





Governance and Performance

Why RTO's Seem Less Reliable and More Expensive Than Utilities

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Managing Partner
McCullough Research
May 6, 2004



State of Energy Markets

January 1, 2002–June 30, 2003:
Staff Report to the Commission



January 22, 2004

Office of Market Oversight and Investigations
Federal Energy Regulatory Commission



Restructuring Today

Friday January 23 2004

FERC resolves 23 West Coast market gaming charges

Enron lost its market-pricing privilege.

Commissioner Joseph Kelliher agreed and reminded marketers that market-based rates are not a right but a privilege.

Charges were dropped against most but two were denied motions to dismiss the charges — Semptra Energy Trading because a settlement is pending and the Colorado River Commission of Nevada.

The latter body had told FERC it had no paper showing a partnership that was mentioned in the initial show-cause order.

The agency brushed that viewpoint aside.

Some litigants settled and FERC OK'd those agreements yesterday — American Electric Power (\$45,240), the City of Redding (\$6,300), Puget Sound Energy

(\$17,092), San Diego Gas & Electric (\$27,972) and Williams (\$45,230).

The agency's authority does not include penalty authority but it has the right to order the return of excess profits whatever that may be.

The commission's staff urged dismissal of show-cause orders on the grounds that it could not find enough evidence to show the 23 had gamed the market in 2000-2001, the California crisis period.

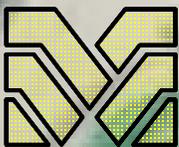
Charges were dropped against Constellation Power Source, El Paso Merchant Energy, Eugene Water & Electric Board, Idaho Power, Koch Energy Trading, MIECO and PPM Energy.

Another group included Arizona Public Service, Automated Power Exchange, BPA,

LADWP, the Power Exchange, Cargill-Alliant, municipal power firms of Anaheim, Azusa, (not Cucamonga) Pasadena and Riverside, PPL Energy, the Northern California Power Agency, Pacific Gas & Electric and its marketing affiliate PGE Energy Services, Public Service of Colorado, Public Service of New Mexico, Salt River Project, Sierra Pacific Power, Southern California Edison, TransAlta Energy Marketing, Tucson Electric Power and WAPA itself.

Chairman Wood was asked what he would say if California critics say the settlement is not enough considering the state's injury.

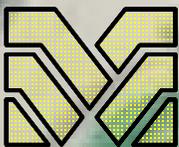
FERC's message, Wood replied, is that "we're doing the maximum we can do."



Governance and Performance

Why RTOs Appear Less Reliable and More Expensive Than Utilities

- Displacing performance based operations
- Monday's Stage 1 Emergency
- The Elusive Goal of Transparency
- What do we now know about "Black December"?
- ERCOT's power crisis of February and March 2003
- The August 14, 2003 Eastern Blackout
- How efficient are ISO markets?
- Lessons For the Future



Replacing Performance Based Operation With Rule Based Operations

- FERC's initiatives to replace open markets with centralized bureaucracies is shifting operations from performance to rules
- The lesson of the August blackout is that rules are a relatively poor approach to resource sufficiency and reliability planning
- Nine months later, the major questions -- why the blackout was cascaded across four RTDs even though transmission links were a very minor part of the resource portfolio
- Rapidly changing rules, high levels of secrecy, and lack of transparency are the major problems
- Vulnerability is provocative



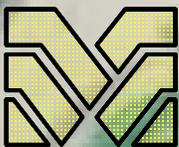
Belden's Approach To ISO Rules

From: Tim Belden/HOU/ECT
Sent: Monday, July 10, 2000 10:19 AM
To: Chris H Foster/HOU/ECT; Greg Wolfe/HOU/ECT; Stewart Rosman/HOU/ECT; John M Forney/HOU/ECT
Subject: Get Shorty

First, congratulations on earning so much money on shorting ancillary services last month. It is a beautiful thing. That is textbook Enron. Find a wierd part of the market, try a few things, a bag of money drops out. It is truly impressive.

Second, we need to ensure that proper controls are in place. It has come to my attention that we had some performance issues last week in terms of zeroing out the schedules. We have to get a handle on this. By the end of the week I would like a written procedure outlining a failproof procedure. As part of this procedure, I would like to see a daily log that illustrates what schedules we have in, who put them in, and who is accountable for zeroing them out.

Once again, amazing job on the A/S plays over the last few weeks. I don't mean to rain on your parade or place blame for past mistakes. But I am serious about getting this procedure ironed out and air tight. Once the procedure is ready let's have a meeting to discuss.

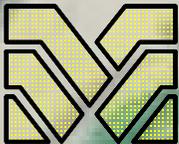


Tim's Later Conclusion

From: Tim Belden/HOU/ECT
Sent: Monday, August 28, 2000 12:36 PM
To: Greg Wolfe/HOU/ECT; Chris H Foster/HOU/ECT
Cc: John M Forney/HOU/ECT; Jeff Richter/HOU/ECT
Subject: Get Shorty Suspended

It has come to my attention that we failed to zero out a "Get Shorty" schedule on Friday. Fortunately, the real time desk was able to fill it. Kim Ward tried to zero it out and put in blanks rather than zeros which doesn't work. This highlights the need to clearly document exactly what is supposed to be done to implement these schedules. For several months I have asked for a written procedure on ancillary service schedules. Nobody has listened to me and mistakes keep happening. Such a mistake occurred in June and is now requiring a \$900k prior month adjustment. On top of that, the California Attorney General is in search of a smoking gun and is looking to find someone who is "gaming" the market. I don't want to provide them with any fuel for their fire.

I AM TEMPORARILY SUSPENDING ALL GET SHORTY ANCILLARY SERVICE ACTIVITY. When I see a written procedure that will be fail proof, and an airtight log that assigns accountability I will be happy to reinstate. The procedure needs to be thorough and thoughtful. The test will be whether someone who knows almost nothing about ISO scheduling can implement the procedure. This is long overdue. Chris or Greg, please let me know how you plan to proceed.



Central Structural Features of the Bureaucratic Authorities Are Protected By Layers of Obscurity

- Has anyone in this room seen the rules for the California ISO's Ex-Post market?
- Does anyone in this room know anyone who has seen these rules?
- Does anyone in this room know how to go about finding these out?



Monday's Stage One Emergency

FOR IMMEDIATE RELEASE
March 29, 2004

Contact: Stephanie McCorkle
Director of Communications
1 (888) 516-NEWS

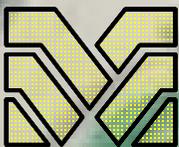
Southern California Heat Wave Sparks Stage One Emergency

