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CALIFORNIA COASTAL ZONE CONSERVATION COMMISSION
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California Coastal Zone Conservation Comm.

ENERGY

Adopted

January 21, 1975

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SECTION I: ENERGY IN CALIFORNIA AND THE COASTAL ZONE

A. RELATIONSHIP OF THE COASTAL ZONE TO THE STATE

Statewide Finding:

1. ENERGY AND THE COASTAL ZONE

The land and water of the California coastal zone can potentially be used to contribute to the State's energy supply in five principal ways: (a) to provide sites and ocean cooling water for power plants that generate electricity; (b) to provide oil drilling, production, and handling sites for recovering petroleum from submerged lands beneath State and Federal offshore waters; (c) to provide terminals to moor and offload tankers and barges bringing crude oil and refined products to California, the region, and the nation; (d) to provide sites for oil refineries; and (e) to provide special terminals and onshore plant facilities for liquefied natural gas imports.

Regional Amplification: None.

Statewide Finding:

2. PLANNING TO MEET ENERGY NEEDS IN THE LEAST ENVIRONMENTALLY DAMAGING MANNER

A principal goal of the Coastal Plan is to protect, enhance, and restore the coastal environment, while still planning for those energy facilities for which a clear public need and a need for siting along the coast can be shown. Coastal planning must not sacrifice the environment of the rest of California; little would be gained if a

coastal area were to be saved at the price of even greater environmental damage inland. Energy planning for the coastal zone must take into account estimates of energy needs, strategies for reducing the need for coastal energy development through energy conservation programs and application of alternative energy forms, the environmental impacts of locating energy facilities in the coastal zone and inland, and the effect of new energy legislation in California.

Regional Amplification: None.

Statewide Finding:

3. NEW LEGISLATION

On January 7, 1975, the new California Energy Resources Conservation and Development Commission (referred to herein as the State Energy Commission) came into existence. This new Commission, created through passage of the Warren-Alquist Energy Act, AB 1575, in the 1974 Legislative session, has a broad mandate (a) to assess trends and to forecast statewide demand for electricity and other forms of energy; (b) to determine the need for new power plants and to evaluate and certify proposed designs and sites either on the coast or inland (power plants in the coastal permit zone would still require separate Coastal Commission permit approval); (c) to study and promote the development of new alternative energy resources and new generation and transmission techniques; (d) to prescribe and carry out new and expanded energy conservation measures; and (e) to make recommendations to the Governor and the Legislature for State policy and actions for the

orderly development of all potential sources of energy to meet the State's needs, among other duties.

Regional Amplification: None.

Statewide Finding:

4. EXISTING LIMITATIONS ON STATE ENERGY COMMISSION SITING AUTHORITY

Despite its very broad mandate to act on energy issues, the State Energy Commission has authority to approve siting for only one of the five types of energy supply-related development that could affect the coastal zone: electric power plants and transmission facilities; however, most of the new power plants presently being planned are explicitly exempted from the provisions of the Energy Act. Under its present mandate, the State Energy Commission will not determine when or where exploration and development of State offshore oil reserves will occur, or have permit authority for siting onshore facilities associated with State and Federal offshore oil development, tanker terminals, refineries, or liquefied natural gas terminal and gasification facilities. Because of the Energy Commission's limited siting authority, and because AB 1575 gives the Coastal Commission a separate permit authority for power plants proposed within the coastal permit area, the Coastal Commission must develop energy facilities siting policies to meet its own planning mandate and deadlines, recognizing that these decisions may ultimately be reviewed by the Energy Commission. Other State agencies, such as the State Lands Commission, the California Public Utilities Commission, the State Water Resources Control Board, the Division of Oil and Gas, and the Air Resources

Board, all regulate activities affecting energy development in California, but none has the jurisdiction over all such facilities that would permit a comprehensive, balanced approach to energy conservation and development throughout the State. The goal of comprehensive energy planning will be best served by the Coastal Commission's working closely with the Energy Commission and other State and local agencies in developing its siting policies and evaluating permit applications. Determinations of energy needs and development of an inventory of sites for all major energy facilities might best be coordinated by a single statewide energy authority, with the opportunity for intensive review and comment at all planning stages afforded to all concerned agencies, and with a separate permit authority for the environmental and land use aspects of coastal siting decisions reserved to the agency designated to carry out the coastal plan.

Regional Amplification: None.

Statewide Policy:

1. NEED FOR A STATEWIDE AGENCY TO PLAN AND REGULATE ENERGY FACILITIES*

Because of the statewide effects of energy production and supply, the Legislature should extend the permit authority of the State Energy Resources Conservation and Development Commission (hereinafter referred to as the State Energy Commission) to all oil and gas production, processing and transmission facilities within the State as well as power plants. Because the people of California have declared by their vote on the Coastal Initiative (Proposition 20) that the coastal

* An asterisk next to a policy title indicates that the policy is a recommendation for action by another agency of government.

zone is a distinct, valuable, and special resource, the agency designated to implement the Coastal Plan should have permit authority concurrent with such authority of the State Energy Commission over the environmental and land use aspects of any such facilities proposed in whole or in part within the coastal zone. To help eliminate the potential for conflict between the coastal agency and the State Energy Commission on coastal siting issues, the coastal agency should participate fully in review and comment procedures established by the State Energy Commission for all initial stages of planning.

Regional Amplification: None.

B. PETROLEUM SUPPLY AND DEMAND

Statewide Finding:

5. NEED FOR PETROLEUM WILL AFFECT COASTAL PLANNING

California's future petroleum demand and supply cannot be firmly estimated. California petroleum demand at present outstrips in-State production, and the deficit is likely to increase, although stringent energy conservation measures, rising retail prices, and development of alternative energy sources could significantly reduce petroleum demand growth and help diminish the deficit.

To meet even a reduced demand growth for petroleum, new sources of supply will be needed. California's petroleum demand can be met by: (a) increased development of the in-State onshore resource, including increased exploration and expanded secondary and tertiary recovery and development of Federal holdings (e.g. Elk Hills); (b) development of the State and Federal offshore petroleum resources; (c) importation from the Alaskan North Slope and Gulf of Alaska resources; and (d) some degree of increased foreign imports. Increased onshore production offers the least environmental risk, but has a limited potential for increasing supplies. However, new sources could require major new developments in the coastal zone, including offshore drilling projects with onshore support facilities, new or expanded refineries, oil tanker terminals, tank farms and pipeline systems, all of which could pose substantial problems relating to coastal air and water quality, land use, aesthetics, and intensity of development.

The Federal Energy Administration (FEA), through its Blueprint for Project Independence, and the newly established Federal Energy Resources Council will eventually be primarily responsible for identifying any national supply role for California, but they have not yet done so. At present, California's only defined role in national energy supply is based on its historical and continuing role within Petroleum Administration for Defense District V (PAD V-California, Arizona, Nevada, Oregon, Washington, Alaska, and Hawaii).

Regional Amplification:

1. North Coast: "The three counties in which the North Coastal Region is located - Del Norte, Humboldt, and Mendocino - used approximately 46.86 quadrillion British thermal units (BTU's) of energy in 1973, equivalent to the energy derived from about 7,907,000 barrels of crude oil. This amounts to an average energy use equal to 46 barrels (1,932 gallons) of crude oil by each of the 172,600 persons in the three counties... In 1973, the three-county area relied on oil products (including liquid petroleum gas) for about 42.5 per cent of its energy, on natural gas for 30.7 per cent, on nuclear energy for 4.1 per cent, and on wood fuel for about 18 per cent. Of the energy used in the three-county area, 79 per cent of the natural gas, all of the petroleum products, all of the nuclear fuel, and about 40 per cent of the electricity were brought in from outside of the area... The area received somewhat higher percentages of Canadian crude oil than did the State as a whole.

"The three-county area is relatively remote from petroleum refining and major petroleum product distribution centers. Products received in the area are refined in the San Francisco Bay, Los Angeles, and Puget Sound, Washington, regions... Products from the Bay Area are brought by barge to Humboldt Bay and Crescent City, by tank truck into Mendocino County, and by rail into Mendocino and Humboldt Counties. Products from the Los Angeles area come by barge to Humboldt Bay and occasionally to Crescent City. Products from Puget Sound are brought to Portland, Oregon, by ocean tanker and from there reach the three-county area by several routes: to Eugene, Oregon by pipeline and thence to the area by tank truck; to Coos Bay, Oregon by barge and then to the area both by barge and by tank truck. Approximately 25 per cent of the petroleum products brought into the area come by way of Oregon. Conversely, some suppliers distribute petroleum products into southwestern Oregon from supplies barged into the three-county area.

"In 1973, the 172,600 people of the three-county area constituted 0.83 per cent of the population of the State. Its 115,300 licensed drivers (0.95 per cent of the State total), and registered vehicles (0.995 per cent of the State total), and drove 154,753 used 85,300,000 gallons of gasoline (0.795 per cent of that sold in the State) purchased from 307 retail gasoline stations (1.46 per cent of State total). The 33,337 trucks registered in the area constituted 1.58 per cent of those registered in the State.

"Use of jet fuel in the three-county area is very near the average per capita use in California."

2. North Central:

3. Central Coast:

4. South Central:

5. South Coast: "It is projected...that the rate of growth [of oil consumption in southern California] to 1985 will average two per cent. [The projected rate of growth for light products is about 1.5 per cent per year and for residual fuel oil and coke is somewhat higher, although the projected rate for the heavy products is subject to considerable uncertainty due to the availability of natural gas and the growth of electricity consumption.]

"Southern California's oil demand and supply trends imply an oil deficit of approximately 925,000 b/d in 1985."

6. San Diego: "Regional Demand for Petroleum Products. Approximately 580 million gallons of the State's 10.4 billion gallons of gasoline consumed in 1973 were consumed in San Diego County. 1973 commercial aviation usage of petroleum products in San Diego County, including military usage by the North Island and Miramar Naval Air Stations, is estimated at 149 million gallons. An additional 240 million gallons of fuel oil was consumed in the region for the production of electricity. In total, excluding petro-chemical products and other residual uses of petroleum, approximately 25 million barrels of petroleum is consumed in San Diego annually. And, like the rest of the State, regional petroleum usage is increasing.

"Regional Import of Petroleum Products. Petroleum products are imported to the San Diego region principally by pipeline; approximately 60 per cent as estimated by the Western Oil and Gas Association. Southern Pacific Pipeline Company is the principal carrier. About five per cent of the refined products are imported by tanker, used principally by the Navy and for power generation facilities. The remaining 35 per cent is imported by road tanker from the Metropolitan Los Angeles area."

Statewide Finding:

6. CALIFORNIA MORE OIL-DEPENDENT THAN NATION

Oil now accounts for over 50 per cent of California demand for primary energy, as compared with the U.S. figure of 45 per cent. The major uses for oil are for electricity generation, industrial process heat, vehicle fuels (gasoline and diesel) and liquid petroleum gas (propane, butane, and iso-butane), but oil is also essential for making medicines, clothing, food, plastics, and building materials, and for pumping water for agricultural and municipal use. Oil will remain vital to meeting our total energy needs; but because it is a depletable resource and because its production, transportation, and use entail adverse environmental effects, demand for oil and continued dependence on it should be reduced to the extent possible.

Regional Amplification:

1. North Coast: "Liquid petroleum gasses include propane, butane and iso-butane. These materials are gaseous at atmospheric pressure and normal temperatures but are easily liquefied under moderate pressure or at reduced temperatures. This property makes LPG ideal for any purpose that requires a gaseous fuel that is easily transportable...

"California produced about 56 per cent of the LPG used in the State in 1973; the remainder is imported from other states, from Canada, and by tanker from other countries. About 15,000 barrels per day are estimated to be available in California in 1974, but the supply is expected to decrease to about 13,000 barrels per day in 1975. Gas production from oil fields ('wet gas') in California declined 47 per cent between 1968 and 1973.

"Although there has been some buyer resistance to recent price increases, demand presently meets or exceeds available supplies. LPG production on the West Coast is projected to gradually decline at least until 1985. No figures are readily available on LPG consumption in the three-county area. It is generally agreed that LPG use per capita in the area is considerably higher than per capita use for the State as a whole. This is primarily because a sizeable part of the area is not served by natural gas pipeline. Figures used for LPG consumption in this report are rough estimates only and should not be relied upon.

"LPG is brought into the area primarily by tank truck, although some also comes in by rail. Supplies are described as tight and the sources of LPG vary greatly from time to time, depending on the availability of supplies in source areas; this is dependent, in part, on seasonal demands in other marketing regions. LPG supplied to the area originates from San Francisco Bay area refineries, and from refineries and oil field gas plants in Canada, the Rocky Mountains, the Mid-Continent, and the San Joaquin Valley."

2. North Central:
3. Central Coast:
4. South Central:
5. South Coast:
6. San Diego:

Statewide Finding:

7. CALIFORNIA'S FUTURE OIL DEMAND UNCERTAIN

Two leading studies on oil demand growth for California (Stanford Research Institute, Meeting California's Energy Requirements, 1975-2000, and California Resources Agency, Energy in California), both completed in early 1973, forecast an increase from 1.29 million barrels per day in 1970 to about 2.5 million barrels per day in 1980 and 2.9-3.0 million in 1985. Factors contributing to these high demand levels might include:

- a. A continued decrease in the availability of natural gas;
- b. Failure of nuclear plants to come on line as scheduled; and
- c. A continuation of pre-1973 gasoline consumption growth.

However, such projections do not take into account the significant potential for demand reduction from increased oil prices, conservation measures, development of alternative energy sources, and other factors, that, according to various other analyses in California and elsewhere, will lead to reduced demand growth rates and consumption levels.

Regional Amplification: None.

Statewide Finding:

8. OIL PRICES SKYROCKET AND MAY REDUCE DEMAND

Since late 1973, foreign oil prices have risen abruptly and unexpectedly by as much as 100 to 300 per cent, with regional differences. This has in turn forced price increases in domestic oil and petroleum products, although these increases are limited by the Federal Energy Administration. Very little is known about the price elasticities of demand (the change in demand due to change in price, in constant dollars) for petroleum products, but the limited experience of 1973-74 suggests significant elasticity. Oil price increases will lead to more efforts for conservation measures and will also stimulate development and use of alternative energy sources that are more economic. A major effect of the price surge, therefore, is to throw into question all previous public projections of demand and supply of petroleum that pre-date the increase.

Regional Amplification: None.

Statewide Finding:

9. CONSERVATION EFFORTS MAY LOWER DEMAND

Since late 1973, there has been a national thrust toward energy conservation. Both the Federal Energy Administration and the new California State Energy Resources Conservation and Development Commission are specifically charged with developing conservation programs to help conserve oil. In addition, the Coastal Commission has a general mandate to conserve and manage coastal resources, which

include energy resources and other coastal resources that would be affected by energy-related development. Most existing petroleum demand forecasts do not reflect adequate consideration of the potential for demand reduction through such programs.

Regional Amplification: None.

