Electricity: Dimensions of a Very Big Western Problem[1]

Philip K. Verleger, Jr.
PKVerleger LLC

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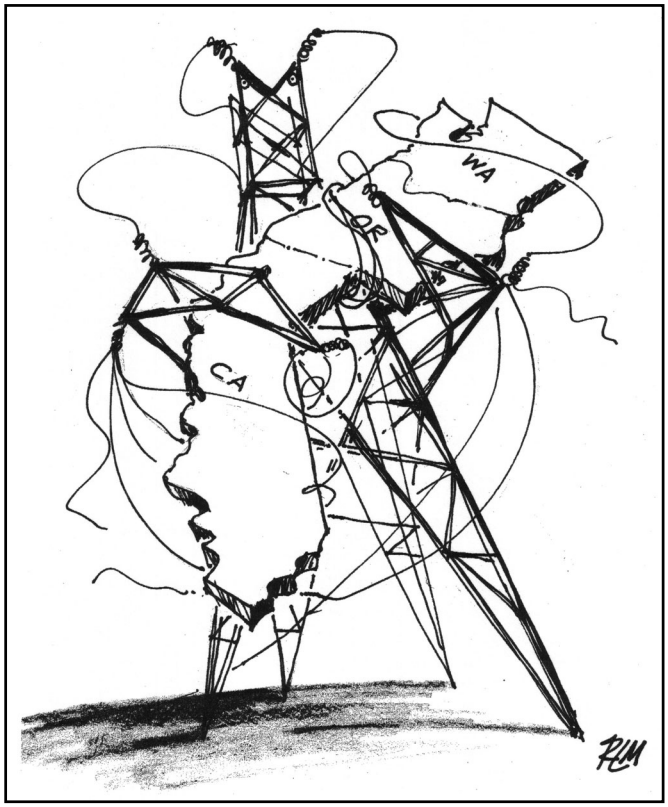
Electricity shortages in the western United States have the potential to disrupt the US and world energy markets. To be precise, electricity interruptions in the West could

- Constrain US economic growth, perhaps to the point of recession
- Aggravate the economic and political relationships between the United States and Canada
- Create a large increase in natural gas demand
- Alter the supply-and-demand balance for distillate and kerosene
- Add between 100 and 200 million barrels to world demand for petroleum over the next nine months, with most of the pressure falling on distillate fuel oil



The last of these five bullet points is reason enough for an extensive focus on the electricity market problems on the US West

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[1] Excerpted from *The Petroleum Economics Monthly*, April 2001, For questions and comments, please contact the author at 949-640-0563 or pverleger@compuserve.com.

Coast. Mother Nature has converted California's electrical soap opera into a national, perhaps even a worldwide crisis. This section examines the turmoil in depth.

FRAMING THE ECONOMIC ISSUE

The graphic on page 1 was created by Robert Miller, a Washington architect and consultant. Mr. Miller is a Yale graduate who fashioned his skills as an artist at the *Yale Daily News*, inheriting the job from a then unknown cartoonist named Gary Trudeau, creator of *Doonesbury*. The cover depicts California, Oregon, and Washington being carted away by an anthropomorphized electricity transmission stanchion. The meaning should be clear: the economic prospects of the West and possibly the nation have been hijacked by a venal, nasty Reddy Kilowatt, the innocuous little character that utilities once used to tout the economic benefits of electricity. This stunning development has a number of origins.

- First, the West is experiencing meteorological bad luck. The 2000-2001 snowfall in the Sierra Nevadas and the Cascades has been less than 50 percent of normal. Furthermore, rainfall in the Columbia River Basin has been well below the typical amount. This unfortunate trick of nature will sharply reduce the volume of hydroelectricity produced over the next year.

- Second, the West's economy is more closely tied to renewable natural resources than other regions. Environmentalists have long criticized the region for its continued dependence on these sources. For example, the western states still count on receiving an abundant supply of electricity produced by hydroelectric dams built by private and governmental entities. In a good year, these facilities provide 40 percent of the region's power.

- Third, by forcing output reductions at in-state power plants, California's ongoing electricity soap opera has stimulated demand for electricity from sources outside the region. Furthermore, the scarce hydro capacity mentioned above has been used unnecessarily this winter to meet the state's needs, leaving the region more vulnerable to disruptions later in the year.

- Fourth, the incompetent management of California's regulatory failure has increased the consumer cost of electricity across the region by discouraging timely conservation.

- Fifth, the coastal states have taken pride in being at the cutting edge of the technological revolution but have refused to permit construction of the infrastructure required to sustain technological growth.

- Sixth, economic growth and technological change have caused electricity consumption to increase rapidly in the region. The rapid growth of demand is now aggravating the squeeze on supply.

- Seventh, these circumstances have occurred just as federal and state governments attempt to transform the economic sector responsible for supplying electricity to the nation. The western drought and national surge in economic growth came along at a very importune time.

- Eighth, the self-centered actions of two utilities have exacerbated the situation. These firms, clearly ignoring the dimensions of the growing regional crisis, have put the interests of their shareholders above those of the public despite the fact that they have enjoyed a monopoly on electricity distribution.

In short, bad luck, bad policy, corporate greed, and technical change have created a unique set of circumstances that could constrain western economic activity for months or even years. This economic plague will not be confined to the West. Indeed, it could very well be transmitted to the rest of the United States and possibly to the world by hydrocarbon markets.

The first section of this discussion examines the basic supply-and-demand balance. Even here, the analysis is convoluted and complicated because data on electricity markets are hideously complex, badly presented, and incompetently maintained. The second background section assesses the effect of the 2000-2001 drought on electricity supply. The third section analyzes the relationship between aggregate levels of electricity consumption, fuel use, and peak demands, which have been the focus of policy makers and politicians. The fourth section assesses the impact of conservation and higher prices on the imbalance. The final segment focuses on the role of California's ill-timed and badly designed program of electricity deregulation in the crisis.

