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FUELS REPORT
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The **Fuels Report** *is prepared in response to legislative requirements specified in Public Resources Code Section 25310(a). The statute calls for the California Energy Commission (CEC) to submit to the Governor and Legislature a comprehensive report on historic trends and long-range forecasts of the demand, supply and price of petroleum and petroleum products, natural gas, coal, and synthetic and other fuels. The report also must include specific recommendations for legislative or administrative actions needed to maintain sufficient, secure and affordable fuel supplies for the state.*

EXECUTIVE SUMMARY

California and the United States are still dependent on oil and are vulnerable to a cutoff, despite the dramatic turnaround in energy markets in the 1980s. California's vulnerability is the exposure of its economy to world oil market disruptions caused by imbalances in supply and demand that could be initiated by geo-political factors.

In the California Energy Commission's (CEC) view, California should not be lulled into a false sense of security by the current atmosphere of surplus. The present stands in sharp contrast to the gasoline lines, natural gas curtailments, spiraling fuel costs, and pervasive government controls of the 1970s. Currently, energy markets are characterized by excess supply, relatively low prices, increased competition, and reduced government regulation. Yet, crude oil and natural gas remain subject to substantial imbalances in supply related to demand, price swings, and changes in government policies. Rapid change and instability are cause for concern. Since oil and gas markets are continually evolving, future policies cannot be based solely on past experience.

California consumes an immense quantity of energy, using an average of 1.8 million barrels of oil and 4.6 billion cubic feet of natural gas each day. Together, petroleum products (57 percent) and natural gas (25 percent) provide 82 percent of total state energy requirements.

California achieved significant gains in fuel conservation and energy efficiency in response to the shortages and price turbulence of the 1970s. Investments in insulation, high-efficiency furnaces, fuel-efficient vehicles, and alternative energy sources helped reduce the state's dependence on fossil fuels. However, discretionary conservation, such as driving less or adjusting the thermostat because of high fuel prices, only temporarily reduced California's requirements for petroleum products. Many consumers abandoned these efforts as fuel became cheaper.

As a result of economic growth, California uses more gasoline and diesel fuel than ever before. At the same time, the collapse of oil prices has undermined the exploration and development of new petroleum reserves, especially in the United States, where production costs are relatively high. The domestic oil industry, in decline for several years, suffered a severe setback from the precipitous drop in oil prices. To make up the difference between growing demand and falling domestic production, the United States is importing more oil.

The country's renewed reliance on petroleum imports means that California is increasingly

vulnerable to the potential economic impact of a manipulated shortage or other international disruptions and attendant federal policy. Since this exposure represents a significant threat to the state's economy, the CEC focuses on California's oil vulnerability in this Fuels Report.

Realistically, the state can do little about public policy to directly stabilize the international oil market. Furthermore, the CEC Fuels Planning Committee concludes that state energy planning cannot proceed as if uncertainty in the international oil market were irrelevant. The following recommendations identify strategies to reduce California's long-term dependence on oil and identify ways to improve its ability to mitigate the impacts should a crisis develop:

- Support the substitution of natural gas for oil where possible
- Expand research in enhanced oil recovery
- Continue research in transportation technologies, alternative fuels and continue to support fuel demand reduction analyses
- Advocate increases in the fill rate and size of the federal Strategic Petroleum Reserve
- Investigate the need for a West Coast strategic petroleum reserve
- Increase coordination with the U.S. Department of Energy's emergency task force
- Maintain coordination with other Western states
- Update the California Energy Shortage Contingency Plan
- Resist federal proposals to establish standby petroleum price and allocation controls

Natural Gas

Because of the increasing emphasis on natural gas, this report provides an assessment of California's current and prospective natural gas supply. The CEC also presents policy recommendations to ensure adequate future supplies and to promote the gas industry's transition to a less regulated, more market-driven industry.

Based on its evaluation of supply and demand, the CEC is optimistic that there will be adequate supplies of natural gas available to meet California's needs throughout the planning period. To ensure that the state is successful in competing for new supply and to overcome potential constraints in transporting gas, the CEC believes:

- The Federal Energy Regulatory Commission (FERC) should issue multiple certificates for proposed interstate pipelines, if need is identified. Then, market forces should determine which one, if any, is built
- The CEC should participate in FERC and California Public Utilities Commission (CPUC) gas regulatory proceedings
- The CEC should participate in Canadian export policy debates

With regard to the regulatory changes in progress, the CEC supports the CPUC's goal to establish a market-driven natural gas industry in California. To reduce uncertainty about the outcome of the CPUC's step-by-step approach to reform, the CEC offers the following guidelines to promote competition in the natural gas industry:

- The utilities' gas delivery services should be separated from the competitive buying and selling of gas supplies
- Utility delivery services should be "unbundled" to provide a menu of gas transportation service options
- Nondiscriminatory access to utility delivery services should be available for all gas merchants
- Utility rates should be based on marginal costs and incorporate other specified means to promote economic efficiency

- Potentially competitive utility services should be deregulated

In addition, the CEC believes that the CPUC should take the following actions:

- Deregulate noncore gas merchant activities
- Unbundle utility gas-gathering services, establish cost-based gathering charges, and investigate the feasibility of divesting utilities of gas-gathering facilities
- Establish interutility gas transportation service on the same terms as regular utility transportation

Alternative Fuels for Transportation

California depends on petroleum products for nearly all of its transportation fuel, making transportation especially vulnerable to the negative impacts of an oil supply disruption. To reduce California's dependence on oil for transportation energy, the CEC has taken a leading role in supporting research and development of alternative transportation fuels. The CEC will complete alternative-fuel development programs in the following ways:

- Complete the methanol demonstration program for heavy-duty trucks and flexible-fuel vehicles
- Sponsor a demonstration program for using natural gas vehicles including heavy-duty applications
- Test and evaluate new developments in transportation technology and fuels
- Sponsor an electric vehicle demonstration program
- Monitor technological and fuel advancements in the transportation sector

Energy Prices

The CEC presents its 20-year fuels price forecasts in the final chapter (5) of this report. The CEC develops these forecasts as part of its statutory responsibilities to assess electricity prices, oil and gas demand, and the cost-effectiveness of conservation and alternative energy sources. While useful for planning and policy analysis, the price forecasts should be used with caution as such projections are subject to considerable uncertainty. Oil prices are likely to be highly volatile over the next few years, and the recent history of oil price forecasting demonstrates that consensus forecasts are more often wrong than right.

Over the next two years, the CEC must approach oil price forecasting by using multiple oil price scenarios to incorporate the effects of oil price uncertainty more systematically. The CEC will also identify key policy decisions that may be sensitive to variations in oil prices.

At the same time, the CEC will focus on uncertainty in natural gas prices. Gas prices are strongly influenced by oil prices and have been subject to many of the same uncertainties. However, the relationship between oil and gas prices is undergoing a fundamental change. The CEC is currently undertaking studies to help understand the future of natural gas prices in a more competitive environment.

CHAPTER 1

CALIFORNIA'S ENERGY VULNERABILITY

California Is Vulnerable To An Oil Cutoff

The current world oil surplus and low oil prices are giving California and the nation a false sense of security. Rising demand and falling production are restoring the ability of Mideast oil producers to induce an oil cutoff with global effects. California and the U.S. are still dependent on oil and vulnerable to a cutoff despite demand management efforts such as federal mileage standards (CAFE). California's vulnerability is the exposure of its economy to world oil market disruptions caused by imbalances in supply and demand that could be initiated by geo-political factors. To prepare for the eventuality of a cutoff, California needs to continue to support programs that increase long term energy security.

California remains heavily dependent on oil, despite advances over the last decade in energy conservation and in the development of alternative energy resources. More than half of the energy consumed in California and almost all the energy used in transportation comes from oil. California's oil consumption has increased in each of the last five years, and this trend shows little sign of abating.

California's dependence on oil makes its economy extremely vulnerable to oil supply disruptions in the Persian Gulf. Although California imports little oil from the Persian Gulf, California oil prices are directly tied to world oil markets. As in 1973 and 1979, a disruption in Persian Gulf supplies could cause a rapid hike in world oil prices as oil buyers bid for limited supplies. California would also face higher oil prices causing other price increases to ripple through the state's economy.

Increasing world oil consumption and a slowing in the rise in non-OPEC oil production are concentrating oil production in the Persian Gulf region. This increases the likelihood that world oil supplies can be seriously interrupted by a single event and strengthens OPEC's ability to manipulate oil supplies to advance its political

objectives. Given the politically volatile nature of the Middle East, the passionate conflicts that grip that region, and the inherent economic leverage of the oil weapon, a future supply interruption is a virtual certainty.

The question is not whether there will be another oil cutoff, but rather what should be done to prepare for one and how to reduce its severity. A cutoff may not happen tomorrow but changing conditions are rapidly increasing its certainty.

California Is Better Off Than It Might Have Been

Lessons California learned from previous oil cutoffs have not gone unheeded. Progress has been made in decreasing oil use and in lessening the impact of future oil price disruptions. Oil consumption in California fell 18 percent between 1979 and 1982. Higher oil prices have encouraged more efficient use of oil and stimulated development of alternative fuels. The establishment of contingency planning measures, such as the Strategic Petroleum Reserve (SPR) and the enhanced competitiveness and efficiency of international oil markets, have provided options to an oil supply disruption. Finally, the 1979 oil price shock spurred the development of non-OPEC oil resources during the early 1980s.

Conservation has occurred for several reasons. Higher prices caused consumers to drive less and to adjust their thermostats. Higher prices also motivated industry to increase fuel efficiency for automobiles and, in California, government enacted more efficient building and appliance standards. Industry has also gradually replaced outmoded equipment with more energy efficient machinery.

At the same time, other fuels have been substituted for oil. Partial decontrol of natural gas has paved the way for increased substitution of this fuel for oil. Increased natural gas availability, increased nuclear power, and vast domestic coal resources have largely eliminated oil use for electricity generation in California and the United States. The state and federal governments have encouraged development of alternative energy such as solar, geothermal and alcohol fuels.

Changes in the marketplace also have moderated the potential impact of a future oil supply disruption. Long term contractual relationships between oil companies and oil producers have largely been eliminated, making companies less likely to make decisions based solely on their relationship with a single supplier. Oil is now freely traded on spot markets, allowing ready access to supplies. The dramatic growth of the futures market for crude oil and petroleum products has vastly increased the visibility of prices and the number of traders in the market, making oil markets more efficient. Finally, the removal of U.S. price controls and allocation schemes has allowed the market to function as a free market, allowing price to balance supply with demand.

The creation of Strategic Petroleum Reserves (SPR) worldwide has enhanced the ability to withstand a supply disruption. The United States now has 520 million barrels of oil stored in its SPR. This volume, when combined with private stocks, is equivalent to 90 days supply at current consumption levels. Other nations have also accumulated strategic reserves to offset future supply disruptions.

California also has in place a comprehensive contingency plan for energy emergencies. The plan provides response to the severity of the energy emergency. It complements the federal emergency plan and provides coordination among state, federal and local authorities as well as private industry.

California Is Still Vulnerable

Despite the progress made in lessening dependence on oil, our vulnerability to the danger of an oil cutoff is very real and getting worse. The retreat of oil prices from their high in the early

1980s has caused demand for petroleum products to increase in California and the nation and caused domestic oil production to decline. Consequently, dependence on foreign oil imports has grown and is increasing, exposing the economy to the severest impacts of a cutoff.

On the world scene, non-OPEC oil production, which earlier in the decade rose rapidly, is expected to start falling soon. Virtually all the world's excess oil production capacity is located in the Middle East, primarily in the Persian Gulf, where the bulk of the world's oil reserves are located. As world oil demand rises and non-OPEC oil production declines, OPEC--primarily its Persian Gulf members--will supply an increasingly larger share of global oil needs.

As dependence on these supplies increases, the likelihood increases that a single event can interrupt world oil supplies and rapidly increase California oil prices. Greater OPEC production means less excess production capacity. As excess world oil production capacity is reduced, a smaller disruption can create a shortage of oil. As the size of an "effective" cutoff decreases, a greater number of producers can more readily be the cause of a disruption. This in turn increases the chances of a deliberately manipulated oil supply disruption.

How Is California Vulnerable?

California is extremely vulnerable to deliberate manipulations of world oil markets. Either an intentional political action or another Mid-East war could be the reason for a cutoff in oil supplies similar to or worse than those experienced in 1973 and 1979.

A cutoff similar to the one in 1979 would probably cause some initial public panic and temporary lines at service stations. However, the oil market is much more efficient than it was in 1979, in large part due to the absence of petroleum price controls and allocation regulations. The increased efficiency of the market combined with availability of the SPR should make localized shortages short-term.

The most serious and lasting consequence of an oil cutoff would be the economic damage caused by the resulting rapid increase in oil prices. When oil prices rise rapidly, more money is spent on energy by consumers and businesses, leaving less for nonenergy expenditures. Lower nonenergy expenditures lead to decreased economic activity in other sectors of the economy, increased inflation and high unemployment. High oil prices also increase the transfer of wealth from this country to oil exporting nations to pay for more expensive oil imports. The loss of this money further reduces economic activity. The overall result is significant reductions in GNP, employment and income, and the political and social disruptions of a major recession.

What Should California Do About Its Vulnerability?

California can lessen its vulnerability by reducing dependence on oil imports through increased domestic oil production, conservation, and substitution of other energy sources for oil. This suggests broad plans for long term options. In the short-term, contingency planning will minimize the potential immediate impacts of an oil disruption.

A program aimed at long-term reduction in imports and short-term mitigation of the damages from an oil supply disruption should include the following:

California should support the substitution of natural gas for oil where possible. California should support the increased use of natural gas as a substitute for oil. Increased availability of natural gas to thermally enhanced oil recovery (TEOR) projects would allow increased production of California's heavy oil resources by reducing the air emissions which currently limit oil development. Substitution of natural gas for

crude oil in TEOR production also saves oil now being burned as fuel.

California should fund increased research on enhanced oil recovery. California should fund and support research to improve enhanced oil recovery (EOR) production of its heavy oil resources. California's deposits of heavy oil are about three times that of offshore oil reserves.

Improved recovery of heavy oil reserves will reduce pressure on environmentally-sensitive areas and decrease reliance on imported petroleum. EOR research should attack problems of increasing production of California's heavy oil resources. The research should include:

- Investigations of technical and scientific constraints
- Environmental factors constraining production
- State and federal fiscal and tax policies
- Marketing problems affecting the industry

California will continue to support increased research on transportation technologies and alternative transportation fuels. The transportation sector relies on petroleum products for almost all its energy needs and is, therefore, the most vulnerable energy-using sector. This reliance could be reduced by improving the fuel diversity of the state's transportation system. The CEC will continue to support fuel demand reduction analyses and will present them in the 1988 Conservation Report.

