California Electricity Price Spikes: Factual Evidence

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On May 22, 2000, the California crisis began with the declaration of a Stage 2 Emergency by the California ISO. The following day, Tim Belden, Enron's chief west coast trader, presented an explanation for the start of the crisis as part of a demand for higher payments for his "fat boy" to Terry Winter, head of the California Independent System Operator:

> Your reliability problems over the next couple of years will be a direct result of too little investment in new generation.[1]

If Mr. Belden's prescience seems false to us today it is because we know that two years later he was to plead guilty to wire fraud in connection with the California crisis. At the time it must have surprised the members of his staff who had not forecasted the reliability problems in the California market he was soon to authoritatively announce to the press and the staff of the Federal Energy Regulatory Commission. It is a tribute to Enron's influence over the industry that his unsupported allegations continue to be debated today.

By the time Tim Belden made a presentation to the Oregon Public Utilities Commission in August this explanation had evolved to:

> Fundamental Summary
> Is Power Scarce?
> - Load Growth Fueled by Strong Economy
> - Fooled by Excellent Hydro Years
> - Little New Generation in Recent Years[2]

While the explanation had superficial credibility during the summer of 2000, due mainly to the secrecy imposed on the power markets by the California ISO, Enron's own internal studies directly contradicted Tim Belden's public statements, showing no resource shortage in either their fundamentals analysis or his presentation to senior management. Tim Belden's comments on the California market tell a very different picture:

> California Market Structure
> - CA ISO responsible for reliability, transmission access, and ancillary services
> - PX Runs Energy Market
> - Full Retail Access
> - ISO and PX have complex set of rules that are prone to gaming[3]

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[1] May 23, 2000 email from Tim Belden to Terry Winter, Kellan Fluckinger, and Zora Lazic.

[2] August 14, 2000, Tim Belden presentation to the Oregon Public Utilities Commission.

[3] May 1, 2000, Tim Belden presentation to John Lavorato. See also, Tim Heizenrader's email to Tim Belden on the same date.

The one item that was not present in Enron's forecasts for 2000 is the onset of the California market crisis or the shortage of resources in California. Tim Belden's public relations efforts have set the tone for the technical review of the hypothetical shortage that occurred on May 22, 2000 and passed away, just as suddenly, by July 3, 2001.

A number of analyses conducted on behalf of the firms that profited from the crisis have followed the path set out by Tim Belden on May 23, 2000. As the factual data has gradually become available, the tone of these studies has become more strident, in part to disguise the lack of evidence in support of their hypothesis.[4]

Surprisingly, the analyses by Kalt, Hogan, Harvey, and Pope ignore almost a hundred years of technical work and industry practice on reliability and system planning. Each study ignores the important fact that reliability is determined by the capacity availability to meet peak loads. Instead, these analysts attempt to prove that an *energy* shortfall along the Columbia River would lead to a *capacity* shortage, not in the Pacific Northwest, but in the neighboring state of California.

A recent addition to their analysis is a tortured argument that California peak loads actually increased in 2000 (and 2001); this analysis ignores the actual peak and instead makes a month by month comparison of the non-peak months. This would be amusing if the proponents were not pursuing these arguments with such ferocity.

The defining principle in the arguments for the spokesmen of the firms under investigation is that the existence of higher prices necessarily means the existence of a shortage. In practice, this leads down a slippery slope of convoluted logic. First, Kalt, Hogan, Harvey, and Pope ignore the fact that the emergency declarations by the California ISO were capacity shortages. Second, they argue that a shortage of hydroelectric generation contributed to the capacity shortage, even though hydroelectric capacity is always calculated assuming adverse hydro. Third, they ignore the extensive evidence that natural gas prices were also manipulated during this crisis. Finally, they assume that the prices on the West Coast are set by an assumed cost of NOx emissions in the L.A. basin, even though South Coast Air Quality Management District policies were changed to cap such prices at a low level in January 2001. At each stage, basic source data is ignored or manipulated to match the public relations materials presented by Enron representatives at the start of the California crisis.

The most recent version of this approach is exemplified in "California Electricity Price Spikes: An Update on the Facts" by Dr. Susan Pope. The study was funded by Mirant, one of the companies implicated in the California crisis. Dr. Pope's paper is clearly intended to rebut my article entitled "Price Spike Tsunami: How Market Power Soaked California," in the Public Utilities Fortnightly last year. Her paper largely restates arguments already presented (and

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[4]Joseph Kalt, Scott Harvey, and William Hogan presented testimony in the EL02-26 proceeding at FERC. More recently Susan Pope has followed substantially the same path in a paper entitled "California Electricity Price Spikes: An Update on the Facts."

rebutted) by Harvey, Hogan, and Kalt in the EL02-26 case before FERC.[5]

The first step in understanding the regional load resource balance during the California crisis is to turn to the source documents. Reliability planning tests whether the balance between capacity resources and capacity loads is sufficient. In the U.S. and Canada reliability planning revolves around the operations of regional reliability organizations known as reliability councils. The western half of North America is the province of the Western Energy Coordinating Council (WECC).[6]

On an annual basis, usually in the late summer or early fall, the WECC issues a ten year coordinated plan summary. This summary has two major uses. First it summarizes on a regional and sub-regional basis the actual results for the previous year. This is the only readily available survey of the entire western region of the U.S. and Canada. Secondly, it reviews in detail the prospects for the next year and the following nine years.

Over the course of the crisis the California Independent System Operator (ISO) declared capacity emergencies on 125 different days. In each case, the ISO identified a specific capacity shortfall that forced them to make the emergency declaration.

The methodology for rating capacity for the region's resources is set out in a policy that has been in place since June 20, 1974.[7] The important reason why participants in this debate should review the basic documents is that the ratings for hydro-electric resources in WECC documents are made at adverse water – in other words, the capacity valuation already assumes drought. As we will see, their unwillingness to take the time to review the basic planning documents has led proponents of the resource shortage theory into some interesting errors.

On a regional basis, forecasts for calendar year 2000 were relatively rosy. The following table shows the forecasted and actual values for the entire WECC for the three peaks during the California crisis.[8]

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[5]Curiously, Dr. Pope's paper seemingly ignores the detailed rebuttal submitted in that case.

[6]Since the onset of the California crisis, the Western Systems Coordinating Council (WSCC) changed its name to the WECC.

[7]Western Electricity Coordinating Council Criteria for Uniform Reporting Of Generator Ratings, Approved June 20, 1974.

[8]Source: 10-Year Coordinated Plan Summary 1999 - 2008, 10-Year Coordinated Plan Summary 2000 - 2009, and 10-Year Coordinated Plan Summary 2001 - 2010, 10-Year Coordinated Plan Summary 2002 - 2011, Western Systems Coordinating Council.

	Summer 2000		Winter 2000		Summer 2001	
	Forecasted	Actual	Forecasted	Actual	Forecasted	Actual
Month	**July**	**July**	**December**	**December**	**August**	**August**
Loads - Firm	**127,857**	**129,030**	**119,587**	**113,525**	**132,637**	**123,193**
Int. & Load Mgt	**4,671**	**1,862**	**1,747**	**2,579**	**2,499**	**1,847**
Total - MW	132,528	130,892	121,334	116,104	135,136	125,040
Growth from Previous Yr. - %	2.7%	1.4%	2.8%	0.7%	3.2%	-4.5%
Generation ± Transfers - MW	159,780	148,377	161,021	138,566	166,267	145,898
Maint./Inoperable Cap. - MW	3,910	10,790	4,660	20,886	3,939	15,525
Reserve Capability	28,013	19,347	36,774	25,041	29,691	22,705
Percent of Firm Peak Demand	21.9%	15.0%	30.8%	22.1%	22.4%	18.4%

