September 2001

Predictably Unpredictable

Volatility In Future Energy Supply And Price From California's Over-Dependence On Natural Gas

CALPIRG Charitable Trust

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California Public Interest Research Group Charitable Trust

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"The oil and gas industry is in painful need of a wake-up call.

"Over the years, the industry's wonderful can-do attitude, coupled with an over-cautious mindset that prices will never rise, created an industry-wide blindness to the many energy problems looming over the horizon, and the train wreck about to occur in the energy markets. Too many problems were ignored for too long. It is a sad commentary to have to make, but I fear we are now in the early days of a severe energy crisis that will take at least a decade to fix."

- Matthew Simmons, consultant to the National Petroleum Council, December 2000[1]

"Future gas prices will oscillate due to shifts in supply availability, demand fluctuations, and regulatory changes... Temporary price spikes will tend to generate high levels of concern throughout the market."

- California Energy Commission, August 2001[2]

"Policies encouraging gas use as a base load fuel for power generation should be rethought."

Emil Attanasi, U.S. Geological Survey, August 2001[3]

Executive Summary

In response to the California energy crisis, state policy makers have rushed to approve and encourage the construction of as many natural gas power plants as possible. This could have dangerous effects on the state's long-term energy stability.

Demand for natural gas across the country is skyrocketing, and domestic supplies are tight. Because California has become more heavily dependent on natural gas for electricity production than any other state, it is particularly vulnerable to supply disruptions and price volatility. By relying so heavily on one fuel source, the state risks setting itself up for another energy crisis in the near future. California policy makers should therefore pull back from their haste in building natural gas power plants and tap the vast in-state potential for renewable energy instead.

Demand for natural gas is skyrocketing.

- Natural gas consumption is growing rapidly in the U.S., with demand expected to be 60% greater in 2020 than it is today. Worldwide demand is expected to double by 2020.
- In California, use of natural gas for electricity generation has increased by 8% since 1999 and is expected to increase by another 29% over the next few years.
- Twenty-six new natural gas power plants with a combined capacity of 11,303 megawatts (MW), enough power for 7.7 million homes, have been approved since 1999.
- 94.5% of new centralized energy production currently under development will come from natural gas. Only 5.1% will come from clean renewable resources - geothermal and wind. 45% of California's electricity will be generated from natural gas when all approved new plants are built.

The U.S. has very limited supplies of natural gas.

- The U.S. Geological Survey estimates that the U.S. has 1,049 trillion cubic feet (tcf) of gas. Only 2.6% of it is in California. Only 16% of it is proved reserves.
- If demand were to grow by 2.3% per year through 2020 as predicted by the Department of Energy and stay constant thereafter, and imports from foreign nations remain around 16% of demand, this amount of gas only constitutes a 38-year supply.

The productivity of gas wells is steadily declining. We are having to drill more wells per year just to produce the same amount of gas.

- There are 2½ times as many wells in the U.S. today as there were in 1973, but each well is only producing a third as much gas.
- If well productivity continues to decline at the current rate, U.S. energy companies will have to drill more than 700,000 wells over the next twenty years to meet national production goals. This is 2.3 times as many wells as are currently in operation.
- Since we've already tapped the more accessible reserves, many of these wells will be deeper in the ground, deeper under water, and deeper into ecologically sensitive areas.

California and U.S. energy officials are knowingly instituting an energy policy that will lead to increased dependence on foreign fuel supplies.

- DOE predicts the U.S. will import 17% of its gas by 2020.
- Because of limited domestic supplies and limits to the growth rate of produc-

tion, this is likely to be a vast underestimation.

- As domestic reserves become further depleted, the shortfall will undoubtedly worsen after 2020.

California's over-dependence on natural gas will lead to steadily rising prices mixed with periodic price spikes. Although prices may drop over the next few years from their currently inflated levels, the long-term trend is expected to be upward.

- As larger gas fields are depleted, smaller ones will be more expensive to develop.
- Gas companies will increasingly have to rely on unconventional reserves requiring advanced equipment to excavate.
- Since shipping gas overseas requires liquefying the gas at -256 degrees Fahrenheit, it is very expensive.
- Gas price volatility has increased since the early 1980s as the industry has become more tied to short-term market signals.
- Occasional price spikes have always been a regular feature of the natural gas market due to periodic supply disruptions. As we narrow the margin between growing demand and available supply, these disruptions are sure to become more frequent and severe.

The cost of renewable energy generation will steadily decline and will not be subject to price spikes. Proposals for new renewable energy projects are ready to go.

- Because renewable energy has no fuel costs, its costs are predictable and stable. Once the plants are built, producers only have to pay the regular operating and management costs to keep the power flowing.
- Both wind and solar energy costs have plummeted over the last twenty years and are predicted to continue declining. Geothermal energy costs are already very competitive and are predicted to remain steady.
- Several new renewable energy projects are currently under construction. Renewable energy companies have already presented many other proposals to the new California Consumer Power and Conservation Financing Authority.

INTRODUCTION

In 1996, major industries in California were calling for deregulation of the electricity market in order to bring down rates. They argued that electricity was more expensive in California than most other states, and that rates needed to come down if the state was to stay competitive in manufacturing and technology development.

Five years later, California regulators approved the largest-ever electricity rate *increase*.

One of the biggest reasons for this rate increase had little to do with deregulation. The price of the natural gas that fuels many California power plants went through the roof. Energy companies had not received sufficient price signals to expand production, and demand for gas had outpaced supply. Natural market fluctuations resulted in greatly increased wholesale prices.

Because the state is so dependent on this one fuel source, the price spikes had a tremendous impact on our energy markets. The higher rates will now be with us for a long time. And so will our over-dependence on natural gas.

Market fluctuations will always be a problem as long as our energy system depends so heavily on a fuel source that needs to be discovered, excavated, and delivered. This is especially true for natural gas, since domestic supplies are very limited and overseas markets and delivery structures are still undeveloped.

Because natural gas is a limited resource, average prices will gradually rise over the next twenty years and beyond. And as we go deeper underground for less certain reserves and rely more on international markets for our gas, we have to be ready for price volatility.

Fortunately, there is a better alternative. California has tremendous untapped potential for renewable energy. The technology is ready to go, and the economics are looking better all the time. Many projects are being developed right now with minimal financial assistance, while others need a boost to get them on the market. As they gain increasing shares of the energy market, their average generating costs will steadily decline.

In addition, electricity from renewable energy sources will not be subject to periodic price spikes, since the fuel is free. Wind, sun, and geothermal fields are not subject to market fluctuations. Once renewable energy producers build their plants, they can count on a steady price for generating electricity throughout the lifetime of those plants.

California has a clear choice for its long-term energy policy: slowly rising prices mixed with price spikes or slowly declining prices without spikes. In approving plants and encouraging technologies, policy makers should take a long-term view and begin now to build the sustainable energy future.

The Future of Natural Gas

Natural gas offers clear environmental advantages over coal, oil, and nuclear power. As a transition fuel, it makes sense to develop some amount of gas-fired electricity production to displace the worst energy-related public health threats. But what's good in small doses can be disastrous on a larger scale.

By relying on natural gas for almost all of its new electricity production, California may be setting itself up for another energy crisis soon after it finds its way out of the current crisis. If the state recklessly puts all of its faith in natural gas, the shortcomings of this fossil fuel can greatly outweigh its benefits.

- Demand for natural gas is skyrocketing in California, across the country, and around the world.
- U.S. domestic reserves of natural gas are relatively small.
- Many of the remaining U.S. gas reserves are less accessible than the reserves that have already been tapped.
- The U.S. will increasingly have to rely on expensive and unreliable supplies of gas from overseas.
- Gas prices will likely rise steadily and remain volatile as supplies fluctuate.

Table 1: 1999 California Electricity Production[4]

Resource	Peak Capacity (MW)	Production (GWh/yr)	Pct of Domestic Production
Natural gas	29,245	84,703	37.4%
Hydro	8,826	41,617	18.4%
Nuclear	6,127	40,419	17.9%
Coal	6,501	36,327	16.1%
Biomass	1,106	5,663	2.5%
Oil	481	55	0.02%
Geothermal	2,213	13,251	5.9%
Wind	1,581	3,433	1.5%
Solar	354	838	0.4%
Total Domestic Production		**226,306**	
Imports		**49,487**	
Total Consumption		**275,793**	

Current California Production and Use

California has been increasing its reliance on natural gas for electricity generation for the past twenty years. More than any other state, California has turned to gas as a way to decrease the negative environmental impacts of power plants.

Before the additions of new natural gas-fired power plants coming online over the past year, California already depended on natural gas for more than one-third of its electricity supply. This is twice as large as the contribution from any other single fuel.