Needing to be examined are alternative fuels such as compressed natural gas, hydrogen, propane, ethanol, methanol, electricity, synthetic gasoline, and diesel.

The CEC will recommend that the federal government increase the fill rate and size of the Federal Strategic Petroleum Reserve. The CEC will support an increased fill rate for the SPR, because the current fill rate, 75,000 b/d, is too low to reach the original 750,000 barrel goal before 1995. Increasing the fill rate now will allow the federal government to take advantage of low oil prices.

The CEC will also advocate increasing the maximum size of the SPR. With a higher level of imports, a bigger reserve is needed to offset the effects of a supply disruption.

The CEC will investigate the feasibility of a regional Strategic Petroleum Reserve. A regional SPR may be needed for the Western United States. The oil market in the Western United States is physically separated from the remainder of the nation. The existing SPR is situated in the Southeastern United States and is linked to most of the country by an extensive system of pipelines. Since there is no pipeline network connecting the SPR and the Western United States, tankers would have to be used to ship oil to the West Coast. Concerns have been raised that during a supply disruption, oil from the SPR might not reach the West Coast soon enough to mitigate a price run-up.

The CEC will examine whether the cost of establishing a regional strategic petroleum reserve would be offset by the benefits of lower petroleum prices. This investigation will encompass a wide range of options available to the state. The strategic reserve concept has traditionally been a physical supply of crude oil available to the United States. The CEC will examine possible alternatives such as the use of fiscal reserves, private production and storage incentives, futures/options markets, and innovative public/private contract arrangements.

The CEC will maintain close ties and coordination with the U.S. Department of Energy's energy emergency task force in order to coordinate California's response to energy emergencies. Because some oil emergency actions are beyond state, the success of California's Energy Shortage Contingency Plan depends on the federal government's plan. For this reason, California needs to continue to develop close working relationships with federal emergency response officials and agencies. The CEC will consistently review federal contingency policies.

The CEC will maintain and enhance coordination with other western states. California and neighboring western states have common energy interests and a need to closely coordinate energy planning activities. The CEC will continue to support regular interaction among western states, developing coordinated regional emergency responses and improving mutual understanding of each state's energy systems and vulnerabilities.

The CEC will revise and update the California Energy Shortage Contingency Plan. State law requires that the Energy Shortage Contingency Plan, adopted most recently in December 1983, be revised every five years. A test of the Plan is scheduled for Spring 1988. The CEC will ensure that the revised Plan reflects changes in oil markets that have occurred since the Plan was adopted and the results of the 1988 test. Specific attention will be given to ensuring that appropriate state mechanisms are in place to stimulate the state's economy and to mitigate potential personal hardships caused by a supply interruption.

California recommends against the development of federal standby price and allocation controls. Many of the costly domestic supply problems encountered during and after the 1979 oil supply disruption were the direct result of federal price and allocation controls on petroleum products. No controls now exist and California should continue to recommend that none be authorized, even on a standby basis.

CHAPTER 2

NATURAL GAS SUPPLY

Natural gas represents one of the most complex and rapidly-changing energy supplies. At the same time, gas provides a vital and growing input to California's economy. Many policy questions that affect gas supply are currently being considered in state or federal regulatory proceedings. As part of its role as the lead State energy policy agency, the CEC will continue to provide leadership in all aspects of current natural gas policy debates. This chapter sets the context for natural gas policy questions by examining the natural gas resource base and supply system which are forecast to serve California's needs over the next 20 years.

California's natural gas supply system may change significantly over the next 20 years in order to continue to meet the State's needs. During this time, gas supplies from traditional supply regions will decrease, and new regions will supply an increasing share of the California market. However, it has become increasingly difficult to specify to what extent each region will supply California during the later years of the forecast period. As gas demand increases and California obtains gas supplies from new regions, the interstate pipeline network serving the State may have to be augmented.

The best strategy for designing a supply system to cope with these changes and uncertainties is one which is adaptable. Accordingly, the CEC's approach to this problem relies largely on market mechanisms and competition to make the critical choices in supplying California's natural gas needs. In the chain of transactions from producer to end-user, accurate price signals are essential to efficient markets and efficient evolution of the supply system. The remaining substantially regulated, transportation and distribution systems require special examination. Regulations should not impede the practical and timely augmentation of the pipeline network serving California.

This chapter provides a detailed discussion of the gas supply issues facing California. Natural Gas Transportation Requirements describes the overall requirements for gas from outside California and compares these requirements to current and projected delivery capacity. Gas Supply Availability assesses supplies available from regions which are expected to provide gas to California during the forecast period. Outlook

for Contract Arrangements examines the changing nature of gas purchase contracts. Finally, Conclusion and Recommendations presents the policy recommendations which can be drawn from this analysis.

Natural Gas Transportation Requirements

The need for additions to the natural gas transportation systems involves a large number of complex considerations. Some of these are under the control of different parties including interstate pipeline companies, local distribution companies and regulatory bodies. In addition, many changes taking place in the natural gas industry have altered traditional business relationships and have made gas demand assessment more difficult. Over the last few years, these changes have increased the uncertainty and brought into question the reliability of natural gas demand forecasts. This has been reflected by the lack of consensus among experts.

Current pipeline capacity to deliver out-of-state gas to California may not be sufficient to meet projected demand. Despite significant instate production, California imports most of its gas from outside the State. The pipelines that carry this gas form a vital part of California's energy delivery system. As in-state gas production decreases and total gas demand increases, more out-of-state gas will be needed. Projected California natural gas demand, forecasted in-state gas production and present pipeline capacity to California are compared in Figure 1 and Table 1. In this projection, the demand for transportation into the State surpasses current pipeline capacity around the year 2000.

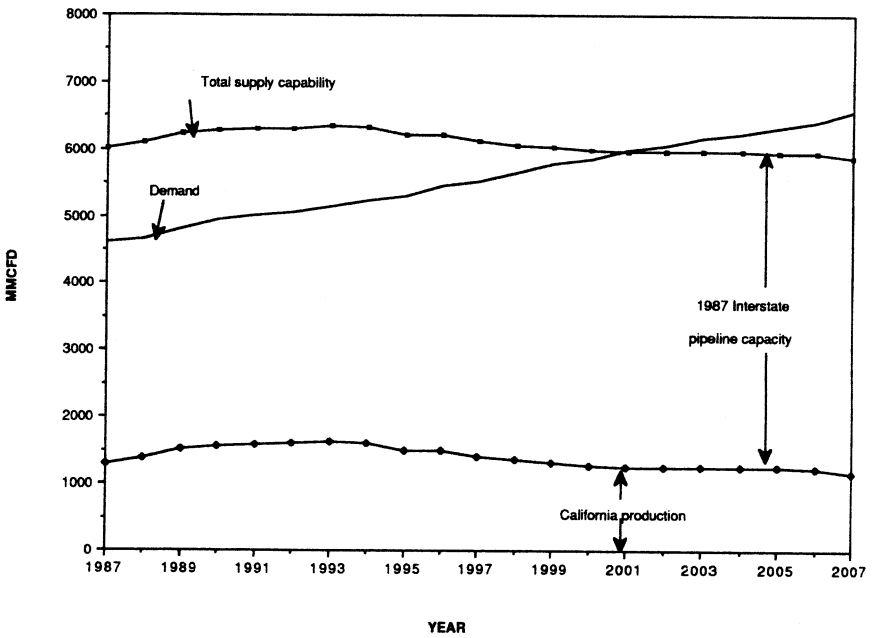
The time when new capacity will be required could be considerably different from what is indicated in Figure 1 for several reasons. Most importantly, there is significant uncertainty inherent in the gas demand and supply forecasts of Figure 1. The gas demand forecast increases are principally driven by potential gas needs for electric generation and thermally enhanced oil production operations. The timing for the need for pipeline additions could change if the demand for gas in the electric generation sector or other sectors differs from the forecast, or if California production increases.

The analysis in Figure 1 and Table 1 tends to understate the need for capacity because it assumes that existing interstate capacity can be fully used throughout the forecast period. However, if California began to purchase more gas from nontraditional supply areas, this assumption might not be valid. It might not be possible to move gas from the new regions to California because existing pipelines, although not full, are in the wrong locations. Therefore, more pipeline capacity might be needed earlier than indicated in Figure 1.

The displacement mechanism might provide a means to keep existing pipelines more fully used as the mix of supply areas changes. An example of displacement would be sending Rocky Mountain gas to, say, Salt Lake City and in turn "displacing" Southwest gas that was originally destined for Salt Lake City, and sending it instead to California. There are constraints on how much gas may be moved from a particular supply area such as the Rocky Mountains to California by displacement. In the example above, the size of the market for gas in Salt Lake City limits the amount of gas that can be displaced. Displacement is also constrained by the capacity of all the pipelines used and by the available displaceable gas supply. In addition, institutional barriers to displacement arrangements sometimes arise, in that not all pipelines have incentives to complete the transaction.

The uncertainty in gas demand and supply forecasts and availability of transportation capacity underscores the need for flexibility in changing the interstate pipeline network serving California. Competitive markets offer the most responsive mechanism for determining the evolution of the pipeline system.

FIGURE 1
CEC STATEWIDE FORECAST
NATURAL GAS SUPPLY CAPABILITY VS. DEMAND



Source: California Energy Commission.

TABLE 1

POTENTIAL NEW INTERSTATE PIPELINE CAPACITY REQUIREMENTS
mmcfd

	Year		
	1995	2000	2007
Potential California Gas Demand	5,290	5,869	6,574
Potential California Gas Production	1,557	1,278	1,159
Required Interstate Supply	3,733	4,591	5,415
Present Pipeline Capacity	4,720	4,720	4,720
Potential New Interstate Pipeline Capacity Requirement			695

Source: CEC staff estimates.

Gas Supply Availability

California currently relies primarily on three regions for its natural gas supplies, California, Southwestern U.S. and Canada. California produces almost 30 percent of the natural gas it consumes. The largest source of gas to California is the Southwestern U.S. In 1986, El Paso Natural Gas Company and Transwestern Pipeline Company delivered from the Southwest 52 percent of California's gas supplies. Canada's Province of Alberta is the other principal source of California's gas supplies with a 19 percent share in 1986. Canadian gas is delivered principally by Pacific Gas Transmission Company. Less than 1 percent of current supply comes from the Rocky Mountains. While arrangements are in place to receive gas from Mexico, no gas was offered or taken during 1986.

The current supply areas will continue to dominate California's future supply picture. The Southwest will continue to provide the largest share of supply although this share will decrease. Emerging as a major supply source will be the Rocky Mountain area of Utah, Colorado, Idaho, Wyoming and possibly Montana. Table 2 and Figure 2 summarize forecasted available supply by source. Figure 3 depicts supply areas and pipelines that serve California.

The distribution of gas supply by source shown in Table 2 should be used with considerable caution. The most important conclusion to be drawn from the table is that the total amount of gas available is sufficient to meet California's needs over the forecast period. Individual supply regions could supply amounts substantially different from those shown in Table 2. The uncertainty in these supply figures contributes to the difficulty in specifying which pipeline additions might be necessary in order to supply California's need for gas imports.

California

Total available California natural gas production from Northern California, Southern California and offshore California, is forecasted to increase until the mid-1990s before starting to decline. Currently, California production provides approximately 30 percent of the State's needs. By 2007, however, only 16 percent of the State's supply is forecasted to be provided by California production.

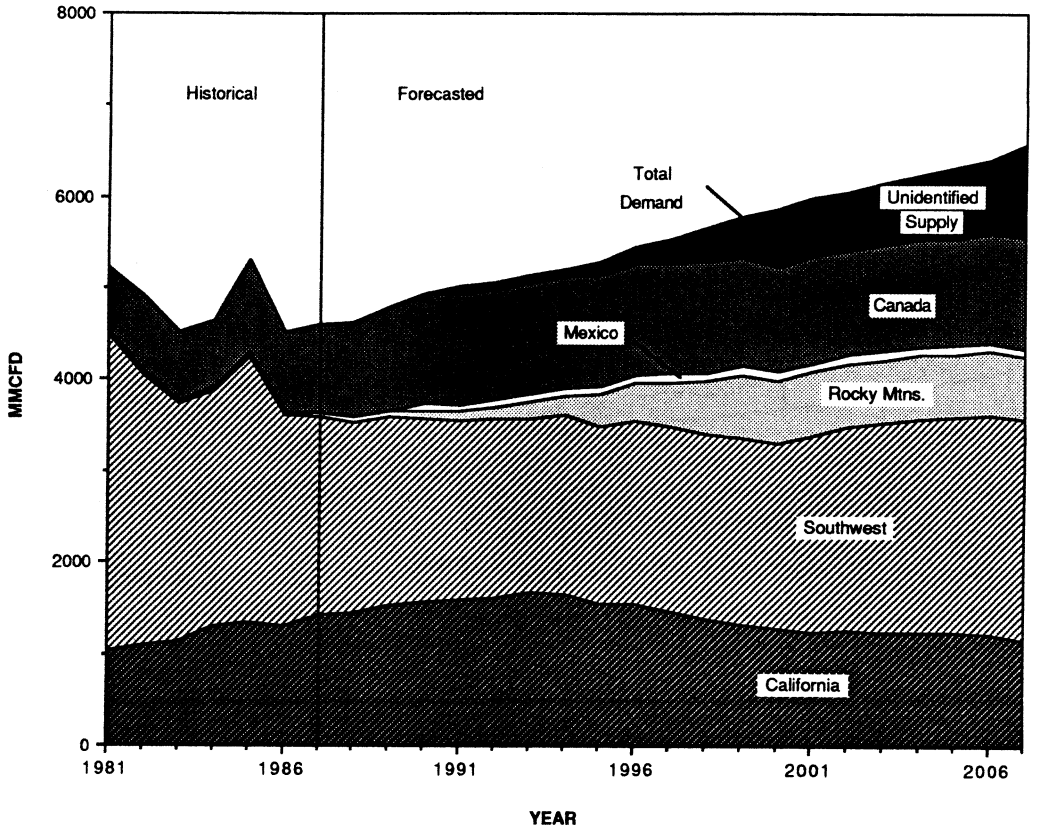
TABLE 2
NATURAL GAS SUPPLY AVAILABLE TO CALIFORNIA 1986-2007
mmcfd

Source	1986	1990	1995	2000	2007
California	1,295	1,572	1,557	1,278	1,159
Southwest	2,317	2,011	1,934	2,020	2,411
Canada	875	1,193	1,211	1,150	1,217
Rocky Mountains	34	81	345	690	690
Mexico		75	90	100	90
Unspecified			153	631	1,007
TOTAL	4,521	5,932	5,290	5,869	6,574

Source: 1986 - California historic production from California Division of Oil and Gas, other 1986 supplies from CEC QFER ER Form 6A.

Forecasted years - CEC estimates.

FIGURE 2
NATURAL GAS DEMAND/SUPPLY SUMMARY



Sources: Historical- 1986 California Gas Report.
Forecasted- California Energy Commission.

