** (obviously over but not under) to access the imbalance market in California. The contract allows us to supply from any source we decide - PX, outside of Cal, internal Cal generator/marketer, imbalance market. Failing to provide a specific schedule, I am assuming we can let Ancor's load just run on the imbalance market for the 1MW - not much risk there, but let's test it "gently" before we do it too often.

This deal is priced at PX day ahead SP15 plus all CISO charges. Ancor does NOT pay us the CalPX admin charge if we purchase the supply from the PX. Ancor also gets 50% of any ancillary services credit that we get by supplying from outside of California.
If you have any questions, please talk to me.

Ali/Michelle, please advise others in your group.
Tom/Ali/ Michelle: how is this handled in terms of the actual scheduling (other than when it is purchased from the PX)? Does real time enter the schedules into the ISO even if it is DA prescheduled? Do we need to advise the schedulers of the details of this transaction or is it all handled "outside" of the scheduling group?

Thanks, Renata

The final paragraph of the Renata Kurschner email addresses a central issue in the impact of treating firm power as inadvertent flows. It is interesting that even Powerex had questions on how overscheduling was scheduled.

Inadvertent Flows

The term "Fat Boy" was coined by Enron's west coast trading staff as a purposeful overscheduling of energy to an actual load. As with many of the Enron schemes, this was designed to take advantage of an error in the computer programming of the California ISO.

The basic model of the California market implementation was a complex balance of responsibilities between the California Power Exchange and the California Independent System Operator. The Power Exchange was intended to be the marketplace for energy, supplying virtually the full requirements of the three investor owned utilities. The ISO was expected to operate the system on the basis of the market conducted by the Power Exchange, In addition, the ISO conducted several other markets:

A/S Markets designed to provide reserves,

A real time market designed to provide price signals on a ten minute basis,

and

A market to price congestion on important California transmission lines.

Translating ISO terminology back into normal operating concepts is often challenging. The easiest approach is to describe what happens in a normal environment and then to use that to describe the operations at the ISO.

Countless times every day, each transmission operator in North America receives schedules for the transmission of energy from one point in their system to another. These requests are pre-scheduled – made before the hour in which the energy is to be transmitted. The schedules are simple -- instructions equivalent to the instructions you would give a taxi driver – move three people from the airport to the center of town. A similar electric schedule would be to transmit 100 megawatts from Malin (in Oregon) to Northern California at 3:00 P.M.

By definition, such schedules are always balanced – it is a central premise that you would not want the taxi driver to "lose" some of the passengers on the way downtown. In practice, some errors do occur. In the real world, electrons cannot read and sometimes do not follow contract paths. In some cases, loads change dramatically between the time of the schedule and the actual hour of delivery. In other cases, plant or transmission outages could take place which might lead to a difference between the schedules and the actual flows. Industry terms for this problem vary, but "inadvertent flows" is one frequently used phrase. Transmission operators have contractual solutions for inadvertent flows – usually surcharges for running higher or lower than the scheduled amounts.

Again, the taxi metaphor makes sense. If the taxi breaks down or becomes lost, most passengers would not pay the fare. If more passengers squeeze into a cab, most cities allow the taxi to surcharge the fare.

The California ISO adopted a simple solution. Differences between schedules and actual loads were charged (or paid) the price from the real time market. Amazingly, the ISO apparently did not choose to check whether they faced a large and continuing differential between loads and schedules. If such a check was made, there clearly was little effort to enforce the balanced schedule rules. FERC staff have commented on the ISO's apparent lack of interest in systematic abuses of inadvertent flows.[17]

> Staff is also concerned that a review of certain Cal ISO reports indicates a complacency with the submission of false schedules, such as in the fat boy trading strategy. The Cal ISO issued a report by its Department of Market Analysis entitled, "Did Any of Enron's Trading and Scheduling Practices Contribute to Outages in California?" This report, which was reviewed by the Market Surveillance Committee, addressed issues raised by Robert McCullough before the California Committee. The report concludes that, based on data available to the Cal ISO, the Enron practices reviewed by Mr. McCullough did not cause the blackouts during the winter of 2001. Rather, the blackouts were caused

[17]Docket No. PA02-2-000 Price Manipulation in Western Markets VI-25

> by a combination of the limited supply of energy that was made available to the Cal ISO and limited transmission capacity available to deliver energy from southern to northern California.[18]
>
> Within this context, an addendum to the report discusses the fat boy trading strategy. Again, the Cal ISO report criticizes Mr. McCullough's previous analysis, but in doing so, the Cal ISO appears to view this strategy as benign or even helpful because it "simply has the effect of reducing the Cal ISO's projected demand for imbalance energy that must be procured by the Cal ISO to meet real time load." The Cal ISO also describes how, in performing its daily operations (such as system load projections and reserve requirements), it ignored the false information contained in the schedules submitted by Enron and others. The report seems to indicate that the Cal ISO was aware of the false underscheduling by the California public utilities and the counterbalancing effects of the false overscheduling of load by Enron and others.
>
> Because the Cal ISO is the control area operator of the transmission grid, it is imperative that the Cal ISO identify poorly designed market rules and make filings with the Commission proposing solutions. However, the Cal ISO must implement the Commission-approved rules until they are changed, as all other public utilities are required to do.

As a general rule, the system is more efficient on a prescheduled basis – simply because system dispatchers are able to make more considered decisions reflecting economic concerns, system reliability, and transmission losses.[19]

Searching For Fat Boys

The California ISO conducted a preliminary study of the Fat Boy scheme in October of 2002.[20] Although the ISO's methodology for identifying Fat Boys is not described in the report, a document accompanying the data to the report does outline a way to search for Fat Boys.

> The threshold level used in the analysis is based on levels proposed as part of a proposed tariff filing (or Oversight and Investigations project), which calls for setting a limit on over scheduling equal to

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[18]"Did Any of Enron's Trading and Scheduling Practices Contribute to Outages in California?" was issued in November 2002 to rebut testimony at the California Senate Select Committee for the Investigation of Price Manipulation on June 6, 2002, and September 17, 2002. The primary theme of the rebuttal was to reject a hypothesis raised on June 6, 2002 that Enron's Death Star scheme might have been the cause of the anamolous congestion data during the Stage 3 emergencies of January 2001. The purpose of the rebuttal was unclear since the ISO had, itself, worked with the Senate Select Committee to clear up the question of the cause of the January 2001 congestion. The cause turned out to be a undocumented policy of the ISO which artificially congested its own transmission lines from December 26, 2000 to December 3, 2002.

[19]Economic dispatch is difficult in real time because many generating units cannot raise or lower their generation without advanced notice. Reliability also is affected since real time information is often incomplete and the time available for critical decisions can be very limited. The final issue, losses, is a combination of the first two – heavily loaded lines lose more electricity to heat. These considerations are not likely to be easily optimized in real time.

[20]Analysis of Trading and Scheduling Strategies Described in Enron Memos, Eric Hildebrandt, October 4, 2002, page 2.