Statewide Finding:

10. OTHER FACTORS MAY HELP REDUCE OIL DEMAND GROWTH RATE

Factors besides price increases and conservation programs that may help reduce the oil demand growth rate include:

- a. An increased availability of natural and synthetic gas, methanol, or other substitutes for petroleum, and alternative energy sources (especially to replace reliance on fossil fuel for electrical power generation);
- b. Strict government allocation or rationing of available supplies of petroleum products;
- c. Changes in lifestyle, particularly in reduced use of the private automobile and of electricity;
- d. A continued decline in the State population growth;
- e. A more modest growth rate in the national economy; and
- f. Net energy accounting.

Regional Amplification: None.

Statewide Finding:

11. CALIFORNIA CRUDE OIL PRODUCTION FAILS TO MEET STATE DEMAND

California crude oil supplied about 75 per cent of all refinery consumption in the State in 1971. However, California crude production has steadily declined since 1968-69, from about 1,000,000 barrels per day in 1968 to about 850,000 barrels per day in 1972. In 1973, only 55 per cent of the crude oil for California refineries came from within the State; 31 per cent came from foreign sources and 14 per cent came from other states. Projections for 1975 indicate that California will furnish only 49 per cent of its own crude oil for refineries, with 41 per cent coming from foreign countries and 10 per cent from other states. If demand/supply trends of the recent past should continue, the portion of State demand satisfied by State crude production would drop markedly by 1985. However, because of possible demand reduction factors listed in Findings 8, 9, and 10 above, some of which are already being felt, and the possibility of increases in California production onshore and offshore stimulated by higher oil prices, a huge in-State deficit is by no means inevitable.

Regional Amplification: None.

Statewide Finding:

12. SOURCES OF INCREASED CALIFORNIA PRODUCTION

California has considerable potential recoverable petroleum resources both onshore and offshore beneath State and Federal submerged lands. Figures describing the size of these potential

resources are given in Finding 71 of "Petroleum Exploration and Production."

Regional Amplification: None.

Statewide Finding:

13. ALASKAN OIL WILL REDUCE NEED FOR CALIFORNIA
PRODUCTION AND FOREIGN IMPORT

Much of California's future crude oil supply is expected to come from the Alaskan North Slope via pipeline and tanker, beginning as early as 1978. Although Stanford Research Institute (SRI) forecast in mid-1973 that oil from this source would amount to .600 million barrels per day in 1980, and .850 million in 1985, more recent information indicates that California could, if necessary, receive as much as 1.2 million barrels per day beginning as early as 1978. In addition, very substantial additional petroleum resources are thought to exist in other parts of Alaska where exploration is in very preliminary stages. Unless such oil is required to serve needs beyond the State and region (as determined by an adopted national energy policy), the availability of these oil supplies could substantially reduce or eliminate the need for increased exploration and production offshore of California and the need for imported foreign crude. With massive efforts to reduce petroleum demand—both through conservation measures and development of alternative sources—lower import rates from Alaska may be possible, thus conserving these supplies for a longer period of time, encouraging optimum recovery efficiencies, and reducing the potential adverse effects of tanker operations and facilities.

Regional Amplification: None.

Statewide Finding:

14. CALIFORNIA PRESENTLY NEEDS LOW SULFUR FUEL OIL

Both residential fuel oil and natural gas are used as fuel for industrial boilers and in fossil fuel electrical power generating plants in California. As natural gas supplies have recently been curtailed, the short-term demand for fuel oil has increased. [See also Finding #22.] State air quality regulations require the use of low sulfur oil in electric utility and industrial boilers when natural gas is not available. Much of California's crude oil is high in sulfur content; and although several new projects are planned, California refineries presently lack adequate direct desulfurization capacity to meet low sulfur crude oil demands. Therefore these demands may be met either by import of low sulfur crude for refining in California, or by import of refined low sulfur fuel oil. The demand for this critical fuel totaled 100,000 barrels per day in 1973. Contingent upon the amount of natural gas available in California, the amount of hydropower available, and the success of energy conservation programs affecting both natural gas availability and electricity demand, demand for low sulfur crude could be as high as 340,000 barrels per day in 1976, according to one expert (Sherman Clark, independent consultant).

Regional Amplification:

1. North Coast: "Because of progressive curtailment of natural gas supplies, demand for residential fuel by Humboldt Power Plant Units one and two is projected to increase several-fold from

past years. Trends in demand by industry will depend largely on the rate and extent of conversion to wood residue utilization for fuel. Considering projected fuel oil availability and cost, such conversions are anticipated to proceed expeditiously."

2. North Central:
3. Central Coast:
4. South Central:
5. South Coast:
6. San Diego: "...[in 1973] 240 million gallons of fuel oil was consumed in the region for the production of electricity."

Statewide Finding:

15. PETROLEUM PLANNING IN CALIFORNIA PRESENTLY
UNRELATED TO OTHER ENERGY PLANNING

At present no State agency is responsible for planning petroleum related development activities within the context of a comprehensive program of energy development and conservation in California. The State Division of Oil and Gas forecasts petroleum supply and demand and drafts policies for petroleum development, but it does not directly determine policy for other sources of energy. The State Lands Commission makes decisions relating to development of the petroleum resource underlying State-owned lands. The California Public Utilities Commission does forecasting of petroleum and gas supplies necessary for the electric utility industry. The newly-enacted State Energy Commission will determine policy for power plant siting and energy conservation and will study petroleum supply and demand and recommend development and conservation policy, but it will not determine policy for siting petroleum related development.

Regional Amplification: None.

C. NATURAL GAS SUPPLY AND DEMAND

Statewide Finding:

16. NEED FOR NATURAL GAS WILL AFFECT COASTAL PLANNING

Natural gas is a desirable fuel because it is relatively clean burning. Its extraction and transportation, however, involve many of the same or similar impacts as those associated with oil. The demand and supply of natural gas is important to coastal planning because it will help determine the need for: (a) liquefied natural gas (LNG) facilities in California, (b) facilities proposed by electric utilities and oil companies to provide additional low sulfur fuel oil to substitute for natural gas in power plants and other industries, and (c) production of natural gas associated with oil reservoirs in California's outer continental shelf. In California, as in the rest of the U.S., the demand for natural gas continues to increase rapidly while traditional sources of supply are dwindling. Even if gas demand should level off at 1974 requirements, if no new supplies are developed peak service to firm customers (residential and commercial) would occasionally be subject to curtailment by the 1980s. At the present projected growth rates, without additional supplies some such curtailment could occur as early as 1978 in southern California. Because of the potential savings from energy conservation measures, however, and the variety of large-scale gas supply projects in which suppliers of gas to California are presently involved, substantially more gas may be available by 1980 than indicated by most present forecasts.

Regional Amplification: None.

Statewide Finding:

17. FUTURE DEMAND DIFFICULT TO ESTIMATE

California demand for natural gas will exceed available supply for some time to come. Future demand for gas will be influenced by the impact of energy conservation programs and price increases for natural gas. Price elasticity studies suggest that increases in price may decrease demand for natural gas through conservation and customer switching to alternative forms of energy. On the other hand, although broad energy conservation programs will presumably result in more efficient use of existing gas supplies, they may also stimulate additional gas demand in the residential and commercial sectors, where direct use of natural gas is more energy efficient than use of electricity. Moreover, price increases of other energy sources may also increase customer switching to gas. For these reasons it is difficult to firmly estimate future demand.

Regional Amplification: None.

Statewide Finding:

18. TRADITIONAL SOURCES OF SUPPLY FAILING TO KEEP UP WITH DEMAND

California produces less than one-fourth of its natural gas needs. Moreover, California's total proved reserves of natural gas have been declining since 1963, and it is estimated by the California Resources Agency that if present State production and demand trends continue, only 17 per cent of demand will be met by in-State reserves by 1985. In 1973, California imported 78 per cent of its gas supply—61 per cent from the southwestern states and 17 per cent from western Canada. However, both the El Paso Natural Gas Company and the Transwestern Pipeline Company have been allowed by the Federal Power Commission (FPC) to curtail their deliveries of gas to California, and further curtailment can be expected in the near term. Additionally, the Canadian National Energy Board has recently refused to permit expanded deliveries of natural gas to the U.S. from Alberta, pending evaluation of the adequacy of reserves to meet Canada's own projected needs.

Regional Amplification:

1. North Coast: "Natural gas is supplied by Pacific Gas and Electric Company via two principal pipelines. The Humboldt Bay-Lower Eel River area of Humboldt County is served by a pipeline originating at the Gerber compressor station in central Tehama County; it crosses Trinity County and passes near Dinsmore, Yager, and Alton. The only producing gas field in the three-county area, at Tompkins Hill north of Fortuna, is tied into this line. Service extends as far north as McKinleyville and Blue Lake. Production of natural gas at the Tompkins Hill field has occasioned no significant environmental problems. The remainder comes from Canada and the PG&E northern California system.

"Eastern Mendocino County, as far north as Willits, is served by PG&E via pipeline from the San Francisco Bay and Sacramento-San Joaquin Delta region. The Bay-Delta region receives gas originating in Canada, in the Great Valley of California, and in southwestern states east of California.

"Del Norte County, far northern and far southern Humboldt County, and northern and coastal Mendocino County, are not served by natural gas. However, in the Crescent City area, the Del Norte Gas Company furnishes propane by pipeline.

"In 1972, approximately 64 per cent of all natural gas used in the three-county area was purchased by interruptible customers.

"Production from the Tompkins Hill gas field appears to have an annual decline rate of between 15 per cent and 20 per cent, although additional development drilling in 1970, 1971, and 1972 temporarily reversed the decline. The field produced 59,108,877 Mcf of gas through 1973, and the estimated remaining reserves at the end of that year were 23,539,948 Mcf.

"Declining natural gas supplies will necessitate progressive reduction of gas deliveries to interruptible customers for some years into the future. Curtailment of service to firm customers... would not occur until about 1984 in northern California."

2. North Central:
3. Central Coast:
4. South Central:
5. South Coast:
6. San Diego: "Existing Gas Supply/Dependence on Import. Over 99 per cent of the San Diego region's total gas supply is transmitted through three major pipelines from the Metropolitan Los Angeles region. In 1973, this amounted to approximately 86 billion cubic feet, providing about 62 per cent of the region's total demand for gas. The void resulting from insufficient supply was made up by curtailing the supply to interruptible customers, most notably gas usage in San Diego Gas & Electric Company's own power plants, and to a lesser extent, by withdrawing gas from reserve underground and LNG storage facilities. SDG&E estimates an inability to meet natural gas requirements by 1979 unless demand is substantially reduced or new sources of supply are realized.

"Potential Gas Supply/Contracted Gas. San Diego Gas & Electric Company presently contracts with Southern California Gas for 221 million cubic feet per day, which can be further increased as San Diego's requirements necessitate. The contract provides for additional firm peak deliveries in excess of daily contract demand upon request by SDG&E, provided that such gas is available in excess of the firm requirements of Southern California Gas Company. It is the continued increase in the availability of this contracted gas which SDG&E is predominately relying on to meet demand past 1979. To this extent, the factors which affect gas availability to the Southern California Gas Company will affect gas availability to the San Diego region.

"Potential Gas Supply/Macario Independent Refinery. San Diego's major dependency on imported gas from outside the region may be somewhat lessened if the region provides for the production of synthetic natural gas. For example, in addition to the primary low sulfur fuel oil production, the proposed Macario Independent refinery could produce, as an alternative to gasoline, approximately 100 million cubic feet of synthetic natural gas per day. This amount of gas would constitute over 60 per cent of the region's total natural gas requirement for firm customers in 1978. This, in turn would: (1) reduce pressures for additional contract gas from Southern California Gas Company, thereby reducing their requirements for additional supply; and (2) reduce pressures for expanded LNG imports—in particular the demand for new LNG marine operations in the coastal zone."

Statewide Finding:

19. NEW DOMESTIC SOURCES WILL ADD TO CALIFORNIA SUPPLY

California and the nation possess large reserves of natural gas on the outer continental shelf, though some of it is not recoverable with current technology due to excessive water depths. In Alaska, large natural gas reserves are associated with the oil deposits in the Prudhoe Bay region on the Alaskan North Slope, some of which will be developed immediately, as well as in Cook Inlet and possibly the Gulf of Alaska. Significant quantities of gas are also believed to be trapped in tight rock formations in the Rocky Mountains, although at present their extraction presents technological as well as environmental problems. Two synthetic natural gas-from-coal (SNG) plants have been proposed to the Federal Power Commission in northwestern New Mexico using coal strip-mined in Utah. These plants would convert the tremendous energy reserves stored in environmentally "dirty" coal reserves to synthetic gas for pipeline delivery to natural gas customers, possibly beginning as early as 1977-1978. California may receive as much as 2/3 of the SNG output of these plants. Although this source

of gas is still developmental in nature, the Stanford Research Institute has predicted that as much as 16 per cent of California's natural gas use could be supplied by this source in 1990. Other potential sources capable of incrementally supplementing natural gas supplies are methane gas, produced from sewage, sanitary landfills, or individual units; and SNG from oil (naphtha), production of which is being considered at a proposed refinery near Carlsbad.

Regional Amplification: None.

Statewide Finding:

20. ALASKAN AND FOREIGN IMPORTS MAY BE TRANSPORTED TO CALIFORNIA IN LIQUID FORM

Where pipelines for long-distance transportation of natural gas do not exist, natural gas is being transported in ships in very cold (about -260° F.) liquid form, which reduces its volume by a factor of more than 600. Projects have been proposed to import liquefied natural gas (LNG) into California from practically every major oil-producing area in the world, including Siberia, Australia, Algeria, Indonesia, the Philippines, and Central and South America. If import of LNG occurs into California from Alaska and abroad it will require LNG port, storage, and gasification facilities, all of which will be located in the coastal zone and involve significant environmental and safety risks. Significant adverse environmental effects can also occur from liquefaction facilities at the point of origin. The exact magnitude of LNG imports is difficult to estimate at this time. The U.S. may ultimately receive additional supplies of gas from Canada via pipeline, thereby reducing the need for LNG imports.

Regional Amplification: None.

Statewide Finding:

21. TOTAL POTENTIAL OF NEW GAS SUPPLIES IS SUBSTANTIAL

Substantially more gas may be available by the early 1980s than is presently being planned on by the gas utilities. Studies by the National Petroleum Council, Stanford Research Institute, and American Gas Association conclude that with regulatory and pricing policies to encourage development of sources, even without extensive new conservation measures, sufficient gas could be available by the mid 1980s to meet nearly all of the presently projected national gas demand. It is conceivable that a modest resurgence in gas consumption by large industrial and utility users would then be possible.

Regional Amplification: None.

Statewide Finding:

22. LESS NATURAL GAS AVAILABLE FOR POWER PLANT FUEL

Power plants have been classified as low-priority users of natural gas by the Federal Power Commission and the California Public Utilities Commission. When gas supply to power plants is interrupted, utilities substitute fuel oil for gas. In recent years electric utilities could count on natural gas for up to 90 per cent of their fuel needs, but in 1974 only about 15 per cent of fuel needs will be met by gas. If present consumption trends continue, and if no new natural gas should become available, utilities might have to depend

on fuel oil for as much as 90 per cent of their needs by 1976. That degree of dependence of fuel oil may last for the short term only, though it is not presently expected that utilities will ever again be able to depend as heavily on natural gas as in the past.