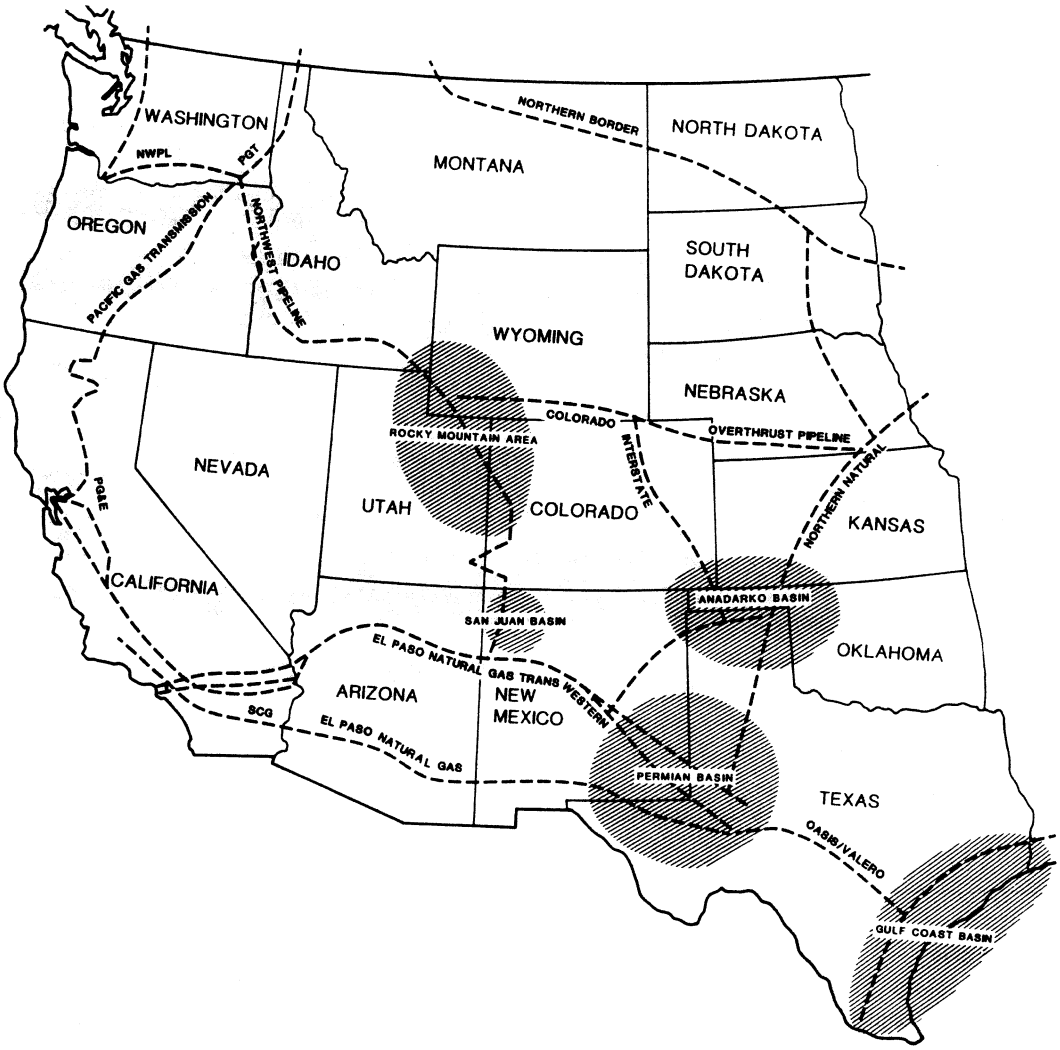
Southwest

California will continue to rely on Southwest gas from the Permian, Anadarko and San Juan Basins for a major portion of its supplies (Figure 3). The CEC forecasts stable Southwest gas shipments to California in the late-1980s and early-1990s, then increasing supplies in the later years. Forecasted deliveries of gas from the Southwest do not decline as they did in previous CEC studies.[1] In the current forecast, less reserve development than previously forecast occurs in the next few years, due to reduced need for gas supply. The slower pace of development preserves resources that can be used to sustain production levels in the later years of the forecast.

Canada

The other supply region that will play a major role in California's future gas supply is Canada. Canada has been supplying natural gas to California since 1960. Licenses to export 1,220 mmcfd of gas to California are in effect through the mid-1990s. These licenses are subject to the control of the Canadian National Energy Board (NEB) on the basis of an assessment of available resources. Recent NEB findings indicate that under then-current export licensing

FIGURE 3
NATURAL GAS PIPELINES AND MAJOR GAS PRODUCING AREAS



requirements, insufficient resources were available to extend the licenses beyond the mid-1990s.[2] Since this finding, however, the NEB has substantially relaxed the restrictions on the export of Canadian gas.[3] Although the new rules appear to make more Canadian gas available to California, the rules are subject to a considerable range of interpretations and their ultimate effect remains to be seen.

In addition, an independent analysis commissioned by the CEC concludes the NEB methodology for assessing resources significantly underestimates the availability of "surplus" gas for export.[4] This analysis indicates, contrary to NEB findings, that the export licenses for California's utilities could be fully extended for the duration of the study period and additional license amounts could become available after 1995, even under the previous restrictive rules.

Rocky Mountains

Gas from the Rocky Mountain basin is expected to play a large role in California's future gas supply. The area is relatively near to California and has large undedicated proven reserves and substantial undiscovered potential resources. This gas might well be needed to fill the gap created by declining supplies from other regions and growing demand.

While the underlying natural gas resource potential is high for the Rocky Mountains, the area faces several constraints in delivering the gas to market. Gas transportation is limited. Portions of the areas believed to contain undiscovered but technically recoverable gas reserves are set aside in wilderness areas that may be environmentally difficult to develop. The complex geology of the area in the overthrust part of the Rocky Mountains requires sophisticated methods to locate new gas fields. Once fields are found, advanced well-development technology is necessary to obtain high gas flow rates.

Gulf Coast

The Gulf Coast region is not expected to be a future source of natural gas for California. While there are currently substantial uncommitted reserves and excess production capacity in the region, experts believe that production will decline substantially in the 1990s even with new reserve additions. Moreover, demand for Gulf Coast gas in its nearest markets--Louisiana and Texas--is expected to increase as onshore production in these areas decline. This increased demand together with the expected decline in production will leave little Gulf Coast gas available for export to California.[5]

Unspecified Available Supplies

In addition to the potentially available supplies discussed in this report, there are additional resources that may become available to California. These resources include production from Northern and Central California offshore reserve, Mexican gas, and additional supplies from Canada, the Rocky Mountains, the Southwest and the Gulf Coast. The availability of these supplies will depend on such factors as regional competition for supply, transportation availability, and new technology development. The uncertainties inherent in these factors make it impossible to specify which additional supplies or quantities will become available in the later years of the forecast. However, sufficient supplies beyond those shown for specific regions in Table 2 do exist. For example, the Rockies and Canada could supply all of the unspecified gas.[6]

Outlook for Contract Arrangements

Two factors are influential in the evolution of the natural gas sales arrangements. Inflexible contract terms and especially take-or-pay provisions are creating flexible and market-responsive contract terms. Second, the spot market is playing an increasingly important

role in the gas supply picture. These two factors create a rapidly changing environment for trade in natural gas.

The changes in the sales terms for natural gas have created some uncertainties and policy concerns. In particular, the rapid emergence of the spot market has raised concerns about the gas acquisition strategies of California gas utilities. Increasing reliance on spot supplies may forego an important opportunity to secure dedicated contract supplies at attractive prices. In addition, spot purchases can intensify the take-or-pay liability of pipelines such as El Paso and Transwestern, and some of this increased liability may be passed on to California gas consumers.

These potential problems stem from the transition from the more regulated to a less regulated environment. Reliance on the spot market arises from a combination of inflexible contracting practices and an excess of gas at the wellhead, both byproducts of the old gas sales regulatory regime.

In the long run, flexible and market-responsive contract terms and access to spot supplies will cause a more competitive commodity market for natural gas. However, this transition must be done with care because of the large potential costs to consumers, distribution companies and pipelines. Consideration of this ongoing transition in contracting arrangements will be a key element of the CEC's participation in state and federal regulatory proceedings. This participation will be based on an analysis of prices and other market information between end-users and producers.

Conclusions and Recommendations

If the relative merits, including environmental concerns of all pipeline proposals are equal, then in keeping with the CEC's Biennial Report recommendations, FERC should consider issuing permits for all pending applications to allow maximum market response. In an increasingly deregulated gas market, competition among producers, pipeline companies and local utilities will determine the most economical supply sources for any pipeline network. However, the construction and operation of pipelines remain under regulation, primarily at the federal level. The CEC believes that market mechanisms should be allowed, to the greatest extent possible, to determine the evolution of the interstate pipeline system.

Issuing multiple certificates would allow market forces to determine which, if any, new pipelines or capacity additions would be built. Under increasingly competitive conditions in natural gas transportation markets, transporters have increasing incentives to build only those pipelines that create a net gain in economic efficiency. This incentive can be strengthened by ensuring that pipeline builders remain at risk for their investment in new facilities. Issuing multiple certificates would have the added virtue of allowing markets to choose the most efficient alternative to serve a transportation need by allowing different proposals to compete in the marketplace. Thus the market, rather than a regulatory decision, would become the final arbiter of which pipeline additions should be made. However, real competition will not be enhanced by the introduction of new interstate pipelines, if the large customer's perception of California regulation continues to be so negative as to disable existing California utilities from competing effectively with new pipeline entrants.

The CEC will participate in regulatory proceedings. The CEC will closely monitor and evaluate the development of federal and state regulatory policies that determine how gas supply, demand and price signals are transmitted between purchasers and producers. If these signals are not transmitted effectively, then the natural gas market cannot function efficiently. The results of these CEC evaluations should be provided to the FERC and the CPUC through selective interventions in cases where the CEC could have the greatest impact.

The CEC will participate in Canadian export policy debates. The CEC will participate in the Canadian National Energy Board's (NEB's) deliberations on gas exports to the U.S. Just as Canada represents a significant source of gas for California, California provides the major foreign market for the export of Canadian gas. Working with the NEB to develop a joint understanding of the future prospects for gas trade between Canada and California will benefit both parties.

FOOTNOTES - CHAPTER 2

1 See California Energy Commission, Biennial Fuels Report, September, 1986, Appendix C.

2. National Energy board, Canadian Energy, Supply and Demand 1985-2005, October 1986.

3. Canadian National Energy Board, "Reasons for Decision in the Matter of Review of Natural Gas Surplus Determination Procedures", July 1987.

4. Testimony of Campbell Watkins, Datametrics Ltd., in CEC Biennial Fuels Report proceeding, Docket 87-BFR-1, May 28, 1987.

5. Testimony of John Brickhill, Foster Associates, in CEC Biennial Fuels Report proceedings, Docket 87-BFR-1, May 28, 1987.

6. Watkins, op. cit., and testimony of Mark Doelger on behalf of the State of Wyoming, in CEC, op. cit.

CHAPTER 3

PROMOTING NATURAL GAS COMPETITION IN CALIFORNIA

As recently as a few years ago, all segments of the U.S. natural gas industry, from producer to consumer, were highly regulated. Gas regulations, particularly at the federal level, have since been scaled back and remaining regulations have been made more flexible to stimulate and harness the forces of market competition.[1] Gas prices nationwide are now largely determined by competition of gas with competing energy sources, along with competition among gas suppliers.

California has made great strides in changing its gas regulatory structure to adapt to the nationwide trend toward a market-driven industry. After lengthy public hearings, the California Public Utilities Commission (CPUC) recently adopted a new regulatory structure for gas utilities that promotes competition. The CPUC is in the process of revising gas rates to conform with the structure.[2] However, the CPUC adoption of new gas rates likely will not end the transition to a competitive market. Natural gas markets and industry practices are still evolving, and State and Federal gas regulations should continue to change with them.

While the general direction of gas regulation in California is established, a generally accepted vision of where California wishes to be in the long term has yet to be enunciated. For example, no resolution exists of such fundamental long-term issues as how far and how fast to go in deregulating the gas industry, the structure of remaining regulations, and the appropriate role of utilities in competitive market segments. Without the guidance provided by a long-term vision, the transition to a market-driven gas industry will be unnecessarily disruptive, with greater potential for costly mistakes.

The CEC, which is charged with developing and maintaining a long-term perspective on energy policy issues, wishes to help develop a clearer long-term view of a desirable gas regulatory structure for California. To that end, the Energy Commission offers guidelines for promoting natural gas competition in California (some are already being implemented by the CPUC).

The CEC's guidelines can be summarized as three interrelated concepts:

1. Separate competitive gas services from those natural monopoly characteristics require some form of government regulation

2. Deregulate the competitive services

3. Structure regulations of the remaining services to nurture whatever market forces exist and to interfere as little as possible with market forces in unregulated segments of the gas industry

A common thread uniting these guidelines is the belief that competitive market forces should not be impeded. Although historically the need to accommodate competition was not a central concern in regulating gas, it will be crucial from now on. Considerable effort is necessary if this fundamental new way of thinking is to become ingrained.

In offering guidelines for structuring a market-driven gas industry, the CEC has given careful consideration to assuring fairness in the provision of gas market services.

Guidelines for Structuring a Market-Driven Gas Industry

Guideline 1: Monopoly and Competitive Gas Industry Services Should be Separated

In the U.S., natural monopolies historically have been regulated in the public interest. Natural monopolies are characterized by economies of scale over the entire range of output of goods or services. Consequently, costs will be lowest if a single firm provides the entire output. Natural monopolies also tend to have large, immobile investments (such as pipelines) that cannot feasibly be recovered and converted to other uses.

Gas utility services that have natural monopoly characteristics are those involved in physical delivery of natural gas, such as distribution, transmission, and storage. Gas delivery requires use of pipelines and other facilities having marked economies of scale. Local gas distribution is a clear-cut instance of natural monopoly. Bulk gas transmission through long-distance pipelines is a grey area, with varying degrees of competition in different regions.

Current utility services that are inherently competitive are the buying and selling of gas, known as "merchant" activities. Merchant activities lack the natural monopoly characteristics of large economies of scale and large immobile investments. To the extent that merchant services are regulated monopolies, they are artificially created rather than natural monopolies.

For regulatory purposes, activities of the gas industry should be separated into services that are natural monopolies and services that are actually or potentially competitive. Services that are natural monopolies would remain the exclusive province of regulated utilities. For all other gas industry services, anyone who desires should be free to compete without becoming a regulated utility. This separation of services is generally called "unbundling," because services previously sold as a single package or bundle are offered individually.