10% of actual loads + actual transmission losses assessed on the SC's supply portfolio.[21]

ISO staff apparently did not have access to any of the materials provided by market participants to FERC or the state and Federal investigations, so some of these adjustments do not seem completely appropriate.[22]

Given that a 10% deviation from an hourly preschedule would normally constitute extremely poor forecasting for anything but a process driven electrochemical facility or a steel mini-mill, we adopted a 10% deviation rule for the identification of Fat Boys.[23]

To our knowledge only Powerex has supplied a listing of their Fat Boy schedules in response to PA02-2-000 interrogatories.[24]

A simple test of the accuracy of the 10% overscheduling rule is to compare the Fat Boy's estimated from ISO data to the actual schedules provided by Powerex to FERC.

---

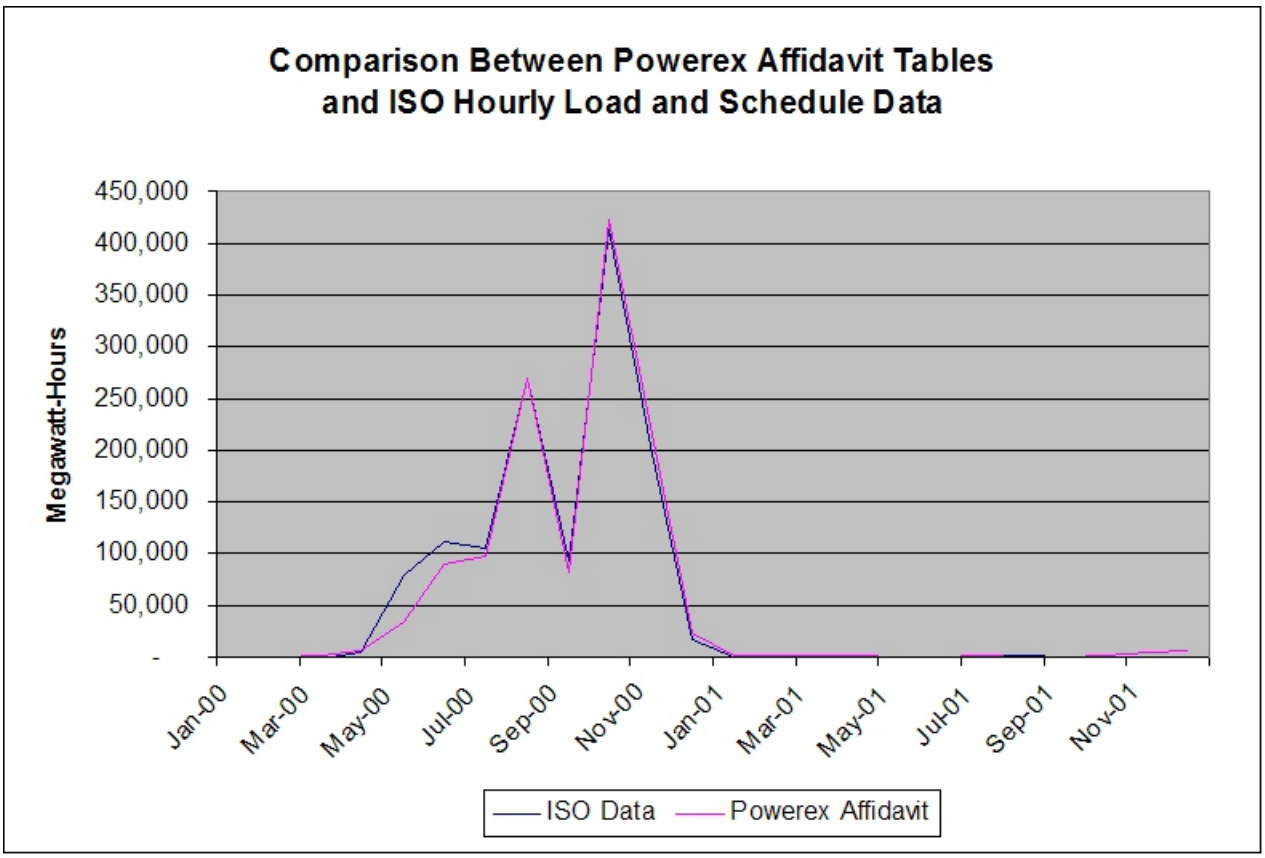
[21]Analysis of Load Over-Scheduling, page 1. The footnote on page one adds some additional clarification.

Transmission losses were calculated each hour by using Generation Meter Multipliers for Hour-Ahead generation schedules and net inter-tie imports. If losses were unavailable or were negative, losses were estimated at 3%. In addition, the threshold was set at the minimum level of 25 MW so that deviations below this level were not regarded as overscheduling.

[22]The decision to restrict Fat Boys to 25 megawatts would appear inconsistent with the Ancor memo reproduced above, for example.

[23]A small number of industrial customers use electricity to "heat" steel and nickel, for example. Each "heat" can spike electric consumption by 400% in a matter of seconds. Given the price of electricity in California, such loads are very rare within the California ISO's control area.

[24]Affidavit of Ken Peterson, May 22, 2002, Exhibit J, entitled "Powerex "Price Taker" Energy Scheduled in the ISO's Day Ahead and Hour Ahead Market."



The match between the actual schedules and the schedules identified by the 10% rule is very, very close.

Significant Fat Boy participants identified by this approach are:

	Fat Boys
ENRON Power Marketing Inc	3,134,436
British Columbia Power Exchange	1,333,094
Mirant	891,813
PG&E Energy Trading Power, L.P.	871,915
Sempra Energy Trading Corporation	846,036
HAFSLUND ENERGY TRADING L.L.C.	514,375
Coral Power, LLC	408,124
California Polar Power Brokers LLC	313,120
Dynegy Power Marketing, Inc.	271,785
NewEnergy Inc.	223,241
PG & E Energy Services	220,905

Economic Impacts

As originally designed in AB-1890, the energy supply for the three California investor owned utilities was intended to be supplied by the California Power Exchange.[25] The California Independent System Operator was intended to operate the transmission system. In addition, the ISO conducted its own market for reserves.

The most innocent explanation of the sudden growth of inadvertent schedules is the incentive provided by the differential between the ISO's real time adjustment market and prices at the PX. This explanation was the basis of Powerex's internal memo on Fat Boys:

> [W]e have come up with a possible reason why the Beep model has been so far off lately . . . . [I]t appears it is due to significantly more overgeneration in California in recent weeks. The increase in overgeneration began after we started putting in high priced buy bids in the sup market to protect our price taker sales. It may be that this has skewed the entire sup market up in price and resulted in generators underscheduling in the day ahead and hour ahead markets so they can overgenerate to take the beep.[26,27]

The California ISO's October 4, 2002 study indicates that the real time market clearing price was lower than the price the ISO was paying for "out-of-market imports."[28,29]