Regional Amplification: None.

D. ELECTRICITY SUPPLY AND DEMAND

Statewide Finding:

23. NEED FOR ELECTRICITY WILL AFFECT COASTAL PLANNING

The need for electricity will determine the need for various means of supplying electricity, many of which will directly affect the coastal zone. In 1973, 59 per cent of California's electricity generation was by burning of fossil fuels (oil 30 per cent; gas 29 per cent); 31 per cent was produced by hydroelectric sources; and 10 per cent by other sources such as nuclear, coal, and geothermal. Most of California's fossil fuel and nuclear power plants are located in the coastal zone, and utilities are considering new or expanded power plants at coastal sites. Such power plants have many environmental, safety, and land use impacts. [See Section IV, Power Plant Siting.] Moreover, the supplying of fossil fuels burned in power plants may require additional coastal facilities.

Regional Amplification:

1. North Coast: "Electricity available from public utilities is generated in the three-county area by two fossil fuel-fired steam units, with a combined capacity of 105 Megawatts (Mw: million watts, or thousand kilowatts), and one 63 Mw capacity nuclear-powered steam unit at PG&E's Humboldt Bay Plant; and PG&E's nine Mw capacity Potter Valley hydroelectric plant in eastern Mendocino County. All other electricity presently available from utilities is generated outside of the area.

"PG&E imports additional electricity to Humboldt and Mendocino Counties. Three transmission lines serve Humboldt County from the east. These originate at the Cottonwood substation in central Shasta County; two lines cross northern Trinity County, by way of Weaverville, to the Humboldt Bay area. The third line crosses southern Trinity County, by way of Forest Glen,

and enters Humboldt County east of Bridgeville. Principal transmission lines into Mendocino County connect the Mendocino substation, between Ukiah and Willits, with the Cortina substation in western Colusa County by way of central Lake County, and with the Fulton substation just north of Santa Rosa by the way of Hopland and Ukiah. A smaller line extends along the Mendocino-Sonoma County coast as far north as Fort Bragg, with east-west interconnections to Willits, Ukiah, and the Fulton substation. A small capacity line also extends northerly from the Mendocino substation, by way of Willits and Laytonville in Mendocino County, through Gaberville to Bridgeville in Humboldt County.

"The Pacific Power and Light Company (PP&L) distributes electricity in Del Norte County. The Company generates no electricity in the County but brings it in by transmission lines in and across Siskiyou County and south of Oregon.

"The quantitative segregation of basic energy types used to generate the electricity imported to the three-county area is beyond the scope of this report; in fact, it may be impossible to determine with any degree of reliability. The mix changes from season to season, and year to year, and probably, even hour to hour. Transmission into the three-county area is probably "richer" in hydro- and geothermally-generated electricity than the statewide average.

"Lumber and wood product companies generate much of their own steam and electricity but, except at Fort Bragg and Scotia, mill-generated electricity is not generally sold to the public.

"There are no known firm plans for increasing the capacity of existing public utility electric generating plants in the three-county area. Further, PG&E's main transmission lines into the area are nearly at full capacity. However, beginning next November, PG&E intends to locate three 17 Mw mobile, distillate oil-burning, gas turbine generators near Eureka to provide emergency capacity during the winter months for outages and other contingencies. These units are tentatively scheduled to remain in Eureka permanently after 1980. Surplus electricity may become available in the near future from one or several private wood residue-fired steam generating plants in the area. Plans for a steam generator utilizing solid waste as a boiler fuel are currently under consideration in Humboldt County. PG&E has not permanently withdrawn its application for constructing and operating a major nuclear steam generating power plant near Point Arena, southwestern Mendocino County; the proposal is currently stalled by an adverse geologic report prepared by the U.S. Geological Survey."

2. North Central:
3. Central Coast:

4. South Central:
5. South Coast:
6. San Diego: "Meeting Regional Electrical Demand. SDG&E plans to meet its anticipated demand by adding additional generating units sufficient to maintain at least a 20 per cent reserve margin above peak loads. Currently, at least 11 different generating units are in various stages of planning to meet the system demand by 1985. Only one, Encina 5, remains to obtain Coastal Commission approval. These additions would more than double the existing power plants' 2196 net Mw capacity for the peak month of December. In addition, SDG&E now relies to some extent on purchased hydroelectric power from other companies. The net purchases, after transmission losses, from Oroville (power from State water project), the Canadian Storage Power Exchange, and the Washington Water and Power Company amounts to 168 net Mw (December, 1974). The total monthly system capacity, including purchases, amounts to 2,364 net megawatts (December). Some variation may occur in hydroelectric purchases due to power availability (rainfall dependent)." [This was previously under Finding # 33.]

Statewide Finding:

24. GROWTH IN ELECTRICITY DEMAND:
POTENTIAL FOR DEMAND GROWTH REDUCTION

Historical trends and projections indicate that electrical energy demand is growing both absolutely and as a share of the total energy market. Its universal applicability, and increasing supply pressures on oil and natural gas, have led to customer switching from primary fuels to electricity. New uses, products, and processes have also contributed to rapid growth in electricity demand.

The growth in demand for electricity in California has averaged 7.7 per cent over the last 25 years, and has now begun to slow. There is considerable potential for demand growth reduction through vigorous energy conservation measures, the impact of rising electricity prices and price rate restructuring, and development of alternative energy sources. Slowed population and economic growth rates in California

will also contribute independently to a lower electricity demand growth. Recently, demand has actually dropped in portions of California because of conservation efforts.

Historically there has been a rough relationship between growth in electrical energy use and growth in such measures of economic well-being as Gross National Product (GNP), Gross State Product (GSP), and per capita income. In the past 25 years, however, electricity use has grown at a much greater annual rate than these economic measures as well as at a faster rate than population growth. The correlation between electricity consumption growth and the economy is blurred by many factors and may be changing.

Regional Amplification:

1. North Coast: "The demand for electricity in Humboldt and Mendocino Counties grew at an annual rate of about $3\frac{1}{2}$ per cent between 1965 and 1970, and at a 6 per cent rate between 1970 and 1973... The severe energy shortages of last winter brought about energy conservation measures resulting in a net decrease of three per cent in the use of electricity in northern California in the first quarter of 1974 as compared to the first quarter of 1973. The effectiveness of these measures appeared to be declining later in 1974."
2. North Central:
3. Central Coast:
4. South Central:
5. South Coast:
6. San Diego: "Electrical energy demand in San Diego County has been growing at an average rate of about 8.9 per cent per year since 1960, compared to the County's average annual population growth of approximately 3.5 per cent for the same period of time. Where in 1960, San Diego Gas and Electric Company reported servicing 322,985 customers with 2.62 billion kilowatt hours of electricity, by 1973, 553,789 customers were using over 7.90 billion kilowatt hours. Growth in the demand for electric power is attributed both to increases in the number of customers served and to

increases in per customer usage. The average per customer usage has jumped 4.8 per cent annually, from 8,112 kilowatt hours used per customer in 1960 to 14,271 kilowatt hours used per customer in 1973.

"Historic Rates of Electric Demand Will Begin to Decline. The region's demand for electricity will continue to climb; however, the rate of increase is beginning to decline. For example, a combination of many factors, such as the declining economy; the impact of price of electricity, particularly in the commercial-industrial sector; the impact of increased conservation efforts; the potential use of alternative primary fuels in place of electrical power; the increased shift in housing stock from single family dwellings to less energy consumptive multiple units; and the anticipated peaking in saturation of home appliances, all should help to decrease the historic rates of growth in electricity demand. SDG&E Company projections generally exceed the California Public Utilities Commission projections, as indicated in the CPUC's Report on Ten-Year and Twenty-Year Forecasts of Electric Utilities' Loads and Resources. Therefore, the demand growth projected by SDG&E through the year 2000...represents a rate of growth which presumably will exceed the region's actual demand." [Changes reflect adopted version.]

Statewide Finding:

25. ELECTRICAL ENERGY USE BY SECTOR;
CONSUMPTION PATTERNS VARY BY REGION

The principal electrical energy market sectors in California are: residential, about 29 per cent; commercial, about 38 per cent; industrial, about 28 per cent; others, including pumping of agricultural and municipal water, about 5 per cent. The commercial sector is both the largest and fastest growing. These electrical energy usage patterns differ regionally within California. Southern California consumes 2/3 of statewide electrical energy produced and has a faster growth rate than the North. In the South, the commercial market is the largest and the residential the smallest; in the North the residential is the largest and the industrial the smallest. It is probable that the market differences will become less pronounced with time in both the North and

South. The North and South have been experiencing declining growth rates in population and overall electrical energy use. Due to the variations in weather conditions, there are also regional differences in the months of maximum electrical energy usage. Pacific Gas and Electric's system peak occurs in July, whereas the San Diego Gas and Electric system peak occurs in December. California's maximum monthly electrical energy usage is usually during August.

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast:
4. South Central:
5. South Coast:
6. San Diego: "Approximately 57 per cent of the 1960-73 growth in electric demand resulted from increased per-customer usage, with the remaining 43 per cent to increases in the number of customers served. In the San Diego region, the commercial and industrial market (including military and schools) account for approximately 59.7 per cent of the total kilowatt hours sales. Second is the residential market, with 36.4 per cent of the total electrical energy consumed in the region. Agricultural electrical demand, the next highest, drops to an almost insignificant 1.5 per cent, and street and highway lighting is next with 0.8 per cent. In addition, approximately 1.6 per cent of the region's total kilowatt hours consumed went to 'other sales', which includes SDG&E's share of power for the California water project pumps and power for the electric company's own facilities.

"Seasonal Peaking Characteristics. Unlike the rest of the State, the San Diego region's peak demand for electrical power is in the winter during the month of December. Reasons for a December peak stem not from a comparatively greater use of electricity during the winter, per capita, than does the rest of the State uses, but from comparatively less usage per customer during the summer...Summer demand is rising, however, and may eventually reach and even surpass the December peak, as East County growth occurs placing additional demands on summer air conditioning loads...Given normal climatic conditions, SDG&E expects peak August demands on the system to begin by 1979."

Statewide Finding:

26. RESIDENTIAL USE

Though there are important regional differences in patterns of residential electricity consumption, a number of general statements can be made. Over half the electricity consumption in the residential sector is due to three types of uses: space conditioning (heating and cooling), water heating, and refrigeration, with space conditioning growing fastest. Demand in the residential sector as a whole has grown for several reasons: the number of new households has grown faster than population; the use of air conditioners has increased; until two years ago utilities actively promoted all electric homes; and many new and sometimes less efficient appliances have been introduced and have approached market saturation. Due to stabilization in the growth rate of new households and the approaching market saturation of many appliances, however, residential demand growth has been forecast to decline significantly from its past annual rate of 8.7 per cent, even without price rises and conservation measures.

Regional Amplification: None.

Statewide Finding:

27. COMMERCIAL USE

In the commercial sector, electricity is used primarily for air conditioning, food and products refrigeration, and lighting. Although increased electricity use has been forecast to continue, it is difficult to assess total consumption and forecast demand growth because

of the diffuse nature of commercial activities, a lack of reliable data, and the sector's sensitivity to electricity price increases and other market factors.

Regional Amplification: None.

Statewide Finding:

28. INDUSTRIAL SECTOR

Industrial electricity demand growth has been due to increased industrial output and floor space, greater electricity use per unit of output, and increased use of electricity instead of primary fuels in industrial processes. The rate of growth has been forecast to slow in the future, however, and much greater reductions may be possible with conservation practices, price increases, and possible rate restructuring.

Regional Amplification: None.

Statewide Finding:

29. MOST AVAILABLE DEMAND ESTIMATES PROVIDE INADEQUATE BASIS FOR PLANNING

With the exception of the Rand Corporation reports, most existing studies of California electricity demand/supply present a questionable basis for planning because they primarily forecast growth simply to continue as in the past. In their demand forecasts, such studies have either predated, ignored, or been unable to reflect changes that can affect demand, such as rising fuel prices, rate restructuring, the potential for alternative energy sources, and energy conservation measures.

Though there are still unanswered questions about the magnitude of future price increases, the impact of price increases on demand, and the use and measurement of price elasticity coefficients for long-term forecasting, the most recent experience and studies indicate that there will be significant slowing of demand growth due to price increases for electrical energy. For example, the Rand study "Case two" applies estimated expected real price increases to a conventional forecast and concludes that electrical energy consumption will be 20 per cent lower than the conventional projections for 1990, and 30 per cent lower for 2000, if the real price increases do materialize.

Regional Amplification: None.

Statewide Finding:

30. RATE STRUCTURE ENCOURAGES ELECTRICITY CONSUMPTION

In the commercial and industrial sectors, declining block rates (i.e., lower rates for successive increments of electrical energy consumed) promote increased use of electricity. A price structure based in part on "marginal cost pricing" would more accurately reflect the cost to the public of the resources being used for power generation (fuels, power plants, etc.), by establishing prices for electricity partially on the basis of the long-run incremental costs of providing electricity to a particular customer, and not merely on the basis of long-run average costs. "Peak load pricing" would more accurately reflect the costs to the public of adding new generation capacity to meet peak demand, and of using less efficient power plants to meet peak demand, by charging consumers higher prices for

electricity consumed during designated periods of peak load. The Wisconsin Public Service Commission has just required a major utility to modify its rate structure by (1) flattening out the declining block structure except where the declining rate can be proved to encourage the most efficient allocation of energy, and (2) ordering a system of peak load pricing. The California Public Utilities Commission has recently undertaken an experimental program to investigate rate restructuring, and the State Energy Commission will also have the authority to study this issue.

Regional Amplification: None.

Statewide Finding:

31. LONG-RANGE DEMAND REDUCTION POSSIBLE
THROUGH CONSERVATION MEASURES

Though price increases and voluntary conservation measures may result in an immediate decrease in demand growth rate, still greater savings could result from mandatory energy conservation policies, efficiency improvements, new energy systems, and revised price structures. Estimates of the additional savings that could result are difficult to make; but it has been estimated that in the long term increased prices and intensive conservation efforts could probably reduce California's estimated demand by as much as 30 to 40 per cent of the conventional projections for the year 2000. [See Finding 39.]

Regional Amplification: None.

Statewide Finding:

32. STATE ENERGY COMMISSION WILL BE
RESPONSIBLE FOR DEMAND FORECASTS

The recently enacted Warren-Alquist Act (AB 1575) provides a framework for making improved electricity demand forecasts to serve as the basis for electrical generation facility siting. The State Energy Commission will develop a standard forecasting methodology to be employed by the utilities in providing input to an independent forecast to be developed by the Energy Commission. The Energy Commission will also conduct studies to develop improved methods of energy demand forecasting and will develop and recommend conservation programs which could reduce energy demand. Such studies will include consideration of rate structure revision and restriction of promotional activities designed to increase electrical energy use.

Regional Amplification: None.