Most of the gas to fuel these plants comes from outside the state. Before the new additions of new natural gas power plants, California already imported 85% of its gas

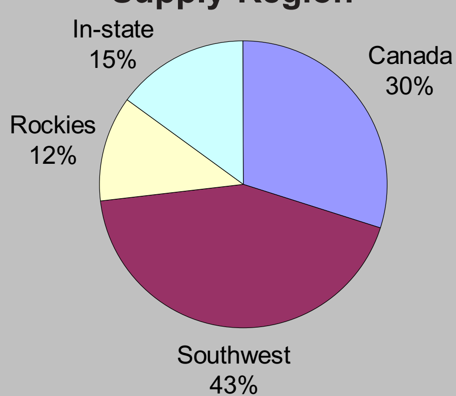
Note on Units

Megawatts (MW) is a unit of measurement indicating how fast a plant can put out electrons. This is the standard measure of the generating capacity of a power plant. It is also used to determine if the total generating capacity on the grid is enough to satisfy demand at any one time. Since California is currently most focused on meeting demand during peak demand times, MW is the most common unit used in discussions of energy policy. Megawatt-hours (MWh) is a unit measuring the total amount of electrons produced over some time frame. A 50 MW power plant operating at full capacity for one hour produces 50 MWh of electricity. This is the appropriate unit for talking about how much of the state's electricity was produced by various sources in a given time frame. To measure how much such a plant would produce in one year, simply multiply the capacity by the number of hours in a year (50 MW x 8,760 hrs/yr = 438,000 MWh/yr). 1,000 MWh equals one gigawatt-hour (GWh).

supply - from the Southwest, from the Rocky Mountains, and from Canada.

Due to concerns over the reliability of these gas imports, natural gas power plants were originally designed to use fuel oil as a backup when gas supplies were tight. As burning oil is extremely polluting, however, use of oil-fired plants has been restricted and phased out over time. When gas prices dropped in the early 1990s, it became unprofitable for the power plants to store oil on-site and most discontinued their oil-burning capabilities. Only four gas-fired power plants in California today maintain the capability to burn oil as a back-up. The rest of the gas-fired power plants, including all new ones under development, have no backup strategy in case of a natural gas shortage.

Figure 1: 1997 California Natural Gas Receipts by Supply Region[5]



Growing Demand

As long as demand is growing for a limited resource, the size of the resource matters much less than the rate of growth. A supply that would last 100 years at a constant demand level is used up in 47 years with only 3% annual growth. Triple the supply and it only adds 31 years. Ten times the original supply would only last another 40 years. Cutting demand by just 1% per year, on the other hand, will extend the hundred-year supply to 1,673 years.

Table 2: Generation Approved Since 1999[8]

Resources	Approved New Capacity (MW)	New Production (GWh/yr)	Pct of New Production
Natural gas	11,303	32,737	94.5%
Hydro	2	9	0.03%
Biomass	26	133	0.4%
Geothermal	98	587	1.7%
Wind	547	1,188	3.4%
Total	**11,976**	**34,654**	

New California Plants

In California, energy policy makers have been in a rush to get new gas plants online as quickly as possible. Use of natural gas for electricity generation has already increased by 8% since 1999, and approved plants would increase demand by another 29% over the next few years.[6]

Twenty-six new natural gas power plants with a combined capacity of 11,303 MW have already been approved since 1999, enough power for 7.7 million homes.[7] 94.5% of new centralized energy production currently under development will come from natural gas. Only 5.1% will come from clean renewable resources - geothermal and wind. A small amount of clean renewable energy will also come online from dispersed photovoltaics, not included in this calculation of centralized production.

Figure 2: Total Current and Approved Energy Mix

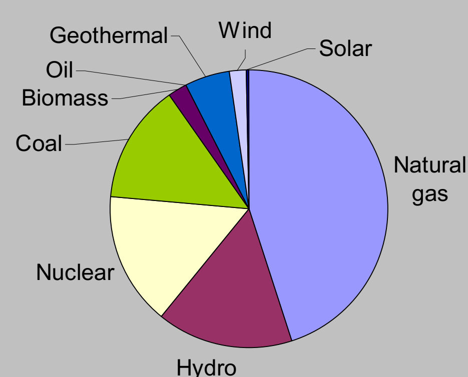


Table 3: Total Current and Approved Energy Generation

Resource	1999 Peak Capacity (MW)	Approved New Capacity (MW)	Total Current and Approved Capacity (MW)	Total Current and Approved Production (GWh/yr)	Pct of Total Production
Natural gas	29,245	11,303	40,548	117,440	45.0%
Hydro	8,826	2	8,828	41,626	16.0%
Nuclear	6,127		6,127	40,419	15.5%
Coal	6,501		6,501	36,327	13.9%
Biomass	1,106	26	1,132	5,796	2.2%
Oil	481		481	55	0.02%
Geothermal	2,213	98	2,311	13,838	5.3%
Wind	1,581	547	2,128	4,621	1.8%
Solar	354		354	838	0.3%
Total	**56,434**	**11,976**	**68,410**	**260,960**	

National Demand

As California rushes to add gas-dependent power capacity, so does the rest of the nation and much of the rest of the world.

The Department of Energy projects that total U.S. gas demand will increase by an average of 2.3% per year for the next twenty years. If this bears true, the nation will be using 60% more gas in 2020 than in 1999, with consumption rising from 21.7 trillion cubic feet (tcf) to 34.7 tcf. [9]

With a limited amount of natural gas and limits to how fast it can be tapped, it is doubtful that this demand growth can be met with domestic supplies. As demand will be difficult to curb once major power plants are built from coast to coast, energy companies will increasingly have to rely on expensive and unstable supplies of gas overseas.

Within the domestic market, California will likely have to continue to pay a premium to secure supplies. With 90% of new power plants nationwide expected to be fueled by natural gas, domestic competition will be intense.[10] California stands at a disadvantage in this competition since it lies at the end of the road for interstate natural gas pipeline deliveries.[11]

Limited U.S. Domestic Supplies

The U.S. has already used up approximately half of its total historical natural gas supply.[12] Since demand is much higher now than the average of the past eighty years and is growing rapidly, our remaining gas supplies are not nearly as abundant with respect to need as they were when natural gas power plants first became common.

By their best estimate, the U.S. Geological Survey and the U.S. Department of Energy predict that there are 1,049 trillion cubic feet of natural gas reserves in the U.S.[13] This includes all anticipated future discoveries and a factor to increase the size of known reserves to account for the possibility of underestimation and more thorough extraction at known reserves.[14]

Only 2.6% of this gas is in California. 40% is in the Gulf Coast, 20% in the Rocky Mountains, and 11% in the Texas/Oklahoma/Kansas region.[15]

If demand were to grow by 2.3% per year through 2020 as predicted by the Department of Energy and stay constant thereafter, and imports remain at 16% of demand, this amount of gas only equates to a 38-year supply.

We will not continue at full production levels until the last wisp of gas is used, of course, but instead will either dramatically increase imports or drastically cut demand well before we reach the end of our supply. Since power plants are designed to operate for more than thirty years, this reversal will come before the end of the useful lifetimes of the plants now being built.

Proved Reserves

The amount of gas in proved reserves - known resources that can be recovered profitably with existing technology - is actually quite small. The 167 tcf of U.S. proved reserves represents a seven-year supply at projected demand levels. Only 16% of estimated total domestic supplies are proved reserves.

Proved reserves are down 15% over the past ten years.[16] That is, the margin between what we've confirmed to exist and we're already extracting is becoming thinner. This gives us a smaller margin of error for difficulties in tapping new expected reserves.

Future Discoveries

There are many areas where preliminary geological data suggests that gas deposits may exist but which have not been developed into producing fields. Until a production company goes in to extract the gas to bring it to market, surveyors are not certain if any gas is actually there. Approximately one in two production wells drilled finds developable gas.[17]

In 1996, the U.S. Geological Survey published the results of a comprehensive three-year survey of natural gas reserves on land and in state waters which are expected but not proved. In this analysis, they found 259 tcf of conventionally recoverable gas.[18] In that same year, the U.S. Minerals Management Service published an assessment of gas reserves in federal waters indicating 268 tcf of gas in conventional reserves.[19]

Table 4: U.S. Projected Natural Gas Supply

	Known Supply	Additional Supply	Total Supply
		(in trillion cubic feet)	
Proved Reserves	167		
New Discoveries		527	
Field Growth		355	
Total Reserves	**167**	**882**	**1,049**

Discoveries of new gas fields have been rare. The largest gas fields were discovered between 1910 and 1956. Only 8% of gas production in the early and mid-1990s was from newly discovered fields, while more than 90% was from extensions in old fields and adjustments to reserve estimates.[20] This trend continued in the late 1990s, with new discoveries 5% lower in 1999 than in 1998 and 31% lower than in 1997.[21] Hence, most of the major resource areas in this country have most likely been identified, with the remaining question being exactly how big each of those fields are.