Separation of delivery and merchant activities permits greater influence of market forces on nonmonopoly services. Separation allows consumers to buy gas from any available source, and pay the utility to deliver it. The result is greater competition among gas buyers and sellers. Moreover, separation is a prerequisite for deregulating nonmonopoly activities, which further increases competition.

The CPUC's new gas regulatory structure separates gas delivery from the gas merchant role for some customers. The CPUC structure divides utility gas customers into a "core" group of mostly small customers lacking immediate alternatives to burning gas, and a "noncore" group of mostly large customers capable of shifting to alternative fuels

such as oil. Gas merchant and delivery services are offered separately only to the noncore group. The CPUC is currently working out the regulatory details of the separation between delivery and merchant services. In the meantime, separate delivery and merchant services are available under interim arrangements.

Separation of delivery and merchant services presents special problems for core gas consumers, because they lack existing capability to burn an alternative fuel if gas becomes unavailable. If a core gas consumer relies on a nonutility gas supplier, and that supplier cannot always deliver gas, the consumer could be left with inadequate energy supplies.

The CPUC believes that only the utilities can provide the assured gas supplies that core gas consumers require. Further, the CPUC is concerned that some gas users may not have the information to make decisions concerning gas service options. Lastly, the CPUC cites a "strictly secondary reason" that unbundling of core gas service would cause administrative burdens on the utilities.[3] Consequently, the CPUC decided that utilities should retain a monopoly over gas service to core consumers, and should not offer them separate delivery and merchant services.

However, protecting core customers from market forces also denies them the benefits market forces can bring. If only the utilities may serve the core market, then core markets will not directly experience competition among gas suppliers, but must rely on the local utility to act on their behalf. This inability to deal directly with gas producers or independent marketers eliminates competition and the market discipline that competition brings.

Currently, core gas customers must rely on the utility companies to negotiate on their behalf with gas suppliers. As a result of this bargaining, the market for gas at the California border has become highly competitive. However, the benefits of this competition have not all accrued to core customers. Lower prices have been directed largely to noncore customers in order to keep them on the utility system.

In a deregulated core market, core customers would be able to shop for the combination of price and terms of service that best suited their needs. If it turned out that in some market segments billing or other efficiencies gave the utility an economic advantage, the utility would win a fair competition for that market.

Examples from Ohio and Ontario suggest that nonutility suppliers can successfully compete in some segments of the retail market. In these examples, groups of consumers -- one in an apartment complex and one group of fast food stores -- purchased gas directly from pipeline suppliers. These arrangements suggest that the benefits to the consumers justified the organizational overhead of forming and operating a buying cooperative.[4]

The appropriate mix of regulation and market discipline for core customers requires further examination. It has not been shown that firm service for core customers is incompatible with competition among suppliers. With unbundled rates, core customers could continue to receive first priority on delivery services. Gas suppliers other than the local utility (interstate pipelines, competing utilities, and perhaps independent marketers) should be able to aggregate gas supplies sufficiently to provide firm supplies, especially if there is nondiscriminatory access to unbundled storage. Alternatively, core customers might pay the local utility for backup service. The benefits of increased competition might outweigh the costs of providing back-up supplies. The Wisconsin Public Service Commission apparently thinks so, because it recently determined that gas transportation services should be available to everyone, with no quantity limitations. Clearly, whether to deny separate delivery and merchant services to core gas users must be studied in detail.

Guideline 2: Gas Delivery Services Should be Unbundled

The physical delivery of gas from the wellhead to the burnertip involves a variety of distinct services that can be priced and offered separately. These services include gathering gas in the field and delivering it to trunk pipelines, long-distance transmission of gas from producing to consuming regions, local distribution, and gas storage to permit consumption and production to vary independently.

Gas transmission and distribution can be further unbundled according to the degree of service dependability. Peak demand, especially during the winter heating season, may exceed the physical capacity of the utility's delivery and storage facilities. To help overcome this constraint and provide flexibility in load management, utilities may offer customers a choice of firm or interruptible delivery service. Interruptible service is provided to customers at a discount, since deliveries are subject to curtailment at short notice.

Competition and consumer choice benefit by regulatory actions to unbundle utility delivery services. Unbundling of regulated delivery services allows utility customers to choose the combination of delivery services that best meets their needs. There is a clear gain in economic efficiency, as well as fairness, from ceasing to force consumers to buy a higher quality of service than they need, or to buy a type of service they do not want in order to get something else that they do want. Also, unbundling gives clear signals to suppliers of services regarding how much of each service is wanted at prevailing prices.

The specific menu of services offered by utilities should be those for which customers are willing to pay. Numerous possibilities exist, as there is a continuum of possible transmission, distribution, and storage services. While avoiding undue complexity, a guiding principle for unbundling delivery services should be to maximize the service options available to customers.

Unbundling gas storage presents special difficulties, because storage serves multiple purposes. Storage is one tool to provide short-term (hourly and daily) utility load balancing, needed to iron out transient imbalances between gas receipts and deliveries. Short-term load balancing is an essential aspect of utility system operation and probably cannot be unbundled.

Storage also provides long-term functions. Storage is used to meet seasonal variations in gas demand, as well as to reduce gas costs by allowing greater gas purchases when gas is cheaper. Long-term storage is performed for the benefit of identifiable customers or groups of customers, and is possible to unbundle. Most utility seasonal storage historically has been provided for core customers, that have a high seasonal variation in demand and require dependable service at all times. To the extent that storage capacity exceeds the needs of core customers, storage can also be provided to noncore customers. Noncore storage could be offered as an unbundled service or range of services. (Storage service for core customers would not be unbundled as long as core customers are not offered separate delivery and merchant services.)

Guideline 3: Nondiscriminatory Access to Utility Delivery Services Should be Available

Not surprisingly, restricting the ability to have gas delivered also restricts the ability to market gas. Fair competition in gas marketing depends on all noncore buyers and sellers having equal, or nondiscriminatory, access to regulated delivery services. To ensure that utilities do not take unfair advantage of their delivery monopoly to favor their own merchant activities, a standard of nondiscriminatory access to the utility delivery system should be a guiding principle for utility regulation.

A nondiscriminatory access mandate would oblige utilities to provide delivery service for other merchants under the same terms, including rates, as they do for their own noncore sales customers. The nondiscriminatory access requirement should apply to the full range of unbundled

delivery services from interstate transmission of bulk supplies to local distribution, storage, and load balancing.

Nondiscriminatory access to delivery services is especially crucial during peak demand periods, when capacity may be inadequate to meet all demand. Competition in gas marketing would be destroyed if utilities were able to provide preferential access to peak-period delivery capacity for their own noncore sales customers at the expense of noncore users that buy elsewhere.

About 70 percent of California's gas supply is obtained from out-of-state producers and delivered to the California border through the national network of interstate pipelines. Nondiscriminatory access to delivery services in California, therefore depends on appropriate regulation at the federal level.

At present, federal policies fall short of full commitment to nondiscriminatory access. The Federal Energy Regulatory Commission (FERC) has an "open access" policy to promote delivery of gas by interstate pipelines, which it regulates. However, providing unbundled delivery services on the federal level is voluntary. True nondiscriminatory access to delivery services on interstate pipelines will not be available until all interstate pipelines offer unbundled delivery services on a nondiscriminatory basis. As discussed in Appendix D, some pipeline companies are understandably reluctant to take this step due to the "take-or-pay" problem.

A take-or-pay provision in a gas purchase contract requires the purchaser to take delivery of a specified amount of gas, or pay for it anyway. In the late 1970s and early 1980s most pipeline companies signed long-term contracts to buy high-cost gas with take-or-pay terms. Many of these companies are now faced with take-or-pay liabilities as high as hundreds of millions of dollars because they cannot market the gas at currentprices. How the liability for take-or-pay costs should be allocated among producers, pipelines, and the pipelines' customers is a contentious issue. Although the outcome is highly uncertain (see Appendix D), California gas consumers potentially might end up paying significantly more for gas due to take-or-pay costs.

Guideline 4: Utility Tariffs Should Promote Economic Efficiency

In a market-oriented gas industry, utility rates should promote economic efficiency. At least four ways to attain this deserve mentioning:

1. Rates should directly reflect the actual costs of providing the particular service for each customer or class of customer. A rate structure based on marginal costs gives consumers accurate price signals and promotes economic efficiency in fuel consumption and the choice of fuel.

2. Utilities need rate flexibility to respond quickly to changing market conditions or to specific customer requirements.

3. To provide an incentive for management efficiency, a portion of the utility's profits should be at risk for substandard performance, with a corresponding opportunity for higher profits for performance excellence.

4. For clarity, rates and other regulations should be logical, and not complex, and the regulatory process should be accessible and comprehensible to the public.

In accord with these concepts, the CPUC is developing cost-based, flexible tariffs that give California's gas utilities an economic incentive to control costs. Pending the outcome of the comprehensive rate design hearings now in progress, the CPUC's interim rate decisions have laid the groundwork for a market-responsive rate structure.

Guideline 5: Potentially Competitive Utility Services Should be Deregulated

Avoiding unnecessary impediments to competition requires that government not

regulate aspects of the gas industry that are inherently competitive. This principle motivated the federal deregulation of gas wellhead prices beginning in 1978. Other aspects of the gas industry that are also inherently competitive, such as buying and selling gas at the consumer level, have not been deregulated.

Once they are separated from utility gas delivery services, the buying and selling of gas should be deregulated. (As long as the CPUC retains a core user group to which separation of delivery and merchant activities does not apply, only the noncore merchant activities would be deregulated.) Competitive market forces rather than regulations should determine the price that end users pay for gas. Competition can operate if separation between natural monopoly and potentially competitive services is correctly made, and if nondiscriminatory access to regulated monopoly services is enforced. In truly competitive situations, market forces will set prices better than can government regulation.

The CPUC has already moved part way toward deregulation of consumer gas prices. The CPUC relies on market competition to set the commodity price that noncore users pay for gas purchased from nonutility suppliers and delivered by the utility. Anyone may compete to sell gas to noncore users. However, the utilities now compete on a different basis than others, because utility gas commodity prices are regulated.

Since gas buying and selling (as distinct from gas delivery) are inherently competitive, no apparent reason exists why the utilities could not, and should not, compete to sell gas on the same basis as everyone else. To achieve equality of competitive opportunity, all price regulation of noncore gas sales should be ended. Furthermore, the nondiscriminatory access principle discussed above must be enforced.

After utility merchant activities are deregulated, a separation of utility merchant activities from regulated gas delivery is essential to maintaining competitive gas merchant activities. Otherwise, utilities might take unfair advantage of their monopoly power over gas delivery to discriminate against other gas suppliers. For example, without separation of utility merchant and delivery activities, the current California system of negotiated utility transportation rates could easily generate anticompetitive utility behavior. With negotiated rates, the utility would have a strong economic incentive to drive a harder bargain with an independent marketer than with the marketing branch of the utility. In effect, the utility marketer would be negotiating with itself.

The best means to achieve the necessary separation between utility merchant and delivery activities is open to debate. One possibility is to require completely distinct utility affiliates, including separate financial accounts, no shared personnel, and no exchange of confidential business information. Separation of utility marketing affiliates is necessary if utility marketing is deregulated. However, it is uncertain whether separation is sufficient. Some question whether establishing separate utility affiliates is adequate to assure absence of anticompetitive utility marketing behavior and argue that it is necessary to prohibit utilities from having marketing affiliates.

The concept of having unregulated utility affiliates is not new in California. Current unregulated affiliates of California gas utilities include real estate developers, an oil exploration and development company, and a large chain of drug stores.

Applying the Guidelines: Some Current Issues.

In recent years, California has come a long way toward changing its gas regulatory structure to accommodate a market-driven gas industry. Despite this considerable progress, market forces are still suppressed in some instances where California gas regulations conflict with the intent of the CEC's guidelines. Selected issues are discussed below.

Nondiscriminatory Access to Gas Delivery Services is Incomplete

Interutility Transportation. The need for interutility transportation occurs when delivery of gas from supplier to consumer requires the gas to be transported through two utility service areas. For example, the most direct route for delivering Canadian gas to Southern California is through the PGandE service area to SoCal Gas.

In September 1987, the CPUC required that utilities offer interutility transportation of gas to help promote competition among gas suppliers in California. Although the new service provides an essential link in the gas delivery system, the new rules fail to fully meet the standards of nondiscriminatory access.

Under the current requirements interutility transportation service has a lower priority than any other utility service, including regular (single-utility) transportation. No apparent justification exists for according lower priority, and therefore lower service quality, simply because the gas must pass through two service areas rather than one. No comparable quality penalty exists on the federal level for transporting gas through more than one interstate pipeline.

Interutility transportation service should be made available on the same terms as regular utility transportation. This action would remove an impediment to equality of opportunity among customers for gas transportation service.

Utility Storage. Nondiscriminatory access to gas storage is lacking. Storage as an unbundled service is unavailable from the utilities. Utilities use storage primarily for their core customers. When storage capacity exceeds the needs of core customers, storage may be used on an interruptible basis for noncore customers benefit. Utility transportation customers receive storage benefits through short-term load balancing services automatically provided to all noncore customers. Only utility sales customers receive long-term utility storage service.

A tradeoff exists between storage and access to firm transmission capacity, because each can increase the dependability of gas supply. (The tradeoff is imperfect, since storage can provide functions that firm transmission capacity cannot, and vice versa.) Thus the unavailability of firm interstate capacity on the pipelines serving California to anyone other than PGandE and SoCal Gas increases the need for unbundled storage.

The CPUC recently decided that gas utilities should provide unbundled storage services.[5] A proceeding is underway to determine appropriate service and to consider other issues. The CEC supports the CPUC's decision to unbundle storage and urges that a principal goal be to enable nonutility merchants to compete equally with the utilities.

Lack of Nondiscriminatory Access to Information. Nondiscriminatory access by all gas merchants to utility delivery services requires equal access to information about those essential services. A merchant with superior information about the cost and availability of delivery services could offer customers better delivery service terms, since delivery facilities are limited and terms for access to those facilities (including price and firmness of service) are negotiable.

Due to their monopoly over delivery services, the utilities have superior access to the most current and data regarding availability and cost of delivery capacity. In addition, over the years the utilities have gathered considerable customer-specific information on fuel-use patterns. Consequently, SoCal Gas and PGandE maintain a considerable informational advantage over other merchants in negotiating with potential customers. If all gas merchants are to be on an equal footing, the utilities must provide capacity availability and cost data to the public.

It has been argued that the utilities could use their informational advantage to constrain competition in merchant services. Means should be devised to prevent such an occurrence. The CPUC should consider updating the current

utility data collection and reporting system, with special attention to nurturing the emerging competition in noncore gas markets. An improvement in the timeliness of reporting procedures may be required, as well as a change in the data categories reported. Administrative and cost burdens imposed by reporting requirements are also an important consideration.

To the extent that it may be impractical or prohibitively expensive to make certain key delivery data publicly available on a timely basis, fairness dictates that neither should the data be made available to the utility's marketing arm. This consideration reinforces the earlier argument for a separation of utility noncore merchant activities from regulated gas delivery.