Statewide Finding:

33. CONVENTIONAL SUPPLY PROJECTIONS PESSIMISTIC
ABOUT ALTERNATIVE ENERGY SOURCES

Many conventional demand/supply projections assume that there will be no significant contributions from alternative energy sources and no major breakthroughs in energy technology that will have a significant impact on electricity supply in this century. Among electric utilities and State agencies such as the Resources Agency and the Public Utilities Commission, there is a consensus that over half of all new capacity in California required to meet electricity demand in the year 2000 will be obtained by nuclear fission

power plants, one quarter from fossil fuel plants, and one tenth from hydroelectric power. Despite their substantial potential in California, only one tenth is forecast to come from geothermal power; and no potential contribution is identified from solar, wind, or solid wastes. If these sources appear at all in conventional forecasts, they are typically allocated only token supply contributions or are dismissed as "futuristic". Stronger, more forceful research and development programs at the State and Federal levels, however, could expedite development of the full potential of alternative energy sources for use in California [See Finding 48].

Regional Amplification: None.

Statewide Finding:

34. ELECTRIC UTILITIES PLAN ON BASIS OF AVAILABLE TECHNOLOGY

Electric utilities take a cautious approach to including alternative sources of electricity generation in supply mix projections for several reasons:

- a. Electric utilities are held responsible for meeting whatever demand for electricity actually exists, and they therefore plan almost exclusively on the basis of available technology as the means to meet 5, 10 and even 20-year forecasts.
- b. The lead time required for construction of any generating facility is significant: typical lead times are 6 years for a combined cycle fossil fuel plant, and up to 12 years for a nuclear plant. Utility power plant planning requires specific identification of equipment and commitment of sizeable sums

of money well in advance of actual plant construction, and almost inevitably in advance of the time new technologies may become available.

Regional Amplification: None.

Statewide Finding:

35. ELECTRIC UTILITY SUPPLY FORECASTS INFLUENCE
OTHER SUPPLY FORECASTS

Although the electric utility supply forecasts represent only one possible supply scenario, they are used as a principal basis for planning by a broad range of public agencies dealing with such complex issues as petroleum and natural gas supply, port facilities, land use, and water resources, to name only a few. These forecasts thus influence, and to some extent structure, planning in these areas, and so become the scenario most likely to actually develop.

Regional Amplification: None.

Statewide Finding:

36. SIGNIFICANT ENVIRONMENTAL IMPACTS FROM DEPENDENCE
ON CONVENTIONAL SUPPLY MIX

The consequences implied in conventional supply mix forecasts are serious: Increasingly severe environmental disruptions for fossil fuel extraction, processing, and delivery; consumption for electrical generation purposes of nonrenewable hydrocarbons that are more valuable for other chemical, industrial, and consumer use; magnified problems of air pollution; problems of nuclear fuel

transport security, radioactive waste handling and disposal, and potential nuclear reactor hazards, which do not yet have definitive solutions and which become more significant as the number of nuclear reactors increases; and problems of cooling water supply and marine life impacts. [See Section IV, Power Plant Siting.]

In spite of such consequences, such energy planning as has been done in California has been based primarily on the conventional utility projection of electricity supply mix.

Regional Amplification: None.

Statewide Finding:

37. ALTERNATIVE ENERGY SOURCES BECOMING INCREASINGLY FEASIBLE

Energy sources for electricity generation that previously were thought to be economically unattractive or technologically unattainable have recently become more desirable or more feasible because of (1) escalating price levels for competing conventional energy sources; (2) new concern for environmental protection, human health and safety, and conservation of nonrenewable hydrocarbon resources; (3) new levels of research commitment for alternative source development; and (4) new concern about political implications of dependence on international markets for energy supply.

Regional Amplification: None.

Statewide Finding:

38. POSSIBLE YIELD FROM ALTERNATIVE SOURCES

It is possible that alternative sources of energy that may be environmentally less damaging or less hazardous than the sources shown in most conventional electricity supply projections may make a greater contribution to future electricity supply than is presently acknowledged. A hypothetical alternative scenario for future electrical generation capacity in California suggests that alternative energy sources for electric power generation might be provided by the following sources by the year 2000:

Solar	16,900 Mw
Geothermal	12,800 Mw
Wastes	3,200 Mw
Wind	<u>3,000 Mw</u>
TOTAL	<u>35,900 Mw</u>

This hypothetical scenario is based on estimates of possible technological developments published in journals of science and technology. It assumes a strong policy commitment by government bodies and electric utilities to high levels of research and development of alternative energy technologies, and to extensive marketing and public education; and it recognizes that economic variables are difficult to define.

This capacity would represent 1/2 of all new generating capacity required between 1973 and 2000 (based on the Rand study Case "two"—i.e., base case plus price increases). This contrasts with the conventional supply mix forecast of less than 15 per cent from these combined sources. Pumped hydroelectric developed at existing

hydroelectric plants could supply an additional 7,500 Mw of capacity at peak periods to reduce the need for new peaking units (i.e., units needed only to produce power during peak hour demand). The future share of generation that will actually be provided by each of these technologies is uncertain, and depends on such things as comparative economics, environmental acceptability, and lead time required from earliest date of feasibility.

Regional Amplification: None.

SECTION II: ENERGY CONSERVATION

Statewide Finding:

39. ENERGY CONSERVATION

The need for energy-producing facilities can be reduced, and the impact on the coastal zone thereby lessened, by vigorous energy conservation measures. Substantial savings can be achieved by curtailing wasteful consumption of energy without harming the economy of the nation or the State. Some experts estimate that as much as 40 per cent of present total energy consumption is wasteful, and that conscientious application of a broad energy conservation program to all sectors of the energy market—homes, businesses, industry, and transportation—could halve our historical energy growth rate. The Ford Foundation Energy Policy Project concluded, for example, that the national energy growth rate could be reduced from the present level of nearly 5 per cent to 1.7 per cent annually without any significant adverse economic effects.

- a. The residential and commercial sectors of society account for about one-third of the nation's annual energy consumption and their consumption is increasing at the rate of 5.4 per cent per year. Overall, it is estimated that nearly 40 per cent of the energy these sectors consume is wasteful. Waste occurs due to poor insulation and ventilation; inefficient heating and cooling systems; poorly maintained and designed appliances; and wasteful use of lighting, appliances, and heating and cooling.
- b. The industrial sector accounts for about 41 per cent of total annual energy consumption in the U.S., and about 33 per cent

in California. Although energy-consumption per unit of industrial output has decreased over the decades, substantial energy waste still exists in energy-inefficient work schedules and industrial processes, poorly maintained equipment and machinery, use of outdated direct-heat apparatus with heat-transfer efficiencies as low as five per cent, and failure to recover and reuse waste heat and waste materials by recycling. Savings of at least 10 per cent of the energy used in the industrial sector should be possible with only minimal efforts, while 30 per cent or more could be saved with concerted application of currently feasible technology.

- c. Transportation of passengers and freight accounts for about 25 per cent of nationwide energy use, and nearly 35 per cent in California. Transportation modes have become increasingly energy consumptive. As presently used, automobiles, which account for 90 per cent of all passenger movement, use more than twice as much energy per passenger mile as buses; in large part this is because on the average each car carries only 1.3 passengers. Automobile inefficiency is increased by high speed driving, air conditioners, automatic transmissions, poor tires, and unnecessarily large engine size and car weight. Remote, scattered, or low-density developments not only increase dependence on automobiles but also tend to require greater travel distances, causing increased air pollution and fuel consumption. About one-third of all freight transport in the nation is by truck, although trucks use over $3\frac{1}{2}$ times more energy per ton mile than railroads, and five times more than pipelines. Savings of 15 to 25 per cent are possible in the transportation sector using only

short and mid-term conservation measures (e.g., consumer education, lower speed limits, rate and service improvements on public transit and rail freight transport).

- d. Energy consumption in electric utilities operations can be reduced through improvements in power generation technologies; reductions in transmission losses by use of improved equipment and by siting generation facilities near to load centers; and use of single-pass ocean water cooling systems rather than evaporative cooling or dry tower systems. In electric utilities operations, the trade-offs for achievement of energy conservation are often stark: a utility may accept energy inefficiencies to avoid high capital costs of alternative equipment, to utilize a generation or cooling technology that meets its particular system needs (e.g., a gas peaking turbine or pumped hydropower project to meet peaking capacity needs), or for other economic considerations; similarly, a conservationist or land use planner may support equipment design or siting standards that sacrifice some energy efficiency in order to meet specific land use planning or environmental goals.

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast:
4. South Central:
5. South Coast: "Single purpose buildings such as office buildings with short occupancy times and lack of diversity for round the clock use, consume more energy per hour of use than multiuse buildings."

6. San Diego: "Transportation [consumption]...amounts to approximately 580 million gallons [of gasoline]...in San Diego County alone (1973)."

Statewide Finding:

40. STATEWIDE ENERGY CONSERVATION EFFORTS

The State of California has already begun to move toward design of energy conservation measures for uniform implementation statewide. The State Energy Commission has a broad mandate to develop programs for reducing wasteful, unnecessary, inefficient, and uneconomic uses of energy through energy pricing strategies; improved lighting, insulation, climate control systems, and other building design and construction standards; improved standards for appliance efficiencies; and advances in power generation and transmission technologies. The Energy Commission will also design recommended per unit energy requirement allotments based on square footage (energy budget codes) for various classes of buildings.

Other energy conservation measures that have been initiated by the Legislature include: (a) SB 277; (Health & Safety Code, Sec. 17920.7), which required development by the Department of Housing and Community Development of minimum insulation standards for residential structures. Such standards have now been adopted by the Legislature as regulations effective February 22, 1975, to be applicable statewide and enforced by local enforcement agencies; (b) SB 144 (1974) (Health & Safety Code, Sec. 19878), requiring similar development of insulation standards for new non-residential structures, to become effective near the end of 1975; and (c) SB 1521, (1974) (Pub. Res. Code, Sec. 25950 et seq.) to eliminate pilot lights in gas appliances (see Finding 42 for a more complete description).

Despite the broad mandate of the Energy Commission to develop energy conservation programs, and the strong interest in ultimately having such programs applied statewide, strong reasons remain for the Coastal Commission to develop policies for energy conservation. First, under AB 1575, (1974) (Pub. Res. Code Section 25500 et seq.) , it may be as long as 2½ years before Energy Commission regulations pertaining to lighting, insulation, climate control systems, and other building and design standards, including recommended energy budget codes, are developed and enforceable. In the interim, development in the coastal zone will continue; and there are many energy conservation measures already clearly identifiable that could serve as guidelines for immediate application to new construction to begin working toward reduction of energy demand growth. Second, the Energy Commission's mandate does not include land use and development planning measures designed to reduce energy consumption.

Energy conservation policies developed and adopted by the Coastal Commission can be forwarded to the State Energy Commission as recommendations for its consideration in developing standards for subsequent uniform application statewide.

Regional Amplification: None.

Statewide Finding:

41. UTILITY RATE STRUCTURES

One of the most important and direct ways to encourage more efficient energy use is to change electric and gas utility rate structures to accurately reflect all of the internal and external costs of producing and delivering additional service. Present rate

structures often encourage consumption by charging reduced per-unit prices for large consumers. Present pricing structures also make no attempt to discourage demand during periods of peak load. Peak load generation typically results in use of the least efficient generating equipment; and it is peak demand that determines the need for expensive new generating equipment. Consumption during peak periods, then, is costlier than during off-peak hours.

The Wisconsin Public Service Commission has recently made a landmark rate decision requiring a major electric utility to implement (a) "flat" rates, except where the traditional "declining block" rate structure can be proved to encourage the most efficient allocation of energy, and (b) a system of peak load pricing that would result in higher rates during summer months, when the system's peak loads occur.

In California, the California Public Utilities Commission (CPUC) has rate-setting authority. The new State Energy Commission will not assume this function. The CPUC has recently undertaken a study of alternative rate structures to analyze possible new approaches for application in California.

Regional Amplification: None.

Statewide Finding:

42. GAS CONSUMPTION AND POTENTIAL CONSERVATION MEASURES

It is estimated that continually operated or lighted gas pilot lights consume more than 223 billion cubic feet of gas per year in the 30 million gas-heated homes in the United States. Pilots on gas dryers and other appliances in commercial, governmental, and industrial

facilities wastefully use additional volumes of gas. Pilots use about one-third of a typical gas range's overall consumption and in some cases may account for as much as 50 per cent of the gas use, especially if pilot flames are set too high. Safe electric or other ignition devices actuated only when the appliance is in operation are available today to replace pilots in most residential-type appliances and can be built into new gas appliances or retrofitted to existing appliances. Electric ignition devices add to the initial cost of a new appliance (about \$3 to \$30); but given current gas shortages and rising prices they are likely to be substantially less expensive to the consumer than pilot lights when costs are calculated over the life of the appliance. Replacing pilots in existing equipment, however, may cost \$80 to \$100, which may not be recouped through lower operating cost over the remaining life of the appliance. Unlike gas pilots in other fixtures, water heater pilots are efficient because the pilot flame contributes directly to heating the water.

In May, 1974, SB 1521 (P.R.C. 25950), was approved, prohibiting the sale or installation of new residential-type gas appliances (furnace, air conditioner, heater, refrigerator, stove, range, dishwasher, dryer, decorative fireplace log, or other similar device, but not including a water heater) equipped with a pilot light 24 months after an "intermittent ignition device" has been demonstrated or certified by the State Energy Commission, or January, 1977, whichever is later. This long lead time was included in the legislation primarily to guarantee advance notice to appliance manufacturers, retailers, and contractors.

The efficiency of most gas appliances, including water and space heaters, can be reduced as much as 50 per cent by dirt build-up or improper adjustment. Routine maintenance on such appliances could effect substantial energy savings.

Regional Amplification: None.

Statewide Finding:

43. ELECTRICITY CONSUMPTION AND POTENTIAL
CONSERVATION MEASURES FOR LIGHTING

Lighting represents 20-25 per cent of all electricity sold in the U.S. In office buildings, lighting represents an average of 40 per cent and in some cases up to 60 per cent of electricity used. Decorative lighting, advertising and display lights, exterior wall lighting, and other promotional uses are also large users of electricity.

Nationwide, average lighting intensity in commercial buildings has risen from 35 footcandles in 1940, to 85 in 1958, and to 124 at present. Many experiments confirm that lighting levels between 10 and 50 footcandles are sufficient for most visual acuity and physiological needs where levels of 60 to 150 footcandles are now being provided. Illumination levels can be significantly reduced in corridors, lobbies, passageways, and storage areas. Within work areas (e.g., classrooms or offices), use of selectively higher lighting levels for "task zones" can both reduce total lighting needs and heighten the effectiveness of the people working in the area. Lighting levels for tasks up to 100 footcandles can be achieved in most buildings designed for a maximum average requirement of 2.3 watts per net rentable sq. ft.

Lighting needs can be further reduced by using natural light wherever possible to replace electrical lighting. In major multi-story office buildings or schools, about 25 per cent of the energy normally used in lighting might be saved if the lighting fixtures near windows could be manually switched off, or automatically operated by a photo cell.

Incandescent light bulbs are inefficient energy converters. Less than 10 to 14 per cent of the energy consumed results in useful lighting; the rest goes into heat. Florescent lamps are more than three times as efficient.