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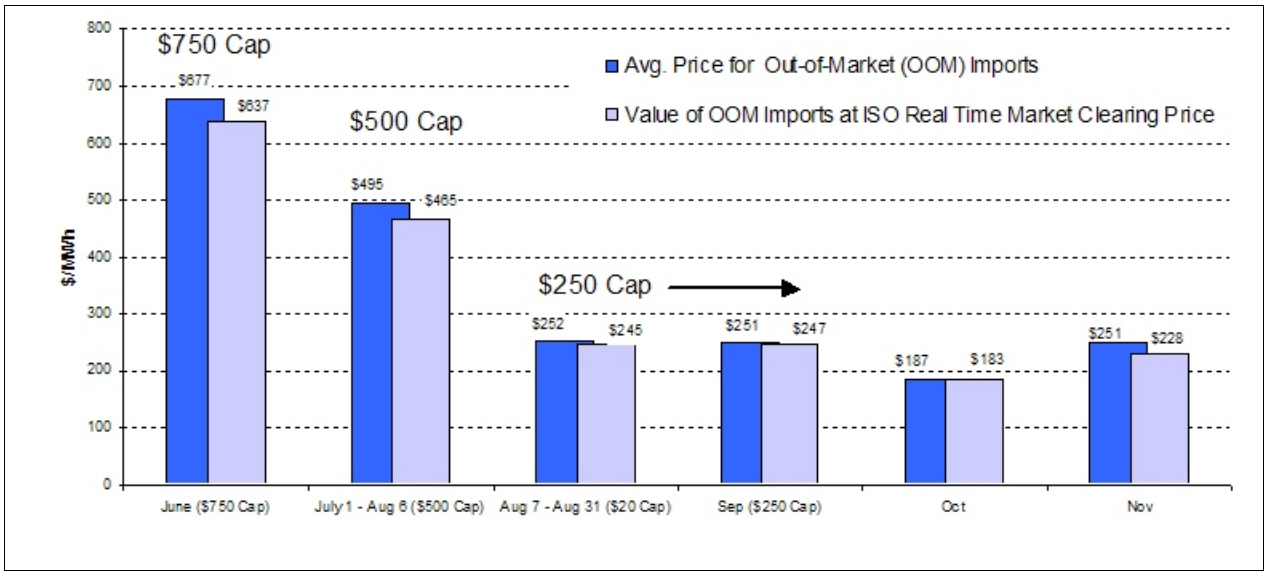
[25]AB-1890 was the bill enacted in August, 1996 to restructure California's electric supply system.

[26]E-mail from Thomas Bechard to Murray Margolis and others, with attached memorandum explaining Powerex deal with PGES, , February 3rd, 2000. Exh. No. CA-46 at in dockets EL00-95 and EL00-98.

[27]BEEP stands for Balance Energy Ex-post Pricing. The real time adjustment bids sorted into ascending order are often described as a "Beep stack."

[28]ISO terminology is often confusing. The term "out of market" means purchases <u>from</u> the market.

[29]Analysis of Trading and Scheduling Strategies Described in Enron Memos, Department of Market Analysis, October 4, 2002, page 4.



This closely matches the conclusions in Tim Belden's May 23, 2000 email to Terry Winter.[30]

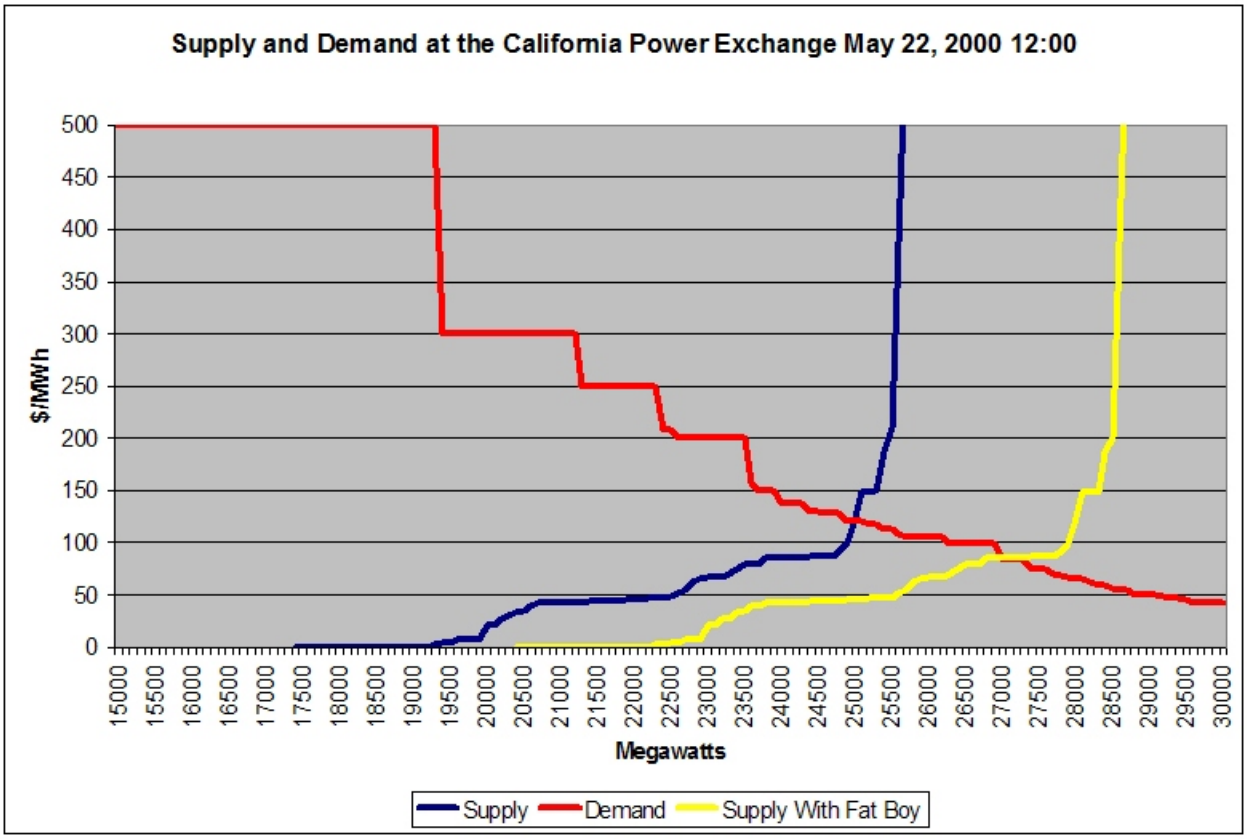
> I just finished talking with Zora about the Out of Market activities yesterday and thought that it would be a good idea to put my thoughts into an e-mail. It appears as though the MW that you procure out of market end up suppressing the ex post price. For example, Enron sold the ISO 100 MW for $750/MWh during hours 17, 18, and 19. It was our impression that the ISO was procuring large volumes of energy out of market during these hours. Yet the ex post price for these hours settled at $379.29, $300.00, and $119.77 respectively. Every MW that you purchase out of market reduces the number of MW that must be procured through the BEEP stack. Reducing the number of MW procured through the BEEP stack naturally puts downward pressure on the ten-minute and ex post price. Yesterday's prices support this theory. We saw this happen in the summer of 1998 as well.
>
> The result is that you harm providers of energy in-state. This could be instructed or un-instructed deviations. Yesterday we had nearly 800 MW of uninstructed generation in the state (in the form of over-scheduled load). Your out of market calls, coupled with the way that you perform ex post pricing, hurt us and everyone else who provided energy within the state to you in real time.