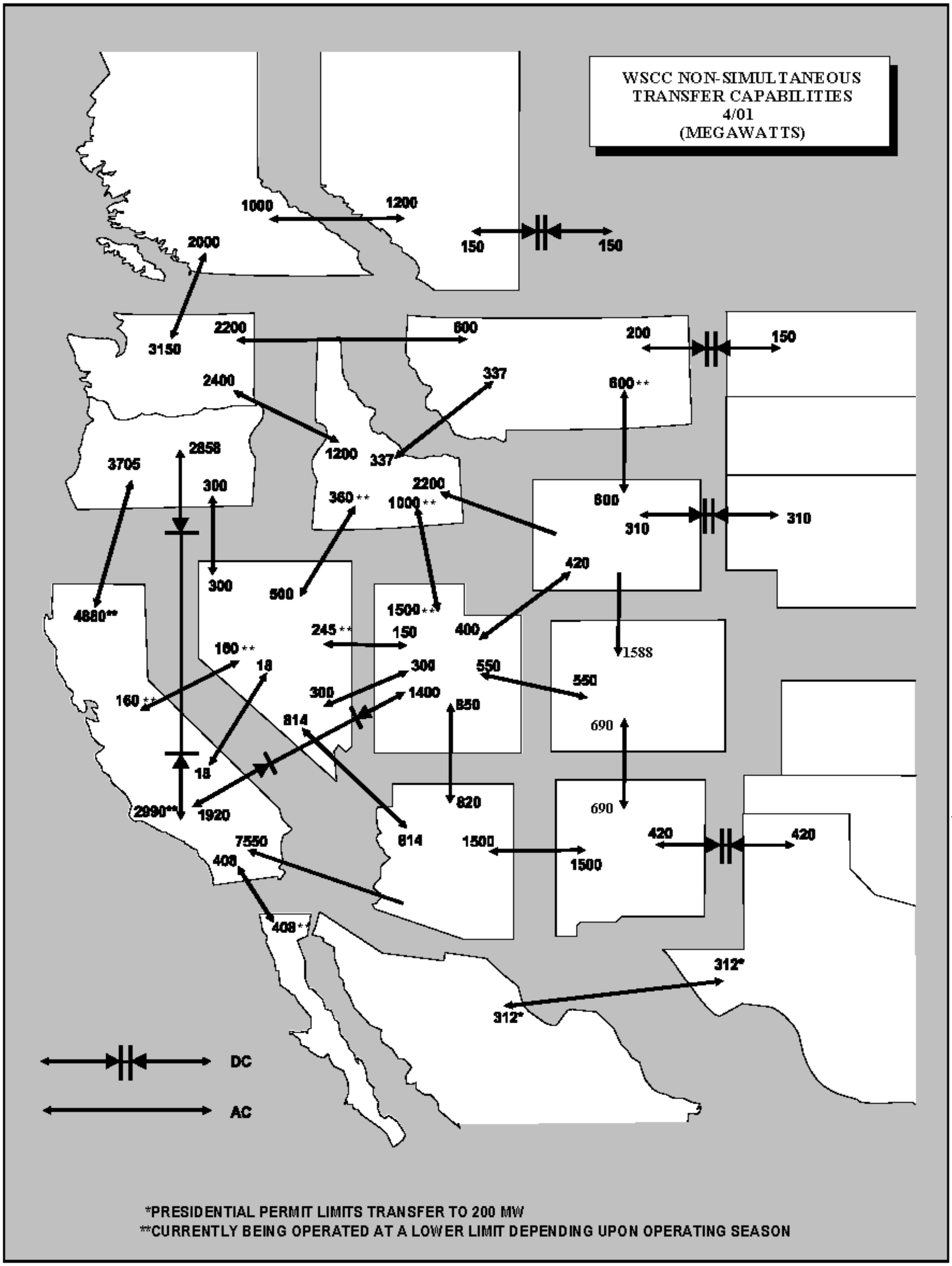
Even the most cursory review indicates that the problem was not peak loads. Overall peak loads were lower than forecast across the summer and winter peaks. The major change from forecast was the massive level of outages throughout the forecast. Even given these outages, overall reserves during the system peaks were quite high.

Although the spokesmen for Enron and other companies facing investigation for the California crisis do not address the issue, a reserve margin of 15% before forced outages is regarded as very ample. A reserve margin after forced outages is excellent. By any standard, it is clear that there was no region-wide capacity shortage over the period of the California crisis.[9]

A region wide capacity surplus may not be sufficient to avoid emergency declarations in California if the California system was isolated from neighboring regions. As a central long term goal of transmission development since the 1960s, this is not the case. The California market is directly tied into the Pacific Northwest and the Desert Southwest by an extensive transmission system. The following chart shows transfer capabilities throughout the WECC during the crisis.[10]

[9]Interestingly, the lowest reserve margin in 2001 took place in May, the month when prices began to return to competitive levels.

[10]WSCC 10-Year Coordinated Plan Summary 2001 - 2010, page 55.


WSCC NON-SIMULTANEOUS
TRANSFER CAPABILITIES
4/01
(MEGAWATTS)
1000
1200
150
150
2000
3150
2200
600
200
150
337
600**
2400
1200
337
3705
2858
300
360**
1000**
2200
600
310
310
300
560
420
4880**
1500**
245**
150
400
160**
18
300
550
1588
160**
300
1400
550
814
850
690
18
2990**
1920
820
690
7550
408
814
1500
1500
420
420
408**
312*
312*
DC
AC
*PRESIDENTIAL PERMIT LIMITS TRANSFER TO 200 MW
**CURRENTLY BEING OPERATED AT A LOWER LIMIT DEPENDING UPON OPERATING SEASON

Loadings on the all important ties between California and the Pacific Northwest are in the public record. The transmission lines into California during the crisis were simply not fully loaded. Clearly, if a capacity shortage existed within California, it was not caused by the lack of transmission capacity entering the state.[11]

Within California, the WSCC's evaluations were also positive.

	Summer 2000		Winter 2000		Summer 2001	
	Forecasted	Actual	Forecasted	Actual	Forecasted	Actual
Month	July	August	December	January	August	August
Loads - Firm	50,832	50,253	39,435	36,790	54,606	47,000
Int. & Load Mgt	2,784	960	4	1,020	996	1,351
Total - MW	53,616	51,213	39,439	37,810	55,602	48,351
Growth from Previous Yr. - %	0.9%	-3.6%	-2.1%	0.5%	8.6%	-5.6%
Generation ± Transfers - MW	59,983	56,199	57,632	40,748	60,869	55,462
Maint./Inoperable Cap. - MW	-	2,911	889	18,670	18	7,175
Reserve Capability	9,151	5,946	17,308	3,958	6245	8,462
Percent of Firm Peak Demand	18.0%	11.8%	43.9%	10.8%	11.4%	18.0%

The narrative pertaining to California in the WSCC Summer Assessment was cautiously optimistic:

> The California-Mexico subregion (CA-MX) projected reserve margins presented in the above table are based on the assumption that up to 1,642 megawatts of additional capacity from the other subregions will be available to control areas in this subregion during July and 776 megawatts will be available in August. Without additional capacity that may be available due to reduced peak demand or from other subregions (referred to as planned purchases/sales in the tables presented in Appendix A) the reserve margins would decrease to 14.7% in July and 16.0% in August. A number of local areas have constraints that may require area load management under certain conditions.
>
> The Northwest Power Pool subregion is expected to have sufficient resources to provide up to several thousand megawatts of additional capacity and energy to the CA-MX subregion. The transmission interconnections to AZ-NM-SNV are also expected to be capable of supporting several thousand megawatts of capacity transfers to the CA-MX subregion. However, if above normal temperatures increase the peak demand and/or forced outages reduce generation resources in the AZ-NM-SNV subregion, its ability to export to the CA-MX subregion may be limited. If the CA-MX subregion experiences high temperatures when the AZ-NM-SNV subregion's export capability is limited, and offsetting capacity is not available from the Northwest Power Pool, operating margins in CA-MX may decline to such a low level that public appeals for reduced electricity consumption may be required to maintain satisfactory operating reserves. Also,