Firm Capacity on Interstate Pipelines. Access to interstate pipeline capacity is within federal jurisdiction. Nonetheless, assured access to capacity (known as "firm" capacity) is an important issue affecting California's ongoing regulatory restructuring.

SoCal Gas and PGandE have contractual rights to essentially all of the firm capacity on the three major interstate pipelines that deliver gas to the California border. Other merchants and end-users have access only to interruptible capacity--that is, they can use the pipelines only when the utilities are not making full use of them. This is an inferior service, subject to curtailment on short notice. Because nonutility merchants cannot obtain assured delivery service for out-of-state gas production, they cannot compete on an equal footing with the utility merchants.

SoCal Gas' and PGandE's rights to all of the firm capacity on the interstate pipelines is a vestige of the old gas regime before wellhead price deregulation and widespread availability of unbundled transportation services. It may be appropriate for the utilities to retain preferential access to some portion of interstate transmission capacity on behalf of their core customers. However, it is inequitable that noncore users obtain preferential access to interstate transmission capacity if they buy from the utilities, but not if they buy from other suppliers. Moreover, it is inequitable that gas utilities other than PGandE and SoCal Gas cannot obtain firm transportation service on the interstate pipeline serving California, even for their core customers. San Diego Gas and Electric Company has complained that it cannot obtain firm gas supplies from any source other than SoCal Gas because of the latter's control over firm interstate pipeline capacity serving Southern California.

The FERC is now exploring possible means to reallocate access to firm transmission capacity. The CPUC has encouraged its staff and other interested parties to work together to develop a California proposal to be taken to the FERC for consideration.

Equality Among Gas Marketers is Lacking

The utilities are marketers of gas to noncore gas consumers, in direct competition with other marketers. Not all marketers have equal opportunity to compete, however, because utility marketing is regulated by the CPUC but independent marketers are not.

The CPUC structures utility commodity rates for noncore customers to cover only the cost that the utility pays to purchase gas. All other costs, such as profits and administrative costs, are recovered in the transportation rates. Thus, utility transportation rates subsidize utility marketing activities. Independent marketers cannot similarly subsidize their marketing activities, because the utilities have a monopoly over transportation. Instead, independent marketers must cover all their costs, including profits, in the commodity price paid by the consumer. This puts the independent marketer at a disadvantage.

On the other hand, independent marketers have the advantage that they are free to charge whatever the market will bear. The utilities can charge for gas only what the CPUC allows. Currently utilities may charge only a single,

specified rate for gas (their weighted average cost of purchasing gas).

Doubtless other significant differences exist between the treatment of utilities and independent marketers. Which group has the net marketing advantage is open to dispute, but one conclusion is clear. Not everyone starts out on an equal competitive footing. The simplest and most efficient solution to rectify this regulatory inequality among marketers is to deregulate marketing.

California Gas Gathering Practices Present Problems

A gas gathering system is a network of small diameter pipelines in a gas field to collect and combine gas from individual wells and deliver it to a gas transmission line. Usually gas gathering also requires purification and compression of the gas to produce "pipeline quality" gas.

Gas gathering in the Northern California gas fields is an area of long- standing controversy. Gas producers have been at odds with PGandE, which buys most of their gas, over the costs of gas gathering and the rate treatment of those costs by the CPUC. Much of the controversy might be resolved if the regulatory treatment of gas gathering costs was changed to parallel with proposed CEC guidelines. Currently, California gas gathering has not been unbundled and rate treatment of the costs is not economically efficient.

PGandE owns most of the Northern California gas gathering lines, which were paid for by ratepayers. Since PGandE provides the gathering service solely for the benefit of the gas producers, the CPUC has determined the producers should reimburse the utility (and thus ratepayers) for owning and maintaining the equipment to gather and treat gas. This reimbursement occurs in two ways. For gas gathered and purchased by PGandE (the bulk of the gas), the utility deducts from the purchase price an amount designed to cover its gathering costs. For gas gathered and transported by PGandE under its unbundled delivery service, PGandE increases its usual transportation rate by the amount of its gathering charge. In either case, the current gathering charge is 34 cents per million Btu (3.4 cents per therm).

The current system in which ratepayers foot the bill for gas gathering and then are reimbursed is convoluted and inefficient. Further, given partially unbundled utility services and a variety of rate classes, it is difficult if not impossible to assure that the ratepayers who originally paid are the same ones who get reimbursed. It makes more sense to charge producers directly for any gas gathering services provided by PGandE. Thus, gas gathering charges should be a separate item, not rolled into sales or transportation. In short, gas gathering should be an unbundled utility service.

Besides being bundled, the utility gas gathering charge maybe economically inefficient. The same gathering charge applies to all producers connected to the PGandE system, although the actual gathering costs are widely acknowledged to vary greatly among producers. In some instances PGandE provides no compression at all. Therefore, gathering charges are not cost-based for each producer, and may not be cost-based even in the total. The resultant inefficiencies and inequities are inappropriate in a competitive marketplace.

Since PGandE charges each gas producer as if the utility provided full gathering services, any producer that provides its own gathering or treatment facilities has to pay twice. Producers have a disincentive to provide their own gathering services even if they could do so for much less than the 34 cents per million Btu charged by PGandE. Consequently, the current practice of bundled gathering services perpetuates a situation in which gas producers, who ultimately must bear the costs, have no control over them. And utilities, which could control the costs, have little incentive to do so.

IV. Recommendations

The CPUC should deregulate noncore gas merchant activities. Buying and selling gas (merchant activities) are inherently competitive activities. Competitive market forces can set prices better than can government regulation, at least for large gas users with alternatives to burning gas (the so-called noncore market). In fact, unregulated gas merchant activities now exist in California. Only utility merchant activities are regulated. Full and nondiscriminatory competition requires that all noncore merchant activities be deregulated. It also requires a separation between regulated (gas delivery) and unregulated (merchant) utility activities.

The CPUC has invited proposals for the future regulation of the utilities' noncore merchant activities.[6] The CEC recommends that the CPUC deregulate noncore merchant activities. To promote full and effective competition there should be no requirement that returns to utilities' at-risk capital be used to subsidize core markets. As a further step, the CPUC should investigate the advantages and disadvantages of extending gas merchant deregulation to all gas customers regardless of size.

The CPUC should unbundle utility gas gathering services and adopt cost-based rates for gas gathering. In addition, the CPUC should hold a public hearing to investigate the desirability and practicality of ordering utility divestiture of gas gathering facilities. The gas gathering services provided by California utilities are not available on an unbundled basis. Thus, California gas producers are denied the ability to decide whether to pay for this utility service or provide it themselves. Further, a standard gathering charge applies regardless of location or other differing circumstances, although costs vary considerably from case to case.

To promote economic efficiency and increase the competition among gas suppliers, gas gathering services should be unbundled and provided at cost-based rates. Since gathering costs vary considerably by location, rates for gathering services should also vary. These actions would lay the foundation for possible later utility divestiture of gas gathering facilities. Divestiture would put costs under the control of those who must bear them.

The CPUC appears to recognize the problems with the current regulatory treatment of gas gathering. The CPUC has also directed its staff to report "on the scope of the issues involved in unbundling and deaveraging [ceasing to use an average for]" gathering costs. Since these matters are not new issues and have been under consideration by the CPUC since 1985, the CPUC should expeditiously institute an investigation into the matter.

The CPUC should require that interutility gas transportation service be made available on the same terms as regular utility transportation. Under current terms of service, interutility transportation is a weak link in the utility gas delivery system. Interutility transportation service is lower priority than is regular transportation service. Requiring that interutility transportation receive the same service priority as regular utility transportation would help assure that reliable gas delivery service is available on nondiscriminatory terms.

FOOTNOTES - CHAPTER 3

1. Recent gas regulatory actions and market changes are discussed in Appendix D to this report.

2. The Energy Commission's previous Biennial Fuels Report (Publication P-300-86-007, September 1986) described the Public Utilities Commission's proposed new gas regulatory structure. The CPUC subsequently adopted the new structure substantially as proposed (Decisions 86-12-009 and 86-12-010, December 3, 1986).

3. California Public Utilities Commission, Decision 86-12-010, December 3, 1986, p. 15.

4. Testimony of Arlon R. Tussing, ARTA, Inc., in California Energy Commission, Biennial Fuels Report proceedings, Docket 87-BFR-1, June 16, 1987.

5 California Public Utilities Commission, Investigation No. 87-03-036, Assigned Commissioner's Ruling, October 1, 1987, and Decision 87-10-043, October 16, 1987.

6. California Public Utilities Commission, Decision 87-10-043, October 16, 1987, p. 33.

CHAPTER 4

METHANOL AND ALTERNATIVE FUELS FOR TRANSPORTATION

While other energy-using sectors have reduced dependence on petroleum based fuels, transportation remains stubbornly reliant on gasoline and diesel. Although energy conservation has made a significant impact on petroleum consumption, actual petroleum displacement involving fuel substitutes has not met with similar success as other market sectors.

The California Energy Commission embarked on programs in 1979, to break the log jam for new transportation fuels. The goal of these efforts is to introduce fuels diversity similar to electricity generation and help reduce the vulnerability of this sector to oil supply disruptions. With additional nonpetroleum-based fuels, transportation can absorb disruption with less impact than experienced during previous oil supply curtailments.

Potential Methanol Fuel Supply

Methanol producers can use a variety of feedstock resources. Methanol is usually produced from natural gas, but other fuel sources such as coal and biomass are also potential feedstocks. The abundance of these resources in the United States provides a degree of energy security, in contrast to that of imported petroleum.

Oil companies in places like Alaska with tremendous quantities of remote associated natural gas may view methanol as a way to capture some economic benefit of their holdings. Currently, the oil companies reinject this gas for enhancing oil recovery. The reinjection process uses compressors that burn 25 percent of the gas. Unfortunately, reinjection does not take advantage of the energy value of natural gas. To capture some of this value, the Atlantic Richfield Company and Standard Oil of Ohio have indicated that their long-term development plans include methanol production plants as an option for their North Slope natural gas. With proper handling, methanol can be transported in batches through the Trans-Alaska pipeline. While many factors influence the decision to make an investment in these plants, the oil companies may

find that they reduce their losses even if they sell methanol at less than their production costs.

The U.S. coal resources provide the greatest measure of energy security. However, although technologically feasible, coal conversion to methanol carries high production costs. Until new innovative processes become commercial, coal is unlikely to make any contribution to methanol supply for several decades.

Apart from the potential of domestic producers, the world's methanol producers currently face the problem of overcapacity. In 1986, the total capacity of the world's methanol plants was rated at seven billion gallons, which exceeded world demand by 1.65 billion gallons. By 1990, this excess supply could grow to 2.6 billion gallons barring unforeseen surges in methanol demand.[1]

Air Quality Benefits of Methanol

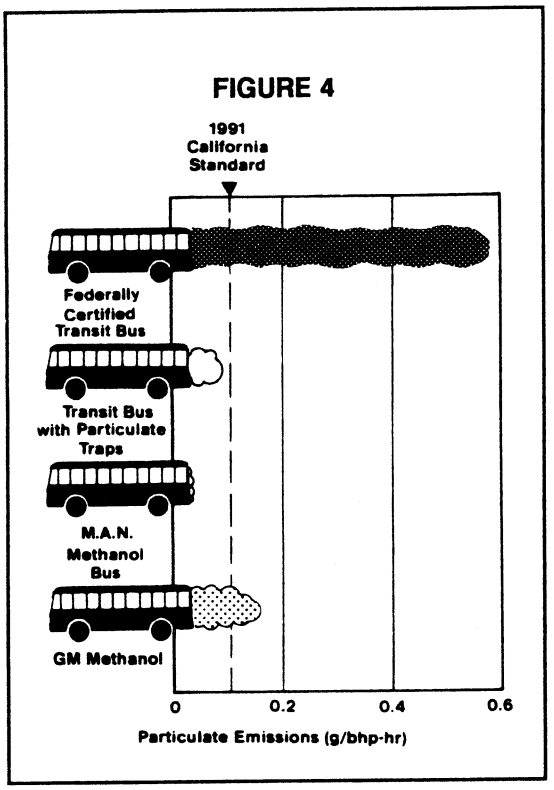
The EPA administrator has stated that the Clean Air Act will be interpreted literally.[2] Federal sanctions will be imposed in districts that do not meet federal air quality (AQ) standards for any of several criteria pollutants, particularly CO and ozone, by the end of 1987. In California, areas not meeting standards include the Los Angeles Basin and Sacramento, Ventura, Kern and Fresno Counties. Los Angeles may require at least 20 years, and other areas at least 10 years, to achieve these standards.[3] To sidestep this impasse of unachievable deadlines, the EPA has instituted the Reasonable Extra Efforts Program (REEP), which enables AQ agencies to submit plans demonstrating a commitment to meeting AQ standards, with emphasis on addressing transportation issues. However, deadlines and sanctions cannot be changed except by Congress according to the EPA general counsel.

Methanol will help improve the state's air quality. Emissions tests show that methanol vehicles can meet hydrocarbon (HC), carbon monoxide (CO), and oxides of nitrogen (NOx) standards.[4] Yet, area of controversy relates to the effect of multi-day episodes. The South Coast Air Basin experiences a number of days during the smoggy season in which portions of the air mass can take two or three days to move through the basin. During these multi-day episodes the unburned emissions have longer exposure to sunlight and may eventually photochemically react to form ozone. The University of California, Riverside performed smog chamber tests to simulate multi-day events for methanol vehicles in the future. This study found that the ozone benefits of methanol decrease significantly on simulated second and third days.[5]

However, all smog chamber studies are "stagnant air" studies and cannot incorporate other basic meteorological phenomena such as wind speed and direction, emissions entrainment inversion layer effects, and other important real world variables, which are all necessary to project the future levels of ozone in any air basin. The California Air Resources Board (ARB) is currently sponsoring a detailed study of multi-day episode effects that occur in the South Coast Air Basin. The results of this study will be available in 1988.

In other applications, the use of methanol to substitute for diesel fuel results in substantially reduced NOx and particulate emissions. Figure 4 shows the dramatic drop in particulate emissions from the two methanol buses operating in the CEC demonstration program in Marin County compared to a federally certified, diesel-fueled transit bus.

Recently adopted federal regulations that restrict particulate emissions from buses and heavy-duty diesel trucks to 0.1 grams per brake horsepower hour beginning in 1991 have caused the industry to review methanol as an option for heavy-duty vehicles. Forced to make major improvements to diesel technology, manufacturers have developed particulate traps, although the durability of this equipment has yet to be shown. In addition to the traps, the Environmental Protection Agency (EPA) and the South Coast Air Quality Management District (SCAQMD) have adopted regulations that may



also require the use of cleaner diesel fuel to achieve future standards. Traps and cleaner diesel fuel will add to the costs of operating heavy-duty diesel vehicles. Methanol vehicles, which will meet the 1991 regulations, may actually prove less expensive to operate than diesel vehicles.