Field Growth

Estimates of the size of natural gas reserves have historically been considerably lower than the reserves have actually turned out to be. This phenomenon, often known as "field growth," happens for three principal reasons: actual expansion in drilling reach through well extensions, improved recovery resulting from new technology, and recalculation of estimates based on continued surveying and experience. Because field growth has consistently occurred, it is now included in USGS assessments of total available supply based on historical averages.

Of the 1,074 tcf of natural gas which USGS estimates to exist in the U.S., 322 tcf (30%) is expected from field growth.

Limits to Production Growth

Several factors indicate that we will have to rely on overseas gas supplies even earlier and more extensively than the numbers above suggest. The actual number of cubic feet of natural gas supplies remaining is not the only crucial consideration when estimating available fuel. Declining production rates of natural gas wells, the time needed to develop gas fields, and accessibility of the reserves are equally important.

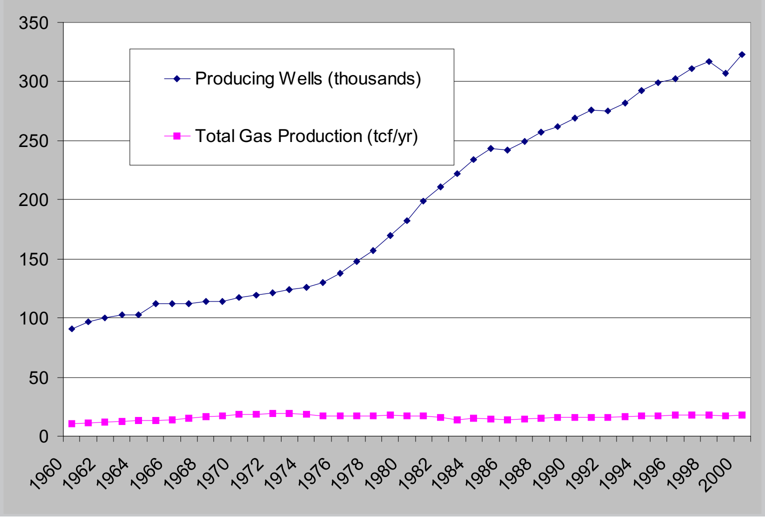


Figure 3: Number of Wells Needed to Sustain U.S. Gas Production[22]

Declining Production Rates

Energy companies have had to drill a vastly increasing number of wells each year to provide a marginally increasing supply of gas. If they are to increase production dramatically over the next twenty years as projected, they will have to increase drilling even further.

The productivity of gas wells peaked in 1973 and has steadily declined since then. The 124,000 wells in the U.S. in 1973 produced an average of 182 million cubic feet (MMcf) of natural gas. This productivity fell sharply in the following years, then continued on a gradual decline. From 1984-2000, the average annual gas production per well declined by 21 percent. In 1999, the country had two and a half times as many wells as in 1973, but each well was producing less than a third as much gas - 307,000 wells produced an average of 55 MMcf/yr each.

The natural gas industry has evidence that the rate per well of natural gas production will continue to decline. William Wise, Chairman and CEO of the world's biggest natural gas company, El Paso Corp., recently stated plainly that gas production in North America is flat despite a recent surge in drilling. Receipts from his company's expansive pipeline systems have stayed roughly constant for the past three years. “Our field services are in all of the basins where all of the drilling in the United States is taking place and we are not seeing a production response. We're just kind of treading water, holding our own,” Wise told an annual energy conference in March. Decline rates - the reduction in well output over the previous year - have increased from 17% per year in 1970 to nearly 50% today. “What not everybody realizes is the same thing is happening in Canada,” Wise said. Decline rates there went from 20% per year in 1990 to 40% per year in 1998.[23]

Rate of Development

Largely because of decreasing well productivity, energy companies will have a difficult time keeping up with increasing demand. To meet the DOE projection of 29.1 tcf annual production by 2020, the gas industry would have to drill an unprecedented and possibly unfeasible number of wells.

If the productivity per well stays constant at the current rate of 55 MMcf/yr, 529,000 producing wells will be needed to produce 29.1 tcf of gas in 2020. This is 72% more than the 307,000 wells in operation in 1999. With the generous assumption that all current wells will still be producing gas in twenty years, the U.S. would need an additional 221,600 producing wells. Since only one out of two wells drilled actually produces gas, 443,200 wells would need to be drilled, an average of 23,300 per year. This is just slightly more than the number of wells that were actually drilled in 2000.[24]

However, since the productivity per well has declined continually since 1973, it would be more realistic to assume that the productivity rate will continue to decline. Between 1984 and 2000, productivity declined by 21%. If productivity declines another 20% over the next twenty years, 707,800 new wells will need to be drilled, an average of 37,000 per year. Since drilling will be significantly less than that in the next few years as the industry gradually expands, drilling in the latter part of the twenty-year period will need to be well over 40,000 wells per year, a truly unprecedented amount.

Table 5: New Wells Needed to Meet Production Goals

	Constant Productivity Scenario	Declining Productivity Scenario
Projected 2020 Annual Gas Production (MMcf)	29,100,000	29,100,000
Average Annual Production per Well (MMcf)	55	44
Producing Wells Needed	529,091	661,364
Current Producing Wells	307,449	307,449
New Producing Wells Needed	221,642	353,915
Percentage of New Wells that Produce Gas	50%	50%
New Wells Needed	443,284	707,829
New Wells Needed per Year	23,331	37,254

If productivity rates decline even faster than the decline of the past fifteen years as we go into deeper reaches to tap smaller gas reserves, even more drilling than that will be needed for the industry to meet its production goals.

In his address to the National Petroleum Council, oil and gas industry leader Matthew Simmons explained, “For the first time in our nation's history, we are out of the capacity to grow our use of petroleum products, out of capacity to increase natural gas supply, and out of electricity generating capacity during hot summer days or cold winter days in too many regions of the country… It is time to begin preparing a national energy contingency plan for what to do if natural gas supplies cannot grow by any significant degree. It is time to begin preparing an escape route for our electricity markets if we fail to deliver the massive growth in natural gas supply needed to provide feedstock for the large backlog of natural gas-fired electricity plants being built.”[25]

Accessibility

Many of the new gas wells needed in the next twenty years will be tapping reserves that are more difficult to reach than those we've already excavated.

As gas producers have extracted much of the gas in the shallow waters of the Gulf of Mexico, they now need to build platforms in deeper waters. As they have depleted the Texas reserves close to the surface, they need to drill deeper wells.

In addition, with the largest reserves gone, it will take more work to extract the remaining gas from smaller fields. The Energy Information Administration recently stated that the natural gas industry is undergoing a “natural progression of the discovery process from larger and more profitable fields to smaller, less economical ones.”[26]

Accessibility challenges are clearly apparent in the Gulf of Mexico, where tapping the bulk of the remaining supply will involve drilling into depths never before reached. The difficulty of this undertaking is evidenced by a new federal subsidy specifically directed toward deepwater drilling, as well as the enormous investments oil companies are making in an attempt to develop technologies capable of the task.

The Outer Continental Shelf Deepwater Royalty Relief Act of 1995 allows the Secretary of the Interior to suspend the royalty payment obligations of companies leasing oil fields in the Outer Continental Shelf of the Gulf of Mexico when certain conditions are met. The Act directs the Secretary to follow an evaluation process to determine which fields “appear uneconomic with royalties but are potentially viable with royalty suspensions.”[27]

Similarly, the multi-billion dollar Deepstar project demonstrates the immense challenge involved with excavating the bulk of the remaining oil and gas in the deep waters of the Gulf of Mexico. Deepstar is attempting to develop a dizzying array of highly sophisticated technology to overcome issues such as extremely high pressures and low temperatures in the sea that remain stubborn barriers to access.[28]

Figure 4: U.S. Natural Gas Consumption vs. Production[31]