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[11]The spokesmen do not mention why a region-wide capacity shortage apparently affected only California, nor do they address the relevance of transmission capacity to such a shortage, if, in fact, it had existed. They spend some time analyzing the flows along the Columbia River. This effectively concedes that the California emergency declarations were not caused by constraints on the paths into California since the emergency declarations could not have been caused by low flows on the Columbia if they also believed that hydroelectric generation could not be transmitted to California.

automatic and/or manual system operator intervention to reduce peak demand may be required, especially if much higher than normal generator forced outages occur during high temperature conditions.[12]

The actual summer conditions in the summer of 2000 were not well documented. The California ISO has stated that its data on outages during this period is sketchy. Good data on loads is available, however. As is clear in the tables taken from the WECC, actual summer peak loads were actually lower than those in the preceding year. Although the generators' spokesmen are usually silent on the point, actual WECC and California peak loads were lower than they had been in previous years.[13]

Hogan and Harvey found the factual problems with their position so troubling that they offered easily the most preposterous argument ever advanced in reliability analysis in their rebuttal testimony in EL02-26. In this testimony they argued that California loads were higher in 2000 for previous years except for the summer peak in August and the winter peak in December.[14]

The problem with their analysis was that it simply ignored the fundamental issue in reliability planning. Capacity is planned to meet the peak load on the system. When Hogan and Harvey ignored the summer and winter system peaks, they were attempting to argue that a capacity shortage had occurred except in the months with high peak loads. Obviously, capacity loads were not the problem if they were lower in 2000 and 2001 than they had been in 1998.

The situation in California was even more extreme. While Tim Belden argued that loads were growing, the reality is that California peak loads have declined since 1994.[15] [16] The dilemma that spokesmen like Harvey and Hogan face is that while the public statements made by Belden in the summer of 2000 could not easily be disproved given the limited data available at the time, the facts are now in the public record and the arguments are looking increasingly desperate.

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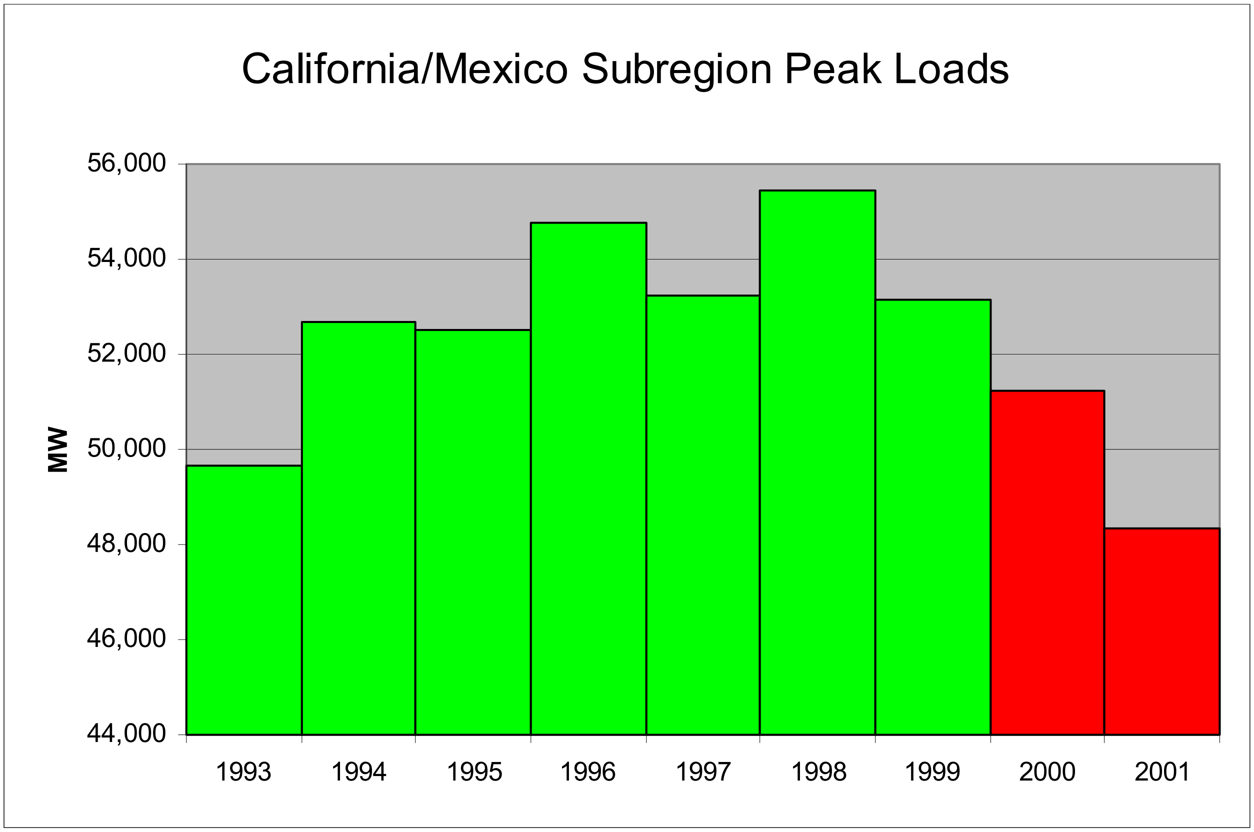
[12]Western Systems Coordinating Council Assessment of the Summer 2000 Operating Period, page 4.

[13]WSCC peak loads reached a high in August of 1998. California/Mexico peak loads reached a high in September of 1998.

[14]Harvey/Hogan Answering Testimony, EL02-26, page 8.

[15]Table 1, Harvey/Hogan Answering Testimony, EL02-26, page 5.

[16]WSCC 10-Year Coordinated Plan Summaries :1994-2001 (1993-2000) http://www.wecc.biz/2001_Peak-Demands -and-Energy-Loads-05-15-02 .pdf (2001)



Although Susan Pope, one of Scott Harvey's associates, must have been aware of the dialog that has taken place in EL02-26 and other arenas, she simply proceeds as if these facts had not been addressed. Her approach is simply to ignore capacity and focus on energy loads and resources.[17]

There are two problems with this approach. The primary problem is that it disregards the 125 capacity emergencies announced by the California ISO during the crisis. These emergency declarations reflected findings by the ISO that it was not going to be able to meet its reserve obligations.[18] Any review of the pricing during the California crisis shows that the highest prices occurred during the declared emergencies – largely caused by emergency purchases by the California ISO. Attempting to analyze a capacity shortage by calculating energy balances is strictly an apples and oranges approach.

The secondary problem is that the simple "energy balance only" approach taken by Dr. Pope has

[17]It should be noted that Dr. Pope uses energy and capacity terminology indistinguishably. All of her analysis, however, appears to apply to kilowatt hours, not kilowatts.

[18]The ISO grades its emergencies by comparing projected resources against loads. A stage one emergency reflects a level of reserves falling below Minimum Operating Reserve Criteria – approximately 7%. A Stage Two emergency is declared when reserves fall below 5%. A Stage Three Emergency is declared when reserves fall below the ISO's single largest resources – approximately 1.5%.

little relevance to the way the region is planned or operated. While energy loads do partially determine the choice of fuels used to generate electricity, energy loads have only a limited impact on system operations during on-peak periods. Ms. Pope's analysis also shows little understanding of the role of hydroelectricity in reliability planning or the role of non-firm generation in resource displacement.

The reason why reliability planning tends to be unduly concerned with capacity is the simple fact that equipment must be available to meet peak loads. Since electric resources take years to build, it is impossible meet peak demand through emergency construction. Plant must be available in advance – usually far in advance of need.