THE ELECTRICITY SUPPLY-AND-DEMAND SITUATION

Data on electricity markets are simultaneously voluminous, skimpy, and useless. Government agencies publish thousands of pages on generation and consumption at annual, monthly, daily, hourly, and minute frequencies. However, many of the statistics are incorrect. For example, the United States is divided into ten "generating regions" (NERC regions) by the National Electricity Reliability Council. These regional councils were formed to coordinate electricity distribution because utility interconnections create very complicated distributional issues. Each council publishes data on the capacity and output of utilities of its particular NERC region. In the past, these data provided a good picture of the region's capacity and generation output. However, deregulation has changed the situation. Today, independent generating companies produce a significant portion of the nation's power, and this is not included in the totals reported by individual NERC regions.

Table 1 illustrates the problem. This table shows electricity generation reported for the Western Systems Coordinating Council (WSCC)[2], electricity generation reported for utilities in the Mountain and Pacific Census regions (with Hawaii and Alaska excluded), and electricity generation reported for non-utility generators in the same Census regions. As the table illustrates, from 1997 to 2000 differences ranging from 2 to 41 percent exist in the total reported output. This disparity has increased with the advent of deregulation.

Table 1. Generation Reported by Different Entities as Published in DOE Statistics
(Million Kilowatt-Hours)

					Annual Increase		
Region	1997	1998	1999	2000	1997 to 1998	1998 to 1999	1999 to 2000
WSCC[1] (US only)	549,039	542,063	534,745	505,074	-1.3	-1.4	-5.5
Generation by Electricity Utilities[2]							
Mountain States	281,080	292,693	296,480	300,301	4.1	1.3	1.3
Pacific "Contiguous" States	278,472	258,416	251,653	227,444	-7.2	-2.6	-9.6
Total	559,552	551,109	548,133	527,745	-1.5	-0.5	-3.7
Generation by Non-Utility Generators[3]							
Mountain States	N/A	N/A	14,873	38,063	N/A	N/A	155.9
Pacific "Contiguous" States	N/A	N/A	106,877	148,699	N/A	N/A	39.1
Total	N/A	N/A	121,750	186,762	N/A	N/A	53.4
Total Generation Reported on State Level	559,552	551,109	669,883	714,507	-1.5	21.6	6.7
Difference between WSCC and State	-10,513	-9,046	-135,138	-209,433			

Notes:
[1]Table 6, *EIA Electric Power Monthly* (various issues).
[2]Table 7, *EIA Electric Power Monthly* (various issues).
[3]Table 61, *EIA Electric Power Monthly* (various issues).
Sources: EIA *Monthly Energy Review* and *Electric Power Monthly*.

The problem is also illustrated in Table 2. This table shows reported August consumption levels in the Western and Mountain states from 1997 to 2000. The reader's attention is called to the

[2] The WSCC is the NERC body responsible for coordinating transmission among utilities located in and west of the Rockies. This includes most of the western Census region except Alaska and Hawaii, most of the mountain states

row for California. According to DOE statistics, consumption in August 1999 declined by 13 percent from consumption in August 1998, while consumption in August 2000 increased by 29 percent from consumption in August 1999. Obviously, if the numbers were correct, the problems that have recently occurred in California could be more easily understood.

Table 2. Electricity Consumption for the Month of August in Western and Mountain States, 1997 to 2000 (Million Kilowatt-Hours)

					Annual Increase		
	1997	1998	1999	2000	1997 to 1998	1998 to 1999	1999 to 2000
Arizona	5,718	6,268	6,140	6,912	9.6	-2.0	12.6
California	20,394	22,320	19,350	24,962	9.4	-13.3	29.0
Colorado	3,344	3,418	3,932	4,903	2.2	15.0	24.7
Idaho	1,837	2,035	2,138	2,203	10.8	5.1	3.0
Montana	1,051	1,318	1,177	1,075	25.4	-10.7	-8.7
Nevada	2,540	2,746	2,768	3,073	8.1	0.8	11.0
New Mexico	1,671	1,735	1,656	1,743	3.8	-4.6	5.3
Oregon	3,786	3,975	3,687	4,303	5.0	-7.2	16.7
Utah	1,864	1,921	2,017	2,331	3.1	5.0	15.6
Washington	6,272	7,322	7,612	7,645	16.7	4.0	0.4
Wyoming	1,002	943	975	1,044	-5.9	3.4	7.1
Regional Aggregates							
Pacific	30,452	33,617	30,649	36,910	10.4	-8.8	20.4
Mountain	19,027	20,384	20,803	23,284	7.1	2.1	11.9
Total	49,479	54,001	51,452	60,194	9.1	-4.7	17.0

Sources: Table 45, *EIA Electric Power Monthly* (various issues).

However the data are not correct. Rather they are a reminder of the old caution "bad data are not just torn IBM cards."[3] According to experts at the California Energy Commission (CEC), deregulation of electricity sales has complicated the reporting of electricity consumption. Traditionally, most utilities tally consumption based on customer sales. However, some measure sales by the amount of power distributed to different consumer classes. This distinction was immaterial as long as all customers purchased power from the utility. With deregulation, though, some users buy electricity from other sources. These new suppliers report their sales, *as do the utilities*

except a small part of New Mexico and a small part of Montana, the provinces of British Columbia and Alberta, and small areas of Texas, Nebraska, and South Dakota.