The Potential Demand for Methanol

Forecasting methanol demand and prices is problematic using standard modeling techniques. In contrast to conventional fuels, methanol fuel lacks meaningful historical data. This problem renders behavioral or time series models unusable for supporting econometric analyses for methanol demand forecasting.

This lack of data forces the development of innovative techniques for forecasting purposes. The technique for the California methanol assessment was a technology and product innovation model to compute a probable market share for the new technology. The market share estimate is based on the profitability of new technology investment and past behavior of the specific industry with respect to the adoption of similar new, innovative technology. While the confidence level in a model of this type is not as high as in formal energy forecasting models, it does provide a basis for discussion of impacts from future prices and innovations.

The energy security and air quality benefits of methanol suggest that this alternative could make in-roads to the transportation market. Estimates of demand for methanol were made using two price scenarios. The first scenario assumes that the lowest prices will occur in the late 1990s and remain stable through the rest of the forecast period. This price stability results from the continuing state of methanol over-capacity. Under this market condition, prices and supply are assumed to remain stable even though a sizeable methanol demand occurs. Table 3 lists the methanol prices and potential demand in the forecasting period.

The second scenario is based on the belief that the methanol overcapacity will not continue. While prices decline in the short term, they do not go as low ($0.25 per gallon) as the first scenario assumes. In addition, prices begin to rise in the late 1990s mirroring the rise in oil prices. The methanol demand for this scenario is also presented in Table 3 and the two demand alternatives are presented in Figure 5.

The two scenarios present two distinctly different alternatives and reflect the infancy of methanol demand analysis. Developing a model that improves the demand forecast requires considerably more data and research. Future work in this area is planned particularly with respect to the transitions from a petroleum-dominated transportation system to a system with greater fuels diversity.

TABLE 3

METHANOL DEMAND UNDER LOW METHANOL PRICES

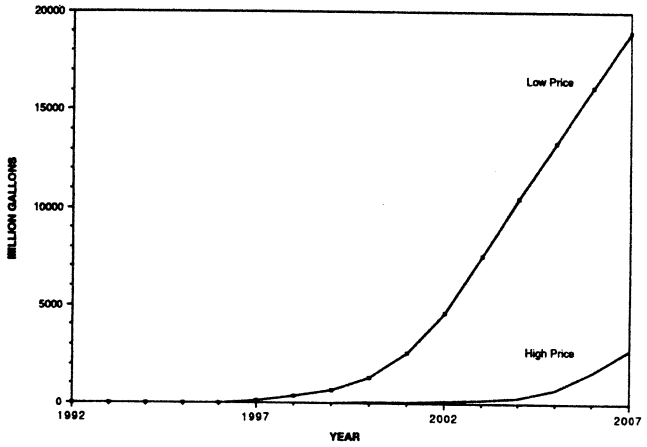
Year	Price Per Gallon Delivered FOB Los Angeles ($/1986)	Demand (Millions of Gal.)
1988	0.49	0.8
1992	0.35	1
1999	0.25-0.35	680
2007	0.25-0.35	8,995

METHANOL DEMAND UNDER HIGH METHANOL PRICES

Year	Price Per Gallon Delivered FOB Los Angeles ($/1986)	Demand (Millions of Gal.)
1988	0.49	0.8
1992	0.35	1
1999	0.45	26.8
2007	0.56	2768.2

Sources: Energetics, Inc., Letter Report to CEC, August 17, 1987.

Figure 5
Estimated Methanol Fuel Demand



Source: Energetics, Inc., Letter Report to CEC, August 17, 1987.

Natural Gas Vehicles

The use of natural gas also offers advantages for aiding fuels diversity in transportation. Italy, New Zealand, Canada, and the United States have the most advanced programs, accounting for nearly half a million vehicles in service. Other countries such as the Soviet Union, Argentina, Columbia, Trinidad, Bangladesh, India, and Thailand have also determined that natural gas vehicles have a high potential.

The natural gas for these vehicles can be stored in either compressed form or liquified form in cryogenic containers. The compressed natural gas (CNG) vehicles store fuel at 2400 to 3000 pounds per square inch (psi) in steel or aluminum cylinders that are placed in the trunks or attached to the frame beneath larger vehicles. Liquified natural gas (LNG), which by volume contains a higher energy content than CNG, requires storage in heavily insulated (cryogenic) tanks to prevent significant loss of natural gas due to boil off. By far, CNG vehicles are the most prevalent since LNG vehicles are still experimental with only a handful of vehicles operating.

In general, emissions from natural gas vehicles are cleaner than comparable gasoline vehicles. The bulk of the emissions is unburned methane, which does not contribute to photochemical smog formation. Based on results from the Federal Test Procedure, emissions of reactive hydrocarbons declined 35 percent to 55 percent when compared to similar gasoline cars. Carbon monoxide emissions were very low and NOx emissions on the average were slightly lower than for gasoline vehicles. These test results indicate that CNG vehicles could become an important part of any strategy to meet the air quality standards in the state.[6]

Most proponents of CNG target fleets as the most appropriate application, particularly large fleets with central fueling facilities. Indeed, several fleets have already placed CNG vehicles in service with satisfactory results. Utility companies own approximately half of the 30,000 CNG vehicles in the United States. In addition, the Gas Research Institute will be funding the development of two-stroke and four-stroke natural gas engines to be used in heavy-duty applications.

Other Alternative Fuels for Transportation

Propane vehicles have established the greatest market share next to gasoline and diesel. As reported in the Energy Development Report, approximately 200,000 propane vehicles are in service in California. Propane is produced as a byproduct of petroleum and natural gas production and processing. Because 80 percent of propane production in California is derived from oil processing, the supply of propane is directly dependent upon oil use. Despite extensive marketing efforts by the propane industry, the future expansion of propane appears limited since the fuel is a byproduct of petroleum and natural gas refining and refineries do not optimize their processes to produce propane.

Prior CEC studies of neat ethanol fuel indicate that this fuel suffers from high production costs and will probably not be competitive with gasoline. However, ethanol in gasoline blends was used extensively when both federal and state tax credits provided incentives to distribute these blends. While the state tax credits have expired resulting in less gasoline blends sold, recent rulings passed by the EPA may improve the prospects for ethanol use. In the "DuPont Waiver" the EPA will allow selling a gasoline blend which includes 2.5 percent ethanol. In very limited instances ethanol fuel may be able to be used 100 percent as a fuel.

Another alternative is electric-powered vehicles. Recent advances with new battery systems and improved drive systems have improved the prospects of electric vehicles. While the utility of the electric vehicles is less than that of petroleum fueled vehicles, EVs may have their own market. The best application is in stop-and-go delivery vans within the urban traffic

environment. Additional technological development is still required to lower operating and front end capital costs.

Recommendations

The CEC should evaluate the technological prospects and the resource potential of all alternative fuels for transportation. Establishing fuel diversities in transportation remains a key objective in reducing the state's vulnerability to petroleum supply disruptions. Full assessment of the alternative fuels should include economic, environmental, safety, consumer acceptance, and technical evaluation. For fuels that appear promising, the CEC should sponsor demonstration programs to evaluate the on road performance of these vehicles.

To expand methanol's capabilities in transportation, the CEC should complete demonstration programs for heavy duty truck applications and flexible fuel vehicles. Both of these programs could help bring methanol one step closer to commercialization. Showing the feasibility of heavy duty methanol trucks will help convince engine manufacturers and truck operators that methanol is a viable alternative. In addition, flexible-fuel vehicles could help overcome barriers of the small retail methanol fueling network.

The CEC should sponsor a natural gas vehicle demonstration program. Several fleets currently operate natural gas vehicles and research activities are being undertaken on heavy duty vehicles. Both areas show promise and could increase the fuel diversity in different market sectors. Therefore, the CEC proposes a natural gas vehicle demonstration program to evaluate the recent advancements in actual vehicle use. The program will include full testing for emissions, performance, and costs.

The CEC should sponsor an electric vehicle demonstration program. Like CNG, technological improvements to electric vehicles have placed this form of transportation in a more positive light. Advanced batteries that have the capability of doubling existing battery energy storage could allow wider applications for electric vehicles. Both CNG and electric vehicle technologies will be discussed in the forthcoming Energy Development Report.

The CEC will propose a demonstration program for electric vehicles and include advanced battery technology beyond the current lead acid batteries. These advanced batteries will be placed in vehicles for on-road testing for performance and costs.

The CEC will investigate the advancements of other technologies and fuels that could aid progress for fuel diversities in transportation. Although methanol, CNG, and electric vehicles have near term potential for commercialization, other transportation technologies could contribute in the long term. These include hydrogen and solar powered vehicles. In addition, recent press reports suggest that superconductivity may dramatically improve electric vehicles' performance. All of these options should be investigated by the CEC.

FOOTNOTES - CHAPTER 4

1. K. H. MacRae, "Global Methanol Supply and Demand", presented at the 1986 World Methanol Conference, Frankfurt, West Germany, 1986.

2. James Richardson - "The Politics of Smog", pp., 285-289, California Journal, June 1987.

3. William Sylte - p. 32 of Transcript of August 13, 1987 California Air Resources Board Public Meeting on "Consideration of Status Report on Clean Air Act Issues of Concern to California".

4. Acurex Corporation, "California's Methanol Program Evaluation Report", Volume II, Technical Analysis, prepared for the California Energy Commission, July 1986.

5. W. P. Carter, et al. "Effects of Methanol Fuel Substitution on Multi-Day Air Pollution Episodes", Final Report to the California Air Resources Board under Contract #A3-125-32, September 1986.

6. R. L. Bechtold and T. J. Timbario, The Status of Gaseous Fuels for Use in Highway Transportation, A 1983 Perspective, Office of Vehicle and Engine R & D, U.S. Department of Energy, Washington, D.C., 1983.

CHAPTER 5

CALIFORNIA ENERGY DEMAND, SUPPLY AND PRICE TRENDS

By the early 1990s, California will rely more on foreign imports to meet its petroleum requirements and on out-of-state supplies to meet its natural gas needs. Demand for oil and gas will increase by 23 percent over the next 20 years; the electric utility and industrial sectors will use more natural gas; the transportation sector will use more oil. By 2007, inflation-adjusted oil prices are expected to approach the 1981 peak level. Natural gas prices are also expected to increase. Residential and commercial customers will continue to pay the highest rates among gas customers because distribution costs for these sectors are high.

Energy Demand Trends

Total Energy Demand

After declining between 1980 and 1983, California energy demand has grown since 1984 at 2 percent per year. The CEC forecasts that total energy demand will grow over the forecast period at a more moderate rate of 1.02 percent per year.[1]

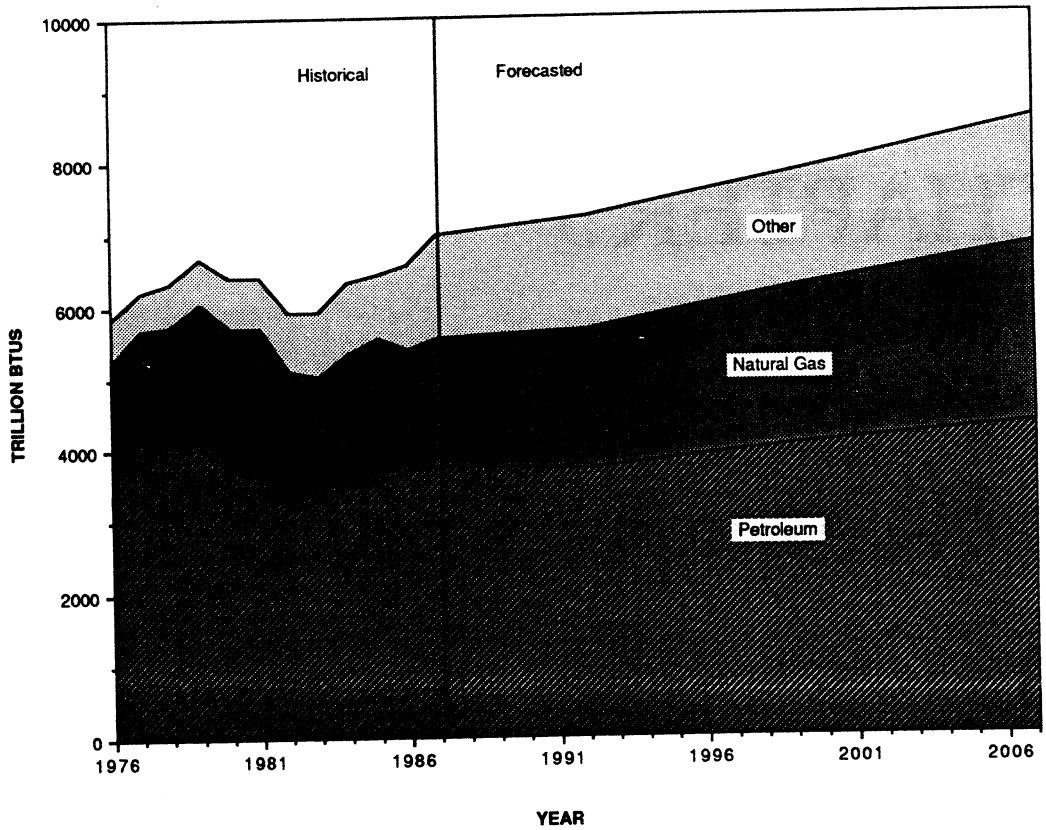
The share of total energy demand met by oil and natural gas, now at 82 percent, is expected to decline slightly over the forecast period. Total energy supplied by these two fuels is expected to increase by 22 percent between 1987 and 2007 (Figure 6) because of economic growth.

Coal, hydropower, nuclear, and renewables (including geothermal, wind, solar and biomass) are expected to meet 20 percent of total demand by 2007. Energy from these sources will increase by 22 percent over the forecast period with the largest increase slated to occur in the renewables category.

Petroleum Demand

Oil will continue to be the State's primary fuel. Since 1976, oil has accounted for about 57 percent of total energy demand. This percentage will decline to 50 percent by 2007, although in total volume the amount of oil consumed is expected to increase. Transportation is the State's largest oil customer, accounting for 75 percent of petroleum

Figure 6
California Energy Demand by Fuel Type



Source: California Energy Commission.

usage. Total transportation fuel demand, which includes motor vehicle, marine, railroad and aviation fuels, is expected to increase 16 percent over the forecast period. Motor gasoline accounts for over half of transportation petroleum demand.

Natural Gas Demand

Natural gas is second to oil in meeting California's energy demand and over the past 10 years has accounted for over 25 percent of total energy use. Natural gas consumption is expected to increase an average of 1.7 percent per year over the forecast period and to provide 29 percent of the state's fuel requirements by 2007. Electric utility and industrial use are expected to account for most of the increase.