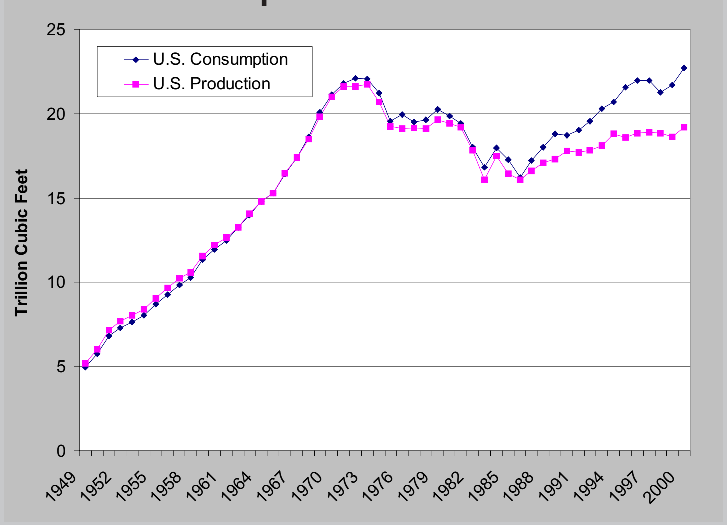
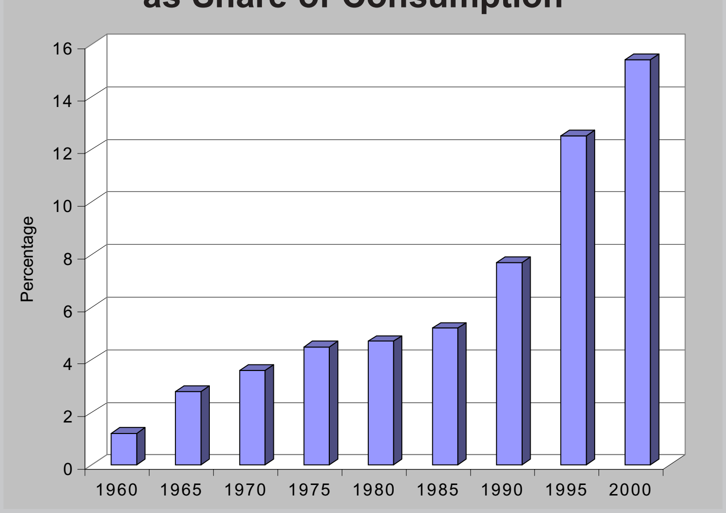


Figure 5: Net U.S. Natural Gas Imports as Share of Consumption[32]



Also impeding accessibility are ecologically important and sensitive areas. Much of the gas in the Rocky Mountains lies below important wildlife habitat. Extreme care would have to exercised if this gas were ever to be developed.

Protected lands in the Rocky Mountains containing gas deposits include Bridger Teton National Forest, Book Cliffs-Desolation Canyon, Grand Staircase-Escalante, Lockhart Basin, Otero Mesa, Red Desert, Rocky Mountain Front, San Juan National Forest Roadless Area, Upper Green River Basin, Upper Missouri River Breaks National Monument, and Vermilion Basin.

Existing environmental safeguards would need to be removed before much of this land could be cleared for drilling. However, stiff opposition from the public will make such moves difficult. According to a recent survey, only 16% of Americans consider more drilling in the U.S. the best energy strategy, while 44% prefer developing alternative energy sources and 31% prefer more efficient use of energy.[29] Without public support for removing wilderness protections, many reserves in the Rocky Mountains region may remain off limits.

Natural Gas Imports

Since about 1986, U.S. production of natural gas has not been able to keep up with the nation's consumption, and the gap is predicted to continue to widen.

The Department of Energy (DOE) estimates that domestic production in 2020 will be 29.1 tcf per year, 83% of the 34.7 tcf projected demand.[30] As domestic reserves become further depleted, the shortfall will undoubtedly continue to worsen after 2020. California and U.S. energy officials are therefore knowingly instituting an energy policy that increases dependence on foreign fuel supplies.

Because of the factors outlined above - limited supplies and limits to the growth rate of production - the gap between domestic supply and demand is likely to widen even faster than DOE projections. The nation's electricity supply would therefore be increasingly dependent on expensive and uncertain foreign supplies of gas.

Liquefied Natural Gas

Gas imported from Canada can be shipped by pipeline, but pipelines are not an option for overseas gas shipments. To import natural gas from other continents, the gas must first be turned into a liquid by cooling it to -256 degrees Fahrenheit. It is then shipped overseas, turned back into a gas at receiving facilities, and sent by pipeline to its final destination. The process is prohibitively expensive for wide-scale use at today's prices.

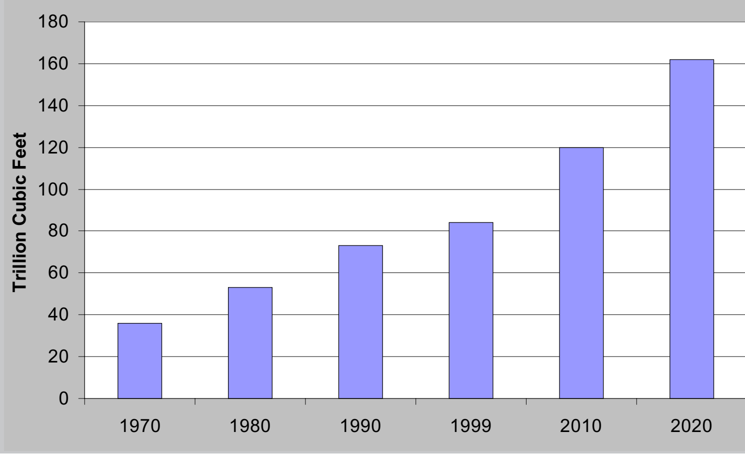
Liquefied natural gas (LNG) currently constitutes less than 1% of U.S. supply, and two of the country's four receiving facilities have been mothballed due to high costs.[33] But companies are responding to expected increases in gas prices by re-investing in those facilities, with plans to resume shipments in 2002.[34] Phillips Petroleum and El Paso Corporation also recently announced a $5 billion plan to ship LNG from Australia to a new West Coast facility starting in 2004.[35]

LNG imports doubled in 1999 over the previous year, then grew by another 35% in 2000 for a total of 0.22 tcf.[36] DOE very conservatively estimates LNG imports will increase by 8% annually through 2020.[37] Trinidad and Tobago, Qatar, and Algeria are the largest LNG exporters to the U.S. market. The increasing need to import LNG from these areas will inevitably drive prices up overall.

Worldwide Demand

By the year 2020, the Energy Information Administration projects worldwide consumption of natural gas will reach 162 trillion cubic feet, nearly double the amount consumed in 1999.[38] Developing countries, most notably in Central America, South America, and Asia, will account for the largest increases in gas use in the next twenty years.[39] There will therefore be plenty of demand for the gas supplies which are easiest to develop.

Figure 6: Worldwide Natural Gas Consumption[40]



Price Projections

Rising Prices

Most energy experts agree that the average price of natural gas will gradually rise over the coming years and decades.

Even the unflinchingly optimistic Energy Information Administration (EIA) predicts that natural gas prices will rise between 1.2% and 2.8% per year in constant dollars through 2020.[41] In the gas price section of its most recent Annual Energy Outlook, EIA states that "increases reflect the rising demand projected for natural gas and its expected impact on the natural progression of the discovery process from larger and more profitable fields to smaller, less economical ones."[42]

EIA also notes that more difficult extraction processes will need to be used in the future: "The projected price increases also reflect more production expected from higher cost

Figure 7: U.S. Natural Gas Prices[47]

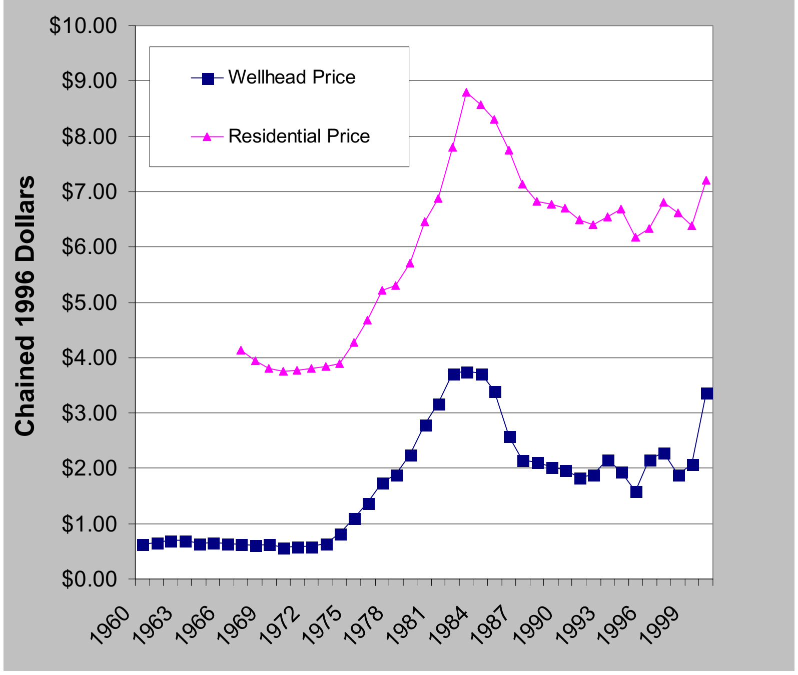
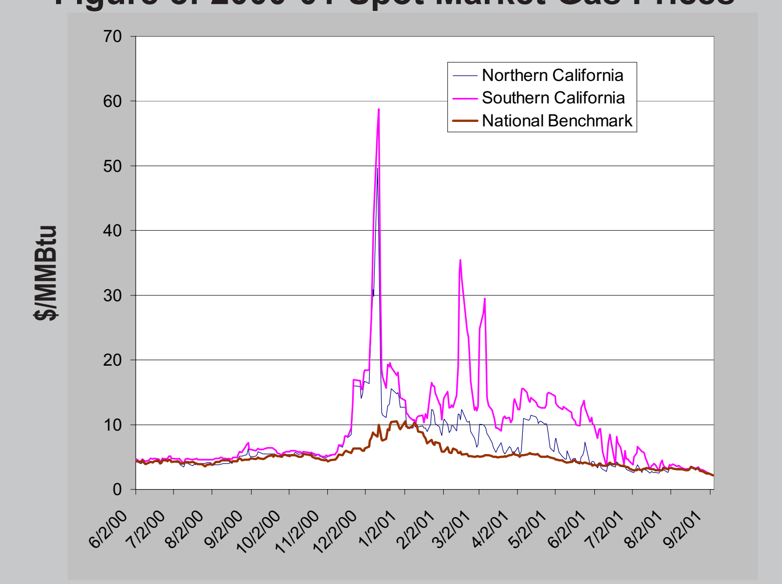