[3] The author of *The Petroleum Economics Monthly* had used this line when teaching econometrics courses until a student approached and asked innocently, "Dr. Verleger, what is an IBM card?" Readers unfamiliar with IBM cards are advised to consult a dictionary for a definition and to revel in their youth!

that calculate sales by the volume of electricity sent to certain customers. The consequence is double counting and inaccurate statistics.

The underreporting problem would not be severe if it occurred in Utah, which accounts for only 4 percent of the region's consumption. However, the error occurs in California, which consumes 40 percent of the region's electricity. Thus, an analysis of the market situation requires some modification of historical information. *The Petroleum Economics Monthly* has made these adjustments.

Table 3 (page 7) presents historical data for each of the states and the regional totals for the years 1997 to 2000 along with a forecast to 2001. The unreliability of the California data stands out. Consumption rose by less than 1 percent from 1997 to 1998, by 2 percent from 1998 to 1999, and by 7 percent from 1999 to 2000, if the numbers are to be believed. *The Petroleum Economics Monthly* doubts such an increase occurred. Indeed, the CEC experts do not believe the state's electricity grid could accommodate such growth. To overcome this problem, *The Petroleum Economics Monthly* assumes that electricity growth in California increased at a 2-percent rate from 1999 to 2000 and will increase at a 2-percent rate from 2000 to 2001. This demand figure provides a basis for analysis of the region's problems.

The next step is to balance supply and demand. This is the electricity equivalent of identifying the missing barrels in the oil market. Unfortunately, the problem is more severe for electricity, where missing kilowatt-hours equal 10 percent of supply. Table 4 (page 7) shows *The Petroleum Economics Monthly's* calculation of the region's missing kilowatts from 1997 to 2000. If the numbers are correct, the region's accounting "misplaces" roughly 80 billion kilowatt-hours every year.

There is no, doubt, though, that the kilowatt-hours produced are consumed. Furthermore, the West imports some electricity from Canada. In fact, citizens of British Columbia enjoy very low electricity prices because their provincially owned utility is supplying power to California at prices Governor Davis has labeled exorbitant and worse.

Some of the missing kilowatt-hours are represented by direct sales by generators to final users. For example, direct sales by the Bonneville Power Administration are not counted in utility sales and so are missed. However, it is not possible to determine the exact magnitude of the direct sales. Consequently, they are included here as missing kilowatts.

Table 3. Annual Electricity Consumption Reported for Western and Mountain States, 1997 to 2000 and Forecast to 2001 (Million Kilowatt-Hours)

						Annual Increase			
	1997	1998	1999	2000	*2001*	1997 to 1998	1998 to 1999	1999 to 2000	2000 to *2001*
Arizona	54,103	55,376	57,605	61,569	*64,291*	2.4	4.0	6.9	*4.4*
California	224,288	224,808	229,483	245,937	*238,662*	0.2	2.1	7.2	*-3.0*
Colorado	37,736	39,326	40,853	45,934	*49,079*	4.2	3.9	12.4	*6.8*
Idaho	21,279	21,348	21,960	22,402	*22,791*	0.3	2.9	2.0	*1.7*
Montana	12,399	13,845	11,124	10,337	*9,818*	11.7	-19.7	-7.1	*-5.0*
Nevada	23,929	25,175	26,241	28,450	*30,144*	5.2	4.2	8.4	*6.0*
New Mexico	17,344	17,819	18,025	18,638	*19,092*	2.7	1.2	3.4	*2.4*
Oregon	47,216	48,160	48,943	52,345	*54,190*	2.0	1.6	7.0	*3.5*
Utah	20,438	20,773	21,928	23,427	*24,523*	1.6	5.6	6.8	*4.7*
Washington	85,599	92,796	94,239	93,427	*96,261*	8.4	1.6	-0.9	*3.0*
Wyoming	12,094	11,813	12,092	13,015	*13,347*	-2.3	2.4	7.6	*2.6*
Regional Aggregates									
Pacific	357,103	365,764	372,665	391,708	*389,113*	2.4	1.9	5.1	*-0.7*
Mountain	199,322	205,475	209,828	223,773	*233,084*	3.1	2.1	6.6	*4.2*
Total	556,425	571,239	582,493	615,481	*622,198*	2.7	2.0	5.7	*1.1*

Sources: Table 45, *EIA Electric Power Monthly* (various issues).

Table 4. The Missing Kilowatts — Calculation of Electricity Imbalance in Western States, 1997 to 2000 (Million Kilowatt-Hours)

	1997	1998	1999	2000
Consumption (Table 3 Total)	556,425	571,239	582,493	615,481
Generation in West (Table 1, Line 8)	559,552	551,109	669,683	714,507
Net Imbalance (Missing Kilowatts)	-3,127	20,130	-87,390	-99,026

Source: PKVerleger LLC.

THE 2000-2001 DROUGHT: EFFECT ON THE MARKET

The electricity supply-and-demand situation has been affected by events in California. For example, some non-utility generators called Qualifying Facilities (QFs) have curtailed or totally suspended operation due to their inability to cover their costs.[4] However, the real story in the West concerns water. The problem in 2001 is the lack of it. A drought in the Northwest and Cali-

[4] See *The Petroleum Economics Monthly*, March 2001, pp. 28–35.

fornia has left snow packs well below normal, and this will substantially reduce hydroelectric production from plants fed by the Columbia River Basin and the Sierra Nevada Mountains.

The lack of water is important because the West relies heavily on hydropower for electricity. The importance can be observed from Table 5, which shows generating capacity by fuel source for plants in the US WSCC and in the United States and Canada combined. As Table 5 illustrates, hydro facilities account for roughly 40 percent of the region's generating capacity. The lack of rain and snow will reduce the output from these plants.