The CEC's electricity system diversity policy specifies that no single thermal energy source should account for more than one-third of a service area's electric generation energy requirements.[2] Electric utility boiler use of oil/gas will stay within this limit on a statewide basis over the forecast period, accounting for 20 percent of the electric generation energy use in 2005. If qualifying facilities cogeneration fuel use is included, however, oil/gas will represent approximately 35 percent of the total energy required to generate electricity statewide. Some

service areas are expected to substantially exceed the 33 percent level. The Southern California Edison service area will generate 40 percent of its electricity by 2005 using oil and gas - 26 percent for utility generation and 14 percent for cogeneration. In the San Diego Gas and Electric service area, utility oil/gas use in conventional boilers will represent 48 percent of the electric generation fuel requirements by 2005. Cogeneration will add another 21 percent increasing the total oil/gas proportion to 69 percent.[3]

Sectoral Demand

Each end use sector's share of total energy demand has remained relatively constant over time except for the transportation and industrial sectors (see Figure 7.) Transportation demand, which accounted for 40 percent of total end user demand in 1976, has increased its share to 50 percent. On the other hand, the industrial sector now accounts for 29 percent of total end use demand, a 6 percentage point decline from 1976 levels. Over the forecast period transportation demand is expected to decline to 47 percent of total end user demand, while industrial demand increases to 31 percent of the total.

Energy Supply Trends

Petroleum Supply

Over the next 20 years, California will be forced to rely more on foreign oil. Between 1992 and 2007, foreign imports are expected to increase more than five fold while instate and Alaska supplies decline from 93 percent of total supplies to 68 percent (Figure 8).

Natural Gas Supply

California produces 28 percent of the natural gas it uses. The largest source of gas for California is the Southwest portion of the U.S. which provided 52 percent of 1986 gas supplies. Canada's Province of Alberta is the other principal source of California's gas supplies, contributing 19 percent of the total in 1986. Less than 1 percent of supply comes from the Rocky Mountains. While arrangements are in place to receive gas from Mexico, none was used during 1986.

Over the next 20 years, as its own supplies are depleted, California will rely increasingly on out-of-state sources for natural gas. By 2007, these sources are expected to account for 88 percent of the State's total gas supplies, a 14 percentage point increase from current levels.

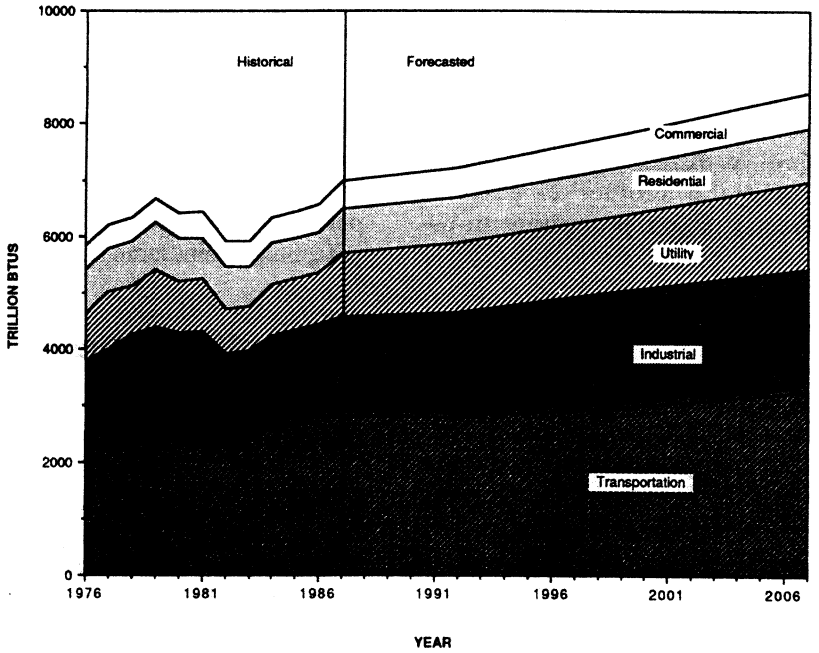
Energy Price Trends

Oil Prices

The CEC oil price forecast projects that prices will recover to approximately $28/per barrel by 1990 and thereafter increase at a more moderate rate through the end of the forecast period (Figure 9). This forecast is based on the assumption that OPEC will maintain sufficient cohesiveness and exercise adequate production restraint to return oil prices to historic levels. The Organization's recent success in reestablishing official prices at $18 per barrel, despite difficult world oversupply conditions and a 1986 price of $13 per barrel, underscores OPEC's determination to reassert control over the market to increase oil income. Current oil prices leave OPEC, particularly Saudi Arabia, with large budget deficits that threaten to exhaust financial reserves within a few years.[4] This situation is expected to induce OPEC to increase oil prices by restricting production.

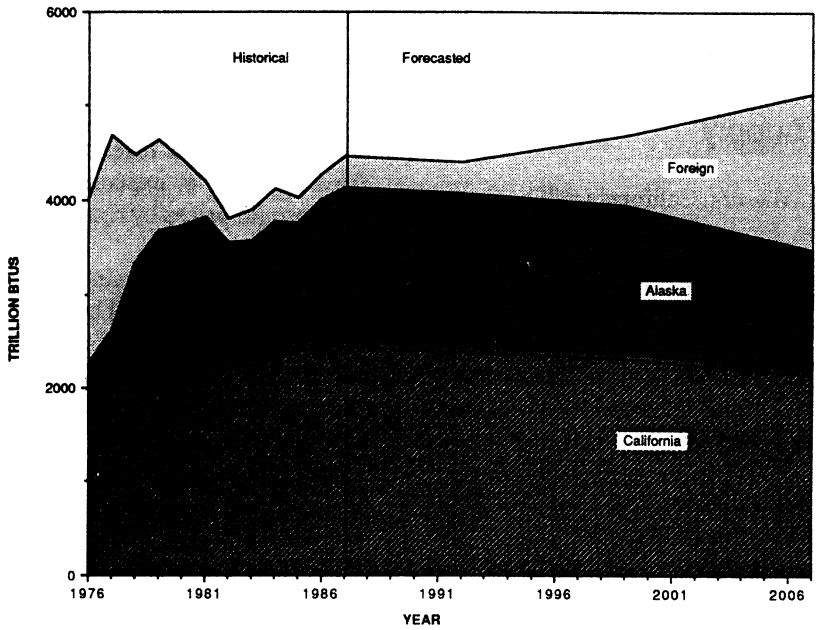
The CEC forecast also assumes that OPEC's intentions will be aided by the relatively low price level that has prevailed since early 1986. Lower oil prices are expected to lead to increased worldwide oil consumption and limit the development of non-OPEC oil supplies. This simultaneous decrease of non-OPEC supply and increase of worldwide oil consumption will increase world dependence on OPEC oil and make it easier for OPEC to impose price increases through production controls.

Figure 7
California Energy Demand by Sector

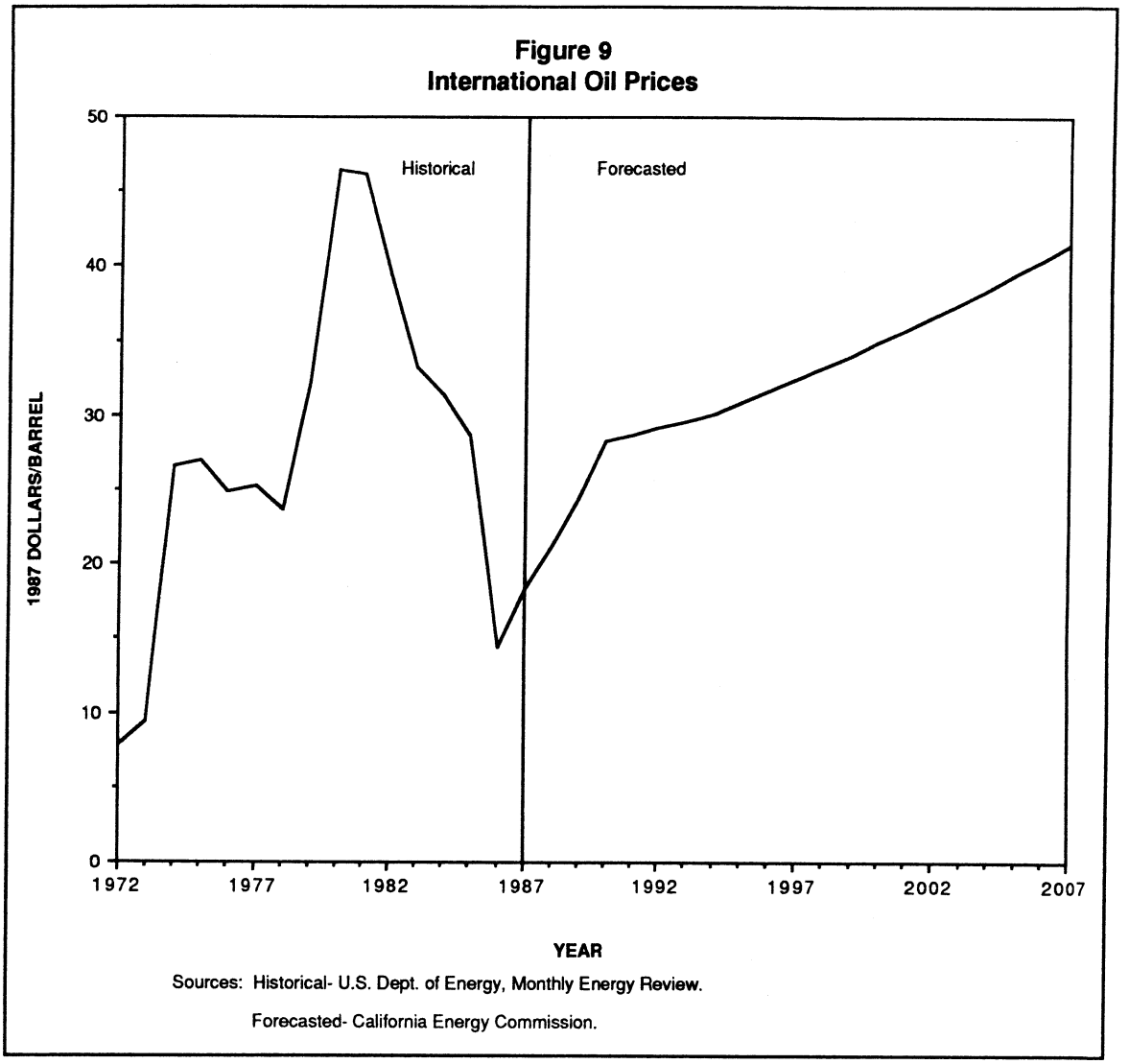


Source: California Energy Commission.

Figure 8
California Petroleum Receipts by Origin



Source: California Energy Commission.



Potential users of the CEC's oil price forecast should be cautious in how they use this or any other oil price forecast in decision making. Long range oil price forecasts are subject to substantial uncertainty. The CEC develops 20-year fuels price forecasts for policy analysis because oil and natural gas prices are major determinants of the price of electricity, the demand for natural gas and petroleum products, and the cost effectiveness of conservation and alternative energy sources. The use of a single point forecast by the CEC for these analyses is appropriate because the uncertainty inherent in forecasting oil prices is offset, to a limited degree, by the CEC's biennial re-evaluation of its forecasts. Notwithstanding this re-evaluation, potential users within and outside the CEC should not feel bound to use this forecast exclusively but should also consider other scenarios.

It may not be appropriate, however, to base long-term energy contracts on any single point price forecast. In situations involving large amounts of capital and long pay-back periods, more flexible assumptions about future oil prices that allow for revisions as new price trends become apparent are needed.

Natural Gas Prices

When discussing natural gas prices, it is necessary to distinguish between the prices paid to gas producers and the prices paid by consumers. Producer prices are largely unregulated and set by market forces. In contrast, federal and state agencies regulate the prices (called "rates") that gas pipeline companies and utilities may charge their customers. In California the CPUC regulates the rates different customers pay for gas service. The FERC regulates the rates that interstate pipelines charge for transporting gas.

Economics dictate that producer prices of natural gas, like all commodities with unregulated prices, will be set by the value in its marginal, or lowest-value, use. The marginal use of gas now is, and likely will continue to be, as a boiler fuel in competition with oil. Consequently, the CEC's natural gas price forecast incorporates the key assumption that natural gas prices will generally track oil prices over the long-term.

However, we are currently experiencing a deviation from the anticipated coupling between gas and oil prices due primarily to a surplus of gas. It is not yet clear whether this decoupling is temporary or permanent. The CEC gas price forecast assumes that the current surplus is temporary and that as it dissipates, oil and gas prices will come more closely in line and maintain an approximate parity with only limited deviations.

Many factors affect the consumer price of natural gas, including the price of competing fuel and federal and state regulatory policies. This combination of factors is expected to keep residential and commercial sector gas rates higher than rates for other sectors throughout the forecast period.

One fuel that competes with natural gas in the industrial sector is fuel oil because many industrial gas customers can burn either gas or fuel oil to meet their energy needs. This substitution or fuel switching capability allows fuel oil prices to place an upper limit on natural gas rates to industrial customers. These customers will not buy gas if it is more expensive than oil. Since residential and commercial customers cannot readily fuel switch, there is no comparable upper limit in the short term for these sectors.