Figure 8: 2000-01 Spot Market Gas Prices



sources, such as unconventional gas recovery."[43]

Increased imports from overseas will also drive up the average price of gas. Liquefying gas, shipping it, and regasifying it is an expensive process. The more we need to rely on LNG to fuel our power plants, the more expensive our electricity will be.

Volatility

Although forecasts of future natural gas prices vary, most forecasters are in agreement that natural gas prices will continue to be volatile.

Through the year 2020, the EIA expects the price to fluctuate: "Like any commodity price, actual natural gas prices are likely to oscillate significantly around the trend line projected in the Annual Energy Outlook 2001 as a result of business cycles in the industry, unusual seasonal temperature variations, or other special circumstances like pipeline ruptures - the kinds of events that have been experienced in the past 24 months."[44]

EIA explains that restructuring of the industry, making gas companies more tied to short-term market signals, has also led to increased natural gas price volatility since the early 1980s.[45]

Short-term price spikes have always been a regular feature of the natural gas market due to periodic supply disruptions.[46] As we narrow the margin between growing demand and available supply, these disruptions are sure to become more frequent and severe.

Recent Price Spikes

Natural gas price spikes plagued the entire country in 2000-2001, but California was hit the hardest. While the spot price at the Southern California trading center averaged 18% higher than the national benchmark in the third quarter of 2000, the price was 112%

higher in the fourth quarter and 136% higher in the first quarter of 2001.[48]

The California Energy Commission lists three main factors that led to recent natural gas price spikes:

- Rapidly expanding demand, particularly in electricity production.
- The lack of alternatives.
- Shortage in pipeline capacity.[49]

Each of these factors will continue and worsen in the near future.

- **Expanding demand:** Demand for natural gas is currently experiencing its most rapid growth ever. As detailed above, energy companies will be greatly challenged to keep up with this growth rate.
- **Alternatives:** With approved gas plants currently under construction, the state will deepen its reliance on natural gas. Gas turbines once used fuel oil as a backup fuel source, but this is no longer an option for both economic and environmental reasons. Clean, renewable energy sources - wind, solar, and geothermal - currently generate just 8% of California's energy. Under the "renewable portfolio standard" proposal currently being debated in the legislature, this would increase by about 1% per year. It would therefore be several years before fuel diversity is significantly increased.
- **Pipeline capacity:** CEC finds that a lack of excess pipeline capacity leads to "extraordinary volatility and price spikes." They predict that the gas industry will remedy the situation, but in a timeline that "can stretch into several years."[50] Utilization levels for pipelines delivering gas to California have been well above 95% in recent years,[51] and intrastate utility pipelines are running at near capacity as well.[52] Without a buffer in capacity, supply and demand dynamics of the market are not able to function to keep prices in check. And increasing capacity comes with a hefty price tag - it costs about $700,000 to build a mile-long stretch of pipeline in an unpopulated area and about $2 million per mile to build a pipeline in a populated area.[53]

Other Traditional Technologies

While over-dependence on natural gas is problematic for California, turning back to coal, oil, or nuclear are simply not feasible options. Coal and oil-fired power plants would severely worsen the state's already polluted air, and nuclear power is an intolerable risk and an economic failure.

Coal and Oil

Coal and oil are the largest contributors to energy-related health problems. Although coal plants make up only 56% of power plant boilers in the country, they are responsible for 93% of the industry's nitrogen oxide emissions, 96% of the industry's sulfur dioxide emissions, and 99% of the industry's mercury emissions.[54] Oil plants are also heavy polluters, emitting twice as much NOx and 80 times as much SO2 as gas plants.[55] These emissions are in turn the greatest contributors to smog, fine particulate matter, and atmospheric mercury deposition. This pollution results in children with exacerbated asthma, youths with diminished attention capacity, adults with chronic bronchitis, and lethal respiratory complications.[56]

Burning coal and oil is also a leading cause of climate change, probably the most dangerous effect of global energy production. Since the advent of fossil fuel technology we have doubled the atmospheric concentration of carbon dioxide, the most prevalent greenhouse gas. Large-scale and irreversible climate change could alter ocean currents, cause devastating droughts, floods, and violent storms, and spread tropical diseases to temperate climates.[57] In the 1990s, extreme weather caused more than $9 billion dollars in damage and emergency management spending in California.[58]

A 400 MW oil-fired plant emits nearly five billion pounds of carbon dioxide per year,[59] and coal plants emit more than three times as much as oil plants.[60]

Because of California's poor air quality, coal and oil have been almost entirely phased out from in-state production, though the state does import electricity generated from coal from Utah and Arizona.

Nuclear Power

Nuclear power puts our lives at risk from potentially disastrous accidents and creates the most harmful substance known, for which there is no safe disposal process. For these reasons, construction of new nuclear power plants or extensions of the lives of old ones should not be considered.

Direct exposure to irradiated fuel from nuclear reactors delivers a lethal dose of radiation within seconds. According to the Department of Energy, 95% of the radioactive waste in this country (measured by radioactivity) is from commercial nuclear reactors. The storage of this waste poses a threat to water supplies throughout the nation. At the Hanford Nuclear Reservation in Washington, 67 of 177 underground tanks have leaked more than one million gallons of waste, contaminating groundwater and threatening the Columbia River.[61]

Presently there are more than 42,000 metric tons of spent fuel in temporary storage in the U.S., with that number increasing by five metric tons every day.[62] The potential risk to human health is staggering. The total radioactivity of our spent fuel at this point is 30.6 billion curies; one curie generates a radiation field intensity at a distance of one foot of about 11 rem per hour; the exposure limit set by federal regulation for an individual is 5 rem per year.[63]

The risks of both catastrophic events and leakage of radioactive material into our environment pose great threats to our public health. Even low-level radiation has been linked to cancer, genetic and chromosomal instabilities, developmental deficiencies in the fetus, hereditary disease, accelerated aging, and loss of immune response competence.

The risk of accidents at reactors is also ever-present. Because many nuclear plants in the U.S. are decaying, the risk of accidents is greater now than it ever has been.

Further risk may come from transporting high-level nuclear waste. The nuclear industry has been trying for years to establish a single national nuclear waste repository. If such a facility were to be established, the risk of accidents and leakage would be immense. Despite all their efforts, the industry has been unable to identify a facility capable of safely storing the deadly waste permanently. Also, transportation of spent fuel rods from reactors to the repository would be extremely dangerous. The Nevada Agency for Nuclear Projects recently calculated the risks of transporting nuclear waste using analyses by the Department of Energy and independent consultants. They concluded, "Accidents are inevitable and widespread contamination possible."[64]

Nuclear power is also uneconomical. Nuclear power would not exist in this country today were it not for massive government subsidies. Taxpayer-financed federal R&D money alone has totaled $66 billion.[65] On top of that, the nuclear industry has received a special taxpayer-backed insurance policy known as the Price-Anderson Act, taxpayer-funded cleanup of uranium enrichment sites, the costly privatization of the previously government-owned Uranium Enrichment Corporation, and unjustifiably high electricity rates from state regulators. Add to this the enormous bailouts for industry spending on nuclear power in state deregulation plans that began a few years ago and will continue in the coming years. "Stranded costs" in just eleven key states may total more than $132 billion.[66]

RENEWABLE ENERGY PROSPECTS

California has vast renewable energy potential. The state has some of the best geothermal and solar resources in the world, as well as excellent wind resources. Renewable projects utilizing wind, geothermal, and solar energy are already operating today throughout the state, proving the technology is ready to economically harness these resources. Currently 2,213 MW of geothermal, 1,581 MW of wind, and 354 MW of solar capacity are operating in the state.[67] Together these resources provide enough power for 2.8 million California households.