California ISO calls for conservation

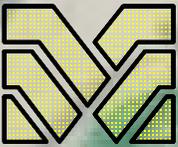
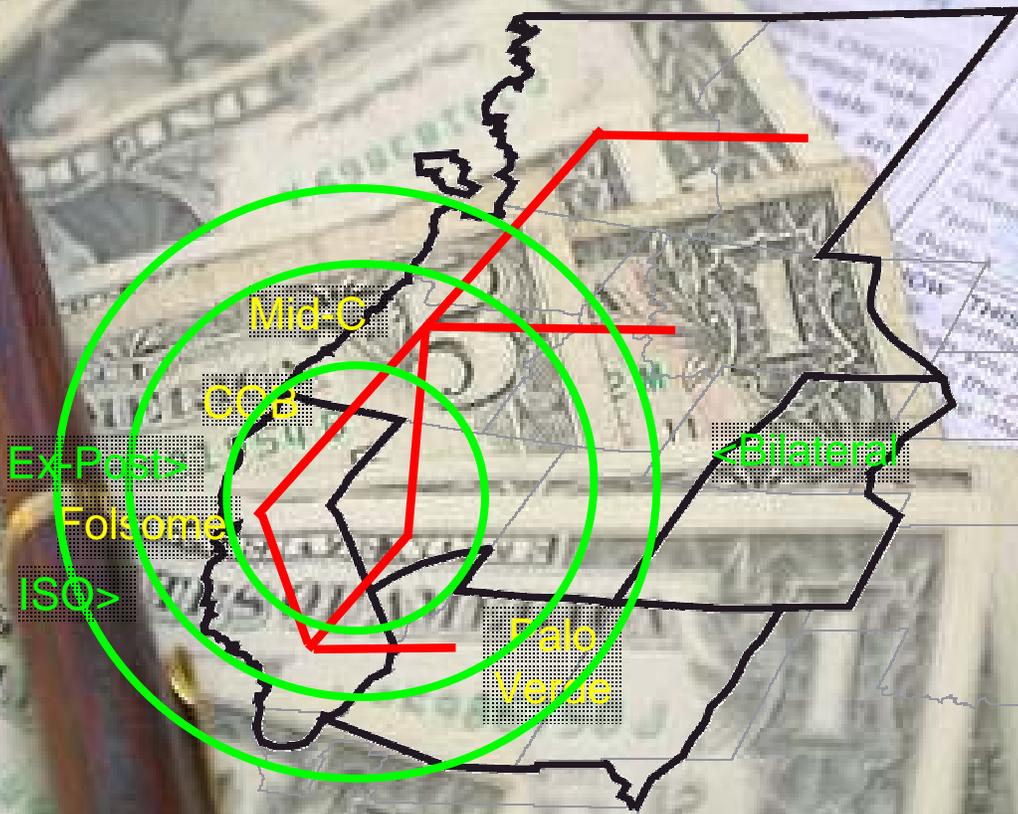
(Folsom, CA) Hot temperatures in Southern California are driving the demand for electricity to unusually high levels for this early in the year, necessitating a Stage One Electrical Emergency today at 1:50 p.m. The Stage One gives the ISO additional authority to require power plants and transmission owners to respond to ISO instructions.

"Temperatures are running about 10 degrees above forecast in Southern California," said Jim Detmers, Vice President for Operations at the California ISO. "We also had 770 megawatts of power plants trip out of service this morning. When outages coincide with high loads, we can quickly run out of options. The Stage One Emergency declaration gives us some more alternatives to draw from."

The general public can help out by avoiding the use of heavy electrical appliances and keeping the thermostat no lower than 78 degrees between the hours of 2:00 and 6:00 p.m. today.

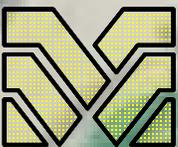


WECC Markets



Peeling the Artichoke

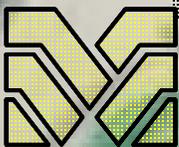
- 75% of the electricity in the WECC is self-generated or transacted on a bilateral basis
- 25% of the electricity is transacted or generated subject to California ISO rules and direction
- 3% of total electricity (estimated, of course, since this is an ISO secret) is transacted in real time on the Ex-Post market
- To quote one trader during the March 2003 ERCOT market manipulations, "why would I answer the phone when I can sell it to real time?"
- Bottom line, lack of oversight and transparency make high value in administered markets a common event.



Traditional load/resource balance

State of the WECC Interconnected Bulk Power System Through 2012

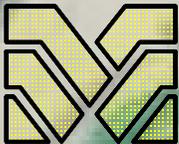
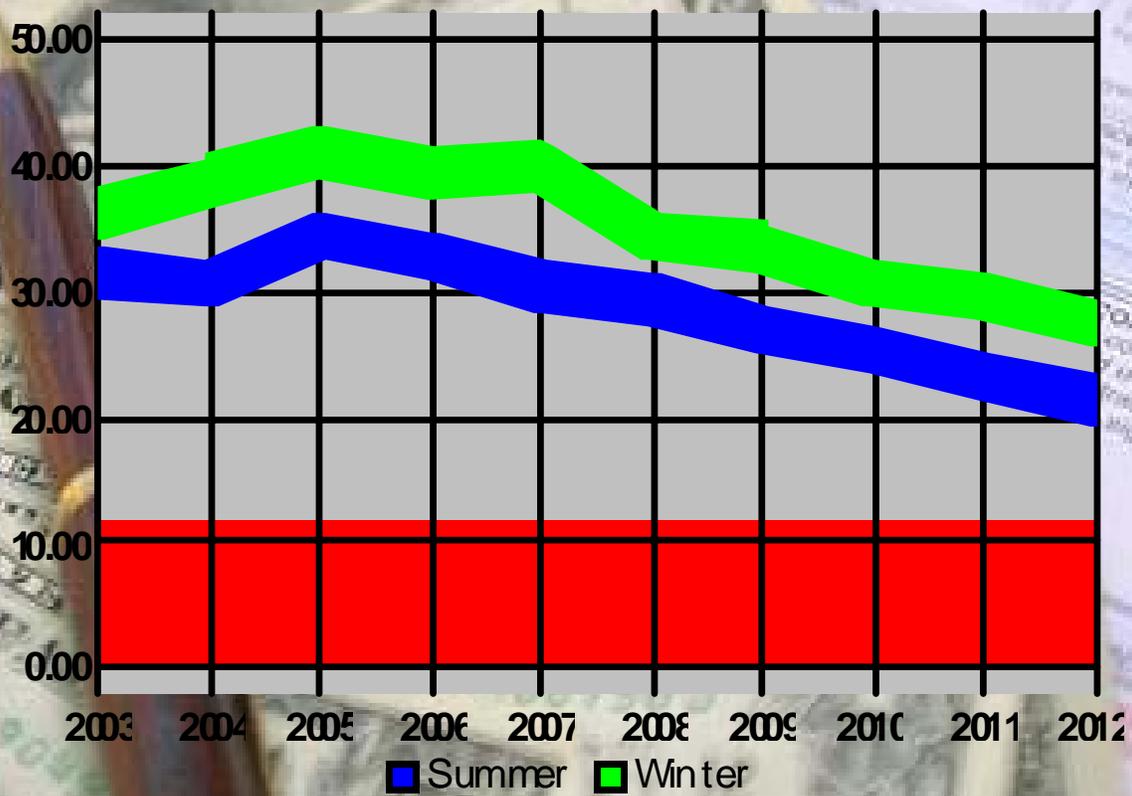
Despite a dramatic decrease in proposed new generation during the past year, generating capacity in the region is expected to be adequate to reliably supply the forecast firm peak demand and energy requirements throughout the assessment period. Transmission capacity is expected to be adequate to supply firm customer demand and firm transmission transactions. Plans have been announced for the construction of 4,319 miles of 230 kV, 345 kV and 500 kV transmission during the 2003-2012 period.



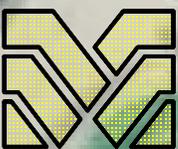
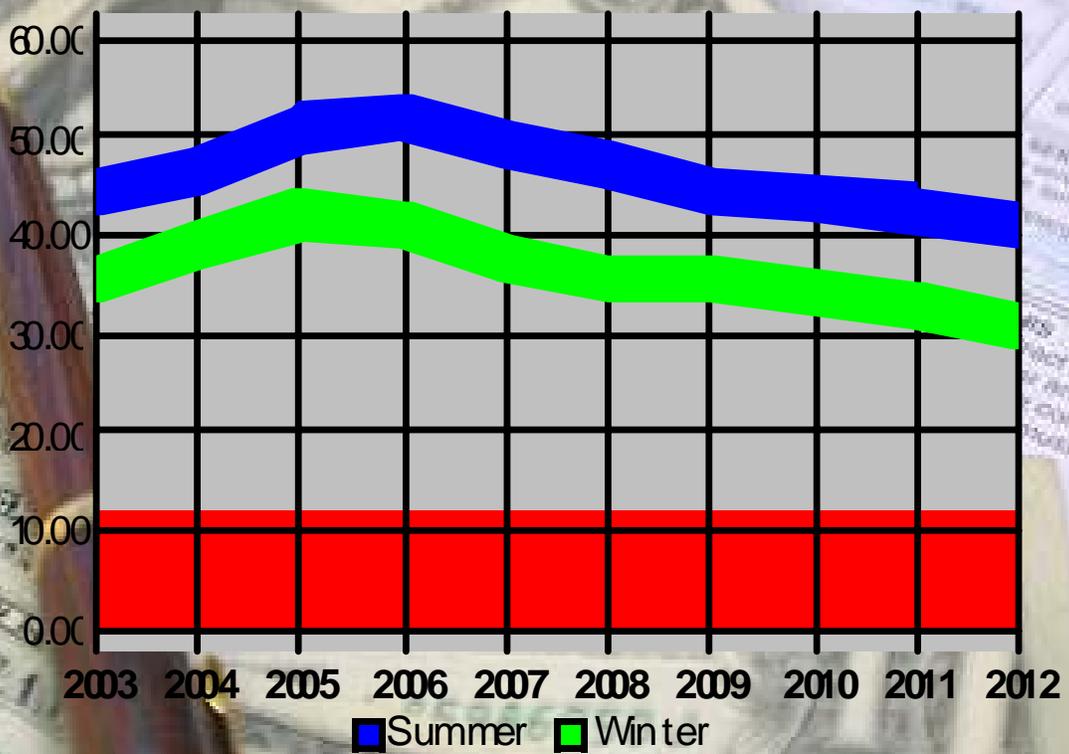
**Western Electricity Coordinating Council
10-Year Coordinated Plan Summary
December 2003**