Table 5. Summer 2001 Generating Capacity in the WSCC

Capacity Type	US (MW)	Share (%)	US and Canada (MW)	Share (%)
Combined Cycle	5,300	3.9	5,300	3.4
Conventional Turbine	6,448	4.7	7,358	4.7
Geothermal	2,562	1.9	3,137	2.0
Hydro	49,007	36.1	60,751	38.6
Nuclear	9,214	6.8	9,214	5.9
Other	6,710	4.9	6,916	4.4
Pumped Storage	4,099	3.0	4,099	2.6
Coal	30,616	22.5	36,495	23.2
Steam Turbine	21,916	16.1	24,215	15.4
Total	135,872		157,485	

Source: WSCC.

The importance of these facilities to the region's electricity supply can be seen from Table 6, which shows that hydro generating facilities account for 35 to 40 percent of the region's locally supplied power if seasonal snow pack and rains provide the required water.

Table 6. Hydro Generation as a Share of the West's Electricity Generation (Million Kilowatt-Hours)

	1997	1998	1999	2000
Total Generation (Table 1, Line 8)	559,552	551,109	548,133	527,745
Hydro Generation (Utilities Only)	236,470	210,022	215,915	188,615
Hydro as a % of Total	42.3%	38.1%	39.4%	35.7%

Source: US Department of Energy, PKVerleger LLC.

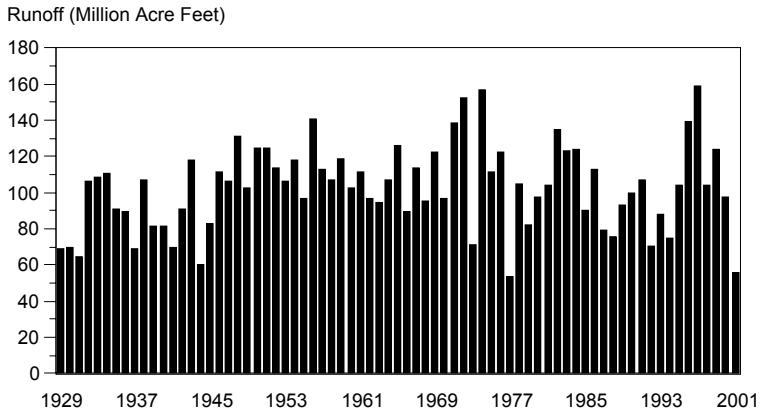
In 2001, the required snow and rain did not come to the Northwest. The Acting Administrator and the Chief Operating Officer of the Bonneville Power Administration (BPA) have been warn-

ing since the start of the year that low water levels in the Columbia River Basin would limit electricity production.[5] COO Steven Hickok explained the consequences in a March 7 speech:

> The Columbia basin this winter is experiencing stream flows that are among the lowest in recorded history. This has eliminated 6,000 MW from the Northwest hydropower system's winter capability; and with snow pack standing at half normal levels, the power prospects for the rest of the year are bleak.[6]

Figure 1 highlights the problem described by Hickok. This figure shows the volume of water (measured in million acre feet) passing The Dalles, a key location on the Columbia located between eastern Oregon and Washington. The data, supplied by BPA to PKVerleger LLC, indicate that the projected volume of water flowing over the dams will be only 58 million acre feet over the next twelve months compared to 98 million acre feet a year earlier. This decline will cause hydro production to drop. BPA predicts that the reduced water flow will cut power generation on the Columbia by 4,700 MW from March to August. Even greater difficulties are projected for the winter if the drought continues through the summer.[7]

Figure 1
Volume of Water Measured at The Dalles, 1929 to 2000, and Forecast to 2001



Source: BPA.

The problem can be seen from Table 7 (page 10), which presents a supply-and-demand balance for the last four years and for 2001. The table shows projected demand, adds in the missing kilowatts, and then balances demand with supply. For calculation purposes, utility non-hydro and non-utility generation in 2001 is assumed to equal 2000 levels. Hydro production is assumed to be cut by 33 percent in

[5] The Bonneville Power Administration operates a network of dams constructed by the federal government to control the flow of the Columbia River and capture its potential to supply electricity.
[6] Steven G. Hickok, "Fundamentals of the Electric Power Situation in the Pacific Northwest," Speech to the Portland Metropolitan Chamber of Commerce Northwest Energy Forum, March 7, 2001 [http://www.bpa.gov/corporate/kc/sp/sp022201.pdf].
[7] See Stephen Wright, "Reducing BPA's Wholesale Power Rate Increases," April 9, 2001 [http://www.bpa.gov/corporate/kc/mediacenter/ratemit5.pdf].

2001 by the drought, which is possibly an optimistic assumption. The resulting calculation reveals an imbalance in 2001 of 76 billion kilowatt-hours if hydro production is cut by one-third. The imbalance increases to 100 billion kilowatt-hours if hydro production is cut in half. (For reference, 1 million kilowatt-hours equal roughly 2 million barrels of oil or 10 billion cubic feet of natural gas.)

Table 7. Calculation of Electricity Market Imbalance Created by Western Drought
(Million Kilowatt-Hours)

	1997	1998	1999	2000	*2001*
Consumption from Table 3	556,425	571,239	582,493	615,481	*622,198*
Missing Kilowatts from Table 4	-3,127	20,130	-87,390	-99,026	*-90,000*
Net Generation (Line 1 less Line 2)	559,552	551,109	669,883	714,507	*712,198*
Less Non-utility Supply (DOE Table 61)	N/A	N/A	121,750	186,762	*186,000*
Less Utility Non-Hydro (DOE Tables 7, 11)	323,082	341,087	332,218	339,130	*330,000*
Equals Required from Hydro	236,470	210,022	215,915	188,615	*196,198*
Available from Hydro	236,470	210,022	215,915	188,615	*120,000*
Imbalance	0	0	0	0	*76,198*

Source: US Department of Energy, PKVerleger LLC (2001 estimates).