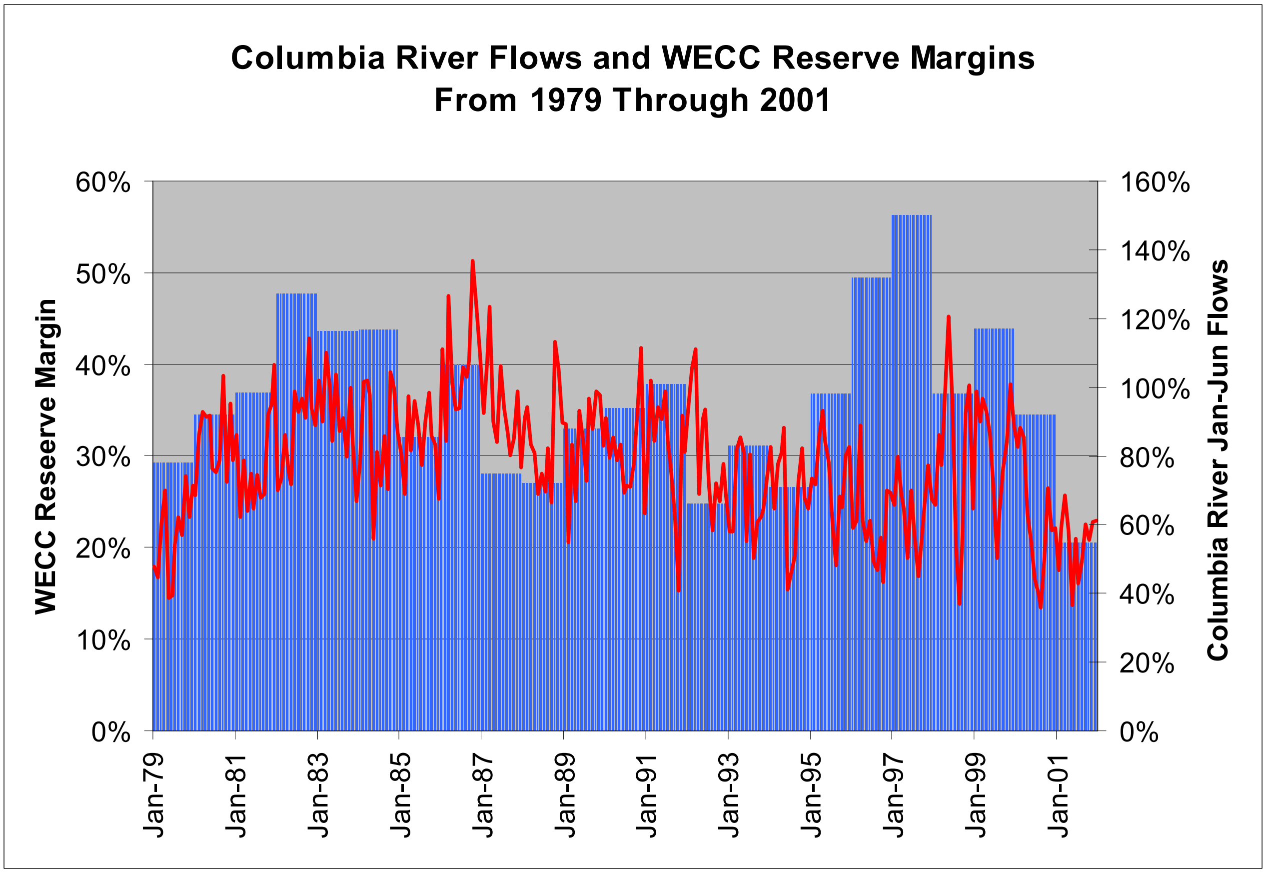
For most systems in the U.S. and Canada, reliability planning requires little more than a careful analysis of capacity needs. For these systems, once the system peak has been met, meeting energy loads is simply a problem of procuring fuel to run the generation.

Energy loads in this context simply determine which of the system's plants will be running. As such, the impact of price in a competitive market will be the increase in the cost of fuel as less efficient units are called into service. For the WECC as a whole, this usually involves a transition from coal to natural gas or a choice between the vintage of natural gas units used to meet load.

While the spokesmen for the firms under investigation for the California crisis tend not to address the point, simply changing energy loads will only change the choice of the least efficient unit operating to meet load unless actual conditions of scarcity are present. In a competitive market, this tends to set the price to the operating cost of the least efficient unit since prices higher than that cost will bring more units into operation than would be needed. By the same token, if prices are less than the operating costs, the unit will not be dispatched and a shortfall will occur.

Obviously, the California crisis was not a competitive market. As has been reviewed before FERC and analyzed by many, many different parties, prices on the West Coast were considerably higher than the costs of the marginal generating unit. It goes beyond the scope of this paper to re-analyze this debate, but it is clear that prices during the crisis were dramatically higher than the costs of undispatched units owned by the generators in California.

While reserve margins in the WECC were not high during the crisis, they were far from those normally associated with crisis conditions.



As this chart shows, reserve margins have frequently fallen to the mid teens, after plant outages, even during periods when hydroelectric generation was significantly below the levels in 2000. As always, it is interesting to note that a true drought occurred in 2001, a period when prices returned to normal levels.

In the Pacific Northwest and a very limited other number of systems in North America, the systems are also energy constrained. Energy constraints occur when there is not enough fuel for the generating units. While this is unusual for thermal systems, it occurs frequently for hydroelectric systems. The Pacific Northwest has a clear planning process for dealing with the reliability implications of drought. Reliability rules are set out in a document known as the Coordination Agreement.

The principles in the Coordination Agreement are reflected in the WECC's June 20, 1974 policy concerning the ratings of generating equipment. In the case of the Pacific Northwest, both capacity and energy ratings are determined under adverse water. Systems north of the California border refer to capacity and energy that is present under adverse water as "firm." Generation above this level is called "non-firm".

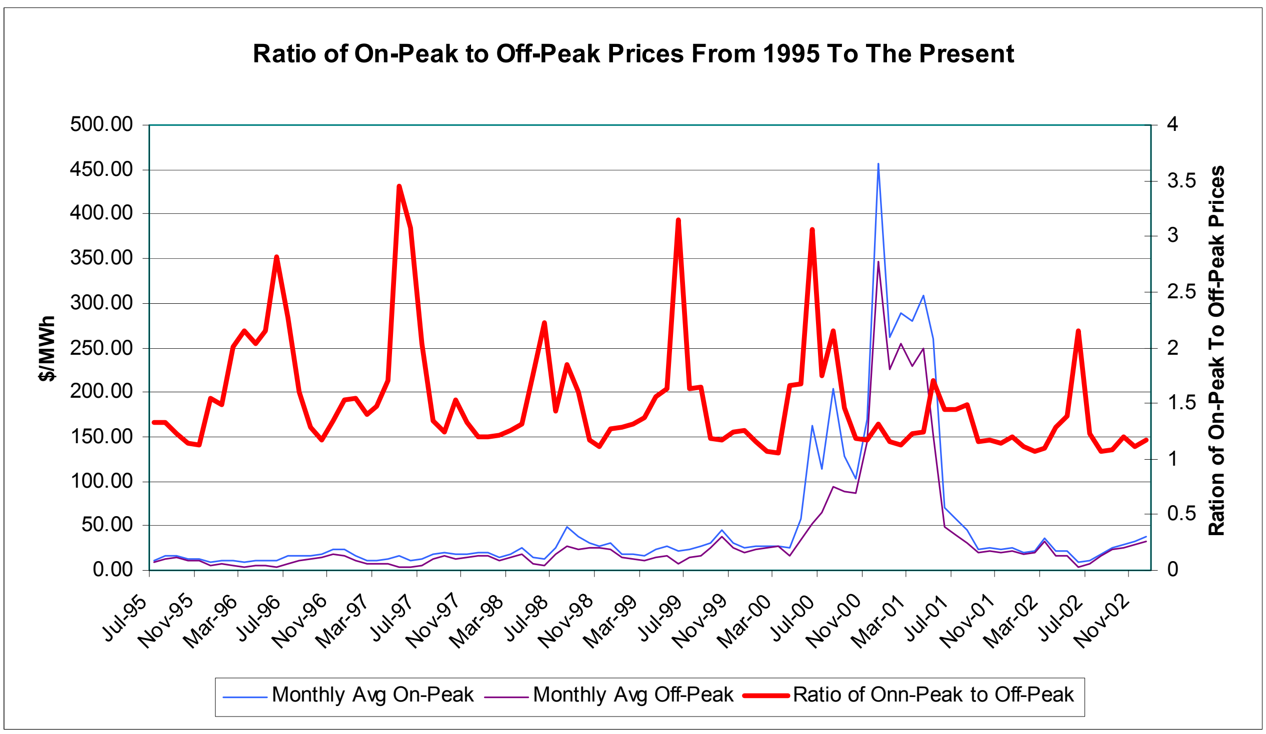
For the past thirty years, the relationship between the Pacific Northwest and California has been on the basis of the short term sales of non-firm energy and longer term transactions involving firm energy.