Despite its substantial progress and vast potential, clean renewable energy sources were only granted two contracts in the first round of long-term contracts negotiated by the California Department of Water Resources in July.

One such project, Mountain View I & II, a 66 MW wind farm in Riverside, was granted a ten-year contract beginning in October 2001 to sell power at 5.85 ¢/kWh. This is considerably less than many recently approved contracts with natural gas plants. Similarly, a ten-year contract has been granted to a new geothermal project in Lake County, California that will provide 25 MW at 6.7 ¢/kWh.[68]

More recently, the state also granted a contract to a second new wind farm - a twelve-year contract for 108 MW at 6 cents/kWh.[69]

While only a baby step forward, these projects represent a great new direction for energy production in California. Dozens of renewable power projects will be presented before the new California Consumer Power and Conservation Financing Authority in the upcoming months. These proposals present viable options for affordable, reliable energy production in California.

Price Stability

Because renewable energy has no fuel costs, its total costs are predictable and stable. Once the plants are built, producers only have to pay the regular operating and maintenance costs to keep the power flowing. The fluctuating fuel costs of fossil fuel-based power plants are not a factor for renewable energy producers.

The fact that more of the costs are upfront rather than spread out in the form of ongoing fuel costs constitutes a challenge in the development of renewable energy projects, since investors need to undertake more financing at the start of the project. However, since this also results in greater certainty of the total costs over the full lifetime of the plants, hesitation over high initial investments can be eased through market certainty. When the state enters into long-term contracts with renewable energy producers, guaranteeing a stable price for much of the lifetimes of their plants, the initial investment hurdle is greatly reduced.

Growth in renewable energy industries over the past decades has also settled and lowered costs. The average prices of wind and solar energy have plummeted over the last twenty years and are predicted to continue declining. Geothermal energy costs, which currently range from slightly higher to lower than conventional fossil fuel power, have also declined historically and are predicted to remain roughly the same over the next ten years.

Growth in renewable energy industries will also create high-paying jobs in California. Rather than allowing the state's energy dollars to go to out of state fossil fuel developers, investing in renewable energy will keep that money in the state economy. A “Renewable Energy Valley” akin to Silicon Valley's dominance in the high-tech industry could become a pillar of the state economy.

Geothermal

Potential

The California Energy Commission estimates that the state has the potential for 4,000 MW of additional geothermal electricity-generating capacity that can be developed using today's technology.[70] The best of these resources can be developed now at a cost lower than the cost of a natural gas power plant.[71] Currently, geothermal facilities can generate electricity for 1.5-8 ¢/kWh.[72] Geothermal fields are producing electricity in Lassen County, Lake County, Coso, Mammoth, and the Imperial Valley.

Economics

The geothermal plants at The Geysers, in Lake County, are the best example of how renewable energy can pay off in the long term. The plants were built in the 1960s and are still operating today. Some of the generating facilities have been modernized, but much of the original infrastructure remains, including the wells. Since the capital costs of the original construction are paid off and the resource continues to fuel the plant at no cost, the only expense these plants have is the ongoing operating and maintenance costs. They are now producing some of the cheapest electricity in the entire state at 3 ¢/kWh.

Figure 9: Map of Best Geothermal Resource Areas

Profile in Geothermal

In Southern California's Imperial Valley, CalEnergy operates eight geothermal plants. They have been producing electricity since the early 1980s. The Salton Sea Plants have a total capacity of 278 MW. The first plant was built in 1982.

The field where these plants are located spreads across 4,800 acres, yet the visible facilities - the buildings housing the well pads and turbines - occupy only 5%-7% of the land. The rest of the land is suitable, and much of it is currently used, for farming.

An individual well pad at the Salton Sea plants that occupies about 250 feet by 500 feet can support three wells. The diameter of the hole of each well is about 9 5/8 inches. The wells at the Salton Sea plants run 5,000-6,000 feet deep, considerably shallower than an average geothermal well. Hot water is tapped from the bottom of the well, drawn up to the surface, and converted to steam. The steam is then used to drive the turbine, which generates electricity.

The Salton Sea geothermal reservoir is unique because of its shallow depth, its high temperatures (ranging from an average of 500°F up to 700°F), and most importantly because of its high mineral content. The new plant, Unit 5, will be the first and only facility capable of using the high-temperature waste brine, which comes from four other Salton Sea geothermal plants, to generate electricity and harvest minerals simultaneously. Much of the electricity generated by Unit 5 will fuel the zinc recovery operation. The remaining power will be sold to Southern California Edison.

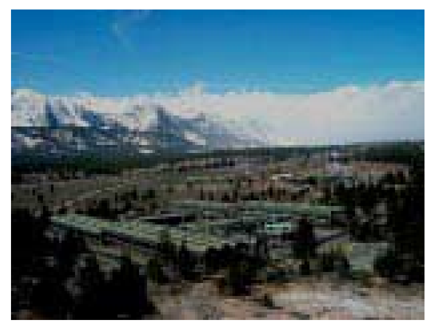
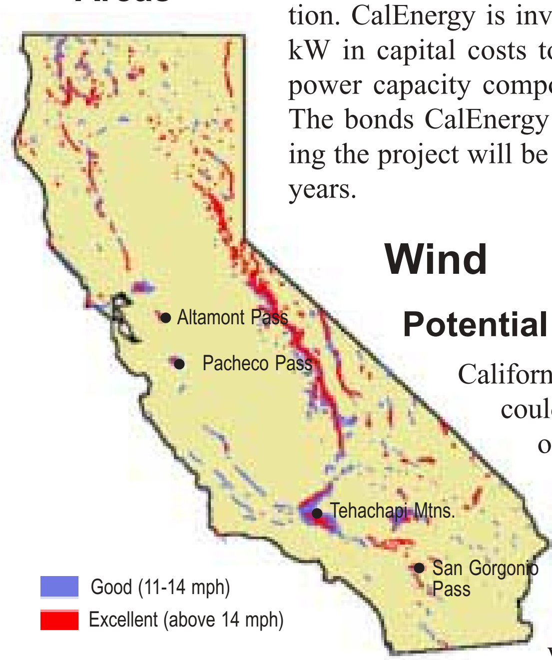


Table 6: Salton Sea Geothermal Plants

Plant Name	Date of Commercial Operation	Capacity
Salton Sea I	1982	10 MW
Vulcan	1986	34 MW
Elmore	1989	42 MW
Hoch	1989	42 MW
Salton Sea III	1989	49 MW
Leathers	1990	42 MW
Salton Sea II	1990	20 MW
Salton Sea IV	1996	39 MW

Figure 10: Map of Best Wind Resource Areas



The biggest geothermal project currently under construction is an addition to the CalEnergy Operating Corporation's current operations near the Salton Sea. The expansion project will create 60 MW of new geothermal electrical capacity as well as the first-ever geothermal zinc recovery operation. CalEnergy is investing about $2,000/kW in capital costs to develop the added power capacity component of the project. The bonds CalEnergy received for financing the project will be paid off in about ten years.

Wind

Potential

California's 36 best wind sites could generate an average of 10,000 MW of power, according to a 1998 Lawrence Berkeley National Laboratory analysis of all previous wind resource studies. Nearly half of that could be economically developed within the next nine years.[73]

Wind farms currently producing the bulk of California's wind-generated power are located on Altamont Pass in Alameda County, San Gorgonio Pass in Riverside County, and Tehachapi Pass in Kern County.

Economics

The cost of wind-generated electricity has declined by more than 80% from the early 1980s, when it averaged 38 ¢/kWh. The best sites are now generating electricity for 3 ¢/kWh, not including the federal wind energy Production Tax Credit.[74] In California, 3,000 MW could be operational at costs less than other energy resources by the year 2010, and an additional 1,600 MW could be operational at just 2 ¢/kWh over conventional power.[75]

One wind provider, SeaWest, was awarded a long-term contract this year with the California Department of Water Resources. It will provide wind-generated electricity for the state at the rate of 5.85 ¢/kWh through September 2011.

Profile in Wind

A typical wind project currently under construction is SeaWest's Mountain View I and II. The projects are located off Interstate 10, just northwest of Palm Springs in the Banning Pass between the San Jacinto and San Gorgonio mountains.