BPA officials are alarmed by the low water levels on the Columbia. Acting Administrator Stephen Wright has spoken frequently on the issue and called for increased conservation in BPA service areas. In a recent BPA paper, Wright warned that prices might have to increase by 200 to 300 percent if emergency conservation measures were not taken. To address the problem, Wright called on industrial users to cut consumption or even shut down. In his paper, Wright stated,

> …we are asking our direct service industries — or DSIs — to agree not to take power from us for up to the first two years of the rate period in return for certain limited compensation to the companies and their workers. It is our expectation that the companies would not be able to operate given a potential tripling of rates anyway.[8]

Wright continued by noting it was not BPA's intention to drive the aluminum industry out of the region. However, he added that BPA would not have a statutory obligation to continue serving firms in the industry after 2006.

The shutdown of aluminum producers should cut western electric demand by roughly 10 billion kilowatt-hours, possibly reducing the imbalance to 65 billion kilowatt-hours.[9] This would still

[8] Wright, p. 4.

[9] BPA's 1994 annual report reported that aluminum producers purchased 18.6 billion kilowatt-hours (p. 50). Subsequently, the agency has since stopped publishing information by industrial users as part of the deregulation process. *The Petroleum Economics Monthly* estimates that consumption remained at these levels until the summer of 2000, when the first wave of price increases caused industrial users to close down and sell their power to California utili-

leave the West with a huge inequity that must be closed. Ultimately, the gap will be closed through three actions:

- Curtailing demand (blackouts)
- Increasing prices
- Substituting fossil-fuel generation for hydro generation

ELECTRICITY DEMAND VS. ELECTRICITY CONSUMPTION AND FUEL IMPLICATIONS

The analysis of electricity markets traditionally addresses issues of instantaneous demand and supply rather than production and consumption over time. This focus is required if the lights are to remain on and the system is to function. Thus, much of the output of utility commissions, utility economists, and utilities addresses the issues of load profiles — projections of peak demands for electricity on the day of the week or month when consumption peaks. In contrast, the less glamorous job of tracking total consumption (kilowatt-hours used), revenues earned, and fuel used is left to the accountants.

Most analysis of the West's problems has been directed at the issue of peak demand, not consumption or fuel requirements. For example, over the last two months, the California Independent Systems Operator (CAISO) and the WSCC have both warned that some peak demands cannot be met during the summer of 2001. Rolling blackouts will be required to maintain system reliability. News of these warnings has been spread widely. Neither organization, however, has attempted to predict demand volumes. Nor has any organization attempted to quantify the fuel requirements created by the electricity crisis.

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ties. Consequently, it is estimated that these users probably purchased around 10 billion kilowatt-hours in 2000. Their purchases are expected to drop to zero in 2001.

Forecasts of Peak Demand

The California Energy Commission forecast of peak demand during the summer of 2001 is shown in Table 8.[10] In its forecast, the CEC projected that peak demand would increase to 61,125 MW on the warmest day this summer. Against this forecasted demand, the CEC was able to identify existing resources of only 59,209 MW, leaving a gap of 3,050 MW. The CEC labeled the gap as "expected outages," presumably a euphemism for rolling blackouts.

This projection now appears to be optimistic because the CEC counted on 4,834 MW of imported electricity from the Pacific Northwest and the Southwest. The drought in the Northwest makes the imports questionable. In addition, some QF generation capacity included in the projected output of 45,025 megawatts in the "Existing CAISO Control Areas" line in Table 8 will almost certainly not be available. The more likely level of existing resources is probably 57,000 MW, leaving a gap of around 5,000 MW.

The CEC also identified 5,000 MW of "Additional Resources with On-Line Potential" for July 2001 and a separate category of "New Generation with On-Line Potential for July 2001." Included in these two categories were 3,262 MW of peaking facilities.

The analysis suggests that California may just squeak through the summer of 2001 with peak demand equaling peak capacity on the hottest days. On those days, there will be no reserve capacity at all.

The CEC projection actually extends a trend in California to have smaller and smaller reserve margins on the warmest days. This trend is observable from Figure 2. There, peak-day demand and available capacity are graphed. One can note that the reserve margin has shrunk steadily from 1988 to 2000.

Table 8. California Summer 2001 Forecasted Peak Demand and Resource Balance (MW)

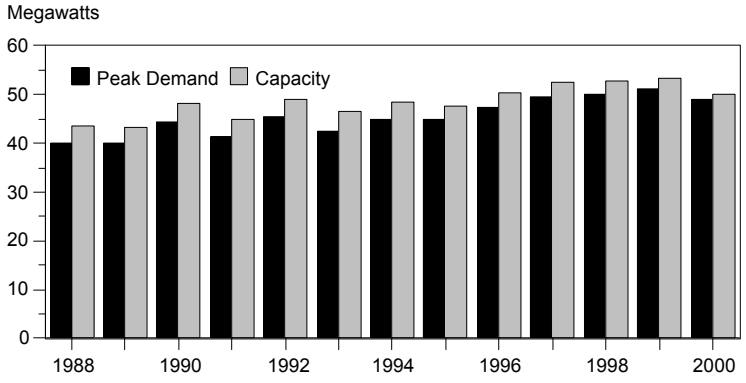
Peak Demand	61,125
Existing Resources	
Existing CAISO Control Areas	45,025
Net Imports	4,834
LADWP Resources	8,198
Imperial Irrigation District	875
Eastern Sierras	277
Total Existing Resources	59,209
Potential Resources from Existing Projects	3,741
Potential Resources from New Projects	1,312
Total Generation Capacity	64,262
Projected Requirements	61,125

Source: California Energy Commission.