A significant message in this unusual email is that Tim Belden, Enron's chief trader in the WECC, is writing an email on behalf of "providers of energy in-state." Since Enron was not an in-state generator, Belden was apparently advocating changes on behalf of his competitors.

In reality, Enron's activities were more likely to benefit Enron's competitors than Enron. A Fat Boy schedule accepted the prices calculated by the ISO's BEEP stack.[31] As such, it was a more risky market than the California PX. If Enron's competitors stayed in the Power Exchange and bilateral markets, they would enjoy the benefits of Enron's scheme without the cost or risk of the ex-post

[30]Email from Tim Belden to Terry Winter and Kellan Fluckiger, May 23, 2000.

[31]In theory, a Fat Boy could earn nothing – or even face surcharges – depending on the results in the ex-post market.



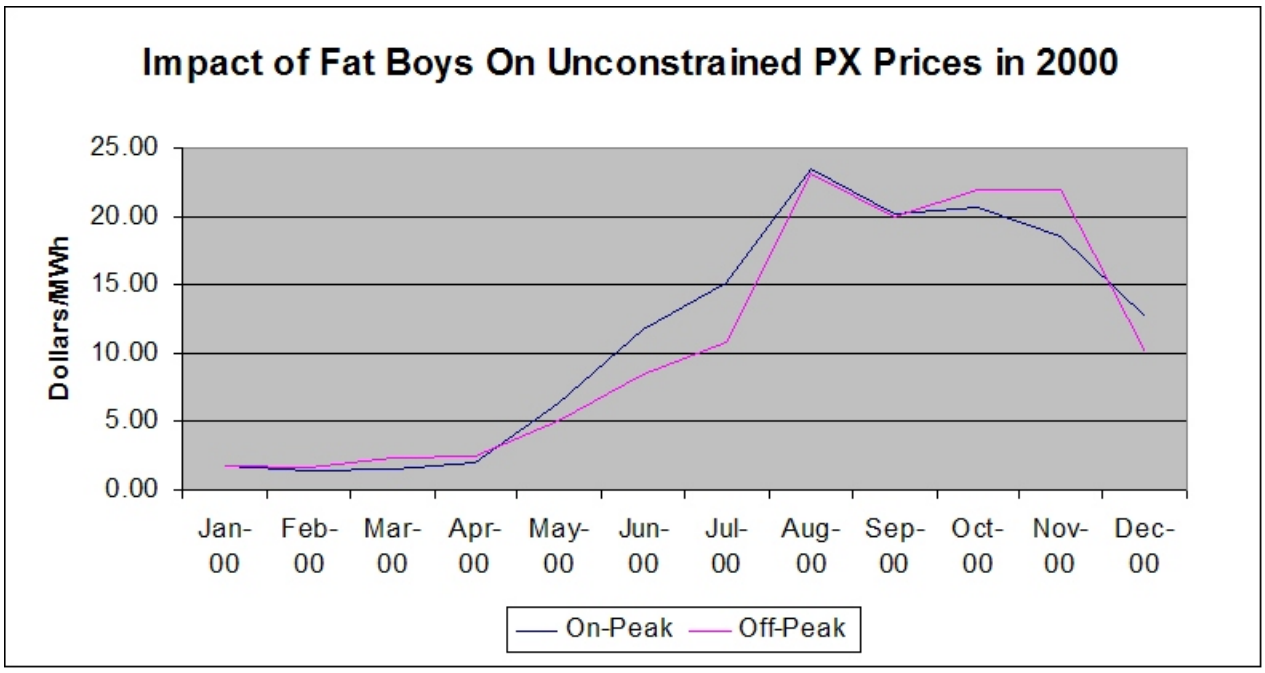
market.

A second implication of this unusual email is that Tim Belden continued to schedule Fat Boys even though the revenues were not as good as "out of market" sales.

The primary impact of scheduling power to non-existent loads was to remove energy from the market at the PX. The following graph shows the supply and demand curves at the PX at 12:00 on May 22, 2000. The shift of energy from the PX to the ISO raised PX prices by approximately $35. Powerex, by contrast, often purchased energy from the PX for sale to the ISO. The mechanics of this approach are identical since in either case the shift raises the price of power at the PX and lowers the quantity supplied.[32]

The impact of overscheduled loads on PX prices for 2000 can be modeled by repeating the same calculations for 8,784 hours.

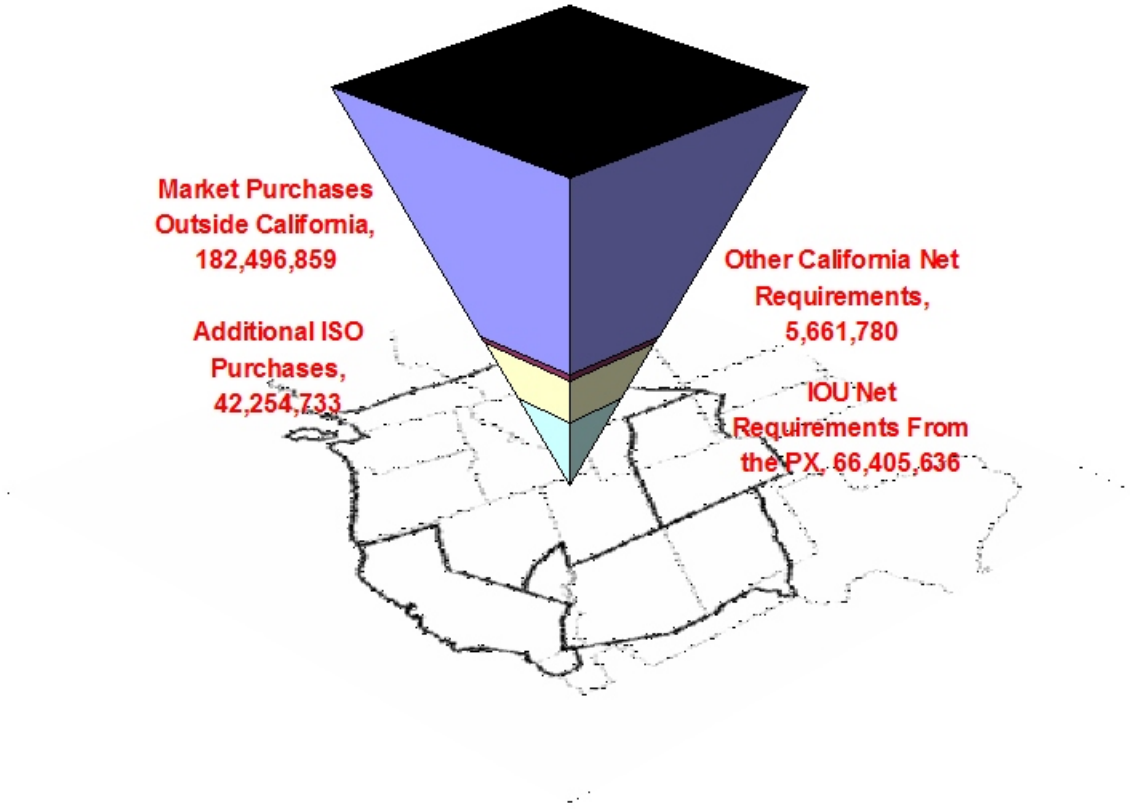
[32] A shift to the supply curve the left is mathematically equivalent to shifting the demand curve to the right.