Combined, the projects will have a capacity of 66 MW, enough power to provide electricity for about 37,500 residences. They will offset 150,000 tons of greenhouse gases.

SeaWest had ten years of wind resource data on the specific sites for the Mountain View plants, and had secured the site prior to initiating development. SeaWest owns part of the land and leases the rest from private landowners.

Mountain View I has 74 turbines and Mountain View II has 37. The turbines stand 50-60 meters high with the blades reaching over 20 meters in length. The actual space occupied by the turbines is about 5% of the total project area. Usually each megawatt of wind power capacity requires less than one acre of land. However, it is important that the area upwind of the turbines remains unobstructed in order to maximize wind flow across the project site.

A single operations and maintenance service center will serve multiple projects. The two new SeaWest projects will be operational by October 1, 2001.

Solar Thermal

Potential

The Mojave desert in southern California is one of the world's best resources for solar energy. There is theoretically enough sunlight in a 100-mile square patch of the desert in the southwestern U.S. to satisfy the nation's demand for electricity.[76]

Economics

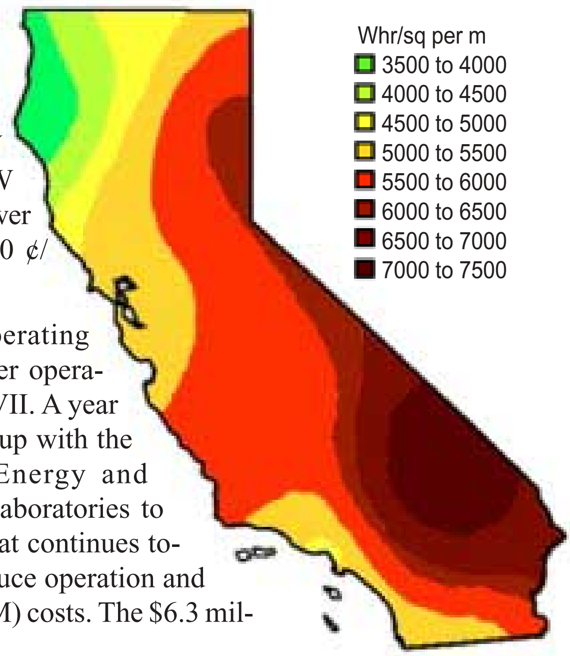
Already California's Mojave desert hosts the world's only utility-scale solar thermal power plants, the Solar Electric Generating System (SEGS) plants. The plants have a capacity of 354 MW and can now generate electricity for 8-10 ¢/kWh, a competitive price for the peak power they reliably provide.

Luz International built the first SEGS plants in the Mojave Desert in 1984. By 1991, the ninth SEGS plant built by Luz was up and running. As the SEGS plants were constructed over the years, the newer ones incorporated increasingly more advanced designs, which translated into decreasing electricity-generating costs.

SEGS I, a 13.8 MW plant, was installed for about $4600/kW and generates electricity at 25¢/kWh (1999 dollars). SEGS III-VII, with capacities of 30 MW each, were installed for about $3500/kW and generate power for 12 ¢/kWh. The last two plants, SEGS VIII and IX, were installed with capacities of 80 MW each for $2900/kW and brought the power costs down to 8-10 ¢/kWh.

In 1991, KJC Operating Company took over operations of SEGS III-VII. A year later, they teamed up with the Department of Energy and Sandia National Laboratories to begin a strategy that continues today to steadily reduce operation and maintenance (O&M) costs. The $6.3 mil-

Figure 11: Map of Best Solar Thermal Resource Areas



Profile in Solar Thermal

All the SEGS plants employ a parabolic-trough technology to collect solar heat. Rows of the reflective trough-shaped mirrors individually track the sun and focus the sunlight on a receiver tube containing synthetic oil, which serves as the heat transfer medium. The oil travels through a series of conventional heat transfer systems, which ultimately produce steam and drive a turbine to generate electricity. With the exception of SEGS I, which has a three-hour thermal storage system and a natural gas superheater as a backup system to supplement the solar power or run the plant during nighttime hours, the SEGS plants use gas-fired boilers as backup power systems.

The nine plants are located at three different sites in the Mojave Desert. Compared to a conventional fossil fuel plant, a solar plant requires more land to harness the diffuse energy from the sun. But when the full cycle of fuel-gathering through power generation (which includes mining and waste disposal) is compared, land requirements for solar plants are no more than those of conventional fossil fuel plants.

At this time, Duke Solar is actively pursuing the opportunity to build a new solar thermal facility in the Mojave using advanced trough technology. It would phase in capacity starting at 80 MW, with the capability of increasing that to 500 MW within three to five years. The new facility would be able to generate peak power for less than natural gas.[78]

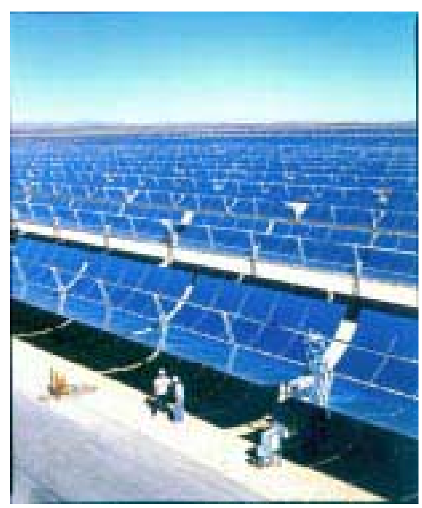


Table 7: Experience Curve for PV Module Price

Doubling	Installed MW	Wholesale Price per Watt	Installed System Price per Watt
0	1,043	$3.50	$6.50
1	2,086	$2.87	$5.33
2	4,173	$2.35	$4.37
3	8,346	$1.93	$3.58
4	16,692	$1.58	$2.93
5	33,383	$1.30	$2.40
6	66,767	$1.06	$1.97
7	133,533	$0.87	$1.62
8	267,067	$0.72	$1.32
9	534,133	$0.39	$1.08
10	1,068,267	$0.39	$0.89

lion joint research and development effort continued for six years. By that time, O&M costs had been reduced by $4 million annually. Over the remaining lifetime of these plants, a 30% savings equaling $42 million will have been realized.

Dave Rib, Vice-President of KJC Operation Co., estimates a new SEGS plant of 100 MW or more could be constructed for a cost of $2,500/kWh and produce power at a cost of about 7 ¢/kWh.[77]

Solar Photovoltaics

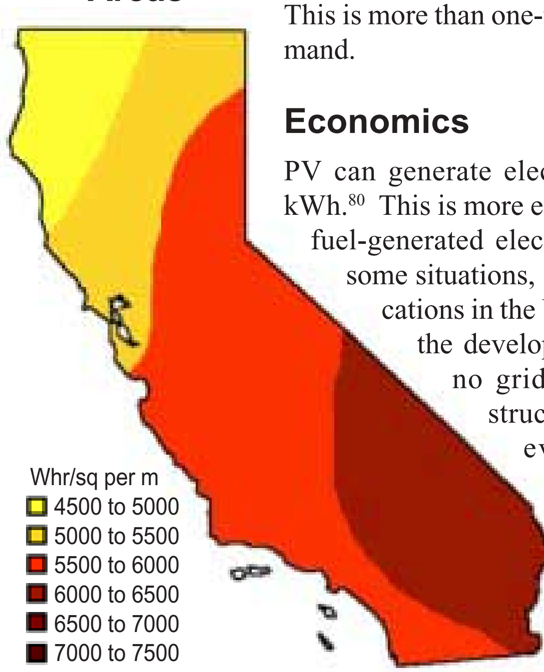
Potential

There is tremendous potential for rooftop applications of PV in California. The California Solar Energy Industries Association estimates that there are enough suitably oriented rooftops in the state to host more than 20,000 MW of PV panels in the long term.[79] This is more than one-third of total peak demand.

Economics

PV can generate electricity for 19-25 ¢/kWh.[80] This is more economical than fossil fuel-generated electricity right now for some situations, such as remote applications in the U.S. and vast areas of the developing world that have no grid/power plant infrastructure in place. However, this is not competitive with the lowest rates from gas-fired power plants today in the grid-connected developed world.

Figure 12: Map of Best PV Resource Areas



Only when the industry is further developed will the cost of PV be on a par with traditional technologies. Although technological breakthroughs may lower prices significantly, the biggest price reductions are expected from economies of scale due to increased PV panel manufacturing volume.

Economies of Scale

The current cost of PV modules is quoted at about $3.50-$3.75 per watt wholesale and $6-$7 per watt for an installed system.[81] This cost is a dramatic reduction from twenty years ago. The cost will continue to decline as PV manufacturers reach economies of scale. Since nearly all of the costs for PV-generated electricity lie in the equipment, the more equipment manufactured on a mass scale, the cheaper the electricity becomes.