[10] See "California Summer 2001: Forecasted Peak Demand Resource Balance," California Energy Commission and Electricity Oversight Board, February 8, 2001 [www.energy.ca.gov/electricity/summer_2001_dsf.pdf].

Both the CEC and the California ISO do not believe the state will make it through the summer without experiencing blackouts.[11] Resource deficiencies of 600 MW and 3,700 MW are projected during the summer. In the most likely case, 34 days of rolling blackouts are expected. These interruptions will enable the system to maintain operation but will restrain peak demand.

Figure 2
Historical Peak Electricity Demand in California and Total Capacity (including Reserves)



Note: Totals omit demand in certain areas not reported before 1996.
These demands boosted total demand in 2000 by 2,500 MW.
Source: PKVerleger LLC.

Fuel Requirements

Blackouts will balance the market. They are, however, unlikely to affect total electricity consumption because use will be shifted from one time of day to another. The blackouts may even boost total usage.[12]

The fuel used in generating electricity is likely to be increased by California's tribulations. Efforts to stave off blackouts will require continuous use of inefficient peaking units if these facilities can operate for long periods reliably. The efforts to prevent blackouts will also require the use of new emergency peaking facilities. The CEC identified a need for 1,000 MW of such capacity in its February forecast. (General Electric is know to have supplied 10 percent of this total by leasing 100 truck-mounted 1 MW gas-fired turbines to various locations in the state.) This emergency capacity, if operated continuously over the summer, would by itself boost natural gas consumption by 76 billion cubic feet, assuming the units are relatively efficient (see Table 9 below). The trouble is there are certainly not enough units. As Table 9 indicates, 3,557 generators would be required to fill the calculated gap.

[11] See "CAISO 2001 Summer Assessment Version 1.0," March 22, 2001, Operations and Engineering Group, California ISO [www.caiso.com/docs/09003a6080/0c/af/ 9003a60800cafcd.pdf].
[12] It can be argued that electricity consumption will be increased in the absence of conservation. For example, refrigerators will consume more electricity because they will operate for longer periods to offset the warming that occurred while power was cut.

In short, if peak demand and electricity demand continue to grow, the West's electricity woes caused by the Northwest drought can be offset (if they can be solved at all) only by substantially boosting the use of peaking facilities that will require much greater use of natural gas. Alternatively, the problem may be addressed by conservation.

Table 9. Calculation of Number of 1 MW Generation Units Required to Fill the West's Generation Gap

Output (kW)	1,000
Days	90
Hours per Day	24
Heat Efficiency Rate[1]	3
Btu per kWh	3,412
Btu per Cubic Foot of Natural Gas	1,032
Cubic Feet of Gas Consumed per Unit	21,424,186
Number of Units Needed	3,557
Million Cubic Feet of Natural Gas Used	76,206

[1]Heat efficiency rate is the number of Btu required to produce 1 Btu of electricity.

Source: PKVerleger LLC.

The Role of Conservation and Higher Prices

California Governor Gray Davis and BPA Acting Administrator Stephen Wright have both called on consumers to reduce energy use. Of the two, Mr. Wright was far more blunt.

In his April 9 speech, Wright explained that BPA was beginning negotiations with customers for the volume of power to be supplied in the next fiscal year and the price that would be charged. Many of the customers are publicly owned or municipal power companies located in the Northwest, but others are investor-owned utilities. Each year these customers negotiate twelve-month contracts that begin on October 1. Many of these customers have a right to buy from BPA. Wright explained in his speech that BPA had entered contracts to deliver 14,000 MW when it had supplies of only 11,000 MW.[13] BPA was forced to purchase 3,000 MW on the open market. Wright noted, "The only way we can meet our obligations is to buy the vast majority of the additional power in a wholesale market where supplies are tight and prices are sky high."[14]

To avoid price increases of between 200 and 300 percent, Wright called on utility customers to reduce their use substantially: "We are beginning negotiations now with our customers. If people don't come to the table with reductions in their demand for electricity, a very large and very damaging rate increase is inevitable."[15] As added incentives, BPA offered conservation and renewable discounts, demand exchange programs, and incentives to those utilities adopting innovative rate structures.

[13] Wright, p. 2.
[14] Wright, p. 2.
[15] Wright, p. 4.

California has also introduced a number of measures designed to conserve electricity use. However, most of the proposals are contained in draft legislation that may not even be enacted before summer and that will certainly have little effect.[16] Meanwhile, California and the rest of the West will need to rely primarily on prices to reduce energy use.

How large a price increase will be required? Mr. Wright suggests that increases of 200 to 300 percent may be necessary, given the imbalance in the Northwest. The California Public Utilities Commission (CalPUC) has asserted that an increase of between 30 and 46 percent should be enough.[17] These estimates appear to be very different, but the increases described by BPA are at the wholesale level, while those described by CalPUC are at the retail level.

However, by one measure the number offered by CalPUC seems too small. According to *The Los Angeles Times*, CalPUC estimated that the proposed rate increase would raise $4.8 billion from consumers at annual rates. The same article also reports that the state and utilities spent $5.2 billion buying power in January alone and the state's Department of Water Resources spent an additional $3 billion buying power during late January, February, and March. Thus, by one simple metric it would appear that an increase of as much as perhaps 300 percent might be required to balance California's market, assuming the higher costs are passed on to consumers.[18]

A 300-percent increase in retail prices would, of course, shock the economies of California and the nation. Consumer expenditures on electricity would be boosted at the expense of other purchases, as would inflationary pressures. Electricity consumption would also be affected, as high prices presumably would induce consumers to cut use.