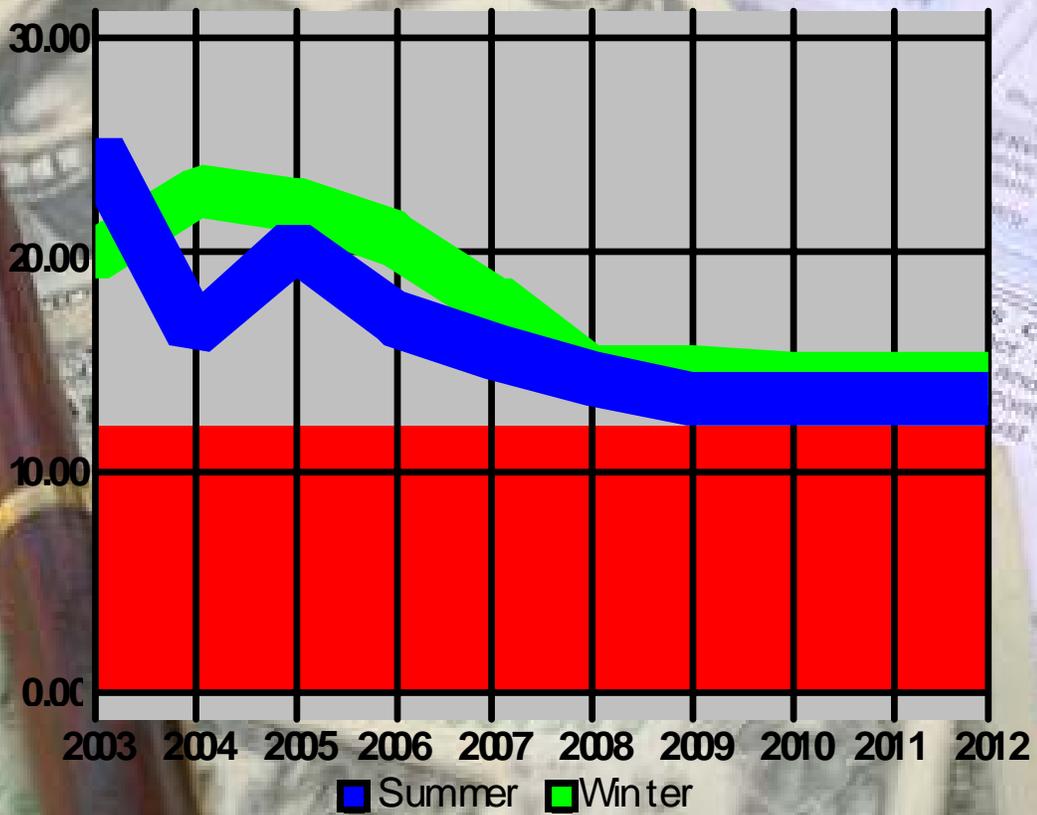
WECC Reserve Margins



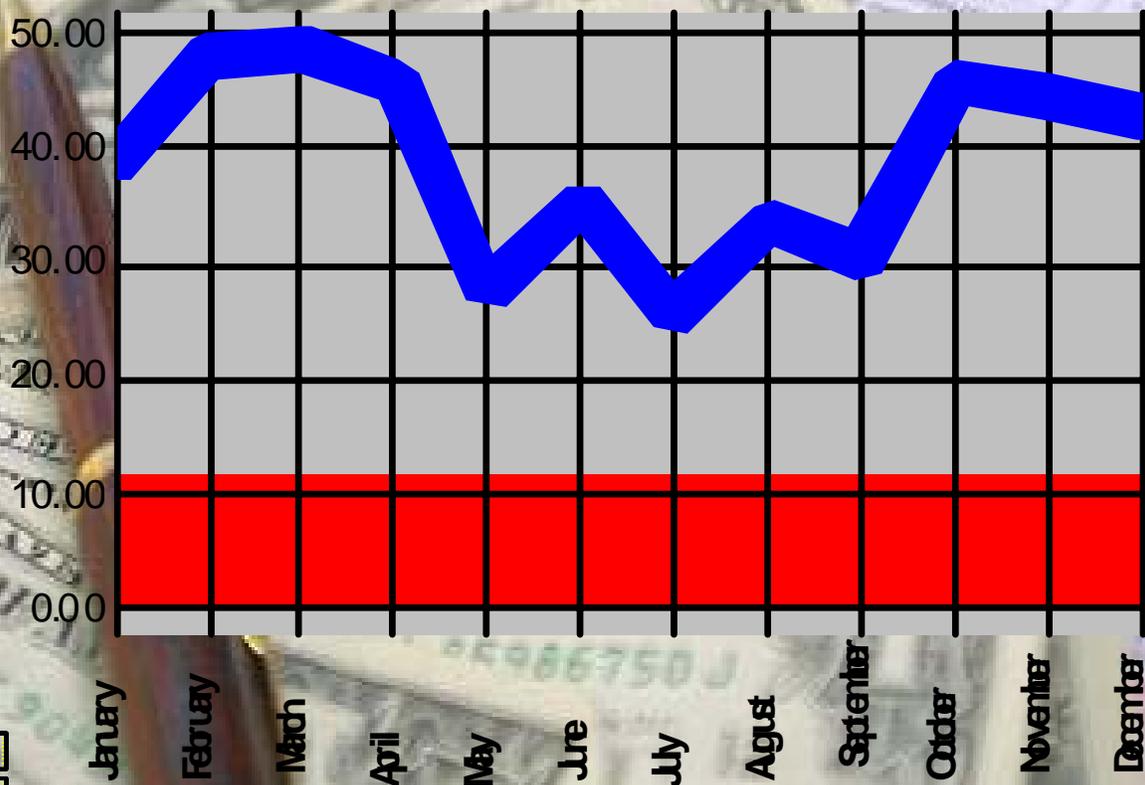
Pacific Northwest Reserve Margin



California Reserve Margins



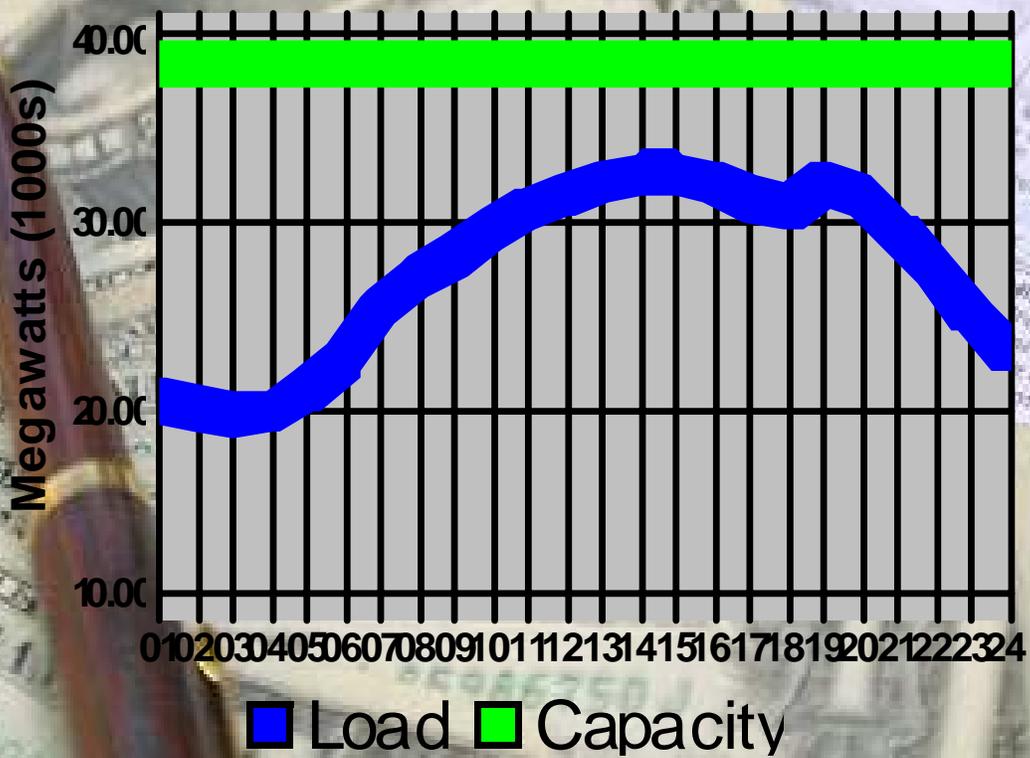
California Reserve Margins During 2002



Caution: Secret Within California ISO



So What Happened On Monday?



WECC Daily Report

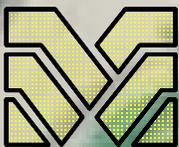
Other Comments: None

Yesterday/Weekend/Holiday Notable Events: At 1124 PST on Monday March 29, 2004 the CAISO declared a Restricted Maintenance Operation due to higher than anticipated temperatures and load. At 1224 the CAISO issued a System Warning due to the high temperatures and load and a loss of resources south of Path 15. At 1350 the CAISO declared a Stage 1 emergency due to an imminent deficiency in Operating Reserves. At 2000 the CAISO terminated the Stage 1 emergency, System Warning and Restricted Maintenance Operation. Stage 2 emergency was not reached and no load was interrupted.

Yesterday's Non-simultaneous Peaks, Reserves, and Generation Limitations at time of Peak

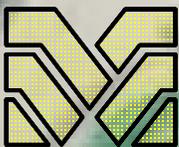
| Area | Peak Demand | Actual Reserves | Req. Reserves | Gen. Outages/Limitations |
|--------------|-------------|-----------------|---------------|--------------------------|
| Northwest SC | 42,375 | 20.5% 8,684 | 2,966 | 5,948 |
| RM/DSW RC | 21,922 | 19.4% 4,245 | 1,481 | 2,743 |
| Calif./MX RC | 40,314 | 9.1% 3,685 | 2,754 | 13,748 |

¹ Required reserves calculated to be 7% of peak demand.



December 2003 WECC Ten Year Report

| Month | WINTER PEAK | | | | | Adverse Hydro Conditions | | | | |
|--------------------------------|-------------|-------|-------|-------|-------|--------------------------|-------|-------|-------|-------|
| | 03-04 | 04-05 | 05-06 | 06-07 | 07-08 | 08-09 | 09-10 | 10-11 | 11-12 | 12-13 |
| | JAN | JAN | JAN | JAN | JAN | JAN | JAN | JAN | JAN | JAN |
| Loads - Firm | 42017 | 42940 | 43881 | 44843 | 45828 | 46818 | 47817 | 48826 | 49856 | 50921 |
| Int. & Load Mgt | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total - MW | 42017 | 42940 | 43881 | 44843 | 45828 | 46818 | 47817 | 48826 | 49856 | 50921 |
| Growth from Previous Yr. - % | 6.5 | 2.2 | 2.2 | 2.2 | 2.2 | 2.2 | 2.1 | 2.1 | 2.1 | 2.1 |
| Generation ± Transfers - MW | 60787 | 61941 | 62954 | 63475 | 63526 | 64302 | 64170 | 66571 | 66503 | 67820 |
| Maint./Inoperable Cap. - MW | 10446 | 9178 | 9314 | 9342 | 9516 | 10688 | 9437 | 10720 | 9493 | 9613 |
| Reserve Capability MW | 8324 | 9823 | 9759 | 9290 | 8182 | 6796 | 6916 | 7025 | 7154 | 7286 |