Excessive and inefficient lighting also wastes energy indirectly by increasing the heat load, thereby increasing the need for cooling. Typically, every two watts of lighting requires one watt of cooling by air conditioning. "Heat-of-light" systems are available that reduce the amount of heat from lighting and thus the amount of air that must circulate in the air conditioning system.

The high pressure sodium lamp (HPS) is a fairly recent development in street lighting and other outdoor illumination.

For various lighting configurations, systems using mercury vapor lamps, which at present are most common, consume 2.3 to 2.9 times the energy required to produce an equivalent amount of light with a system using HPS lamps. The HPS lamp is initially costlier than the mercury vapor lamp; it also has a shorter life, and thus requires more investment in replacement lamps. Experts concur, however, that because of greater lamp efficiency, HPS systems are less costly over the system life cycle than mercury vapor lamps. Where existing street lighting in California uses series circuits, HPS lamps, which at present can operate only on a multiple circuit, are not compatible. In addition to using efficient lamps, it may also be possible to reduce the illumination level of street lighting without adversely affecting public safety.

Electrical consumption for promotional signs and lighting could be reduced through regulating the size, type of lighting, and extent of such uses. Regulation of signs for public safety and welfare

reasons (including aesthetic values) has been upheld by court decisions. Sign industry data state that electric signs use less than 2/10 of one per cent of the total energy used in California (the percentage of total electricity use is slightly higher). New lighting standards for energy conservation will ultimately be developed and prescribed by the Energy Commission for mandatory application statewide. These standards are to be developed and applicable by mid-1977. (See Finding 40 above).

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast:
4. South Central:
5. South Coast: "Total consumption of electrical energy for street lighting for public streets and highways in Los Angeles County for 1973 was on the order of 307.6 million kwh. By substituting high-pressure sodium lamps for the existing mercury vapor lamps, a total of approximately 205 million kwh could have been saved (from information supplied by L.A. Dept. of Water & Power).

"By prohibiting all outdoor ornamental and advertising flood lighting and limiting businesses to one outdoor illuminated sign (used for advertising purposes), an annual savings of approximately 1½ per cent of total energy used in the region could be effected. In Los Angeles County alone that would be over 200 million kwh annually (from figures supplied by LADWP).

"An office building might use over a kwh/year/sf for decorative advertising, and display lighting."

6. San Diego: "Total consumption of electrical energy for street lighting for public streets and highways in the San Diego region (SDG&E service area) for 1973 was on the order of 60 million kwh. By substituting high-pressure sodium lamps for the existing mercury vapor and incandescent lamps, between 30 and 40 million kwh could have been saved."

Statewide Finding:

44. ENERGY USE AND POTENTIAL CONSERVATION FOR CONVENTIONAL HEATING, COOLING AND VENTILATING SYSTEMS

Of the total national consumption of energy, 18 per cent is for heating buildings. Only one out of every ten buildings operated at 90 per cent or more of potential energy efficiency. Up to 50 per cent of the heating and cooling demand in buildings is a result of infiltration of outside air, due to inadequate insulation, caulking, and weather-stripping of almost all existing buildings. If these were improved in all existing buildings, 7.2 per cent of total nationwide energy consumption could be saved. In new construction, more stringent insulation standards (applicable to walls, ceilings, and floors) and double glass windows, possibly with special coating, could effect significant reductions of energy usage. Savings of up to 50 per cent of the energy required for heating and 20 per cent of the energy required for cooling in new residential construction and 10 per cent of both the heating and cooling energy in new commercial construction can be achieved.

Use of electric resistance space heating results in consumption of at least twice as much energy to heat a given space as direct use of a primary fuel (e.g., gas or oil). The conversion efficiency for a fossil or nuclear fuel thermal electric power plant is only about 35 per cent; inefficiencies in transmission and delivery systems still further reduce the overall conversion efficiency for electric space heating. If gas is used directly for space heating, overall efficiency will range from 50 to 80 per cent, even considering inefficiencies due to improper furnace adjustment and start-up and shut-down operations.

Air conditioning's share of annual total national energy consumption has grown from an infinitesimal amount 20 years ago, to 1.6 per cent in 1960, to 2.5 per cent in 1968, to possibly as much as 4 per cent now. Because most of this energy is consumed during just a few months of the year, the strain air conditioning loads put on electric generating resources can be severe. One of every two homes in the country has at least one room air conditioner. One-half of new houses being built today are centrally air conditioned, compared to 1/20th a decade ago.

Among various types and makes of conventional room air conditioning units, energy efficiency in actual "cooling capability" can vary by as much as 80 per cent. Large central heating and air conditioning systems generally use 10 to 15 per cent less energy on the average than smaller decentralized systems. If central systems are to operate with the same flexibility as individual systems, however, proper controls must be installed. In portions of the temperate coastal zone, proper design of structures and landscaping can obviate the need for air conditioning.

The use of trees, shutters, sun screens, awnings, or roof overhangs to shade windows from direct sunlight can substantially reduce heat build-up in buildings, and thus air conditioning requirements. Special glazing (metal-coated and/or double wall glass) can cut both cooling and heating requirements by about half. It is much more efficient to screen glass on the exterior, rather than with blinds, drapes, etc. on the interior of a building.

Heat transmission rates are also affected by the proportion of exterior walls, the amount of surface area in windows (heat loss and gain from windows causes much greater energy use than the potential

saving in natural lighting), and the color, orientation, shape, and angle or exposure of building surfaces.

Operable windows in lieu of fixed glass will allow natural ventilation to enter the building, eliminating some of the need for air conditioning and mechanical ventilation during much of the year. Such windows must be well fitted and weather-stripped to reduce infiltration of outside air.

Heating and cooling systems are usually based on outdoor conditions not exceeded more than $2-2\frac{1}{2}$ per cent of the time. Except for facilities for the elderly, for industrial process, or for health care, such systems could be designed for the five per cent condition with only a slight increase in discomfort during a few hours per year. Excessive safety margins and failure to account for people and appliance heat-loads also result in oversized space conditioning equipment and inefficient operation.

Heating and cooling of vast amounts of outdoor air that circulate through buildings can also consume energy wastefully. By reusing already circulated air, the amount of outdoor air required for ventilation can be substantially reduced, from 5-15 cfm (cubic feet per minute) per person to 3-4 cfm per person in most buildings. Air quality can be maintained by using odor-absorbing devices and better filtration. Initial costs are no greater, since savings in fans, heating and cooling equipment, and ductwork more than offset the added costs for better filters and odor absorption equipment, and there are significant savings in energy and operating costs. Heat exchangers which allow the use of already air conditioned exhaust air from a building to preheat or precool system intake air, are a means for reducing heating and cooling requirements in large buildings.

The present lack of capability of buildings to store heat and cold and to control appropriate areas separately results in a loss of energy which otherwise could be used later to offset peak electrical demand loads. Conventional chimneys, fireplaces, combustion devices, kitchen, laboratory, and laundry exhaust hoods are all energy wasters. Heat exchangers can be used to recapture energy otherwise given off as waste heat.

Pursuant to legislative mandate, the State Department of Housing and Community Development has developed new insulation standards, recently approved by the Legislature, for residential structures. The standards, which are to be enforced by local governments February 22, 1975, prescribe maximum allowable heat loss values for ceiling, walls, and floors, and provide limits on the amount of glazing. The same agency is presently developing insulation standards for non-residential construction. All such standards shall be operative until superseded by standards developed by the State Energy Commission. (See also Finding 40 above).

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast:
4. South Central:
5. South Coast: "Heat losses and cooling loads due to transmission through walls, ceilings, and floors are greater with light-weight panel construction and lack of adequate insulation. Some mobile and modular homes, in particular, have relatively high heat transmission rates. Heat transmission rates are also affected by the color, orientation, shape of building and angle of incidence of the sun's rays.

"The stack effect in buildings, that is, the tendency of high buildings to internally generate a powerful rising draft of air within the vertical service stacks, introduce unwanted outside air (infiltration), since building designs are generally inadequate to prevent it."

6. San Diego: Same as South Coast.

Statewide Finding:

45. POTENTIAL FOR ENERGY SAVINGS IN ALTERNATIVE
HEATING AND COOLING SYSTEMS

Solar or Solar-Assisted Heating and Cooling. Refer to the Alternative Energy Sources, Finding 52.

Heat Pumps. A heat pump is, in effect, a refrigeration machine that can work in a reverse cycle; thus it can either heat or cool a given space. Large electric heat pumps are comparable in efficiency to properly maintained gas furnances; they can operate two to three times more efficiently for cooling than most systems, especially compared to compressive refrigeration. A heat pump system can also be operated by solar power, thus further reducing electricity demands.

Nocturnal Evaporative Cooling. Roof-pond nocturnal cooling systems are technically feasible and practical for residential and low-load buildings in desert or valley climates such as in southern California, and are as effective as solar-powered absorption air conditioning. The evaporation in one hour of 1-1½ gallons of water is the equivalent of one ton of refrigeration capacity; the operating cost would be only a fraction of the cost of electrical refrigeration. This is the simplest system that can accomplish both heating and cooling.

Rock-Bed Regenerators (RBR). Rock-bed regenerator (RBR) cooling systems use evaporation of water in the discharge air to chill rocks in a switched-bed rock-filled recuperator, which then cools inflow air. RBR's have been used successfully in Australia. The power consumption per square foot is only 1.0 watts compared to 8.8 watts (3-4 watts in California's coastal climate) for mechanical refrigeration.

Regional Amplification: None.

Statewide Finding:

46. POTENTIAL FOR ENERGY SAVINGS THROUGH IMPROVED APPLIANCE EFFICIENCIES

Home and business appliances utilizing both electricity and natural gas account for approximately eight per cent of total national energy consumption. Water heaters alone use four per cent of the national energy budget. Appliances vary greatly in the amount of energy required for identical tasks. Innovations in appliance technologies frequently result in more energy-intensive appliances. Frost-free refrigerators and freezers, for example, use nearly twice as much energy as manual defrost units; and color televisions use about 40 per cent more energy than black and white sets. More efficient appliances may initially cost more, but they enable consumers to save money operating costs. Labeling of appliances as to energy efficiency would enable the public to make informed purchases, and would encourage energy efficient design by appliance manufacturers.

The State Energy Commission is mandated to prescribe standards for minimum levels of operating efficiency for all appliances whose use requires a significant amount of energy on a statewide basis.

One year after adoption of such standards, sale of non-complying appliances in California will be illegal.

Regional Amplification: None.

Statewide Finding:

47. POTENTIAL ENERGY SAVINGS IN TYPES OF BUILDING MATERIALS

It takes approximately six times as much electric energy to produce a ton of aluminum as a ton of steel. In an analysis of a high-rise building, it has been demonstrated that its skin would require 5.75 million pounds of stainless steel, which takes .77 million kwh to produce, compared to only four million pounds of aluminum, but which takes 2.1 million kwh to produce.

Where wood is appropriate for use, it is significantly more favorable in energy required for production than steel or aluminum. The production of a ton of wood takes only 12 per cent of the energy required to produce a ton of steel and 2 per cent of that required to produce a ton of aluminum. Wood is also the only renewable major building material. Concrete and masonry have higher heat storage capacity and longer life cycles than metals or woods.

Regional Amplification: None.

Statewide Finding:

48. ENERGY BUDGET CODES

Experts believe that substantial reduction of energy consumption could be achieved by designing and implementing "energy budget codes" which would require new buildings to meet maximum allowable levels

of energy consumption according to building type, net building floor area, number of stories, height of individual stories, and local climate, among other possible criteria. Use of energy budgets would require architects, engineers, and builders to design with some focus on energy conservation, but would afford them maximum flexibility as to what conservation measures to employ. The State of Ohio Board of Building Standards has recently adopted an energy budget code.

The State Energy Commission is mandated by 1575 (1974) [P.R.C. Section 25402(b)] per unit energy requirement allotments based on square footage for various classes of buildings. No date is set within which the State Energy Commission must perform this function. Standards developed will not be mandatory. (See Finding 40 above).

Regional Amplification: None.

Statewide Policy:

2. ENERGY CONSERVATION SHOULD BE AN IMPORTANT
FACTOR IN ESTABLISHING UTILITY RATES

Because utility rate restructuring can be used to encourage energy conservation and to encourage reduction of peak demand levels through load spreading, it is recommended that the California Public Utilities Commission (CPUC), which is responsible for determining utility rates in California, revise utility rate structures to more accurately reflect the actual costs of production and transmission of a customer's gas and electricity, and to thereby discourage rather than stimulate consumption, discourage inefficient, wasteful allocation of energy, and reduce the need for facilities expansions and use of inefficient peaking units by utilities. The State Energy Commission, whose mandate includes study of the relationship of energy pricing to wasteful, inefficient, and uneconomic energy uses should assist the CPUC in the rate structure revisions as soon as it is able to do so.

Regional Amplification: None.

Statewide Policy:

3. COASTAL DEVELOPMENTS SHOULD MINIMIZE
ENERGY USE IN TRANSPORTATION

To reduce total vehicle mileage and fuel consumption, air pollution from automobiles, and the need for expansion of roads and highways in the coastal zone, recognizing that the State Energy Commission's energy conservation mandate does not include development of land use policies to help conserve energy, the agency designated to carry out the Coastal Plan:

- a. Shall permit significant new residential, commercial, institutional, or industrial developments or other traffic-generating uses in remote locations only if it can be shown that they are adequately served by alternative transportation modes that are less polluting or that reduce total vehicle mileage and energy consumption (such as buses) or if it can be clearly demonstrated that the project will not harm coastal resources, will not contribute directly or cumulatively to significant degradation of air resources, and will not result in unnecessary fuel consumption. Determinations of fuel consumption shall include consideration of distances to employment and service centers and alternative locations for such developments.
- b. Shall strongly encourage development of energy-conserving transportation modes (e.g., public buses, trains, bicycles, etc.) in new or expanding developments.

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast: Same language as South Coast (see below), but adopted as a "guideline" rather than as a requirement.
4. South Central:
5. South Coast: "Discourage Auto-Dependent Remote Development. In order to reduce vehicle miles travelled in this critical air basin, residential development shall not be permitted in locations remote from employment and commercial centers unless adequate public transportation services or alternative transport modes to the automobile are available which reduce total vehicle mileage and air resource degradation." This language is stricter than the proposed State language, in that it provides no escape clause other than the availability of energy-saving transportation modes.
6. San Diego:

Statewide Policy:

4. ENERGY CONSERVATION MEASURES RECOMMENDED TO
STATE ENERGY COMMISSION *

To reduce non-essential consumption of energy as much as possible, and thereby reduce the adverse environmental impact of energy supply facilities on the coastal zone:

- a. The energy conservation standards contained in Policies 5, 6, 7, 8, and 9, below, are recommended to the State Energy Resources Conservation and Development Commission ("State Energy Commission") for its consideration in developing statewide energy conservation measures in fulfillment of its legislative mandate. Clearly such standards should be applied statewide. If, for any reason, a significant energy conservation program is not in effect statewide by January 1, 1977, then, because of the need to conserve energy to alleviate the adverse effects of new energy facilities upon the coast, the standards set forth in Policies 5, 6, 7, 8, or any improvement upon them recommended or enacted by the Energy Commission, shall be applied by the agency designated to carry out the Coastal Plan to all development proposed within the agency's jurisdiction. Until that time, the application of such standards should be encouraged in any development as a contribution to energy efficiency and resource conservation.