The relationship between increased volume and decreased price is called the experience curve. For PV, it is estimated to be 82%. That is, for every doubling of production volume, the price of PV is expected to decline by 18%.[82]

To compete on equal footing with traditional power sources in a short-term economic view, PV prices will need to be around $1/watt for an installed system.[83] According to this experience curve, that price will be reached once PV installations total 500,000 MW.

In 1999, total installed PV capacity was 1,034 MW.[84] The PV industry clearly has a fair distance to go, but it is steadily progressing toward its goal.

Market Growth

PV module shipments in the U.S. and worldwide have steadily increased over the past twenty years. Furthermore, the rate by which shipments have increased has risen.

From 1989-99, the worldwide PV growth rate averaged 18%. For the same time period, the U.S. growth rate was 21%. Recently the growth rate has been much higher. The average growth rate in 1997-99 in the U.S. and worldwide was a healthy 31%. In 1999, the U.S. growth rate was 52%, the highest ever.

If the growth rate in PV manufacturing activity continues at the 52% level it reached in the past year, cumulative worldwide PV capacity will have reached 500,000 MW by 2016. If growth in manufacturing only grows at the 1997-99 average rate of 31%, the industry will have reached this milestone in 2023.

Figure 13: Annual PV Manufacturing Volume[85]

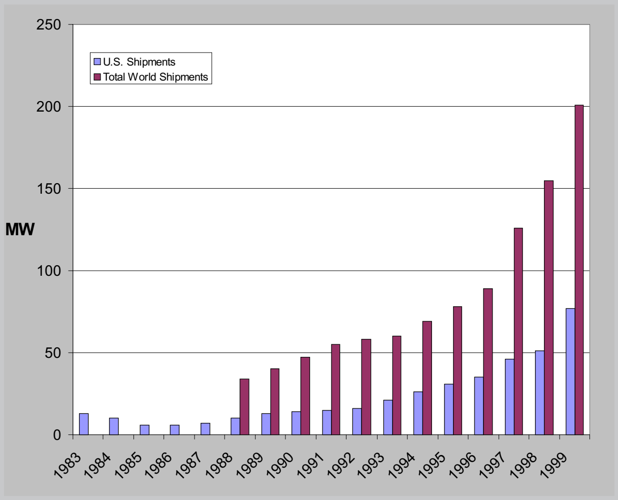
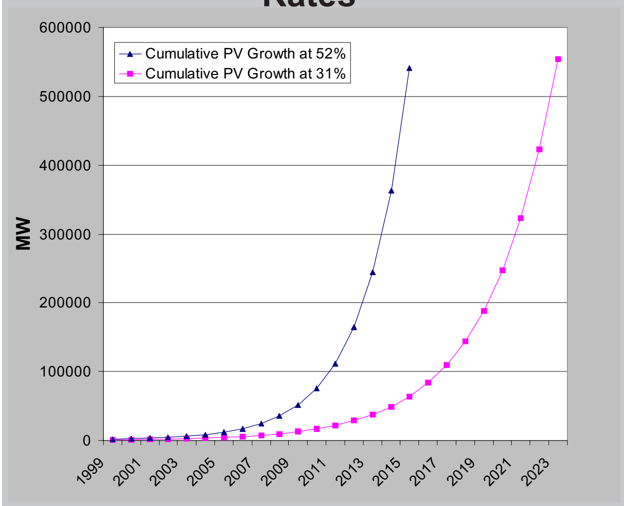


Figure 14: PV Market Growth Rates[86]



Profile in Solar Photovoltaics

PV technology is best suited for dispersed generation, rather than centralized generation at utility-owned power plants. Nonetheless, utilities and local governments can facilitate large PV projects.

Alameda County's strategy to incorporate PV technology today has been to purchase in bulk. Installation of the largest rooftop solar photovoltaic system in the country is nearly completed at Alameda County's Santa Rita Jail.[87] PowerLight Corporation and CMS Viron Energy Services have teamed up to combine solar photovoltaics with state-of-the-art energy efficiency at the jail. The project is a model for both self-generation and energy savings.

The total cost of the project was $4 million, of which $2.5 million was spent on the solar array, $1 million on the air-conditioning water chiller plant, and $500,000 to resurface the roof with a "cool roof membrane." With the California Energy Commission's renewable energy incentives, Matt Muniz, the Energy Program Manager, expects to pay for the project in seven to eight years. The jail will save between $200,000 and $400,000 annually on electricity over the next thirty years.

The 500 kW solar array, consisting of 4,000 roof tiles, will provide 15% to 20% of the jail's electricity. The energy efficiency measures implemented include a patented polystyrene foam roofing insulation, an improved air-conditioning water chiller, and a computerized energy management system called UtilityVision. UtilityVision automatically responds to fluctuations in the intensity of solar radiation. When clouds block the sun, UtilityVision reduces power consumption and then resumes normal consumption once the clouds have passed.

The county is now considering additional solar PV installations on the remaining jail rooftops as well as other county buildings, which could potentially increase the total PV capacity to 1.2 MW.

Policy Recommendations

The California state government has a responsibility to develop an energy policy that ensures reliable supplies at stable prices produced with tolerable impacts. The state should diversify its energy sources and begin now to develop a sustainable energy future.

Natural Gas

Deny Pending Proposals

Deny licenses for all proposed natural gas power plants that have not already been licensed. The state has already issued permits for more than 11,000 MW of gas plants. This is more than enough to meet near-term needs. There are 35 additional proposed plants currently under review, totaling more than 9,000 MW.[88] All of these proposals should be denied in favor of renewable energy projects to meet demand growth in the medium term.

Long-Term Contracts

Review all long-term contracts with natural gas facilities negotiated by the Department of Water Resources. Renegotiate contracts that are not on fair terms. Explore the cancellation of contracts which involve the construction of new natural gas power plants.

Renewable Energy

Renewable Portfolio Standard

A minimum of 20% of electricity production from wind, solar, and geothermal by 2010 is reasonable and achievable. This would create economies of scale, spur innovation, and establish markets and technologies. Renewable energy industries would be able to springboard off this boost to achieve higher levels of market penetration with less assistance. 50% of electricity demand met by renewable energy by 2030 should be the goal. The best policy instrument to move the state toward this goal is a requirement that all electricity retailers acquire 20% of their electricity from renewable energy producers by 2010.

Long-term state contracts

The biggest barrier to developing renewable energy resources is that nearly all of the costs are upfront. To ease this hurdle, the state can enter into long-term contracts with renewable energy producers, guaranteeing a set price for most of the lifetime of the renewable plant.

In June 2001, California created the Consumer Power and Conservation Financing Authority. Part of the stated purpose of this new agency is to "create financial incentives for ... use of renewable energy resources."[89] The most effective incentive to ensure that new renewable energy facilities actually get built is a guaranteed stable wholesale price for the electricity from these facilities. Administering long-term contracts in conjunction with private utilities would achieve this guarantee. The power authority should invite bids for new renewable energy projects and award contracts to the best bids.

Tax equity

Tax equity needs to be established between renewable energy producers and traditional energy suppliers. Since the assets of renewable energy producers are worth more in terms of replacement value, they currently pay higher taxes. Several policy options exist to level the playing field:

- Energy producers could be taxed on output rather than assets.
- Tax rates could be adjusted for renewable energy producers to make taxes on their facilities roughly equivalent to traditional power plants per unit of output.

- The state could tax traditional fuels to compensate for the negative environmental and public health effects of fossil fuel combustion and nuclear fission.

Given the positive effects a healthy renewable energy industry will have on the state economy, reducing the industry's debilitating tax burden would be a wise financial move for long-term economic strength.

Subsidies for development and production

New energy technologies need assistance in order to compete with mature technologies, as well as to ensure the state does not miss out on opportunities that need a development boost but will be beneficial in the long run. Historically, there has never been a new energy technology commercialized without government financial help. If a new technology proves to indeed provide a valuable benefit to and gain acceptance from the public, assistance will gradually become unnecessary and can be terminated at that time. Since subsidies to a few manufacturers are easier to administer than subsidies to consumers, they can be even more effective at pushing the commercialization of new energy technologies.

Subsidies for consumers

As long as consumers are expected to shoulder the burden of the investment costs of solar panels and small wind systems, the government must provide financial incentives to install this equipment. Even though wind and solar power generation is cost-effective for consumers over the lifetime of the panels, the high initial investment precludes most consumers from taking advantage of good opportunities they may have. A well-funded buy-down program would result in considerable load reductions on the grid. Since many residential solar arrays produce more power than a household uses during peak demand times, this will reduce the need to build power plants throughout the state which only serve peak need.

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