The impact of Fat Boys on the larger market is complex to estimate.

The total WECC market is composed of a number of different components. Within the complex AB-1890 structure, the PX prices applied to total IOU loads and total IOU resources.[33] The net impact on the three IOUs in the ISO control area was equal to net purchases.

[33]IOU stands for Investor Owned Utility.



However, the California Power Exchange is just one part of the AB-1890 machinery. In 2000, total PX schedules for ISO control area loads were approximately 83% of total loads. Net requirements of other California utilities added another 2.3%.[34]

Most transactions in the WECC take place outside of the California AB-1890 structures. Monthly net purchases by investor owned utility in the WECC (plus all net utility loads in the Pacific Northwest) increase the load affected by overscheduling by an additional 77%.

This structure of PX loads, increased by additional ISO purchases, increased by additional California loads, and then adding in the rest of the WECC creates an inverted pyramid of impacts where the

[34]This is conservative. LADWP, for example, was unwilling to provide its monthly net purchases for inclusion in the calculations.

actual PX market is simply the apex.

Actual ratepayer impacts varied depending on how directly ratepayers were exposed to the price increases in the spot market and created by the Enron-style scheme. These impacts also include long term contracts which reflected a premium paid due to the volatility experienced in the market due to the aforementioned manipulation. . AB-1980 insulated most California ratepayers from market impacts.[35] Rates outside of California ranged from highly structured like those of the Bonneville Power Administration to market indexed tariffs for the major industrials who did not already have direct market access. Ratepayer impacts outside of California were almost certainly higher than those in California in 2000, simply because the ratepayers in other states did not receive the "beneficial" treatment of the AB-1980 rate freeze.

Preemptive Fraud

Beginning with the original Yoder/Hall memos, participants in this scheme have argued that assigning energy to non-existent loads was good for the system since it offset the underscheduling by California's utilities. Shorn of the details, their argument is that they were forced to file fraudulent schedules because the three investor owned utilities were also gaming the PX market.[36] As it turns out, they were preempting the PX by unilaterally removing their bids from the PX market.

Is this a case where two wrongs actual make a right? There is little evidence that it is.

This argument was pioneered in the original Yoder/Hall memo:

> Interestingly, this strategy appears to benefit the reliability of the ISO's grid . It is well known the California IOIJs 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).[37,38]

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[35]AB-1890 provided for a rate freeze until the Competition Transition Charge (CTC) had been collected from rate payers. At the beginning of the California crisis, only the ratepayers at San Diego Gas and Electric had paid their CTC and were placed at the mercy of the market.

[36]An excellent rebuttal to this theory can be found in Gary Stern's testimony in EL00-95.

[37]Traders' Strategies in the California Wholesale Power Market/ISO Sanctions, Christian Yoder and Stephen Hall, December 6, 2000, pages 2 and 3.

[38]As with many of Tim Belden's arguments, spokesmen for marketers have echoed his original arguments. An extensive repetition of this curious theory can be found in Hogan and Harvey and Tabors in EL00-95-069.

The basic argument shows little understanding of the system as originally proposed. In theory, the ten minute real time adjustments in the ex-post market reflected unplanned operational adjustments. As a simple matter of engineering, few plants are designed to make major changes in generation in real time. Even for those with the best capabilities to respond often face transmission limitations.[39] The raison d'etre of the BEEP stack was to pay units which could respond in real time for the right to increase or decrease their generation. Even when schedules from the PX were less than anticipated loads, the California ISO should have relied on reserves or purchases before the hour of shortage. In theory, there is no reason why decrements from schedules should be larger than increments in the real time market. In practice, forced outages of generation are probably more likely to occur than "forced repairs." This would lead to a bias towards incrementing generation rather than decrementing planned generation. Logically, if Enron had been planning to "help" the ISO, they would have simply made bids into the Replacement Reserves market and not scheduled to imaginary load.[40] If the ISO naively believed in Fat Boy schedules, the system should have required decrements as ISO schedulers discovered that massive loads simply hadn't materialized.[41]

Of course, the use of Fat Boys did show a sophisticated understanding of ISO operating problems. The pricing of a Fat Boy schedules is the price that generators receive for real time adjustments in generation. The supply of Fat Boy schedules did not directly figure into the ex post pricing – only the bids made by the generators for real time adjustments. As Tim Belden's email to Terry Winter and Kellan Fluckiger shows, he expected that an emergency declaration would "run through" the ISO reserves and force incremental bids in the real time market.[42]

As an economic argument, it has little merit. In the original design, it was expected that alternatives available to the California utilities outside of the PX market would lead to the utilities filing a traditional backward bending demand curve. By definition, such a demand curve reduces the amount of energy demanded as the price increases. As the supply curve moved towards the origin – in part due to the withdrawal of energy from the PX market for use in Fat Boys – the schedules from the PX were reduced below the level of full load. In theory, demand response programs and special contract rights should have explained the difference between the forecasted demand and the PX schedules on behalf of the three IOUs.

The irony of the preemptive fraud argument is that if the three IOUs had adopted the alternative approach – a vertical demand curve which reflected the same loads at all prices – the incentive to filing Fat Boys would have increased, not decreased. The vertical demand curve would have

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[39]The main stem Columbia projects are capable of real time adjustments. Unfortunately, these projects are far from California loads and require pre-scheduled transmission. Most units face considerable operational constraints in reacting to real time changes.

[40]A simple glossary of ISO terms can be found in "Balancing the ISO Grid" in the ISO's "information kit."