Regional Amplification: None.

* Asterisk denotes a policy that is primarily a recommendation to another agency.

Statewide Policy:

5. REDUCE CONSUMPTION OF ELECTRICITY FOR LIGHTING*

As set forth in Policy 4, to decrease electricity consumption and demand, unnecessary lighting in new or substantially remodeled residential, commercial, institutional, or industrial development shall be reduced in the following ways:

- a. Lighting shall not exceed 2.3 watts (2.5 volt-amperes) per square foot except in instances where higher levels are shown to be necessary for public health and safety. Lighting for specific tasks that require an extremely high degree of visual acuity shall be excepted on a case-by-case basis, depending on degree of "visual difficulty".
- b. Only efficient lamps and luminaires, as defined in the criteria of Section 9.3 and 9.4 of the Design and Evaluation Criteria for Energy Conservation in New Buildings (Proposed Standard 90-F) of the American Society of Heating, Ventilating, Refrigeration, and Air Conditioning Engineers (ASHRAE), shall be allowed.
- c. In large office buildings, light switches shall be provided so that portions of the building, including portions of each floor, not in use or receiving adequate natural light can be switched off selectively.
- d. New street and highway lighting luminaires shall be of the high pressure sodium (HPS) type, unless there are environmental, aesthetic, or public safety reasons for utilizing a different type of light source. Fixtures equal to or greater in efficiency than HPS with respect to energy requirements may be substituted with approval of the State Energy Commission or the agency

* Asterisk denotes a policy that is primarily a recommendation to another agency.

designated to carry out the Coastal Plan. Other appropriate energy-conserving devices (e.g., astronomical clocks that eliminate lighting during daylight) and designs shall also be incorporated in all new public lighting systems.

- e. Proposed new advertising or ornamental signs in the coastal zone, whether on business sites or off, shall not be electrically lighted, except that businesses shall be allowed on-site lighted identification signs containing only the name, address, and major project or service of the business, and these signs shall be illuminated during darkness only when the business is open to the public.
- f. Building and facade lighting, exclusive of signs, shall be no greater than 1,000 watts or two per cent of the total interior lighting load of the building, whichever is greater.
- g. On-site signs and facade lighting shall be included in the projects's energy budget.

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast: Adopted as a "guideline: the same amplification as South Coast (below), for subsection (e).
4. South Central:
5. South Coast: Subsection (d): The South Coast Commission expressed a strong desire for replacement of existing street and highway lighting with HPS or other higher efficiency luminaires, and recommended a mechanism for achieving this goal, as follows:

"A capital improvement fund shall be established by passage of a State bond issue or by other appropriate State funding for the conversion of existing county and municipal incandescent or

mercury vapor-type street and highway lighting luminaires to high pressure sodium (HPS) type or a type which provides an equivalent or greater amount of lumens per watt over the life of the lamp within such time as is reasonable, given the financial resources thus made available and the available manufacturing and installation capacity. Capital conversion moneys shall be repaid in accordance with a schedule adjusted to energy cost savings resulting from said conversions. Esthetic consideration shall be given reasonable weight in the choice of luminaire types."

(This language is now included in Statewide Policy 9 as subsection (e), in the list of measures recommended for a statewide energy conservation program.)

Subsection (e): The South Coast Commission required that the local governmental agencies assume the burden of energy conservation regulations for on-site signs, as follows:

"Include provisions for illuminated on-site signs in their respective sign ordinances for the purpose of energy conservation. Such provisions shall include but not be limited to:

- (1) limitations on size and intensity of illumination;
- (2) requirements for use of high efficiency lighting;
- (3) limitations on hours of illumination;
- (4) limitations on number and size of signs; and
- (5) installation and maintenance measures directed toward conservation."

6. San Diego:

Statewide Policy:

6. REDUCE CONSUMPTION OF ELECTRICITY FOR HEATING AND COOLING*

As set forth in Policy 4, above, to decrease electricity consumption and demand, unnecessary use of electricity for heating, cooling, and ventilating in new or substantially remodeled residential, commercial, institutional, or industrial developments shall be reduced in the following ways:

- a. No electric resistance heating (water or space) shall be allowed unless: (1) an effective solar delivery system and/or natural gas

* Asterisk denotes a policy that is primarily a recommendation to another agency.

service are not available or adequate for meeting energy requirements; (2) electrical heating is needed for medical, health, or public safety reasons; (3) some other unusually high requirement for clean heat exists; or (4) a back-up system for solar heating and cooling systems is required.

- b. Air conditioning needs shall be reduced by: (1) incorporating either mature planting, exterior architectural shading projections, or reflecting and/or insulating glass or exterior solar screens to shade or protect windows receiving direct sunlight in warm climates; (2) incorporating operable sash and vents in all exterior rooms for which ventilation is required by the local building code, and making such sash and vents weather-tight by use of weather-stripping; and (3) having variable thermostats for areas with different air conditioning requirements.
- c. An air conditioning design using the best practical available technology with low-level or no electricity consumption shall be required. New conventional (compressive refrigeration) air conditioning shall be permitted only if an applicant can demonstrate that the life cycle costs of the conventional system are substantially less than the lowest cost alternative system available. The demonstration shall include a comparison of the conventional and potential alternative schemes, including electric energy consumption, cooling output, and life cycle cost, together with outline specifications and sketch plans to scale for both the conventional and alternative systems. The comparison shall be submitted and signed by a California registered engineer. (Alternatives may include cooling systems based on evaporative cooling, solar cooling, nocturnal radiation, absorption refrigeration, heat pumps, rock bed regenerators, and coolness storage, among others.)

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast: Adopted as a "guideline" the same language as in the South Coast regional amplification for subsections (a) and (b), below.
4. South Central:
5. South Coast: Subsection (a): The South Coast included as exceptions to the prohibition against electric resistive heating circumstances "where the use of infrared bulbs for heat as needed for short periods in small rooms such as bathrooms", and "where a solar (water or space) heating system is capable of meeting over 50 per cent of the demand on the heating system, and a back-up system is required."

Subsection (b): The South Coast included as an exception from the requirement of operable sash or vents all "interior or exterior windowless rooms that the local regulating building code allows to be vented by mechanical means".

Subsection (b)(2): "Such sash and vents shall have the capability of being operated by any person in the room in which they are located and shall not have the capability of being permanently locked by key except in special cases where the need for security can be demonstrated."

6. San Diego: Subsection (a): Same as South Coast with regard to infrared bulbs for heat.

Subsection (b): Same as South Coast.

Statewide Policy:

7. REDUCE WASTEFUL CONSUMPTION OF NATURAL GAS
IN PILOT LIGHTS AND OPEN GAS FLAMES

As set forth in Policy 4, above, to decrease natural gas consumption and demand, wasteful use of natural gas in new or substantially remodeled residential, commercial, institutional, or industrial developments shall be reduced in the following ways:

- a. To decrease natural gas consumption, intermittent electric ignition systems or other acceptable means shall be used in lieu of gas pilot lights in all residential, commercial, and industrial equipment (with the exception of water heater gas pilots) installed in proposed new construction or additions to existing structures unless the equipment manufacturers can conclusively demonstrate that the gas pilot device: (1) has a substantially lower life cycle cost than an electric ignition or other alternative system, computed at prime interest rates; (2) that for particular equipment, the gas pilot is more energy efficient than available alternatives; or (3) that public health or safety necessitates the use of gas pilots.
- b. Open gas flames that are to be used for advertising, promotional, or decorative purposes shall not be allowed in proposed new industrial, commercial, or residential construction or additions. This applies to both exterior and interior installations.

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast:
4. South Central:
5. South Coast: "b. This applies but is not limited to devices such as tiki-torch type lanterns and mantle type gas lamps designed to use natural gas. It also applies to decorative fire pits using open gas flames."
6. San Diego:

Statewide Policy:

8. ESTABLISH ENERGY BUDGETS FOR NEW DEVELOPMENTS*

As set forth in Policy 4, above, to reduce non-essential consumption of energy as much as possible, thereby reducing the potential impact of energy supply facilities in the coastal zone, while at the same time permitting the maximum latitude in designing projects and selecting equipment to conserve energy, an energy budget code should be formulated, to be applied to all new or substantially remodeled residential, commercial, institutional, and industrial developments. The code should set required energy budget performance levels for a range of building types, sizes, occupancies, projected levels of intensity of use, and location. The energy budget shall state the energy inputs and outputs of the proposed building or other development in BTU's per cubic foot or in watts per square foot; and shall give the extreme mean heat loss/gain of all buildings in peak heating and cooling seasons. All proposals for enclosed developments shall include outline specifications for the following: microclimate description of the building site; microclimate modifiers such as planting, total building exterior cladding material; building insulation; building thermal inertia and energy storage capability; major building energy using and controlling equipment such as for lighting, heating, ventilating, and air conditioning. The energy budget, including outline specifications, for residential developments of four or more dwelling units, or commercial or industrial projects of 5,000 square feet of floor area or more, shall be signed by a California registered engineer or certified architect. Proposed light commercial structures of less than 2,700 square feet may be exempted from the specification

* Asterisk denotes a policy that is primarily a recommendation to another agency.

standards without submitting an energy system analysis, provided a California registered engineer or certified architect states in writing that the specific proposed design would be expected to meet or have a lower annual energy consumption than the minimum established performance for the project type. Consideration should also be given to developing an exemption procedure for single family homes that would permit administration of energy conservation measures through local building codes without necessitating undue cost in the preparation of energy budgets. A proposed building or development that meets a predetermined level of energy budget performance set in the energy budget code, as shown through an energy system analysis, shall be exempt from such specification criteria as those described in the foregoing policies 5 through 7 in this Energy Conservation section. In order to qualify for this exemption, the applicant must submit a comprehensive energy budget for the proposed development, signed by a California registered engineer or certified architect. If the Energy Commission has not made substantial progress toward development of an energy budget code by January 1, 1977 (as set forth in Policy 4, above) the agency designated to carry out the coastal plan shall consider adoption of an interim budget code, to be applied to all development proposed within the agency's jurisdiction. Such an interim code might be submitted by a responsible professional organization to the coastal agency for public hearing and possible adoption. If adopted, the energy budget code would be implemented through the coastal permit process in the same manner set forth above. Until January 1, 1977, the development and application of energy budgets should be encouraged as a contribution to energy efficiency and resource conservation.

Regional Amplification: None.

Statewide Policy:

9. IMPLEMENT ENERGY CONSERVATION MEASURES STATEWIDE*

To reduce energy consumption throughout California, and thereby reduce the need for energy-related projects in the coastal zone, the State Energy Commission and the State Legislature should, as part of a comprehensive statewide energy conservation program, do the following:

- a. To reduce electricity and natural gas consumption, a long-range phased program for improving the energy use standards of existing buildings in California, including replacing energy inefficient equipment with equipment prescribed in Policies 5 to 7, should be devised and implemented. Special loans and/or tax incentives should be considered to assist in upgrading insulation, and in incorporating low- or non-fuel using technologies that involve higher capital costs;
- b. To reduce automobile fuel consumption, tax legislation should be enacted that encourages the use of lighter automobiles with smaller engines and increased energy efficiencies;
- c. To reduce energy waste in inefficient appliances, legislation should be enacted requiring that (1) all appliances sold in California meet specified energy efficiency standards, and (2) all appliances be clearly labeled with energy efficiency or energy consumption information.

* Asterisk denotes a policy that is primarily a recommendation to another agency.

- d. To reduce electricity consumption by public lighting systems, consideration should be given to establishment of a capital improvement fund by passage of a State bond issue or by other appropriate State funding, for the conversion of existing State, county, and municipal incandescent-or mercury vapor-type street and highway lighting to high pressure sodium (HPS) type or equivalent. Conversion should take place as quickly as possible given the financial resources available and manufacturing and installation capacity. Funds expended could be repaid from energy cost savings resulting from the conversions; and
- e. To facilitate development and implementation of an energy budget code statewide, detailed research should be undertaken to define energy code standards, and a State-financed program of in-service training for building inspectors to administer the energy budget should be instituted.

Regional Amplification: None.

SECTION III: ALTERNATIVE ENERGY SOURCES

Statewide Finding:

49. ALTERNATIVES TO CONVENTIONAL OIL AND GAS USE

There are advantages and disadvantages to development and use of all forms of energy. Oil and gas, however, on which California now relies for about 90 per cent of its total primary energy, have the potential to cause significant adverse environmental impacts at all points of the fuel sequence: extraction, transportation, processing, and consumption. There are several alternatives to continued heavy dependence on oil and gas that are environmentally superior both for the coastal zone and for California, and that help conserve hydrocarbons for more valuable uses such as petrochemicals. These sources cannot in the short term supplant a continuing fundamental dependence on oil, gas, and even nuclear fission, in California. But with a strong policy commitment by government bodies and electric utilities to high levels of research and development, and extensive marketing and public education, it is possible that alternative sources could provide as much as 50 per cent of the additional electrical generating capacity needed in California by the year 2000, and in so doing substantially reduce a broad array of environmental impacts on the coast and throughout California.

Regional Amplification: None.

Statewide Finding:

50. HYDROPOWER

- a. Hydropower's Role for Power Generation Is Limited. According to the California Resources Agency, the percentage of California's energy and electricity supply provided by hydropower has declined

sharply from 59.7 per cent of the total electricity supply in 1950 to about 36 per cent in 1970 (9 per cent of the State's overall energy supply). Hydropower appears unlikely to meet any substantial part of an increase in the State's energy needs. There are undeveloped potential hydropower sites in California; however, their limited potential, combined with concern about the environmental impact of such facilities, land use conflicts, and high capital costs, may preclude significant future hydropower development within the State.

b. California Imports Significant Portion of Hydroelectric Power.

In 1970, 23 per cent of California's hydroelectric power was transmitted from facilities located along the lower Colorado River and in the Pacific Northwest. There is considerable undeveloped hydroelectric potential in the Pacific Northwest, some of which may yet be developed. Because of the expected increase of energy demand within that area, however, it is possible that export of electrical energy to California in future years may significantly decline.

- c. Pumped Hydropower May Be Used to Store Energy. The principal application of hydropower in the future may be "pumped hydropower" projects for storing energy to meet peak demand. Such projects would permit more efficient use of base load power plants, and would help reduce the need for additional power plants otherwise necessary primarily to meet peak demand, although in some instances such projects may require more electrical energy for pumping than they actually produce. Present plans of electric utilities project 3,600 megawatts of pumped hydro capacity by 1991, and one source forecasts 10,500 Mw pumped hydro capacity by 2000. Pumped hydro projects can in some instances be built at existing hydroelectric

sites, but will in other instances involve reservoir and dam construction, with attendant land use and environmental problems, and with loss of fresh water and increased water salinity due to evaporation.

Regional Amplification: None.

Statewide Finding:

51. COAL

a. Importance of Coal as a Direct Fuel in California Is Minimal.