| Percent of Firm Peak Demand | 19.8 | 22.9 | 22.2 | 20.7 | 17.9 | 14.5 | 14.5 | 14.4 | 14.3 | 14.3 |



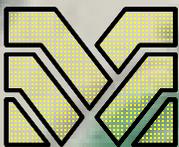
So What Really Happened?

- The ISO did not receive sufficient bids for reserves
- ISO rules required them to "invent" an emergency to go outside of their market
- Savvy market participants received a small windfall
- The extent of the windfall is (of course) secret!



Vanishing Transparency

- On an annual basis, each of NERC's reliability councils publishes a ten year appreciation
- Spokesmen for market manipulators often disparage these reports. Bill Hogan, for example, simply ignores these reports in his frequent efforts to convince policy makers that the WECC was short on resources in 2000 and 2001
- Simultaneously, a massive lobbying effort is underway to remove these reports from the public and restrict them to market participants -- in ERCOT these are no longer available to the public
- There is a certain irony in the argument that reporting on resource adequacy is of so little importance that it should be discontinued and so important that it should be made confidential
- The central theme is to remove critical market data from the public view



How Do Real Time Markets Work?

- Actual mechanics are secret from non-participants
- In ERCOT, even market participants are often excluded -- no clear rule has been offered to explain why
- And, of course, everything is secret at the California ISO



What about "price signals"?

- Ah, price signals
- Even Tim Belden described ISO market calculations as a "black box"
- This is all the more surprising since Enron received preferential ISO briefings concerning market operations and mechanics
- The innermost heart of the onion is an enigma cloaked in secrecy
- Actual real time market mechanics are only available to politically adept market participants as a general rule



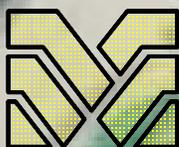
"Black December"

- Three years ago I addressed this group with the report that we could no longer find any correlation between actual data and California events
- At the time we focussed on simple fundamentals
 - Congested lines during an energy shortage
 - Massive forced and planned outages at industry standard plants
 - Incorrect ISO reports
- At the time I said, "I hope this is fraud, because if it is real, our entire planning methodology is totally flawed"
- As it happens, I called this one correctly – the facts were right and the reports were wrong



What do we know now?