No system, in California or elsewhere in the WECC, proposes meeting its peak loads with non-firm electricity from hydroelectric systems – simply because such electricity is not firm. In interesting contrast to the analysis of the marketers' spokesmen, the Pacific Northwest views non-firm electric generation in terms of "displacement" – the temporary reduction of generation from base load electric generation elsewhere.

In severe conditions, like those of 1993/1994, it is possible for the Pacific Northwest to face energy constraints. In extreme cases, the supply of "fuel" – water – for the hydroelectric projects could reaches conditions where on-peak and off-peak costs and prices are equalized. While we have not faced this situation, if the WECC as a whole became energy constrained, generators would have to forego serving loads off-peak for every kilowatt hour they serve on-peak. Clearly, if prices were higher during on-peak periods, generators would shift their energy limited generation to daytime hours. The natural operation of the market would bring on-peak and off-peak prices into balance.

While Dr. Pope's arguments on this issue are not very clear, her continued references to energy loads and generation in the context of scarcity makes it possible that she believes that the WECC became energy constrained over the period of the California crisis.

If this is, in fact, her belief, it is clear that this was not the case. The following chart shows the ratio between monthly average on-peak and off-peak prices from July 1995 to the present.



The difference between on-peak and off-peak prices remained relatively stable during the crisis.[19] If Dr. Pope believes that the WECC was energy constrained during the California crisis, she would also have to believe that the region had been energy constrained for sizable periods both before and after the crisis. Clearly this is not the case.

The actual dispatch of hydroelectric generation is a very different picture than the simple stories told by Harvey, Hogan, Kalt, and Pope. On a planning basis, the first and most important use of hydroelectric generation is as a peaking resource. While this may seem surprising to those raised in thermal systems, the highest and best use of an energy limited resource is to meet system peaks. Once as much hydro is loaded into system peaks, hydroelectric generation is used to displace successively less expensive thermal generation on a firm basis.[20] In practice, this means that droughts tend to affect the supply of hydroelectricity to off-peak or shoulder periods rather than peak periods.

Non-firm generation, the generation that is discussed in the testimony of Harvey and Hogan in EL02-26 and reprised in the paper by Dr. Pope, is not a firm resource and should not affect the capacity load/resource balance of either the Pacific Northwest or the WECC as a whole.[21]

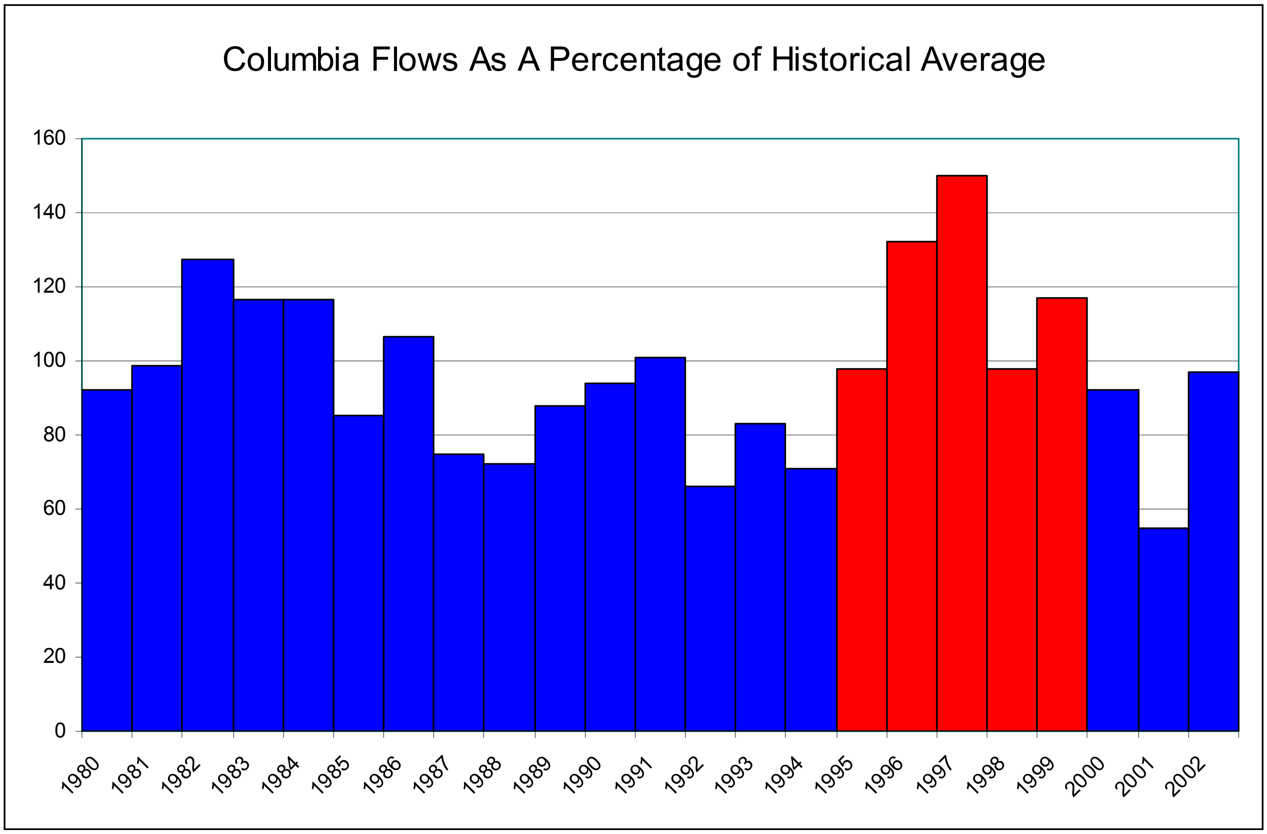
Dr. Pope reprises the testimony of Harvey and Hogan in EL02-26 by comparing WECC hydroelectric generation against a very select number of years – apparently in an attempt to prove that normal isn't normal if it is only compared with wet years. The following chart[22] shows Columbia River flows from 1980. Dr. Pope has attempted to prove that the relatively normal flows in 2000 weren't normal by comparing them with an average of three very wet years, 1996, 1997, and 1999 as well as two normal years. The years that Dr. Pope uses for her comparison are colored red.

[19] Monthly average of Mid C prices from Energy Market Report

[20] All planning is conducted using "firm" hydroelectricity – hydroelectric generation that can be depended upon during adverse water. This is one reason that planning studies from the WECC specify "Adverse Water" in the upper right hand corner of each chart.

[21] Before the California crisis almost any utility planner would have replaced the word "should" in this sentence with "would". The exception to the rule is the dispatch of the Helms pumped storage unit during the California crisis. The California ISO repeatedly announced that Helms "had run out of water." One possible interpretation is that Helms had been removed from the traditional hydroelectric generation regime and was being operated as a non-firm resource. If this is the case, the ISO may have contributed to their own operating problems.