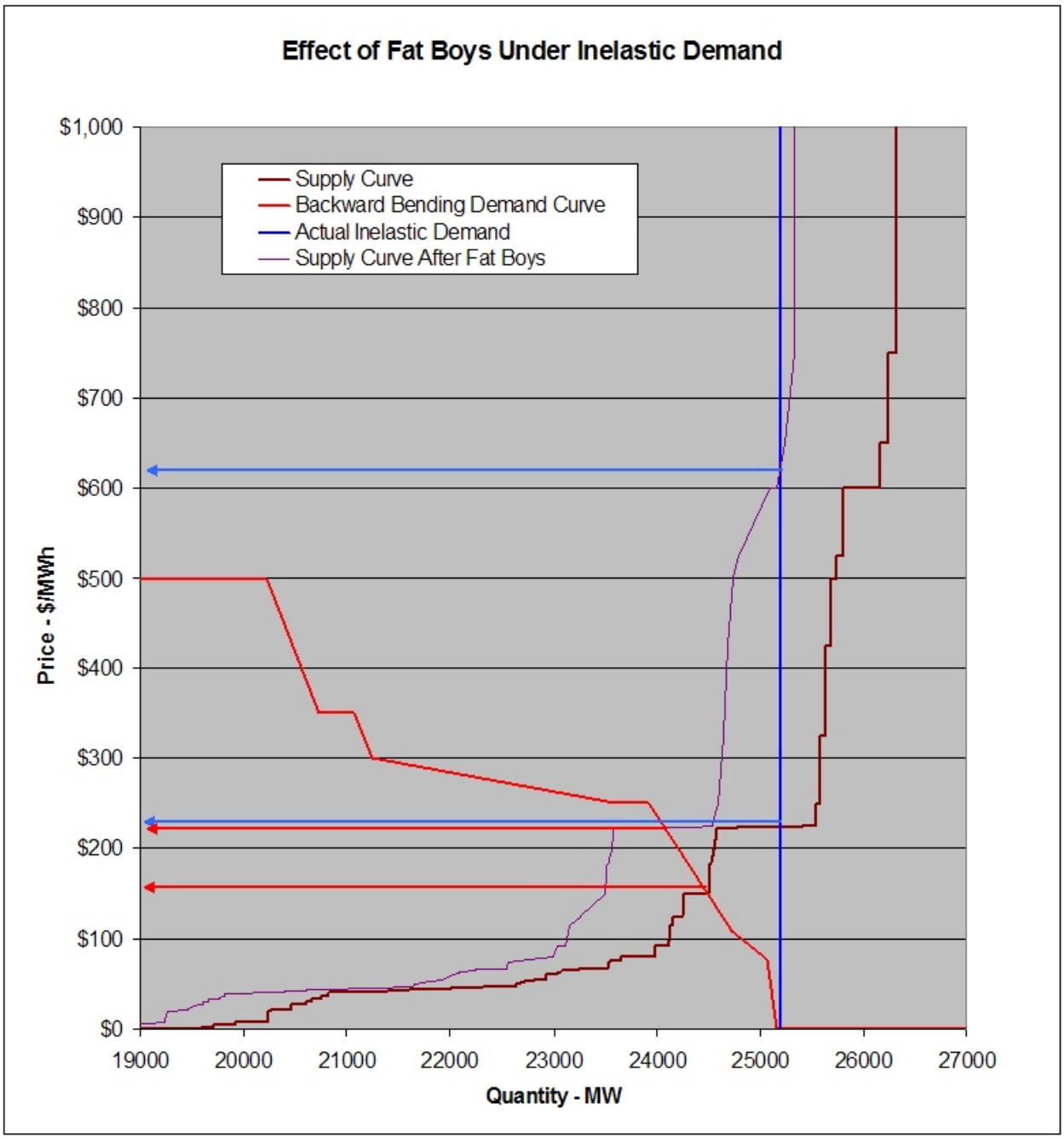
[41]The continuing debate whether the ISO actually believes in Fat Boy schedules for transmission scheduling is addressed below in the section on reliability impacts.

[42]Email from Tim Belden to Terry Winter and Kellan Fluckiger, May 23, 2000.

rewarded remaining bidders into the PX market for every megawatt-hour withdrawn to serve imaginary loads. Since the payment to the Fat Boys would have been unaffected, prices in the PX would have been even higher.

The following chart shows how adopting a vertical demand curve would have benefitted Fat Boys. In traditional economic theory demand curves are "elastic" – demand responds to changes in price. In California, the argument of the marketers is that demand was "inelastic" – loads were the same across all prices.

The chart below shows market results at the PX in both the actual case – where the utilities submitted an elastic, backward bending supply demand curve and what would have occurred if the demand curve had simply been set at expected load.



The elastic demand curve is displayed in red. Market price with the pre-Fat Boy supply curve is approximately $150/MWh. When the energy used in the Fat Boy schedules is removed from the Power Exchange, the supply curve shifts left towards the origin and prices increase to approximately $210/MWh. The impact of the Fat Boy schedules is to increase the market price at the PX approximately $60/MWh.

The inelastic demand curve case is shown in blue. Market price with the pre-Fat Boy supply curve is approximately $220/MWh. When the supply curve is shifted to the left to account for the Fat Boy

schedules, the market price increases to approximately $625/MWh.

In this example, the marketers would have had a $60/MWh incentive to submit Fat Boy schedules with the actual demand curve submitted by the utilities and a $405/MWh incentive if the demand curve was vertical.

As with many of Tim Belden's arguments, the description has a superficial logic, but the actual economics turn out to be diametrically opposed. We would have seen even larger Fat Boy schedules if the utilities' demand curves had reflected Tim Belden's desires.

Reliability

The impact of Fat Boys on reliability has two different facets. First, how did the existence of overscheduling affect transmission operations? And second, how did Fat Boys affect the overall balance between capacity and loads?

Transmission Schedules

Shorn of the immense complexity of the ISO scheduling process, a schedule filed with the ISO is simply a notification that a quantity of electricity is expected to flow from point A to point B. It is the ISO's job to arrange operations within its control area so that the actual physics of electricity match expectations. Since we can't actually "dispatch" electricity, we accomplish this almost superhuman feat by planning a schedule of plant operations that will elicit the planned flows. In practice, we arrange for surplus generation in the area the energy departs from to a shortage of generation in the destination area. False schedules, if believed by the ISO dispatchers, will lead to erroneous dispatch decisions.

Spokesmen for the firms that practiced this scheme tend to disregard the actual purpose that transmission schedules are supposed to serve. A list of 106 specific Fat Boys has been created by querying Enpower for transactions with Fat Boy mentioned in the comment field.[43] We know that the actual number of Fat Boy's was vastly larger.[44]

Deal 284185 on Janaury, 24, 2000 was booked by Casey Morris. His comment notation was "Fatboy deal with Glendale (profit sharing with $32 basis)."[45] This transaction, if implemented by the ISO, would have caused a 50 megawatt overgeneration at a Glendale load. In terms of scheduling, the ISO would have tied up transmission capacity to meet the fictitious load. In real time, the ISO would have had to enter the ex-post market to purchase a real time decrement the generation in the area.

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[43] DO4_107_Enpower_FatBoy_Trades.xls.

[44] Not only do we know that many schedules were submitted that exceeded loads by a substantial margin, we also have the explicit schedules from Powerex's exhibits to their May 23, 2002 Affidavit.

[45] DO4_107_Enpower_FatBoy_Trades.xls, line 15.

Obviously, the large Fat Boy schedules experienced across the California crisis would cause extreme operational adjustments to accommodate the imaginary flows and then to adjust in real time to the "disappearance" of the scheduled loads.

In November of 2002, Dr. Eric Hildebrandt of the ISO strongly disagreed that the ISO faced reliability implications from Fat Boys in his rebuttal to my comments before the California Select Committee to Investigate Price Manipulation of the Wholesale Energy Market.[46]

> However, overscheduling of load simply does not have any such impact on the ISO's assessment of operating reserves for the following reasons.
>
> > First, it should be noted that the ISO's determination of operating reserves and whether to declare a system emergency is based on a combination of (a) the ISO's short-term projection of system loads, (b) the difference between projected loads and scheduled generation (i.e. the projected demand for imbalance energy), and (c) the ISO's assessment of the generation and reserve capacity that will be made available to the IS0 by suppliers to meet system demand for energy and operating reserves.
>
> > Within this framework, any generation that is "overscheduled" (i.e. scheduled by an SC against demand not served by that same SC) simply has the effect of reducing the ISO's projected demand for imbalance energy that must be procured by the IS0 to meet real time load. Thus, generation that "overscheduled" is not hidden from the ISO, as McCullough assumes or suggests, and is instead directly factored into the ISO's decision about how much generation would be required to meet real time demand (or avert a system emergency).
>
> > Meanwhile, any "fictitious" load that is used to overschedule generation is in no way included in the ISO projection of system loads used in ISO's decision about how much generation would be required to meet real time demand (or avert a system emergency). Rather, the ISO projects short-term loads based on actual observed loads and trends, independent of the amount of load scheduled by Scs.
>
> > Thus, the net effect overscheduling is to increase the amount of generation scheduled to meet system loads, and thereby decrease the amount of additional generation that the IS0 projects will be needed to meet the anticipated demand in real time (or avert a system emergency).[47]

Dr. Hildebrandt's position does not seem completely consistent with other California ISO representatives. Both Terry Winter, the ISO's CEO, and Ziad Alwayan, Director of Operations have described the situation somewhat differently.