- In early December, ISO management made a secret filing with FERC to eliminate price controls without board approval or public notice
- Simultaneously Kellan Fluckiger directly applied to Tim Belden – Enron's West Coast trader for a job
- At the end of the month the ISO secretly congested their own lines out of the state, effectively cancelling Pacific Northwest seasonal and energy/capacity exchanges – only Enron was briefed on this bizarre undertaking
- Evidence presented during the "100 Days Proceeding" at FERC indicates that the ISO knew about many of the Enron schemes during the California crisis



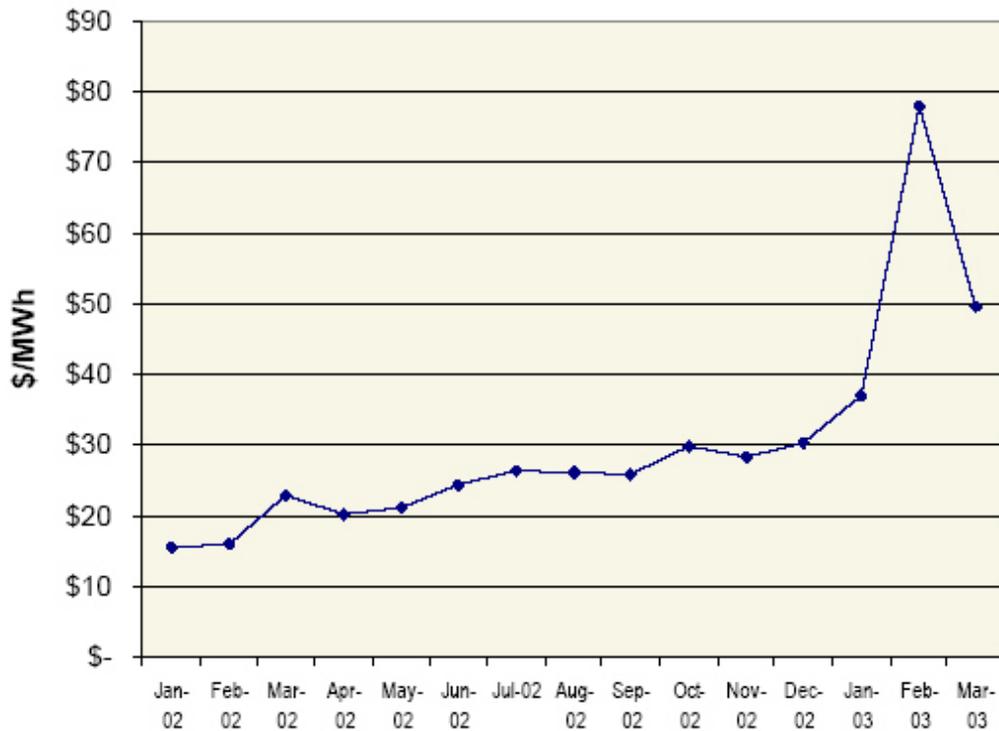
ERCOT's 2003 Reliability Crisis

- In February and March last year, ERCOT (spelled Texas by lay folk) experienced a shortage of real time energy
- We now know that the crisis reflected a change in the rules called "relaxed balancing" that allowed major players in the Texas market to manipulate ERCOT's real time market
- The rules were changed almost immediately after the price soared from \$30/MWh to \$990.01/MWh during an off-peak month
- Texas rules are kinder and gentler than California's -- secrecy is less pervasive



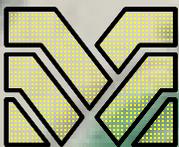
Average ERCOT Real Time Prices

Monthly BES Up Price

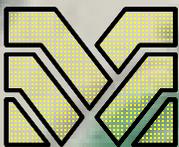
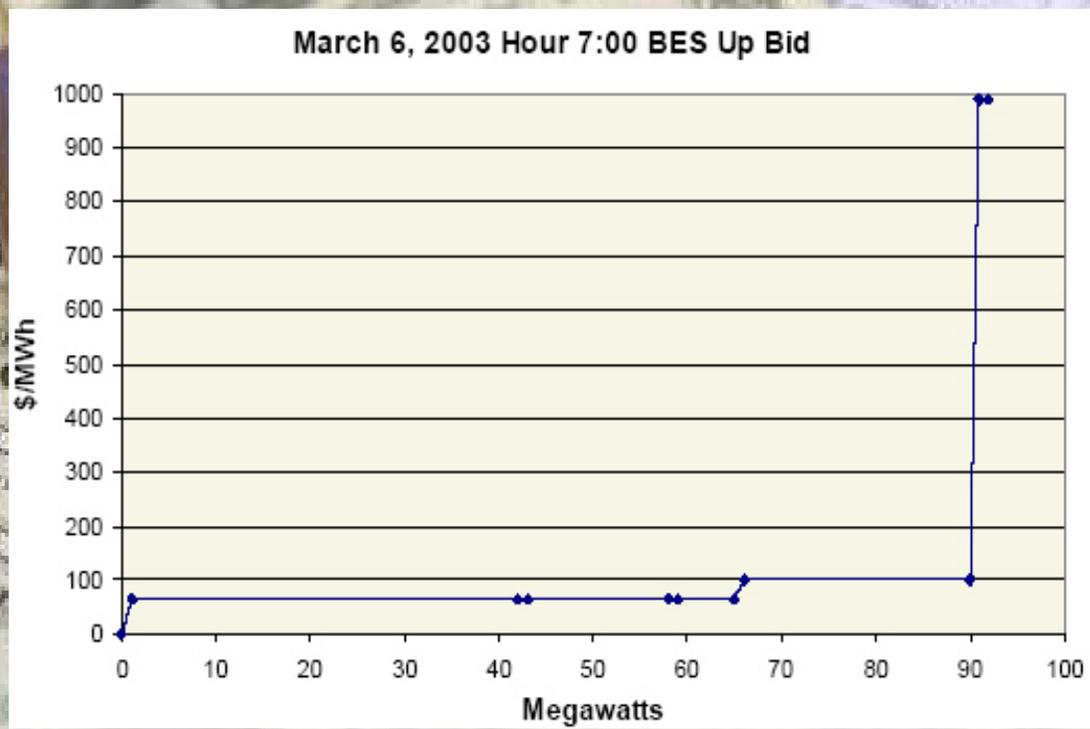


Mr. \$990.01

- In ERCOT, an RTO generally regarded as a success, real time prices have frequently been set at \$990.01/MWh
- The identity of the market participant who sets this unusual "signature bid" is a tightly kept secret
- While Mr. \$990.01 has been active for almost two years, his actual market presence is miniscule -- about 60 megawatts -- even though he is one of the most influential market operators in North America
- Mr. \$990.01's significance is based on his knowledge of the computer computations under ERCOT's real time (BES) market
- ERCOT finally began to adjust their market rules in June after Mr. \$990.01 raised real time prices to \$990.01/MWh on a number of occasions -- bankrupting a number of market participants
- Use of such signature bids was one of the topics recorded in Mary Hain's infamous notes during the meetings that led to the Yoder/Hall "Death Star" memo



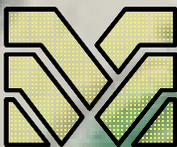
Mr. \$990.01's Signature Bid



Texas Reserve Margins

TABLE 3: ESTIMATED 2002/2003 WINTER RESOURCES AND DEMANDS (MW) AND MARGINS (%)