[22] http://waterdata.usgs.gov/nwis/discharge

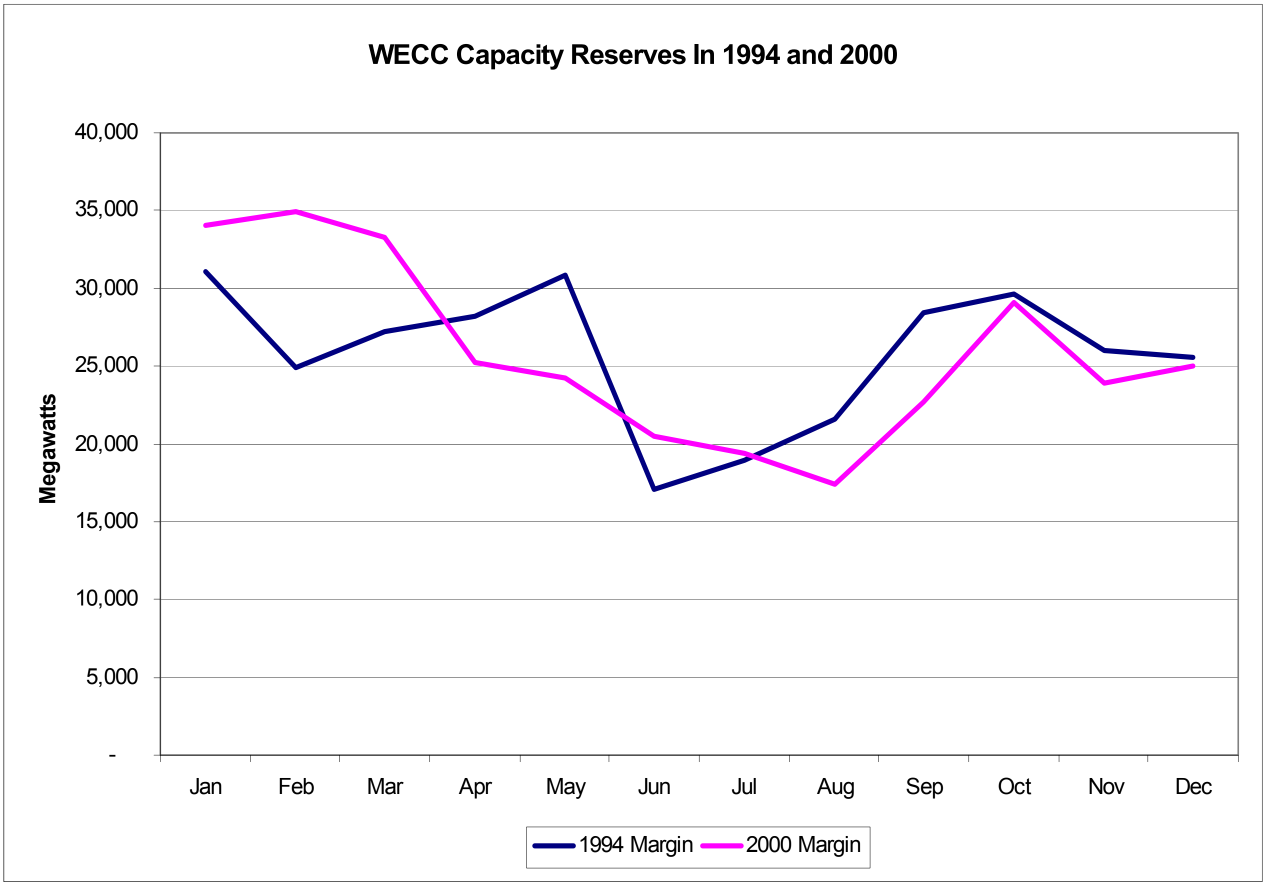


While this is not important per se, it is part of Dr. Pope's effort to avoid the comparison between market conditions in 2000 with the drought in 1994. The problem faced by the spokesmen for the firms under investigation is that the ISO declared emergencies on 55 days in 2000 while considerably worse conditions in 1994 did not cause significant problems.

The importance of the comparison with 1994 is that the theories invented by Tim Belden and currently articulated by spokesmen like Dr. Pope implicitly question the reliability criteria that we use to plan and operate the system. If they are correct, the systems currently in place are wrong and the WECC faces catastrophic failure. This is not an insignificant issue.

In 1994, the region was in the second year of a severe drought. Reserve margins were roughly equivalent to those in 2000.[23]

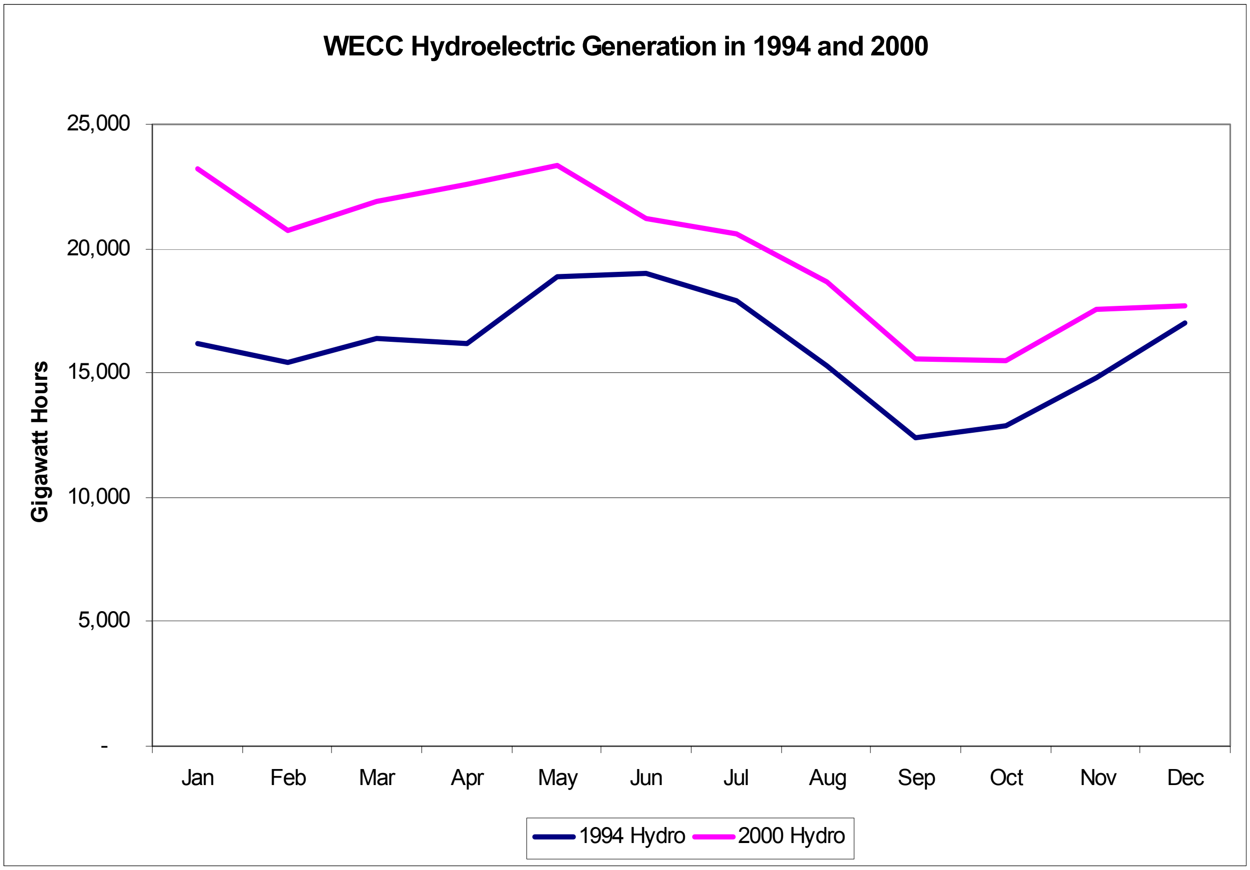
[23]WECC 10-Year Coordinated Plan Summary 2001-2010, Table 3 WSCC Actual Loads and Resources for 2000; WECC 10-Year Coordinated Plan Summary1995-2004, Table 3 WSCC Actual Loads and Resources for 1994



While regional margins for the entire WECC were roughly comparable, reserve margins within California were actually lower – in June 2000 the reserve margin in California fell to 5,312 megawatts as opposed to 4,773 megawatts in June 1994.