Although the U.S. has an overwhelming abundance of coal, California has no significant indigenous coal supplies. Coal has not traditionally been an important fuel in California; the high costs of transporting it, and the lack of large coal deposits closer than 350-550 miles from the State's major cities, have made coal a poor primary energy alternative in a state relatively rich in oil and gas. Strict State air quality regulations have made coal a still less attractive fuel in California though desulfurization and particulate control are available.

b. California Imports Electricity Generated by Out-of-State Coal-

Fired Plants. In 1970 coal provided only one per cent of California's energy needs. The California Resources Agency forecasts that by 1985 this figure will rise to three per cent. Most of this increase will be accounted for by increases in the amount of coal-fired electricity generated in Arizona, Nevada, or the Four Corners area and imported by high-voltage transmission into southern California. The Stanford Research Institute (SRI) has estimated that 5,000 to 15,000 Mw of electric generation capacity

from out-of-State coal-burning power plants could be available to California users by 2000.

- c. Synthetic Natural Gas to be Produced from Coal and Imported to California. When commercial production of synthetic natural gas (SNG) from coal is begun in the Rocky Mountain coal deposit areas, California will begin to receive some measure of SNG from coal by pipeline—primarily for residential and commercial use. If large-scale coal gasification plants scheduled for construction and operation near mine sites in the Western states should come on line as scheduled, such SNG imports could begin as early as 1978-79. SRI has predicted that SNG from coal may constitute about 16 per cent of California's natural gas use by 1990. The cost of developing such sources, as well as the amount of water required, has put some of the more optimistic figures in doubt.
- d. Environmental Problems from Use of Coal. The coal mining and coal conversion operations in the Rocky Mountains and Four Corners areas have severe environmental consequences in the immediate mining areas. In addition to problems of water supply, water quality, and air quality, there are still serious unresolved questions regarding the ultimate feasibility of land reclamation efforts following strip mining in arid regions that are presently being exploited to supply California's energy needs.

Regional Amplification: None.

Statewide Finding:

52. NUCLEAR FISSION

- a. Nuclear Fission Power Generation Expected to Grow; Public Safety Problems. The Atomic Energy Commission has predicted that nuclear energy will become the dominant source of electricity in the 1990s and will account for as much as 60 per cent of the nation's generating capacity in the year 2000. The proponents of nuclear power point out that it is smog-free, and that its use reduces air pollution that would otherwise result from fossil fuel power generation, and conserves fossil fuels. They also argue that nuclear energy is safe and the prospects of a serious accident extremely small, and express optimism over the resolution of radioactive waste disposal problems. Reliability and high cost factors in nuclear reactors are also of increasing concern. There is a growing public concern, however, over such matters as the safety hazard associated with the potential for a serious accident that might permit escape of radioactive material; the possibility of acts of sabotage or terrorism using nuclear materials stolen prior to or during the transport of fuels or wastes; and the uncertainty as to how to dispose safely of nuclear waste materials that will remain highly toxic for many thousands of years.

At present, almost all nuclear power plants are light-water reactors (LWRs). High-temperature gas-cooled reactors (HTGRs) are, however, beginning to achieve some market penetration. An intensive research and development effort is currently underway to make liquid-metal fast breeder reactors (LMFBRs) commercially available by the end of the 1980s.

- b. Nuclear Plants Require Cooling Systems. LWRs, in which the U.S. has invested most heavily, are thermally less efficient than fossil fuel power plants, and therefore emit more waste heat. HTGRs are thermally as efficient as the most modern fossil fuel plants. Systems for dissipation of waste heat can have significant environmental and land and water use impacts.
- c. Breeder Reactors Also Have Problems. France, England, and the U.S.S.R. have experimental liquid-metal fast breeder reactors (LMFBRs) in operation at this time. The Federal government is committed to the rapid development and widespread deployment of this technology. Most of the problems associated with converter reactors also affect breeder reactor development. In fact, because breeder reactors require a fast neutron flux and a highly concentrated fuel, they actually present greater health and safety problems than conventional reactor technology. The most significant danger is the large increase in the amount of plutonium that breeder reactor development would cause to be produced, stored, and shipped about the country, greatly increasing the possibilities of theft, accident, and sabotage involving this weapons-grade nuclear fuel. Breeder reactor core stability in the event of a loss-of-coolant accident also remains a major unanswered question. Other breeder reactor programs underway include the Gas Cooled Fast Breeder Reactor (GCFBR), the Molten Salt Breeder Reactor (MSBR), and the Light Water Breeder Reactor (LWBR).
- d. Accelerated Breeder Reactor Program May Be Unwarranted. The high priority assigned by the Federal government to the early development and commercial deployment of the breeder reactor is attributed by some to the supposition that, without the breeder, a supply-

price squeeze on uranium will soon occur, resulting in a shortage of reactor fuel and/or a significant cost increase for electricity. A recent study conducted by the Environmental Quality Laboratory at California Institute of Technology shows, however, that even the most enthusiastic projection of the expansion of nuclear generation through 2020 could be fueled from presently known domestic uranium supplies. Though the cost for these supplies would rise, the effect on the average delivered cost of electricity would be minor because of the small contribution to total costs made by fuel costs on nuclear generating systems. Recent analysis by the Environmental Protection Agency, Scientists Institute for Public Information, and Resources for the Future have similarly concluded that there is not sufficient justification for an accelerated breeder reactor development program.

Regional Amplification: None.

Statewide Finding:

53. GEOTHERMAL

- a. Geothermal Power Is a Desirable Energy Source. Geothermal energy is very abundant in California, and despite environmental problems of waste water disposal, soil erosion, disruption of wildlife habitat, disposal of drilling muds, hydrogen sulfide and small Radon 222 air emissions, land subsidence, and noise, (all of which experts believe are manageable), its fuel cycle is less polluting than that of fossil or uranium fuels. Geothermal energy represents a very long-term resource that may have the potential to supply up

to 15 per cent of the additional electrical energy capacity required by 2000. California's only commercial electrical energy produced from geothermal is the dry steam field in Sonoma County under development by Pacific Gas and Electric (PG&E), called The Geysers; geothermal energy already has non-electric applications in California for space heating, hot water, and recreation. By fully capitalizing on its geothermal resource, California could reduce its need for additional fossil and nuclear plants, its consumption of oil and gas for electric power production, and its need for additional import and processing facilities and recovery activities directed toward oil and gas supply.

- b. Geothermal Potential Is Significant. There are 35 potential geothermal resource areas covering more than 15 million acres within California. The presence of geothermal resources has been verified. Geologic research and activity has largely been confined, however, to the three most promising sites: The Geysers, a dry steam field in Lake and Sonoma Counties where PG&E facilities have a present capacity in excess of 400 Mw; the Imperial Valley; and the Mono Lake-Long Valley area. A fairly conservative range of potential generating capacities from geothermal sources is as follows (listed in megawatts):

	<u>The Geysers</u>	<u>Imperial Valley</u>	<u>Other Areas</u>
1980	1,300	0-700	0
1990	1,300-3,000	1,000-4,000	0-3,000
2000	1,300-5,000	1,000-8,000	0-3,000

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast:
4. South Central:
5. South Coast: The South Coast Region addressed the problems and possibilities of recovering energy from geothermal pools in the South Coast area, possibly using a device called a "downhole heat exchanger":

"Another method, the downhole heat exchanger, which theoretically would eliminate all the major difficulties with geothermal exploitation, would make geothermal energy available in more locations (including offshore) and would provide an inexpensive, abundant, accessible source of power.

"Instead of elevating the geothermal brine and steam to the surface, this system would leave the geothermal pool intact. Heat would be exchanged by circulating water or some other clean, stable secondary heat transfer fluid to the bottom of the well in a closed system. This fluid is then heated by the geothermal brine, brought back to the surface as clean steam to power turbines then recirculated to the heat exchanger at the well bottom. Because only the heat is exploited, the geothermal brine is not depleted—the fluids of the pool remain in the underground habitat to continue drawing heat from the virtually unlimited energy resource within the earth's core.

"There are geothermal pools in the South Coastal area which some believe may be adequate for the downhole heat exchanger to produce the necessary steam for turbines to provide electric energy."

6. San Diego:

Statewide Finding:

54. SOLAR

a. HIGH POTENTIAL FOR SOLAR ENERGY USE IN CALIFORNIA

Solar energy is unlimited in its supply and appears to pose the fewest environmental problems of any major energy source. It will make a significant contribution on a smaller scale, as applied to

heating and cooling individual buildings, and on a large scale, as applied to major electric power generation. The basic technology for solar energy applications exists; the principal remaining barriers to broad feasibility concern economics and engineering refinements to overcome the low energy intensity of sunlight, its daily seasonal variability with weather and time, and the need for associated energy storage systems. There is also concern over the large land areas and fresh water for cooling that could be required for large-scale solar energy power stations. California is particularly well suited for development of solar energy because of its high number of hours of sunshine.

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast:
4. South Central:
5. South Coast: "The South Coast Region lies in a particularly favorable location for mean daily solar radiation. As measured in units of Langleys (Ly), for comparison, the data for Seattle is 300 Ly; Phoenix, 500 Ly; Los Angeles, 463 Ly; and South Coast coastal locations around 450 Ly."
6. San Diego: "The San Diego Region lies in a particularly favorable location for mean daily solar radiation. As measured in units of Langleys (Ly), for comparison, the data for Seattle is 300 Ly; Phoenix, 500 Ly; Los Angeles, 463 Ly; and South Coast locations around 450 Ly."

Statewide Finding:

54b. SOLAR ENERGY CAN HEAT WATER AND HEAT AND COOL
INDIVIDUAL BUILDINGS

Use of solar energy systems for heating and cooling individual buildings can reduce (1) the need for costly new generating facilities, (2) the adverse effects of fossil and nuclear fuel cycles, (3) consumption of non-renewable energy resources, and (4) the need for foreign energy imports. As many as 60,000 solar water heaters are believed to be in use in south Florida today, nearly all having been installed in the 1930s and 1940s, before the advent of all-electric living. They are also in common usage in several foreign countries, including Japan, Australia, and Israel. With minor engineering developments and relatively simple architectural modifications, solar energy could now be used in some areas of this country for both space and water heating at prices competitive with oil and gas furnaces. It is expected that commercially installed solar heating and cooling in single buildings will be in use in many parts of the nation by 1985 and will be common by 1993. It is possible that an intensive development effort could bring these dates five years closer. NSF/NASA predicted that ultimately solar energy could supply 35 per cent of the nearly 20 per cent of the U.S. energy consumption now consumed for space conditioning, and that it will significantly reduce summer peak electricity demands. However, even if supported by energy storage systems, individual solar units may not be capable of supplying total energy needs for space conditioning and water heating. In addition to the solar units, builders may have to install some conventional supplemental equipment.

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast:
4. South Central:
5. South Coast: The South Coast Region directly correlated implementation of solar energy systems with savings in natural gas in their Region:

"In a large area of Southern California, over two-thirds of the natural gas consumed directly in space and water heating could be saved by the use of solar energy. On a month-to-month basis, the share of space and water heating provided by solar energy can be expected to range from 50 per cent to 80 per cent. Since solar energy can supply the major share of energy for space and water heating on a year round basis, utilization of solar energy can directly reduce the growth in baseload demand for natural gas. A corresponding reduction in requirements for new gas supply would also be indicated; or, alternatively more natural gas could be burned in the Region's electric generating plants."

The South Coast Region also adopted (and the San Diego hearing draft recommends) findings describing the potential contributions of two basic types of solar energy systems to household needs in that Region:

"Solar active (mechanical heat transfer) systems, that is solar systems using flatplate solar collectors with circulating fluid, can optimally provide up to 80 to 90 per cent of the total water and space heating needs of a house in the South Coast Region, with gas assistance as the back-up fuel.

"Solar passive (direct heat transfer), such as roof-pond systems, can optimally provide up to 100 per cent of the heating and cooling needs of a house."

6. San Diego: Same as South Coast.

Statewide Finding:

54c. ECONOMIC BARRIERS TO WIDESPREAD USE OF SOLAR ENERGY SYSTEMS

Solar energy systems for heating and cooling in new construction are now practical in both large commercial buildings and houses. Although the capital investment required for solar systems is higher than conventional systems (which increases marketing problems for home builders), any cost evaluation of heating systems should be done on a life cycle basis. Leased systems, now being studied, may overcome some of the marketing problems. The life cycle costs of a solar heating and cooling system in the new GSA building in Manchester, New Hampshire, for example, are estimated to be 25 per cent less than the costs of conventional electric resistance heating and electric compression cooling. The economic advantages of solar systems should improve as production techniques reduce the initial costs, and as the costs of conventional fuels increase. Economy and energy-efficiency can be further enhanced when:

- i. Both cooling and heating are accomplished through utilization of the solar energy collector;
- ii. The solar energy system components and the building heating and cooling systems are compatible with each other and are integrated in a total systems concept;
- iii. The buildings and the conventional mechanical and electrical systems are initially designed and constructed to conserve energy.

Conversion of existing houses to solar energy is more problematical. No more than about 35 per cent of existing houses can be retrofitted to solar energy because of shading by other buildings or

trees, or because building orientations or roof angles are not suitable for collectors. Retrofitting of older houses with solar systems would be difficult to justify on a life cycle cost basis because of the shorter remaining life of the building.

One of the major obstacles to near-term implementation of solar energy systems is the present lack of an effective delivery system (design, production, marketing, and installation skills) at the scale needed for a significant percentage of new construction to incorporate solar assisted water and space heating. However, such a delivery system is now beginning to appear in California: several corporations have undertaken programs for production and marketing solar units. With some governmental encouragement, the delivery system necessary for broad implementation of solar systems could be available within a few years.

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast:
4. South Central:
5. South Coast: The South Coast added a finding reflecting the costs of flat plate collectors in its Region:

"Cost per square foot (pfs) of a flat plate collector can vary considerably and is sometimes quoted as \$6.00 to \$12.00 pfs, which does not include shipping, insurance, or installation. Now, with more manufacturers considering mass production of collectors, lower prices can be anticipated."

The South Coast Region also elaborated on what constitutes an "effective delivery system" in its Region, and on the present progress toward such a system.

"In the South Coast Region, an effective delivery system does not yet exist that is capable of supplying the design, technical, production, and installation skills at the scale needed for a significant percentage of new construction to incorporate solar assisted water and space heating. However, such a delivery

system is beginning to grow and has a high probability of reaching the needed scale between 1975 and 1978, especially if the Commission adopts a policy requiring the installation of solar heating on all single and multiple housing units in the permit zone prior to January 1, 1977, and throughout the coastal zone subsequent to adoption of the plan by the legislature.

"There is presently more delivery system capability for active solar systems using flat plate solar collectors than for proprietary passive roof pond systems which are not yet commercially available."

"If 10 per cent of annual new construction starts were capable of economically incorporating solar energy systems, that could be considered a reasonable indicator of the existence of an effective delivery system."