Unfortunately, there is little economic precedent for predicting the impact of such a large price increase. Consumers have rarely been confronted with 300-percent price raises for any commodity.

Not surprisingly, the one recent experiment with a large increase in electricity prices occurred in California. Between June and September 2000, consumers purchasing electricity from San Diego Gas & Electric faced increases of almost 100 percent. James Bushnell and Erin Mansur recently

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[16] See, for example, Julie Tamaki, "Legislators to Promote Energy Conservation," *The Los Angeles Times*, February 6, 2001, and Jennifer Warren and Carl Ingram, "Raft of Bills Aimed at Energy Conservation," *The Los Angeles Times*, March 31, 2001.

[17] See Nancy Vogel and Tim Reiterman, "PUC Approves Largest Electricity Rate Increase in State's History," *The Los Angeles Times*, March 28, 2001, p. 1.

[18] This is calculated on the theory that CalPUC's proposed increase of 3 cents per kilowatt-hour, which was described as a 46-percent rate increase, would raise $5 billion in a year, while up to $32 billion might be required to pay the cost of purchased power if the estimates of amounts covered by the current rates for January through March were extrapolated to the entire year.

published an analysis of the impact of these increases.[19] They found that large rise in prices reduced consumption by 1.6 to 2.3 percent. However, they do not convert the calculation to a price elasticity due to the nature of the price increase.

Bushnell and Mansur noted that prices in San Diego rose when San Diego Gas & Electric (SDG&E) was relieved of rate caps that had prevented it from raising rates.[20] This allowed SDG&E to pass on purchased power costs immediately, unlike Southern California Edison and PG&E. Consequently, the average retail rate rose from 12.1 cents per kilowatt-hour for the period August 1999 to June 2000 to 20.7 cents per kilowatt-hour from June 24 to July 11, and then to 24.3 cents per kilowatt-hour from July 12 to August 31, 2000.[21] The increase prompted an immediate revolt on the part of consumers. An *LA Times* article published at the time noted that residents in San Diego were the first in the nation to pay the true market price for power.[22]

San Diego consumers quickly took matters into their own hands. Petitions to the legislature demanded the reinstatement of regulation. At the same time, a widespread consumer boycott began as consumers refused to pay the higher rates. By the end of August, the legislature enacted a law freezing rates for small and medium-sized retail customers. Average rates dropped to 15.1 cents per kilowatt-hour for September through December.[23]

Bushnell and Mansur studied San Diego's short experiment with high prices. They noted that the consumer response to higher prices was probably delayed because consumers did not receive their first real notice that prices had increased until mid-July, roughly four weeks after prices had gone up. They also suggest that the consumer response to higher prices may have been muted following the increase because politicians were publicly attacking SDG&E by the time the bills arrived and, further, were promising to roll back the price increases. Concerning their statistical estimates, they report,

> Although it is tempting to treat these results as estimates of the price elasticity of demand, the caveats given above [concerning the uncertainty regarding future prices] warn against such a strict interpretation. Although we observe a reduction of demand around 2.3% during this pe-

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[19] James Bushnell and Erin Mansur, "The Impact of Retail Rate Deregulation on Electricity Consumption in San Diego," Working Paper PWP-082, Program on Workable Energy Regulation, University of California Energy Institute, Berkeley, California, April 2001 [http://www.ucei.berkeley.edu/ucei/PDF/pwp082.pdf].
[20] SDG&E's rate increases as well as those of California's two other utilities, PG&E and SCE, were capped until the utilities recovered their "stranded costs" created by regulation. The utilities accepted this capping of rates as part of the state's deregulation of electricity. SDG&E was the first utility to finish recovering its costs and escape regulation.
[21] Bushnell and Mansur, p. 11.
[22] Tony Perry, "Sticker Shock Hits Customers of San Diego Utility," *The Los Angeles Times*, July 17, 2000, p. A1.
[23] Bushnell and Mansur, p. 6.

> riod, it is nearly impossible to estimate what price customers thought they were going to pay.[24]

They later conclude that a doubling of prices should lead to roughly a 2.3-percent reduction in demand.[25]

These statistics have very troubling implications for the West because they suggest that price increases of as much as 500 percent may be necessary this summer to balance supply and demand, assuming aluminum processors shut down. This startlingly high estimate is based on the calculated imbalance in Western markets shown in Table 7 above. This table showed a "predicted level of demand" that exceeded supply by 76 billion kilowatt-hours before adjusting for the shutdown of the aluminum industry, or around 65 billion kilowatt-hours after adjustment for reduced aluminum output. This represents 9.7 percent of projected consumption. The Bushnell and Mansur analysis suggests a price increase of 500 percent to balance supply and demand. According to this calculation, the average price paid for electricity by California consumers might have to increase to 50 cents per kilowatt-hour. Were this to occur, expenditures by Californians on electricity would rise from $8 to $40 billion per year.

Such extraordinarily large price increases would be required only if the region could not replace some of the power lost due to the drought through greater use of fossil-fuel plants. Most experts and *The Petroleum Economics Monthly* expect that part of the generating gap will be filled by output from these plants. The possible magnitudes were discussed earlier. Roughly speaking, one may speculate that the generation gap shown in Table 7 could be filled by increased output. This would cut the magnitude of the required price increase in half.

The need for an extraordinary price increase in the short run could also be mitigated by the fact that price elasticities increase over time. Very short-term elasticities may be small. However, longer-term elasticities tend to be four to ten times larger, increasing as consumers replace capital, change processes, and adjust to higher price levels.