WECC hydroelectric generation was actually considerably lower in 1994.[24]

[24]EIA's 1995 Electric Power Monthly, Table 11 Electric Utility Hydroelectric Net Generation by Census Division and State; Table 11 Electric Utility Hydroelectric Net Generation by Census Division and State, http://www.eia.doe.gov/cneaf/electricity/epm/matrix96_2000.html; and Stats Canada Table 127-0001 from http://cansim2.statcan.ca



If Harvey, Hogan, Kalt, and Pope are correct, we should have seen extensive problems in 1994. The facts are that we didn't. Instead, pricing in 1994 reflected a smoothly operating competitive market where the price for power reflected the operating costs of the last unit dispatched.

One of the ironies of this debate is that if the proponents are correct, the entire idea of deregulation comes into question. The implication that they have seem to have missed is that they would have us believe that scarcity occurs more easily under competition than traditional vertically integrated utility operation. During the crisis, I often advised McCullough Research clients that if we were lucky, the crisis was due to manipulation. If the crisis had actually reflected regional scarcity, we would have been facing the imminent collapse of the entire West Coast electric system.

What was really different in 1994 and 2000?

First and most important, the competitive market had been replaced by a centralized administered market at the California Power Exchange and the California ISO. Although Professor Hogan has argued eloquently for some years that bureaucrats are better at setting up markets than entrepreneurs, the facts show that centralized administered markets are very susceptible to manipulation. In 1994, market participants were not required to do business with a centralized authority. Market data was transparent and the fad that keeping market data from consumers for their own good was not in vogue.

Generation in California was vertically integrated, so the interests of generators were aligned with the interests of the utilities serving consumers. Actual dispatch decisions were managed by experienced dispatch centers at the utilities and not by a centralized bureaucracy

Second, manipulations in the natural gas pricing and supply were not present in 1994. Analysis of manipulations by El Paso Gas (Professor Kalt's employer in this debate) are still ongoing. Recent revelations indicate that abuses in this area may be as large, if not larger than the manipulations in electricity.

Third, and least important, are the environmental issues raised repeatedly by apologists for the price increases during the crisis. The establishment of the NOx market for industry and electric generators in the L.A. basin has been cited as a major cause of price increases. Even a cursory review of the facts indicates that the role assumed by Dr. Pope for the impact of NOx on prices is greatly exaggerated. Dr. Pope chose to ignore the rebuttal to this argument in EL02-26, but the facts are straightforward.[25]

Most of the manipulations we have identified over the past two years simply had no relevance to industry organization in 1994.

First, Dr. Pope spends some time arguing that generation by Non-Utility Generation (NUGs) was higher during the crisis than it had been before. This is certainly correct, although she attempts to attribute generation shortfalls to NUGs as a whole and not the plants divested in the course of the California implementation of AB-1890.

Her argument, unfortunately, disguises the problem instead of answering it. The reason why the California ISO was forced to declare emergencies on 125 different days during the crisis was its inability to meet its Minimum Operating Reserve Criteria (MORC). This problem was severely exacerbated by the low levels of capacity at the plants owned by Duke, Dynegy, Mirant, Reliant, and AES/Williams – often referred to as the "Big Five."

Traditional NUG contracts do not provide capacity value for the plant unless it meets stringent availability criteria during on peak periods. The plants owned by the "Big Five" not only failed to generate near their capacity during system emergencies, they only averaged operating rates of 50% to 60% during emergency conditions.

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[25]Actual emissions for the steam units in the L.A. basin are approximately one pound of NOx for one kilowatt-hour, not the two to four assumed by Dr. Pope. The EPA maintains an extensive database of actual generation and emissions by hour for these units. This data is available on the EPA web site. NOx emission rates vary from unit to unit, but the average is vastly lower than the assumed values in Dr. Pope's paper. The market for NOx allowances in the L.A. basin is managed by the South Coast Air Quality Management District (SCAQMD). Concern about the increasing level of prices for allowances caused a major change in the operation of the market in January 2001. At that time, the market was bifurcated into two parts. The utility submarket had the option to overrun their allotments for $7.50 per pound. This policy was formally adopted in June of 2001.

Big Five Generation	MW		
Nameplate Capacity	15636		
Maximum Generation Observed, 2000-2001	13712		
		% of Capacity	% of Maximum
Average Generation, May 22, 2000 - July 3, 2001	7993	51.1%	58.3%
Average Generation, Stage 1 Emergencies	8698	55.6%	63.4%
Average Generation, Stage 2 Emergencies	8493	54.3%	61.9%
Average Generation, Stage 3 Emergencies	8277	52.9%	60.4%
Average Generation, January 17, 2001	8578	54.9%	62.6%
Average Generation, January 18, 2001	8442	54.0%	61.6%
Average Generation, July 4, 2001 - August 31, 2001	8560	54.7%	62.4%

Overall, the big five plants only managed to generate at rates equal to 54.7% of rated capacity during the crisis.[26]

Several arguments have been put forward to explain why the availability was so low. The most common argument is that these plants were old and were incapable of operating at high levels. This argument is very, very weak. The units under discussion are natural gas fired steam units. The technology behind the operation of these units makes them simple to operate and maintain. The North American Electric Reliability Council (NERC) maintains an extensive database on availability of units by technology, fuel, and size. The following chart[27] shows each of the California plants owned by the big five and the availability rate from the appropriate NERC classification.

Interestingly, NERC does not classify plants by age. It is a simple matter to compare the age of the plants submitting data to NERC by finding the average age from the Energy Information Administration's generation database. The age of the plants in California averaged one year older than gas fueled plants throughout the United States.

The reason why NERC does not classify these units by age is the "grandfather's ax" effect.[28] For simple technologies like these, routine maintenance replaces boilers, steam supply systems, and turbines on an ongoing basis. The power manager of one of the large paper mills on the West Coast laughed when he heard the explanation of the "tired" California units. He noted that his

[26] http://www.epa.gov/airmarkets/emissions/raw/index.html

[27] http://www.nerc.com/~filez/gar.html

[28] Your grandfather's ax continues to be of use even though the blade and the handle have been replaced many times.

plant had comparable equipment that was older than he was which was available 95% of the year.

Clearly, the entire argument for independent ownership of these units is that competition will provide higher availability and more efficiency than traditional cost plus regulation. A certain irony is attached to the current claim that these units are unable to meet the same standards of availability as units operating under regulation.

Plant	Capacity	1995-1999 Availability	1999 Availability
Contra Costa 6	345	82.7%	83.7%
Contra Costa 7	347	82.7%	83.7%
Moss Landing 6	767	81.1%	81.0%
Moss Landing 7	768	81.1%	81.0%
Pittsburg 1	167	85.8%	85.4%
Pittsburg 2	163	85.8%	85.4%
Pittsburg 3	163	85.8%	85.4%
Pittsburg 4	163	85.8%	85.4%
Pittsburg 5	325	82.7%	83.7%
Pittsburg 6	325	82.7%	83.7%
Pittsburg 7	700	81.1%	81.0%
Alamitos 1	186	85.8%	85.4%
Alamitos 2	201	84.7%	82.4%
Alamitos 3	331	82.7%	83.7%
Alamitos 4	336	82.7%	83.7%
Alamitos 5	497	83.5%	81.3%
Alamitos 6	493	83.5%	81.3%
Cool Water 1	81	89.6%	88.3%
Cool Water 2	88	89.6%	88.3%
Cool Water 3	272	84.7%	82.4%
Cool Water 4	273	84.7%	82.4%
El Segundo 1	188	85.8%	85.4%
El Segundo 2	179	85.8%	85.4%
El Segundo 3	354	82.7%	83.7%
El Segundo 4	345	82.7%	83.7%
ENCINA POWER PLANT ST1-ST5, GT1	968	88.8%	83.6%
Etiwanda 1	132	85.8%	85.4%
Etiwanda 2	140	85.8%	85.4%
Etiwanda 3	340	82.7%	83.7%
Etiwanda 4	336	82.7%	83.7%
Huntington Beach 1	233	84.7%	82.4%
Huntington Beach 2	251	84.7%	82.4%
Mandalay 1	229	84.7%	82.4%
Mandalay 2	227	84.7%	82.4%
Morro Bay 1	171	85.8%	85.4%
Morro Bay 2	174	85.8%	85.4%
Morro Bay 3	347	82.7%	83.7%
Morro Bay 4	355	82.7%	83.7%
Ormond Beach 1	794	81.1%	81.0%
Ormond Beach 2	792	81.1%	81.0%
Redondo Beach 1	185	85.8%	85.4%
Redondo Beach 2	165	85.8%	85.4%
Redondo Beach 3	497	84.4%	84.4%
Redondo Beach 4	503	84.4%	84.4%
South Bay 1	160	85.8%	85.4%
South Bay 2	158	85.8%	85.4%
South Bay 3	187	85.8%	85.4%
South Bay 4	238	84.7%	82.4%