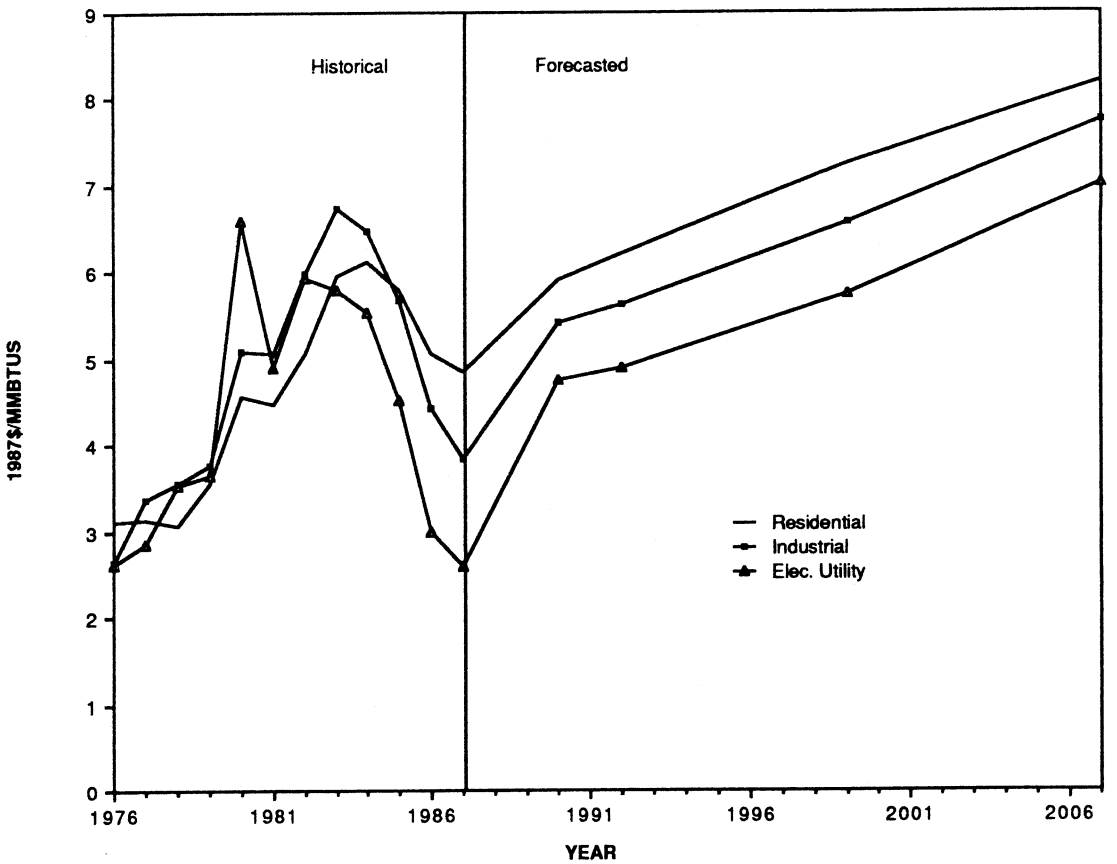
Federal and state actions, taken to reduce government regulations and promote competition, are having an effect on gas rates. Pipeline companies are being encouraged to compete to transport gas for any customer rather than gas owned only by the pipelines. In California, new rate structures are being developed to reflect the full cost of service unmodified by subsidies from customers with fuel-switching capability. Cost-of-service rates will tend to be higher for residential and commercial customers because of the absence of subsidies.

California natural gas rates peaked in 1983, after seven years of increases averaging 11 percent per year above inflation. The decline that began in 1984 continued through 1986. However, natural gas rates are expected to increase in the future (Figure 10). Residential rates will increase 2.7 percent per year and commercial rates will increase 2.9 percent per year. Industrial rates and electric utility natural gas rates are forecast to increase at rates comparable to oil prices because of these customer's fuel switching capability.

Coping with Uncertainty in Oil Price Forecasts

Although much effort is invested by the CEC in developing accurate forecasts, the oil price forecasts in the preceding trend analyses are subject to considerable uncertainty. This uncertainty exists in part because geo-political events that could significantly change future oil prices are not amenable to reliable prediction. However, there is a natural tendency to gloss over uncertainties in favor of looking at the future through the context of a "best" or "most likely" price forecast. This may not be an ideal

Figure 10
Natural Gas Prices by Sector



Sources: Historical- Based on Utility Reports.
Forecasted- California Energy Commission.

framework for decision making if unexpected deviations from a forecast could render obsolete strategies and programs based upon that forecast.

One of several methods for better coping with the effects of fuel price forecast uncertainty on decision making is to use multiple oil price scenarios. A scenario is a consistent story about one hypothetical evolution of the future. Multiple scenarios, by covering a range of different futures, can help planners identify and analyze the potential consequences of critical uncertainties. This analysis can create a deeper understanding of the dynamics of energy and nonenergy systems, place bounds on possible outcomes, and develop appropriate strategies in a range of plausible outcomes.

Multiple scenario analysis involves more than the use of several different forecasts. Each scenario needs to reflect internally consistent assumptions that are systematically distinguishable from the assumptions of other scenarios. Different decisions may require a different set of scenarios. The logistics of scenario planning also require flexible simulation models and specialists in key areas to rapidly assess the consequences of different alternatives.

The CEC must develop new approaches to oil price forecasting including using multiple oil price scenarios to incorporate the effects of oil price uncertainty more systematically in its planning process. Current statutes require the CEC to make certain decisions using a best forecast, and not without good reason. However, multiple oil price scenarios may be a useful adjunct and may suggest improvements in the CEC's decision process. The CEC will develop alternative oil price scenarios, identify policy decisions that might be sensitive to different oil price futures, and report on its findings in the next Fuels Report.

FOOTNOTES - CHAPTER 5

1. All statistics in this Chapter are based on information in Appendix A to this report.

2. This policy is discussed in more detail in the California Energy Commission, 1986 Electricity Report, December 1986, p. 5-5.

3. Appendix B to this report contains more detailed information on utility oil/gas requirements for electric generation.

4. Appendix E to this report provides additional information on the financial situation of Saudi Arabia.

COMMENTS OF THE CALIFORNIA PUBLIC UTILITIES COMMISSION ON THE CALIFORNIA ENERGY COMMISSION'S ADOPTED FUELS REPORT(*)

The California Public Utilities Commission (CPUC) has reviewed the Final Fuels Report (FR) adopted by the California Energy Commission on December 16, 1987. As required by Public Resources Code Section 25310(b), the CPUC hereby submits its written comments on the FR. These comments address recommendations and discussion contained in Chapters 2, 3 and 5 of the FR. The CPUC would like to express its appreciation to the CEC for the opportunity to participate in these proceedings and for the various modifications and revisions made by the Planning Committee to certain portions of the draft report.

Chapter 2 - Natural Gas Supply

This Chapter sets forth the potential California gas demand as forecast by the CEC staff and concludes that according to these figures that current pipeline capacity may not be sufficient to meet projected demand by about the year 2002. The CEC does admit that the time when new capacity will be required could be considerably different from what is indicated in the FR for several reasons. The most important of which is the significant uncertainty in the gas demand and supply forecasts. The CPUC agrees with the CEC that long-term demand forecasting is uncertain and subject to many variables. The CPUC submits in these comments that the long-term gas demand forecasts developed by the California gas utilities in the 1987 California Gas Report show that existing interstate pipeline capacity is adequate to meet projected gas demand through the year 2005, the last year included in that forecast.[1]

The FR chapter on natural gas supply concludes with a recommendation that "(I)f the relative merits, including environmental concerns of all the pipeline proposals are equal, then in keeping with the CEC's Biennial Report recommendation, FERC should consider issuing permits for all pending applications to allow maximum market response." In the opinion of the CPUC, this recommendation fails to recognize the significant potential adverse impact of certification on California ratepayers, and how important it is for the State to retain its jurisdiction in order to protect its citizens. In summary, the CPUC opposes this recommendation because: 1) existing utility capacity is adequate to serve the California market, 2) a large adverse rate impact on ratepayers will result if an interstate pipeline is constructed and 3) an interstate pipeline will not increase effective competition. Additionally, it is the CPUC position that the issuance of multiple certificates violates the Natural Gas Act and the Ashbacker doctrine.

A detailed explanation of the CPUC's position on the issuance of certificates for interstate pipelines to serve California was presented in the "Comments of the Public Utilities Commission Concerning the Energy Commission's Adopted Biennial Fuels Report" from September 1986.[2] The CPUC is presently an ac-

tive participant in a Federal Energy Regulatory Commission proceeding in which two entities have requested certification of their proposed interstate pipeline projects into California. The CPUC has submitted testimony in that proceeding which opposes the requests and opposes the issuance of certificates to the applicants.[3]

Chapter 3 - Promoting Natural Gas Competition in California

This Chapter offers a formulation of issues being discussed before the CPUC presented in the form of guidelines and recommendations for structuring a market-driven gas industry. Most of the CEC's ideas are not very controversial and do not directly conflict with the course the CPUC has already decided to pursue by its investigations into gas ratemaking and procurement. The Executive Summary of the FR offers these guidelines and recommendations in pursuit of an overall vision of how the gas industry should ultimately be structured and to reduce uncertainty about the outcome of the CPUC's step-by-step approach to reform. However, the CPUC is concerned that the CEC could disrupt the course already taken by the CPUC in restructuring the natural gas industry in California, should some of the CEC's guidelines and recommendations be adopted as California's State policy. According to Article XII, Section 1 of the Constitutional Provisions of the State of California, the CPUC may establish its own procedures subject to statute and due process. As acknowledged in the FR, the CPUC has recently adopted a new regulatory structure for gas utilities and is the process of revising rates to conform with that structure. While these initial decisions leave a number of issues unresolved, the CPUC believes they establish the broad outlines of a manageable framework for the California gas industry which secures maximum benefit from competition while appropriately protecting the interests of captive California gas customers. The CPUC will address gas supply and procurement policy of gas utilities in a separate investigation (OII No. 87-03-036) scheduled to begin early next year. These investigations and proceedings which the CPUC has initiated to establish a new gas regulatory structure in California provide all interested parties an opportunity to participate. The CPUC must consider all of the proposals set forth by the various parties in these proceedings and make decisions and establish rules, regulation and rates based on our findings and conclusions of law. Furthermore, through our investigations, rulemaking and other procedures, the CPUC can assure that the rates charged and the services provided by the gas utilities subject to its jurisdiction are just, reasonable and in public interest along with the goal of structuring a more market-driven gas industry in California.

The CEC recommends that the CPUC take the following actions which are underscored with a brief summary of the current status of the CPUC's policies and efforts:

The CPUC should deregulate noncore merchant activities

As the CEC has stated in their text, the CPUC has invited proposals for the future regulation of the utilities' noncore merchant activities as set forth in CPUC Decision 87-10-043.

The CPUC should unbundle utility gas gathering services and adopt cost-based rates for gas gathering. In addition the CPUC should hold a public hearing to investigate the desirability and practicality of ordering utility divestiture of gas gathering facilities

The CPUC announced the intent to do this in last May's interutility transportation decision. Developing an order instituting investigation to do this has had a lower priority than the gas implementation proceeding and the CPUC's investigation into gas procurement and system reliability which are restructuring the gas industry in California. The CPUC plans to address these concerns in the near future as part of a separate investigation, segregated from other gas procurement issues.

The CPUC should require that interutility gas transportation service be made available on the same terms as regular utility transportation.

The CPUC has already taken the main step which is ordering the utilities to offer the service under filed tariffs, so that they must provide it on a mandatory basis. Unbundling storage will help interutility transporters to increase the reliability of the service. Presently it seems unwise to give interutility transportation priority parity with regular transportation until the Commission has gained some real experience with this service. This issue is likely to be revisited sometime in the near future.

The CPUC encourages the CEC and its staff to participate in the CPUC's gas procurement investigation as well as other regulatory proceedings related to the gas industry, as recommended in Chapter 2 of the FR. The CEC should come forward with actual proposals for gas procurement, storage, data collection and other gas deregulation guidelines and recommendations submitted in the FR, and thereby subject their proposals to examination in formal CPUC proceedings by a broad range of experts from the natural gas industry.

Chapter 5 - Energy Demand, Supply and Price Trends

The CPUC is not required to use the oil/gas price forecast developed by the CEC in its FR. However, our desire for consistent energy policy requires that the adopted CEC fuel price forecasts be considered in CPUC proceedings. Therefore, the CPUC offers the following comments on the CEC forecasts.

Oil Prices

The CEC assumes that oil prices will return to historic (i.e. late 1970s) levels as OPEC reestablishes sufficient control of the market. The CEC forecasts a rapid climb from $18/bbl to $28/bbl (in 1987$) by 1990. This does not seem to

be an appropriate base case. The CPUC would accept this figure only as a very high scenario. OPEC has not demonstrated cohesiveness lately as to its likely marketing strategy, and under these circumstances CPUC believes that the CEC forecast is too high and very unlikely. The CPUC's staff currently forecasts a crude oil price of $21/bbl in 1990.

The CEC's forecast for 1990 is 16 percent higher than the "high" case projected by its own panel of experts in the Delphi IV survey. The 1995 forecast falls within the Delphi high-low range, but is 36 percent over the "most likely" forecast. The CEC's forecast is significantly greater than the "high" scenario of the National Petroleum Council through the year 2000 and also exceeds the base case forecasts of the U.S. Department of Energy and SRI International.

The CEC's apparent reason for forecasting "high" is uncertainty. The CEC claims uncertainties are glossed over when looking at the future through the context of a "most likely" forecast, ignoring the fact that "most likely", "best" or "base case" forecasts implicitly include forecasters expectations about the future, including the subjective probability of such "uncertain" events as major supply disruptions. The CEC regards a future major supply disruption as a "virtual certainty". What is unclear is whether such a disruption underlies the CEC's selection of a price forecast that deviates so considerably from the consensus. The CEC also points to a lack of consensus among oil forecasters, purportedly indicated by an increasing standard deviation over time. This is a characteristic of any forecast. The Delphi IV results actually show smaller standard deviations in 1990 and 1995 relative to Delphi III indicating that panelists feel more certain of their forecasts for those years.

The CPUC is extremely concerned with the CEC's recommendation of a single point high oil price forecast. The ramifications of this are that once the oil price forecast is adopted by the CEC in the FR, this adopted forecast is utilized in all other CEC proceedings including the Conservation, Energy Development and Electricity Reports (ER). With respect to the ER, the adopted FR oil price forecast affects the energy demand forecast for the State's utilities and a host of policy recommendations which ultimately determine the adopted amount of new capacity needed by utilities. Among these recommendations are plant retirements and refurbishments, oil/gas displacement, the need for new transmission lines, imported power and conservation and load management. Ironically, a "high" oil price forecast makes QF's seeking certification from the CEC appear to be more cost effective because it exaggerates the fuel saving benefits of displacing utility generation. Thus a QF would have a better chance of being certified at a time when the CEC is concerned about oversupply and is participating with the CPUC in legislatively mandated hearings on this topic.

The CEC states that potential users within and outside the CEC should not feel bound to use this forecast exclusively but should also consider other scenarios. However, this high single point oil price forecast remains the CEC's base case forecast which is not the consensus of its own panel of experts. The CPUC believes that these price forecasts should not be construed as the final word for every CEC decision needing fuel price forecasts.

The CEC concludes this chapter with a recommendation to develop new approaches to oil price forecasting including using multiple oil price scenarios to incorporate the effects of oil price uncertainty more systematically in its planning process. The CPUC shares the CEC's concerns of uncertainty in oil price forecasting and enthusiastically supports this CEC recommendation.

Gas Prices

The CEC also forecasts a rapid escalation of gas prices in the late 1980s, to reach almost $5/MMBtu by 1990 for utility purchases. This also is too high, in our opinion, as it relies on the rapid increase in oil prices to lift gas prices. The CPUC believes that producer competition and current oversupply will keep gas prices low for the next several years at least.

(*) These comments were adopted by the CPUC on Dec. 9, 1987 by a vote of 5-0.

(1) 1987 California Gas Report, pp. 8-10.

(2) Biennial Fuels Report, California Energy Commission, September 1986, pp. 122-126.

(3) FERC Docket No. CP85-437-000 et al.