California's Unneeded Contribution

The West would face electricity constraints in 2001 even in a perfect world. The world is, however, far from perfect. The electricity situation has been complicated by California's inept handling of electricity deregulation, by the actions taken by the state's largest utility, Pacific Gas and Electric, and by other regulations imposed as part of the deregulation of the state's natural gas and electricity industries. In addition, California's refusal to allow retail rate increases

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[24] Bushnell and Mansur, p. 18.
[25] Bushnell and Mansur, p. 21.

blocked the market signals that otherwise would have encouraged consumers to begin adjusting to higher rates in a more timely fashion.

It is impossible to catalogue all the mistakes made by California. However, a partial list would include

- The failure to deal promptly with the problems created by Southern California Edison's and PG&E's failure to pay operators of Qualifying Facilities
- The refusal of the state PUC to allow some recovery of higher costs for purchased power by the state's utilities, thereby sending consumers the proper market signal
- The flawed structure of the California ISO, which permitted unaccountable individuals to purchase power with no regard for price or economic consequences
- The imposition of regulations that made the construction of competing natural gas pipelines in the state impractical
- The imposition of regulations that discouraged construction of distributed generation facilities until the eleventh hour

These actions have (a) allowed demand to rise to artificially high levels while (b) depressing electricity generation in California. The incremental demand has pushed up electricity prices across the West, augmenting the economic harm caused by the drought.

The state's failure to address the economic circumstances confronted by operators of QFs was addressed in the March issue of this publication. Depending on the sources consulted, refusal to pay operators of QFs has idled between 3,000 and 5,000 MW of capacity. This output has been replaced by purchases from utilities located outside the West and from non-utility generators. The increased demand has clearly pushed prices higher.

The refusal of the state's PUC to approve rate increases at the beginning of the year also exacerbated the situation. In December 2000, California's three major utilities petitioned for rate increases that would have allowed them to recover the costs of power purchased for them by the state's ISO. The California Public Utility Commission refused to grant the increase, offering instead a token rate boost of 9 percent rather than the 100-percent increase required to resolve the problem.[26] CalPUC's failure exacerbated the West's difficulties in two ways. First, the refusal to

[26] Nancy Vogel, Dan Morain, and Nancy Rivera Brooks, "PUC Plans $5-a-Month Electricity Rate Hike, *The Los Angeles Times,* January 4, 2001, p. A1.

act put the utilities in danger of going bankrupt and increased the risk of selling power to California. This increase in financial risk caused firms selling to California to raise prices to offset the chance of not being fully paid. The risk premium has been factored into prices charged to California buyers and buyers in other areas.

CalPUC's refusal to permit price increases also prevented markets from encouraging consumers to conserve. The absence of a price signal meant that consumers had no incentive to reduce consumption. Instead, use continued at high rates without regard to the approaching problems.

California also added the problem by giving its ISO responsibility for purchasing power for the state. ISO operators are generally engineers, not traders. There is every indication that the engineers operating the system have done a generally incompetent job of acquiring electricity for the state, many times offering unnecessary premiums for the power they bought. Their inexperience and ineptitude has undoubtedly lifted prices across the West as other buyers have been forced to match the prices offered by California.

California made the problem worse by imposing regulations that impeded completion in the intrastate natural gas market. When California deregulated its natural gas transmission pipeline system, it agreed to require consumers choosing to use alternative gas lines to pay a prohibitive residual load tariff should they ever be forced to switch back, even for a day. This "tax" would be paid to the owners of the existing pipelines to assist in recovering investments made at the time the system was regulated (so-called "stranded assets). This tax has discouraged construction of competing pipelines to power plants located on the coast and left the southern part of the state with a single monopoly pipeline system.[27] Capacity is tight and prices paid by generators for natural gas have been extraordinarily high at times. These high prices have contributed to the high rates (in excess of $500 per MW) charged over the last six months.

Lastly, California adopted policies that discouraged construction of "distributed generating facilities." Over the last decade, a large number of industrial customers across the country have cut loose from the electricity grid in part or in total by constructing "distributed generation facilities" at their offices or plants. For example, the Detroit Metropolitan Airport built its own generating plant as part of a recent expansion. Unfortunately, California has adopted policies that have made such decisions uneconomic. Consumers proposing to build distributed generating facilities are required to continue paying fees to utilities even though they take little power. This charge has reduced the installation of such facilities and made California more dependent on out-of-state generators.

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[27] Christine Hanley, "Tariff May Limit Flow of Natural Gas," *The Los Angeles Times,* April 16, 2001, p. A3.

In total, the counterproductive actions taken by California represent nothing more and nothing less than a repetition of history. More than thirty years ago, the US Supreme Court ruled that the field price of natural gas shipped in interstate commerce was subject to federal regulation. The Federal Power Commission responded by imposing price controls on gas. Over time, these controls discouraged production while encouraging consumption. The gap between supply and demand that developed was filled by oil, raising the nation's dependence on imported petroleum.

A few years later, the Nixon Administration imposed price controls on domestically produced oil. These controls moderated the effects of OPEC's 1973 price increase and protected consumers from the world price of oil. Consumers responded by using more. Their increased consumption boosted demand for OPEC exports and put upward pressure on world oil prices. At the time, Japan and its European allies roundly criticized the United States for playing into OPEC's hands.[28]

Today, California's counterproductive policies are having an identical effect. The drought in the Northwest would require large increases in Western power prices even if California were following perfect policies. However, California's polices are far from perfect. As a result, prices in the West will be pushed much higher. The cost of these policy errors will be measured in billions, perhaps even tens of billions of dollars.

[28] Flora Lewis, "European Achievement: Harmony on Oil Problem," *The New York Times,* June 23, 1979, p. D1, and Leonard Silk, "Tokyo Meeting: Test on Energy," *The New York Times,* June 22, 1979, p. D2.