| | December | | | | January | | | | February | | | |
|----------------------------|----------------|----------------|-------------|-------------|----------------|----------------|-------------|-------------|----------------|----------------|-------------|-------------|
| | Available | Net | Available | Available | Available | Net | Available | Available | Available | Net | Available | Available |
| | Resource | Internal | Capacity | Reserve | Resource | Internal | Capacity | Reserve | Resource | Internal | Capacity | Reserve |
| | s | Demand | Margin | Margin | s | Demand | Margin | Margin | s | Demand | Margin | Margin |
| (MW) | (MW) | (%) | (%) | (MW) | (MW) | (%) | (%) | (MW) | (MW) | (%) | (%) | |
| United States | | | | | | | | | | | | |
| ECAR ³ | 118,884 | 81,868 | 31.3 | 45.6 | 121,749 | 84,394 | 30.7 | 44.3 | 118,215 | 81,417 | 31.1 | 45.2 |
| EROT | 73,849 | 41,097 | 44.3 | 79.7 | 74,588 | 43,725 | 41.4 | 70.6 | 74,588 | 37,183 | 50.1 | 100.6 |
| FRCC | 46,889 | 32,924 | 29.8 | 42.4 | 49,166 | 39,565 | 19.5 | 24.3 | 49,166 | 34,188 | 30.5 | 43.8 |
| MAAC | 65,495 | 41,859 | 36.1 | 56.5 | 66,345 | 44,015 | 33.7 | 50.7 | 66,345 | 42,082 | 36.6 | 57.7 |
| MAN | 69,162 | 38,595 | 44.2 | 79.2 | 68,405 | 39,066 | 42.9 | 75.1 | 67,727 | 37,095 | 45.2 | 82.6 |
| MAPP | 32,330 | 22,579 | 30.2 | 43.2 | 32,067 | 22,926 | 28.5 | 39.9 | 32,319 | 21,692 | 32.9 | 49.0 |
| NPOC | <u>60,852</u> | <u>45,540</u> | <u>25.2</u> | <u>33.6</u> | <u>61,136</u> | <u>46,310</u> | <u>24.3</u> | <u>32.0</u> | <u>61,981</u> | <u>45,230</u> | <u>27.0</u> | <u>37.0</u> |
| New York | 29,619 | 24,550 | 17.1 | 20.6 | 29,619 | 24,550 | 17.1 | 20.6 | 29,619 | 24,550 | 17.1 | 20.6 |
| NEPOOL | 31,233 | 20,990 | 32.8 | 48.8 | 31,517 | 21,760 | 31.0 | 44.8 | 32,352 | 20,680 | 36.1 | 56.5 |
| SERC ^{6,7} | <u>167,327</u> | <u>122,302</u> | <u>26.9</u> | <u>36.8</u> | <u>168,916</u> | <u>131,161</u> | <u>22.4</u> | <u>28.8</u> | <u>168,576</u> | <u>126,139</u> | <u>25.2</u> | <u>33.6</u> |
| Entergy | 29,023 | 20,004 | 31.1 | 45.1 | 29,023 | 18,924 | 34.8 | 53.4 | 29,023 | 18,443 | 36.5 | 57.4 |
| Southern | 42,101 | 30,777 | 26.9 | 36.8 | 43,815 | 34,413 | 21.5 | 27.3 | 44,024 | 32,715 | 25.7 | 34.6 |
| TVA | 31,346 | 25,001 | 20.2 | 25.4 | 31,610 | 26,998 | 14.6 | 17.1 | 31,611 | 25,824 | 18.3 | 22.4 |
| VACAR | 64,384 | 46,520 | 27.7 | 38.4 | 63,859 | 50,826 | 20.4 | 25.6 | 63,309 | 49,157 | 22.4 | 22.8 |
| SPP | 46,935 | 28,290 | 39.7 | 65.9 | 46,935 | 28,611 | 39.0 | 64.0 | 46,935 | 27,346 | 41.7 | 71.6 |
| WECC ⁶ | <u>131,794</u> | <u>98,965</u> | <u>26.4</u> | <u>35.9</u> | <u>131,067</u> | <u>97,143</u> | <u>25.9</u> | <u>34.9</u> | <u>127,858</u> | <u>91,805</u> | <u>28.2</u> | <u>39.3</u> |
| NMPP | 47,539 | 35,026 | 26.3 | 35.7 | 48,096 | 34,816 | 27.6 | 38.1 | 47,862 | 31,790 | 33.6 | 50.6 |
| RMPPA | 10,780 | 8,495 | 21.2 | 26.9 | 10,722 | 8,279 | 22.8 | 29.5 | 10,652 | 8,198 | 23.0 | 29.9 |
| AZ-NM-SNV | 23,691 | 16,421 | 30.7 | 44.3 | 22,846 | 16,747 | 26.7 | 36.4 | 21,898 | 15,684 | 28.4 | 39.6 |
| CA-MK | 49,784 | 37,023 | 25.6 | 34.5 | 49,403 | 37,301 | 24.5 | 32.4 | 47,446 | 36,133 | 23.8 | 31.3 |
| Total-United States | 813,044 | 551,819 | 32.1 | 47.3 | 819,765 | 576,906 | 29.6 | 42.1 | 813,101 | 545,177 | 33.0 | 49.1 |



TXU Traders Planning the Shortage

Jim Dunkin: *"I'd still go the same strategy tomorrow of having plenty on, but cut the load."*

Tim Drennan: "Hey, cut -- cut the load, go short, but just hold the price below 100 bucks.

Jim Dunkin: "Yeah, hold the price below 100 bucks. But I wouldn't roll a hundred bucks until I got the CT."

Tim Drennan: "Exactly. That's what I've done. I've got -- I've got -- here is my bid stack right now; 47 bucks, 52, 54, 59. And then I break -- that -- that -- I've got 18 -- well, I had 18. I'm revising it right now, but this is this morning, too. I had 1800 bid in there. And then the -- the remaining 1200, it broke over -- for that 1801 megawatt, it broke over to 250, 270, 290."

Jim Dunkin: "Okay."

Tim Drennan: "And that's what we did this morning. And what we'll do is we'll just -- we'll pull those prices back and keep it under 100, and I'll pass that on to Chad. And we're going to be fine."



A Little Customer Respect

TXU Trader 2: "Did I put Caller ID on that or something?"

Tim Drennan: "No. Well, you do. You've got Caller I.D. I just didn't know who it was. I knew it was a 972 prefix, so I just -- I wanted to make sure it wasn't somebody local here, Garland or somebody like that trying to call me. Oh, City of Garland calls me all the time."

TXU Trader 2: "For what?"

Tim Drennan: "They got a little power plant out there. I think they've got 250, 300 megs. And if they're short, you know, they buy it from me sometimes."

TXU Trader 2: "Is that right?"

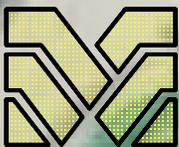
Tim Drennan: "When I -- when I bend them over the bench and give it to them."

(Laughter)