In Terry Winter's deposition, for example, he answers that

> When people over-schedule, I then am put in the position of trying to identify do they know something I did not know about the load?
>
> In other words, I can say it's 40,000, but let's say I had a qualifying facility that was generating 400

[46]Three Crisis Days at the California ISO, September 17, 2002.

[47]Did Any of Enron's Trading and Scheduling Practices Contribute to Outages in California?, Dr. Eric Hildebrandt, November 15, 2002, page 12.

> megawatts of load, and they're supposed to but they don't always tell us when they're going to take their units off, so now all of a sudden I've got a generator – or I've got a scheduling coordinator who I'm thinking should only buy 200 megawatts, but because, in fact, he's going to have this generator off he's going to buy 600, since he has 400 megawatts and generator and load that is there because the unit is off, so he submits 600 generation to meet that load.
>
> Then what you're asking me to do on over-scheduling is look at every possible combination of the people over-scheduling and say is this good or bad, and my answer to that is it's bad, tell me to the best of your knowledge what it is. Then I can schedule congestion, I can schedule units, I'm dealing with real numbers rather than inflated numbers.[48]

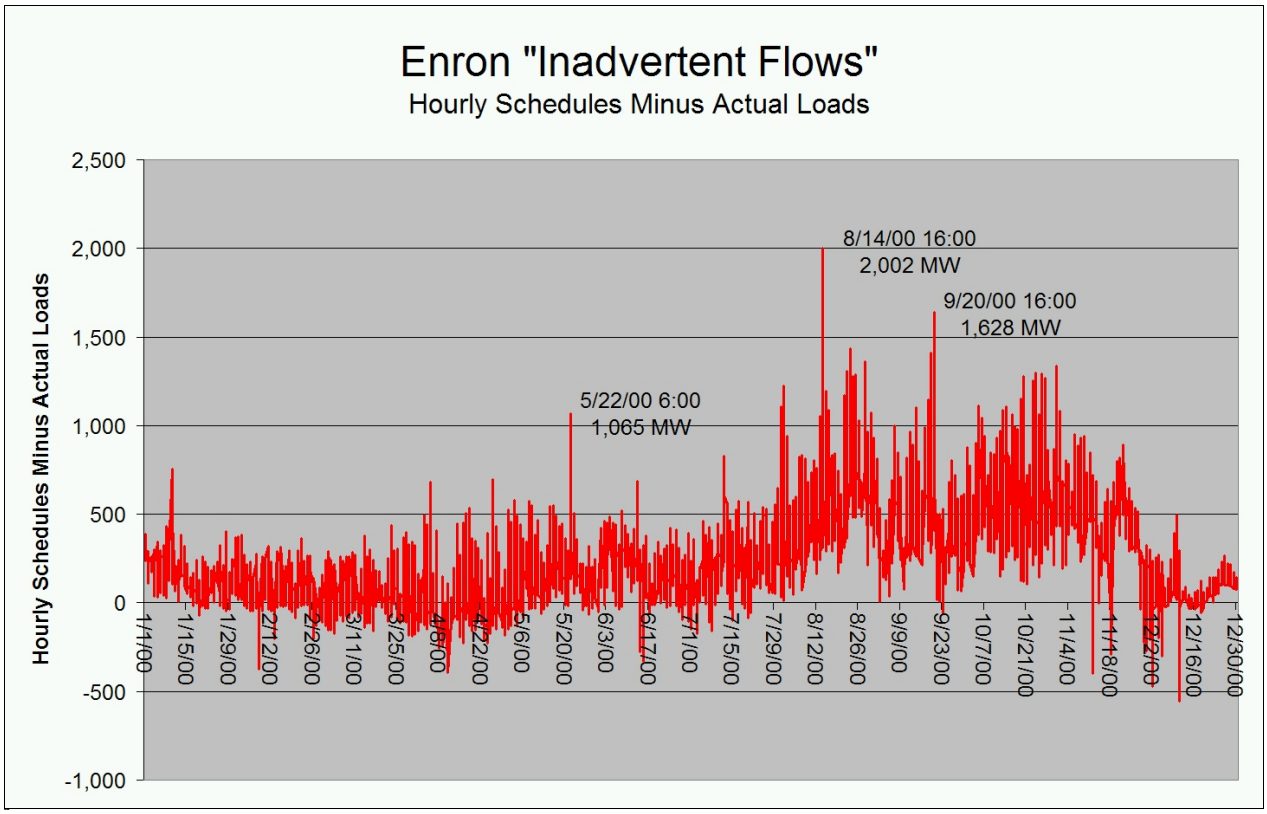
Ziad Alaywan's comments to the ISO board on October 4, 2000 puts the matter more succinctly:

- This under-scheduling which is inconsistent with
  - Operating practices in prudent control areas operations
  - Inconsistent with the design of the ISO Market, which relies on Real-time Imbalance market to protect against small load forecast errors and unforeseen system condition
- The facts are that operators are busy lining up the unscheduled energy, scheduling that energy and controlling the system at the same time[49]

The following chart shows the scale and volatility of Enron's "inadvertent flows." Clearly, fluctuations like these made the reliable operation of the transmission system more difficult.

[48]Terry A. Winter Deposition, February 23, 2003, pages 62-63.

[49]Operations Overview, Ziad Alaywan, October 4, 2000, page 3.



A secondary problem is the question of congestion pricing. Since the ISO is handling non-existent transmission schedules (more appropriately, actual schedules to non-existent loads), the calculation of the ISO's congestion pricing is very doubtful.[50]

Emergency Declarations

Dr. Hildebrandt's concerns appear more directed at whether Fat Boys could affect the declaration of system emergencies. In practice, the ISO's declaration of emergencies have never been well documented and we do not have evidence whether the ISO actually evaluated schedules for feasibility. There is some evidence, the telephone call from the ISO to Tim Belden during the Silver Peak incident, that the ISO did review outrageous schedules.[51]

The problem pertains to the use of inadvertent flows as a firm resource. As a matter of common

[50]We do not have sufficient data at this time to estimate the costs that schedules to fraudulent loads may have placed on the system. An examination of the schedules identified by FERC staff from Enpower does not indicate that internal California paths were significant for Fat Boys. This information is anecdotal, however, since the only schedules flagged were those with specific mentions of Fat Boys in the DL_comment field. Other Fat Boys, with Path 15 as part of the schedule, might simply not have had "Fat Boy" mentioned.