Several defenders of the low level of operations have argued that the owners could not afford to operate the plants more extensively. We have conducted a detailed review of the costs and benefits of dispatch of these units on an hour by hour basis.

As opposed to the assumed NOx prices and NOx/kWh ratios, we used actual of experienced prices and rates. Natural gas prices were taken from actual market data. The results are striking[29]:

	Northern California	Southern California (Outside of SCAQMD)	SCAQMD	Total
	aMW	aMW	aMW	aMW
Forecasted				
Jan-97 to Mar-98	125.63	552.11	545.66	1,223.39
Apr-98 to Apr-00	2,097.07	2,145.22	2050.38	6,292.66
May-00 to Jun-01	4,081.24	4,631.54	4260.00	12,972.77
Jul-01 to Dec-01	2,702.32	2,790.27	1601.55	7,094.15
Actual				
Jan-97 to Mar-98	1,252.64	1,157.25	1060.72	3,470.61
Apr-98 to Apr-00	1,245.07	1,386.62	986.31	3,618.00
May-00 to Jun-01	2,578.61	2,768.38	2452.82	7,799.81
Jul-01 to Dec-01	2,233.29	2,136.41	2273.95	6,643.65
Difference				
Jan-97 to Mar-98	1,127.02	605.13	515.07	2,247.22
Apr-98 to Apr-00	(852.00)	(758.59)	(1,064.07)	(2,674.66)
May-00 to Jun-01	(1,502.63)	(1,863.16)	(1,807.17)	(5,172.95)
Jul-01 to Dec-01	(469.03)	(653.86)	672.40	(450.50)

Over the period of the crisis, generation from the Big Five units is 5,172 megawatts lower on average than what we would have expected from a decision to dispatch into the market based on a comparison of market prices to plant operating costs. It is interesting to note that the shortfall takes place throughout California, even in areas that were not subject to the NOx market in the L.A. basin.

[29]Results of Economic Dispatch Model, Rebuttal Testimony of Robert McCullough on Behalf of Public Utility District No. 1 of Snohomish County, Washington, FERC EL02-26-000, September, 2002.

Dr. Pope raises a third argument. This argument is simply incorrect. She attempts to explain the low operating rates by ascribing the problem to peaking units. As she is no doubt aware, the units mentioned above are base load and intermediate units, not peaking units. Most of the units under discussion here have ramp rates that would forbid their use as peakers. Most importantly, even if they were peakers, this still would not explain the very low level of availability during declared system emergencies.

Second, Enron style schemes (practiced, as we are finding out, by a number of the participants in the California market) simply have no relevance to an open bilateral market. The two most common schemes, Fat Boy – intentional oversheduling of generation to imaginary loads -- and Death Star – imaginary circular routing of electricity to take advantage of congestion payments -- simply do not occur in decentralized markets.

The debate is still raging on the cost impact of these schemes. We know that Death Stars had an explicit impact on price, because the congestion payments were recovered from legitimate market participants. We are still investigating to see if Death Stars were used to apparently congest lines as opposed to simply gain fraudulent payments

Of more concern is the widespread use of Fat Boys. In traditional markets, scheduling energy to an imaginary load simply has no relevance. Since there was no one to defraud, this practice was simply unheard of. The Rube Goldberg nature of the centralized California market made this a very interesting ploy. A number of market participants simply withheld large supplies of energy from the California Power Exchange, hoping that the frequent emergency declarations would provide a profit in the "ex-post" market.[30]

Third, recent discovery efforts by the California Senate Select Committee have identified a series of ill-judged decisions by the California ISO to congest their own transmission lines during the crisis. Using its authority to impose "capacity benefit margin" (CBM) requirements on interties, the California ISO created a series of imaginary transmission contracts (such as C66 and N66, designed to mimic existing transmission contracts on the interties to the Pacific Northwest), to block day ahead and hour ahead transmission that would allow electricity to "leak" out of the state.

One of the deeper problems posed by the centralized administered markets proposed so

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[30]As with many of the schemes, Fat Boy is not at all obvious. The frequent charges of underscheduling by the utilities in California actually misstate the complex mechanics of the California PX and ISO. Utilities entered a staggered demand curve at the PX on the theory that it would be less expensive to purchase energy from the ISO than the PX for some level of their load. Generators could trigger this "underschedule" by raising prices or withdrawing from the PX altogether. A Fat Boy removed energy from the formal markets and placed it the "back door" of the ISO where it was paid a price determined only after the fact. Logically, the generators faced a penalty for this practice, since they sacrificed a certain return for a price that could be zero if the energy was not needed. The role of Fat Boys in the reliability calculations leading to ISO emergency declarations is still unclear. One ISO representative, Eric Hildebrandt, believes that overschedules to imaginary loads were treated as a firm dependable supply by the ISO even though the penalty for not supplying power to an imaginary load is not at all clear.

energetically by power marketers like the "Big Five" is the age old question of who will watch the watchers. The California ISO adopted this secretive policy at the height of the crisis, apparently in the misguided illusion that it would prevent other utilities from purchasing electricity in California in order to refill their reservoirs.[31]

In practice, it reproduced the worst of "beggar my neighbor" policies so opposed by students of trade policy. The result was to disrupt long term contracts, discourage energy factoring between the two regions, and, ultimately, to raise the price of energy the ISO was purchasing from outside the region.

In sum, there is more than enough evidence that the reliability analyses practiced throughout the U.S. and Canada are relevant to the determination of scarcity. Low stream flows and modest reserves in 2000 did not lead to over one hundred emergency declarations in California. Average stream flows and modest reserves did lead to emergency declarations, helped by low levels of generation by the divested plants in California, marketing schemes, and policy errors at the California ISO.

Dr. Pope's overall conclusions leave much to be desired. She has not addressed how we can have 125 days of emergency declarations at the California ISO while reserve levels, after plant outages, were always higher than 13%. She has not satisfactorily answered why the plants owned by her clients failed to operate during system emergences, or why they failed to operate above 50% throughout the crisis.

Her conclusion that prices should have been higher in 2000 than 1999 is correct and undisputed, as far as I know, by anyone working in this area. The problem is not that prices increased, but that electric prices outpaced costs by a massive degree. Her desire to replace detailed reliability planning approaches with ad hoc calculations should be viewed with deep suspicion and concern. If she is right and the WECC is wrong, we face terrible risks and the costs of deregulation are unfathomably high. Luckily, it appears that Dr. Pope has followed the well trodden path blazed by Tim Belden two years ago and that reserve margins <u>after outages</u> above 13% are not a definition of scarcity.

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[31]The California ISO has indicated that this policy was not secret. To our knowledge, this policy was unknown by market participants elsewhere in the WECC. Tim Belden's staff was clearly briefed on this policy by the ISO during the spring of 2001, but we have been able to find no other references elsewhere.