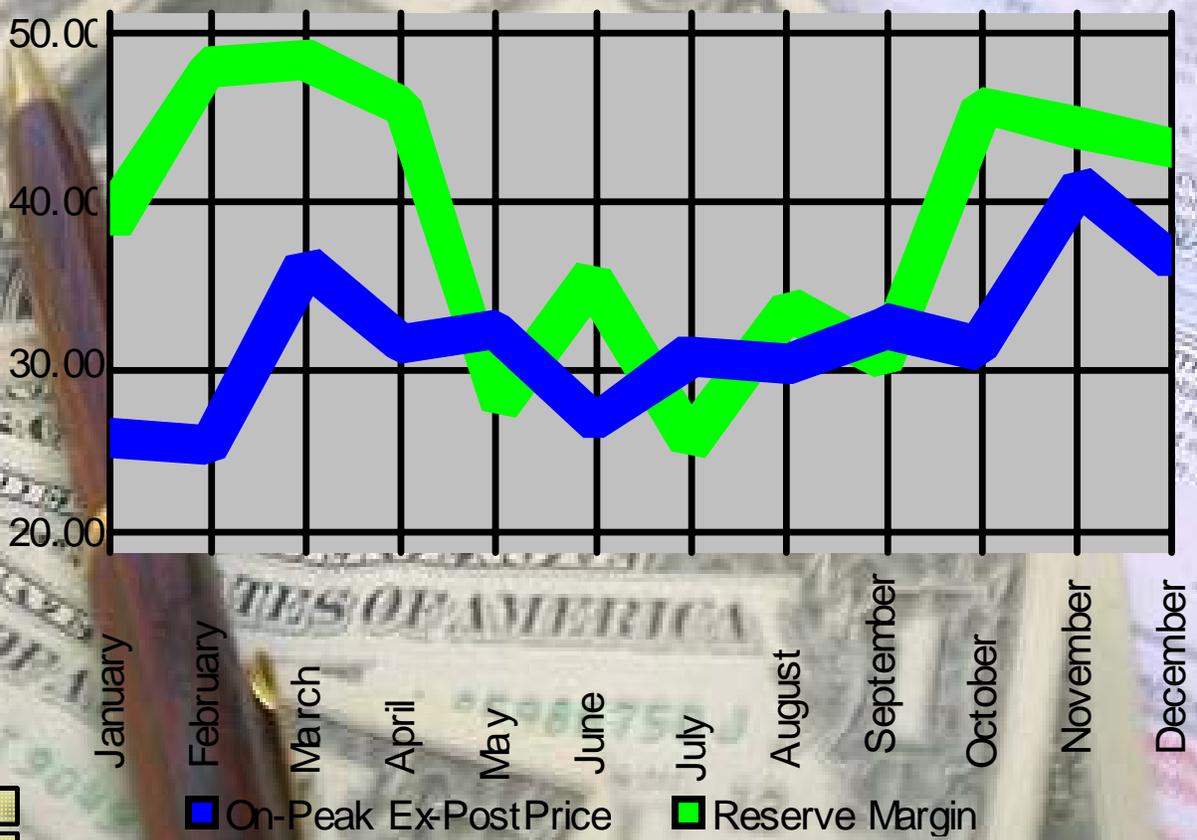


How Efficient Is The California Real Time Market

- The Ex-Post market provides energy to the California ISO every ten minutes
- Enron shipped thousands of megawatts from Northwest markets to California during the California crisis using a poorly understood scheme called "Fat Boy"
- This was the most significant of the Enron schemes since Fat Boy energy received the Ex-Post price was not counted as a supply in the Ex-Post market
- As far as I know, no one has ever checked to see if this market is a good deal



2002 On-Peak Ex-Post Prices



This leads to many questions

- Why were prices so high?
- Why were they high when reserve margins were good?
- What was the rate of return for assets committed to the Ex-Post market?
- The first two questions have no answers. The third is very simple.



How much money did a peaker make in the California Ex-Post market in 2002?

- A peaker with a 10,000 mmBtu/kWh heat rate would have been dispatched 2,848 hours -- approximately 35% of the time
- Capital costs for a peaker would have been \$63,000/MW
- Profits would have been \$36,574 -- a rate of return of 58%

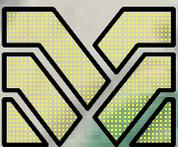
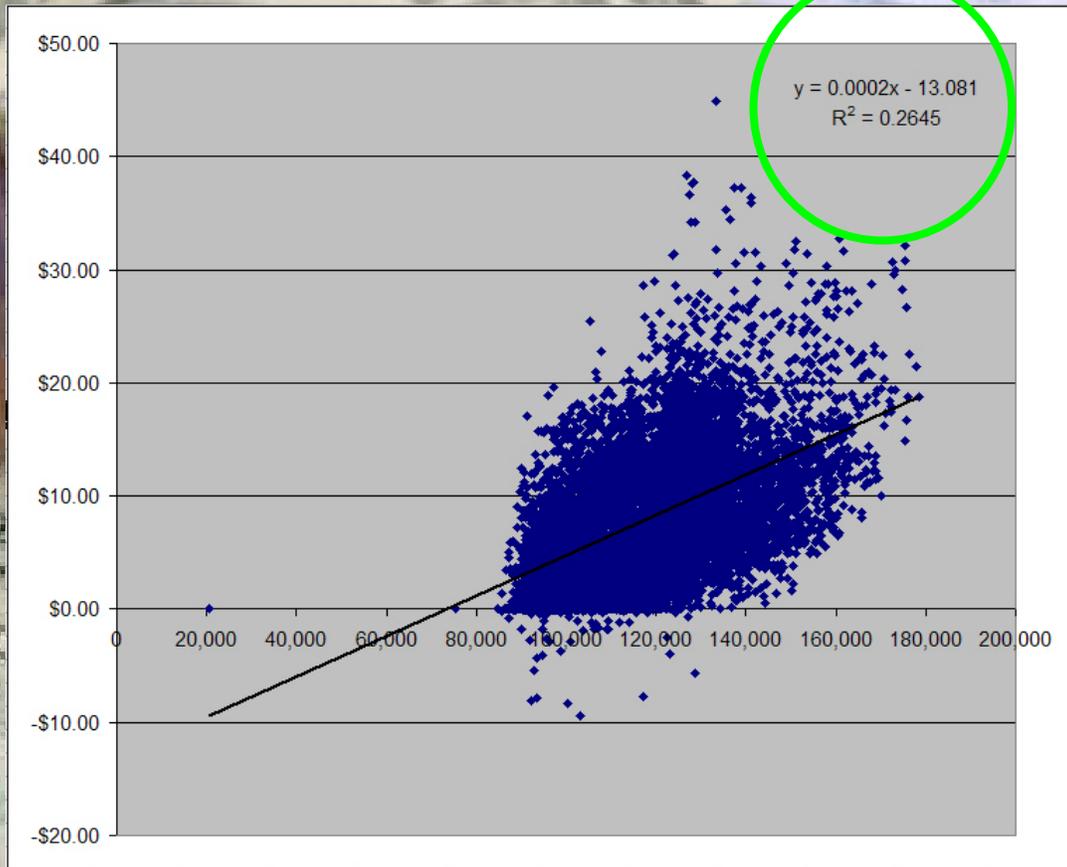


How much money did a Frame 7 make in the California Ex-Post market in 2002?

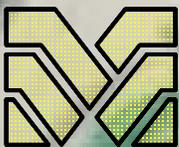
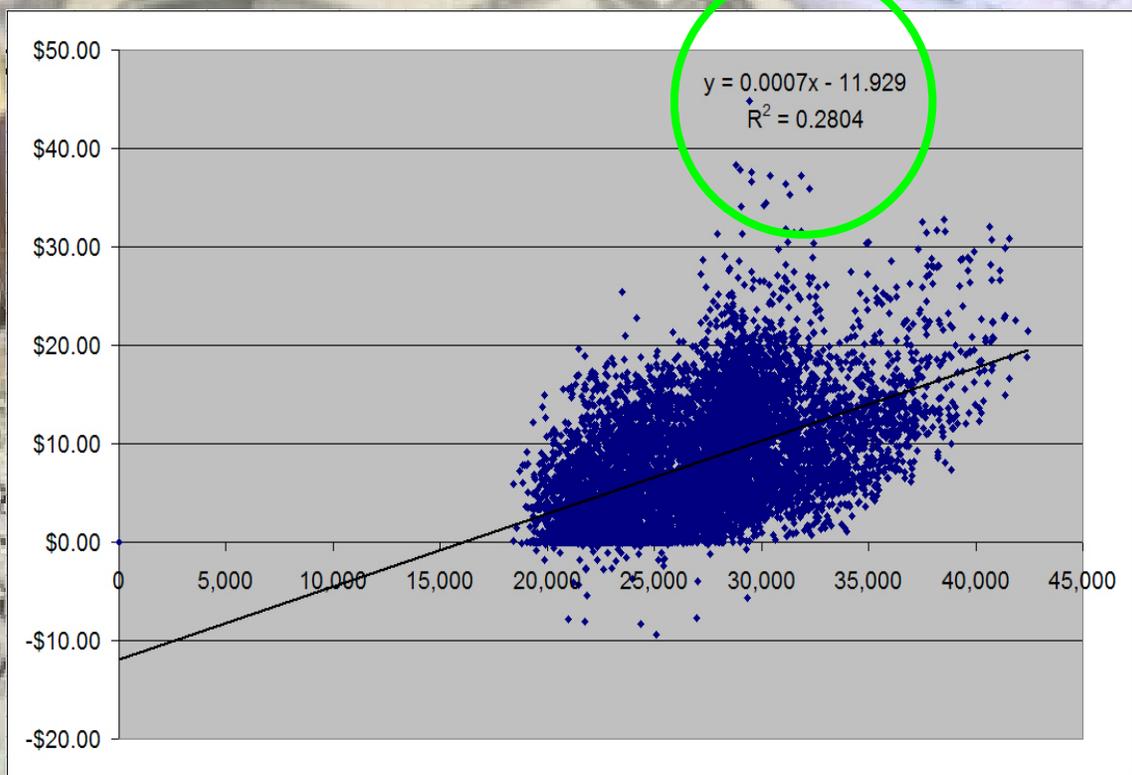
- A Frame 7 with a 7,000 mmBtu/kWh heat rate would have been dispatched 4,180 hours -- approximately 65% of the time.
- Capital costs for a peaker would have been \$108,000/MW.
- Profits would have been \$70,905 -- a rate of return of 65%.