[51]On May 25, 1999, Tim Belden scheduled approximately 3,000 megawatts across the 17 MW Silver Peak line from Nevada to California. ISO staff called to verify if this was an error.

sense, Fat Boys are not a dependable resource:

1. The schedule is clearly infeasible;

2. It is impossible to tell whether the scheduler intends to fulfill the schedule or it is simply an error;

   and,

3. There is no penalty for changing the schedule.[52]

The final point is central to the question. The penalty for filing a Fat Boy is exposure to the ex-post price. Changing a Fat Boy back to the actual load releases the marketer from the penalty. The filer of a Fat Boy schedule is relieved of the penalty for not fulfilling the schedule.

If a marketer wanted to make sure that the ISO did not treat their Fat Boys as a firm schedule, they would simply return the schedule to the actual load (if there is one) on a frequent basis.

A secondary scheme where the flexibility of the Fat Boy schedule is used to pursue congestion adjustment payments from the ISO is suggested by Powerex's instructions to its traders concerning its Fat Boy arrangements with PGES.[53]

> The advantages of scheduling to load directly are:
>
> 1) We receive an ancillary services credit from the CISO for firm energy brought across the intertie up to the metered load amount.
> 2) We can over or under schedule to the load in the day ahead market to arbitrage the DA price against the hour ahead or expost market.
> 3) We can put adjustments on the interchange schedules by adjusting the load along with the interchange. For example this will allow us to alleviate congestion at NW1 in the hour ahead market by adjusting the load in NP15 and the COB interchange schedules down in the HA market or collect P15 congestion by adjusting the load in NP15 down and scheduling an export on NW3.

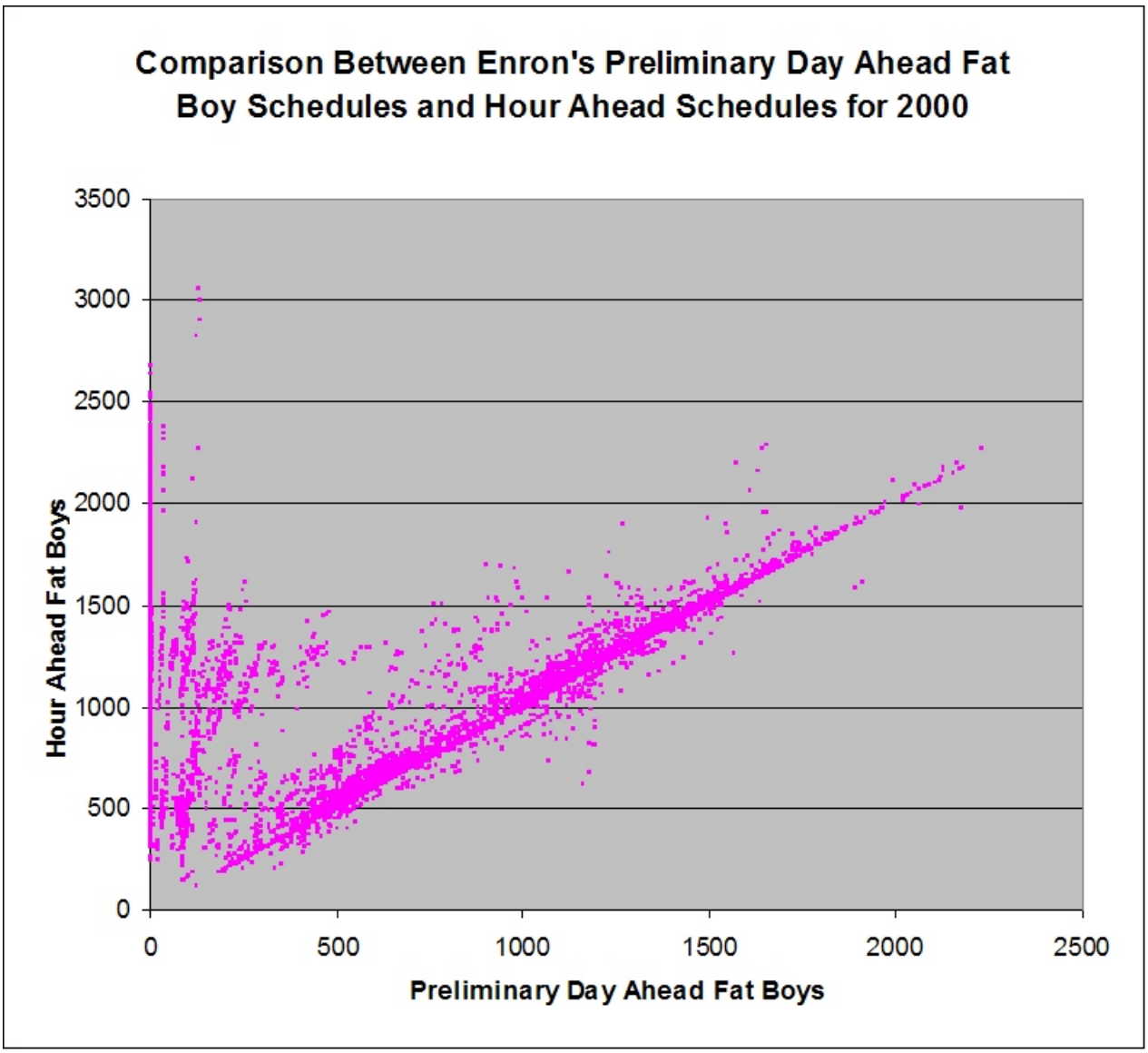
This set of instructions clearly did not expect that Fat Boy schedules would be a firm resource for the California ISO.

The ISO has yet to provide actual load data pertaining to Fat Boy schedules. Some evidence is provided by Enron's behavior over the period. Enron's Fat Boy schedules actually increased as the

[52]Email from Dr. Hildebrandt to Christian Schreiber, January 17, 2003.

[53]Thomas Bechard email attachment, February 3, 2000.

scheduling process proceeded. In the preliminary day ahead schedules, Enron averaged 545 MW. In the final day ahead schedule they averaged 987 MW and in the hourly schedules they provided 1,011 MW.



Clearly, forecasting Enron's actual behavior from their preliminary schedules may have been challenging. Logically, Enron would have a reason to keep this forecast as difficult as possible. The best situation in Enron's view would be to make the Fat Boy schedules attractive enough for the ISO to not forbid the practice, but unpredictable enough to make depending on Fat Boys for capacity difficult.

Conclusions

Unlike Enron's other schemes, Fat Boy is relatively easily traced through the complex PX and ISO structure and into the larger regional markets.

Fat Boy exploited a hole in the AB-1890 structure where energy was removed from the PX market and priced at the ISO ex-post market, without being treated as a supply in that market.

Belden's defense that Fat Boy was "fixing" problems in the PX market neither made sense operationally, nor would have been true even if the California IOUs had adopted a vertical demand curve.

The reliability impacts of Fat Boys are hard to judge. Different ISO officials apparently hold very different opinions about the impact of Fat Boys. Clearly, the capacity value of a fraudulent non-firm resource is minimal. Whether the ISO overlooked this problem is still unknown.