Loads and Prices in the WECC

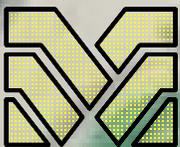


Loads and Prices at the ISO



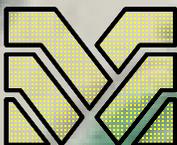
August's Blackout

- On 6.30 P.M. on Thursday, August 14, cascading failures occurred across the RTOs in the Midwest, PJM, New York, New England, and Ontario
- The traditional system serving Quebec was not, nor were a variety of pockets within the RTOs
- Although an august committee has studied the issue extensively, almost no attention was directed to the role of the RTOs themselves

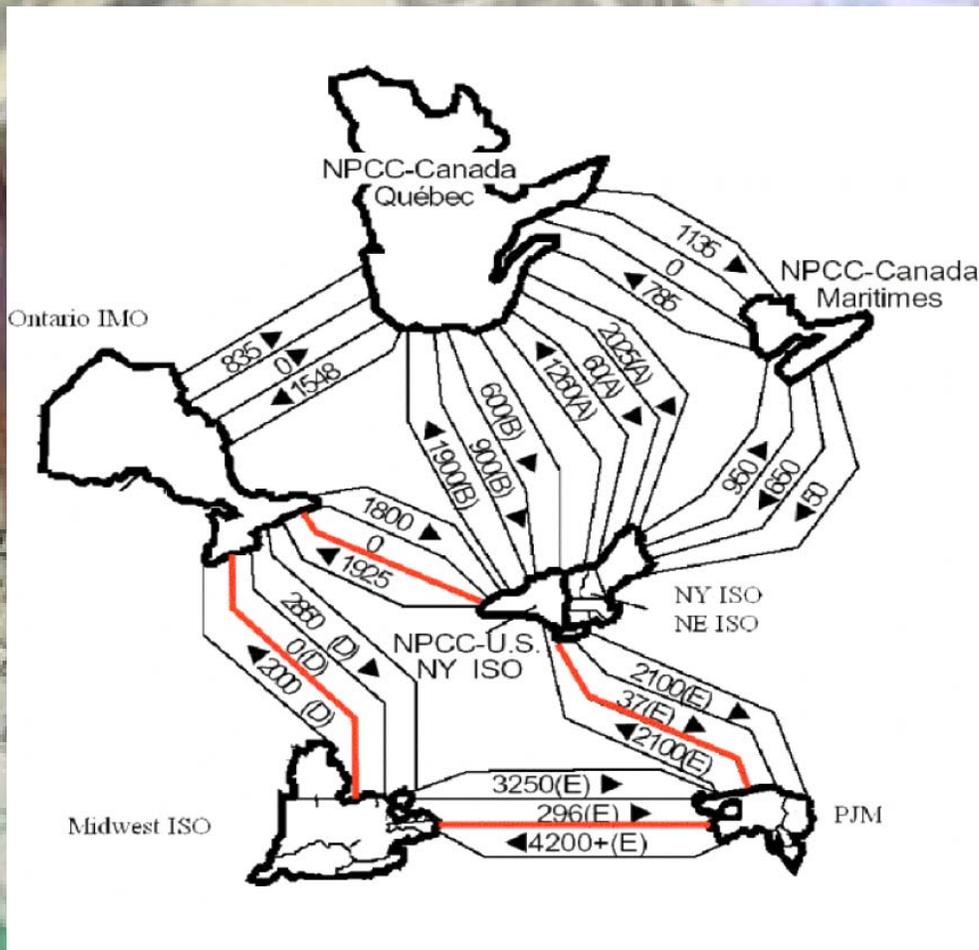


Reserves in New England

| | August | | | | August 14, 2003 4:00 P.M. | | |
|-------------------------|-------------------|--------------|---------------------------|--------------------------|---------------------------|---------------------------|--------------------------|
| | Resources (MW) | Load (MW) | Capacity Margin (%) | Reserve Margin (%) | Load (MW) | Capacity Margin (%) | Reserve Margin (%) |
| ECAR (Eastern Mid-west) | 125,786 | 97,046 | 22.8% | 29.6% | | | |
| ERCOT (Texas) | 77,563 | 56,945 | 26.6% | 36.2% | | | |
| FRCC (Florida) | 46,459 | 38,823 | 16.4% | 19.7% | | | |
| MAAC | 65,308 | 53,337 | 18.3% | 22.4% | | | |
| MAIN (Illinois) | 63,136 | 53,544 | 15.2% | 17.9% | | | |
| MAPP | 34,755 | 27,885 | 19.8% | 24.6% | | | |
| NPCC (NY and NE) | 69,465 | 56,550 | 18.6% | 22.8% | | | |
| NYISO | 37,756 | 31,430 | 16.8% | 20.1% | 28,709 | 24.0% | 31.5% |
| ISO NE | 31,709 | 25,120 | 20.8% | 26.2% | 23,347 | 26.4% | 35.8% |
| SERC | 177,248 | 150,411 | 15.1% | 17.8% | | | |
| Entergy | 30,418 | 25,194 | 17.2% | 20.7% | | | |
| Southern | 51,422 | 44,404 | 13.6% | 15.8% | | | |
| TVA | 31,884 | 27,368 | 14.2% | 16.5% | | | |
| VACAR | 64,455 | 53,445 | 17.1% | 20.6% | | | |
| SPP | 47,590 | 38,706 | 18.7% | 23.0% | | | |
| WECC | 152,976 | 117,499 | 23.2% | 30.2% | | | |
| NWPP | 48,251 | 32,732 | 32.2% | 47.4% | | | |
| RMPA | 11,531 | 9,584 | 16.9% | 20.3% | | | |
| AZ-NM-S. NV | 30,827 | 24,923 | 19.2% | 23.7% | | | |
| CA-Mexico | 62,367 | 50,260 | 19.4% | 24.1% | | | |
| Total - U.S. | 860,286 | 690,746 | 19.7 | 24.5 | | | |
| Canada | | | | | | | |
| MAPP | 6,912 | 5,251 | 24.0% | 31.6% | | | |
| NPCC | 61,205 | 45,657 | 25.4% | 34.1% | | | |
| Maritime | 4,476 | 2,736 | 38.9% | 63.6% | | | |
| IMO (Ontario) | 28,102 | 23,021 | 18.1% | 22.1% | 22,258 | 20.8% | 26.3% |
| TransÉnergie | 28,627 | 19,900 | 30.5% | 43.9% | | | |
| WECC | 21,812 | 15,513 | 28.9% | 40.6% | | | |
| Total - Canada | 89,929 | 66,421 | 26.1% | 35.4% | | | |
| Eastern Interconnection | 775,427 | 624,155 | 19.5% | 24.2% | | | |

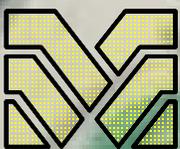


Interties In New England



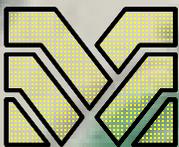
Unasked (and unanswered) Questions

- Why was the 1994 earthquake at Sylmar resolved so easily?
- Why didn't the relatively minor interties between the RTOs fail gracefully?
- Were reserves sufficient to sustain the system if the ties had cut?
- Were any sanctions applied and to whom?



Lessons For the Future

- Open meeting laws and public documents are not a luxury -- they are a necessity
- Responsibility needs to be clearly identified -- when all are equally responsible, no one is responsible
- Market surveillance should not report to the entities being "surveilled"
- Enforcement should be independent -- the police should not report to the criminals
- Simple tests for efficiency are required
- Rules are not a suitable replacement for performance



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