6. San Diego:

Statewide Finding:

54d. INSTITUTIONAL BARRIERS TO WIDESPREAD USE OF SOLAR ENERGY SYSTEMS

Other barriers to wide use of solar systems are institutional. The building and real estate industries are slow to adopt and promote any new device that raises capital costs even if long-term overall costs are lower; there are no published building design guidelines for solar energy utilization; and there are no known existing building code regulations for solar units. In addition, although some electric utilities have made low level research commitments to development of individual solar units, there has until recently been little or no serious commitment from electric utilities, State and county energy planners or legislators to this application of solar energy. The Los Angeles City Council has begun a program of solar energy investigation and development, and as an initial step will heat municipal swimming pools with solar energy.

New legislation is needed to encourage the use of solar energy systems. In 1974 the State of Florida passed into law a measure

directing that "no single family residence shall be constructed within the state unless the plumbing therein is designed to facilitate future installation of solar water heating equipment." The Florida legislature is also considering legislation that would set standards for testing and certification of solar systems (SB 700). Arizona has enacted a law (SB 1231) which allows a state tax deduction on solar equipment to be amortized over five years. And Indiana has passed legislation (Public Law 15) to exclude solar systems from property tax assessment.

"Sun rights legislation" is needed to ensure user's access to solar radiation free and clear of potential obstructions on contiguous property. Appropriate regulations must consider the shadows, angles, and orientation of buildings varying with the time of day, the season, climatological conditions, and the slope of the building site. Setback regulations in zoning codes are precedents for sun rights laws. A program to provide public information concerning cost, availability, and performance characteristics of solar energy systems is essential to encourage the use of solar energy.

Regional Amplification: None.

Statewide Finding:

54e. LARGE-SCALE ELECTRICITY GENERATION FROM SOLAR ENERGY

The full potential of solar energy can be realized only after large-scale generation of electricity from solar energy becomes technically and economically feasible. Steam-electric systems based on the initial conversion of solar energy to heat have yet to be built on any but the smallest scale, and the necessary technology for

large-scale plants, though well understood theoretically, has not been adequately demonstrated on a commercial scale. The principal problems scientists and engineers face is making solar-generated power economically competitive with other electric power sources. This will require further engineering developments. The constraint of high initial costs may, without government encouragements, delay the commercial testing of large-scale solar-thermal power generation until 1990, although unforeseen and unprecedented rises in fossil fuel prices since mid-1973 have suddenly made solar-thermal power significantly more competitive.

Regional Amplification: None.

Statewide Finding:

54f. SOUTHEAST CALIFORNIA HAS CONSIDERABLE SOLAR
POTENTIAL FOR LARGE PLANTS

Solar collecting equipment for large-scale solar-thermal plants can be centralized for commercial production of power only in areas with high annual sunlight-hour values. Much of southern, and particularly southeastern California, receives as much solar radiation and annual sunshine—up to 4,000 hours per year—as any other area in the U.S.

Regional Amplification: None.

Statewide Finding:

54g. AMOUNT OF LAND NEEDED FOR SOLAR-THERMAL
POWER PLANTS SUBSTANTIAL

The main environmental concern about large-scale solar-thermal power plants is the commitment of many square miles of land to collecting surfaces. NSF/NASA estimates that at 20 per cent efficiency a 1,000 Mw solar generating plant—about the size of the nuclear power plant units being built today—will require about 15 square miles or 9,600 acres of land. It is difficult to compare this with the amounts of land required by different methods of electrical energy generation because of the extreme diversity of the fuel extraction, transport, and generation methods involved. The 2,000 Mw coal-burning plant in the Four Corners Area, for example, will require the strip mining of 40 square miles of land for fuel during its operating lifetime. Similar comparisons could be made to land use requirements of other energy sources such as oil fields, hydroelectric reservoirs, etc., with due recognition of the multiple land use possible with such projects. Although the commitment of land for solar power generation purposes alone may seem significant, when total land use for all aspects of electricity production from other sources is considered, this quantity is not significantly disproportionate. Improved technology resulting in better efficiency would significantly reduce land use.

Regional Amplification: None.

Statewide Finding:

54h. WASTE HEAT DISPOSAL A PROBLEM FOR SOLAR-THERMAL POWER PLANTS

The potential for waste heat disposal problems would still be present in large-scale solar-thermal power plants. Such plants would still require cooling water, and this may be problematical since the optimal locations for solar plants will be arid. There is also some concern that large-scale solar collecting surfaces may upset local thermal balances, but the consequences, if any, are thus far expected to be quite small.

Regional Amplification: None.

Statewide Finding:

54i. SOLAR CELLS AN ALTERNATIVE TO SOLAR-THERMAL POWER GENERATION

A second approach to production of electricity from solar energy involves the use of solar cells. Solar cells convert sunlight directly into electricity without the need for intermediate thermodynamic cycles. Solar cells exist already; they have been used to power manned orbiting spacecraft. Presently, however, solar cells are too costly, too inefficient, and not sufficiently durable to have practical application for large-scale commercial electricity production. The use of solar cells to provide energy is viewed by some sources—including most State agencies, electric utilities, and national petroleum companies—as having little commercial feasibility over the next 15 years. Others believe, however, that solar cell technology is sufficiently far advanced that mass production of rooftop units for new housing could become technically and

economically competitive within three to five years, and that within ten years use of solar cells to power new houses may be common.

Regional Amplification: None.

Statewide Finding:

54j. SOLAR CELLS HAVE A VARIETY OF POSSIBLE USES

Proposals for using solar cells to generate electricity include (a) a proposal to cover large land areas with solar cells and the necessary collecting surfaces; (b) a proposal to establish a huge station, orbiting continuously in sunlight, and beaming power to two six-square mile receiving antennas on earth; and (c) a proposal to install individual rooftop solar cells that are interconnected with existing regional transmission networks, into which are fed any amounts of solar-generated electricity in excess of those required by the individual building.

Regional Amplification: None.

Statewide Finding:

54k. OCEAN THERMAL GRADIENTS CAN GENERATE ELECTRICITY;
CALIFORNIA POTENTIAL IS SMALL

One approach to production of energy from solar energy involves the use of ocean thermal differences to generate electricity for cable transmission ashore or for electrolytic production of hydrogen for pipe transmission ashore. The difference in temperature between the sun-warmed ocean surface and the cold ocean depths can be utilized

in a heat engine to produce low pressure steam to drive a turbine and produce electricity. However, because ocean waters off the California coast offer insufficient temperature differences, thermal gradient technology is not expected to make a contribution to California's future energy mix.

Regional Amplification: None.

Statewide Finding:

55. WIND

- a. Wind Potentially Important Energy Source. Wind energy is pollution-free, involves no fuel costs, and is non-depletable. If wind were actively promoted, and its problems solved, it could become an important auxiliary energy source. Various sources (e.g., NSF/NASA, Heronemus, Oregon Study) indicate that by the year 2000 wind energy could provide from 1 to 20 per cent of total national electrical energy needs. Thus far, however, no California public agency or electric utility forecast for future California energy supply includes any contribution from wind energy.
- b. Potential for Individual Windmill Units. Individual windmill generating units can make single buildings or small building clusters wholly or partially energy self-sufficient, thereby reducing overall electricity demand and consumption of non-renewable fossil fuels. Because they are no longer manufactured in quantity, individual unit capital costs (including battery storage) are presently high—though fuel costs, of course, are negligible.

- c. Problems Must Be Solved. Wind is a problematic source of electrical energy. It is erratic, low in average velocity and density, and variable in direction, and its energy is not easily stored on a large scale. Wind will make its most significant contributions to energy needs only when systems have been developed that can efficiently and inexpensively convert wind to electricity or other energy forms on a very large scale. Scientists believe that these problems are not technologically difficult.
- d. Environmental Concerns. The principal environmental concern about wind generation is with the appearance and noise of both individual and large-scale wind generation equipment in scenic coastal areas. Offshore locations could mitigate these concerns.
- e. More Wind Research Required. Additional wind research is required to establish the ultimate potential of California's coastal and inland wind resources. However, it is probable, based on other studies, that the California coastal zone would be a suitable location for use of single household or small community windmill units if pleasingly designed.

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast:
4. South Central:
5. South Coast: With regard to exploring the near-term possibility for small-scale wind-powered generators in the South Coast Region, the Commission found:

"Additional research, development, and demonstration programs are required to establish the ultimate generating potential for the South Coast Region. Demonstrations of large windmills might be combined on offshore oil platforms or on, for example, the Los Angeles/Long Beach Harbor breakwater."

6. San Diego:

Statewide Finding:

56. SOLID AND LIQUID WASTES

- a. Solid Wastes A Potentially Important Energy Resource. Solid wastes represent still another resource with substantial energy potential already exploited in other parts of the world, although recycling of suitable waste material may result in greater overall benefits to society from both an energy and resource preservation point of view. Half of the 75 million tons of solid wastes produced annually in California is collectable, and that refuse, a SRI study for PG&E concluded, could furnish about 10 per cent of the fuel oil needed by utilities at prices competitive with other power generation fuels, or could furnish gas for direct use by residential and commercial customers. Despite the significant potential of solid waste conversion for reducing the demand for depletable fossil fuels and nuclear expansion in California, few efforts have been made to realize the potential. A 1972 act establishing the State Solid Waste Management Board may help overcome institutional problems that partially impede development of State and county programs for the recovery of energy—and materials—from solid waste. There are four principal methods of energy recovery from wastes, as described below.

b. Incineration Already in Use in Two Major American Cities.

Incineration, or direct burning, of refuse can produce recoverable heat for production of steam, which in turn can be used in power plants (St. Louis), in industry, and in local heating and cooling systems (Nashville). Municipalities typically incinerate urban refuse only to reduce its volume for easier and more economical disposal. Incineration systems can present air pollution problems.

c. Pyrolysis Pilot Project Proposed for El Cajon. Pyrolysis is a

flexible method by which separated, shredded, treated wastes are heated in a kiln to cause their chemical decomposition into various low heat value gaseous or liquid hydrocarbons. These can be utilized with other fuels in conventional fossil fuel plants. SRI expects commercial systems will be available in 1976-77. An EPA-funded pilot plant proposed for El Cajon would process about 200 tons of solid wastes per day, with each ton ultimately producing one barrel of low heat value oil. San Diego Gas & Electric would burn the oil either directly or mixed with No. 6 fuel oil to produce steam for electric power generation. A Baltimore pilot project newly in operation will convert 1,000 tons per day into gas for steam-generation. A Seattle project will use pyrolysis to convert solid wastes to methanol for use in the city's fleet of 1,200 vehicles.

d. Hydrogenation Most Efficient System for Oil from Wastes. Hydro-

genation involves adding steam carbon monoxide and a catalyst to organic wastes in a pressurized container, and heating it to cause chemical reduction into a heavy paraffinic oil and other hydrocarbon forms. A system using dry waste solids can

produce as much as two barrels of oil per ton of solids—twice the yield of pyrolysis systems. Construction costs will be high, the economic feasibility of such projects is unevaluated, and technical problems remain, but several pilot plants are in operation or are planned with commercial application expected by 1980.

- e. Bacterial Conversion Can Produce Methane Gas from Solid and Liquid Wastes. Bacterial conversion is a process using anaerobic bacteria (which flourish without free oxygen) to decompose organic wastes to produce a mixture that is 72 per cent methane—the principal component of natural gas, a traditionally "clean", easily transportable form of energy. A ton of dry organic waste can produce 10–20,000 cubic feet of methane. Commercial recovery of methane is feasible at sanitary land fills.

Sanitary engineering has long utilized anaerobic digestion but use of this process to maximize methane recovery has received little or no attention. Methane recovery from the secondary treatment of liquid wastes can make an important incremental contribution to natural gas supplies.

Regional Amplification: None.

Statewide Finding:

57. TIDAL

Although the total potential energy in the world's tides is enormous, and represents a nondepletable source of energy, present technology can only economically convert tidal energy to electricity

where tidal ranges are very large and inlet mouths are small enough to make damming for a hydroelectric plant feasible. Such conditions are rare, and exist nowhere in the U.S. except in Maine and Alaska. The damming of an entire bay or estuary for a tidal hydroelectric generating plant has severe environmental and ecological effects. Unless there is a radical redesign of existing technology for the conversion of tidal energy California should not expect tidal energy to make a contribution to meeting its energy requirements.

Regional Amplification: None.

Statewide Finding:

58. NUCLEAR FUSION

Nuclear fusion differs from nuclear fission in that energy is released through fusing the nuclei of two atoms, rather than through splitting atoms. Nuclear fusion would use as basic fuel heavy hydrogen, which is limitlessly available in seawater. The various economic, environmental, and safety advantages expected from nuclear fusion appear to make it a significantly more viable long-term energy alternative than fossil fuels or nuclear fission. Even with greatly increased research and development activity, however, most experts believe that various theoretical and technical problems still blocking the path to electricity from fusion are so enormous that fusion probably will not become a commercial reality or a significant factor in meeting California or national energy needs within this century.

Regional Amplification: None.

Statewide Finding:

59. METHANOL

- a. Methanol Provides a Versatile Fuel for Immediate Use. Methanol, or methyl alcohol, constitutes an alternative fuel form whose widespread use could immediately help to solve both energy supply and pollution problems.

Methanol is a colorless, odorless liquid which can be made from practically any other fuel—natural gas, petroleum, coal, oil shale, wood, and farm and municipal wastes—giving methanol practically unlimited flexibility in utilizing various energy sources as the economy and conditions dictate. Coal is a likely primary source for methanol production in the next few decades. Methanol production from sewage, farm animal wastes, and solid wastes offers great potential, however, not only for producing fuel but for reducing the Nation's waste disposal problems.

- b. Methanol Economically Competitive Fuel; Easily Implemented into Present Fuel Economy. The costs of manufacturing methanol vary according to the accessibility and supply of the primary fuel and the costs of producing methanol from it. A 1972 AEC report estimates the cost of producing methanol from lignite, coal, and natural gas to be slightly higher than the costs of producing gasoline from crude oil. Since 1972, however, the cost of crude oil, particularly from foreign sources, has increased dramatically, thereby making methanol production comparatively more economical.

Methanol use would not require any major changes in current technology to accommodate its integration into the present economy.

It can be easily stored in tanks in the same manner as conventional fuels, and can be shipped or piped, as can conventional petroleum products. More importantly, up to 15 per cent methanol can be added to commercial gasoline in cars now in use, without it being necessary to modify the engines. Some carburetor adjustment would be required. This methanol-gasoline mixture results in higher octane ratings (thus reducing the need for lead), improved economy, lower exhaust temperatures, lower emissions, and improved performance. Tests have shown that engine conversions to accommodate 100 per cent methanol, which cost about \$100 per vehicle, result in one-twentieth the amount of unburned fuel and one-tenth the amount of carbon monoxide released to the atmosphere compared to burning gasoline. Furthermore, methanol use would eliminate the need for catalytic treatment of exhaust. Even greater economy and performance could be expected from engines designed specifically for the use of methanol.

- c. Methanol in Electric Power Generation. A potential use of methanol is for electric power generation, particularly in gas turbines. As recently reported by the American Chemical Society, methyl fuel, when compared with No. 5 fuel oil and natural gas in a full-scale boiler demonstration, demonstrated that: (1) no particulates were released from the stack; (2) the amount of NOx in flue gases was less than the amount emitted from natural gas and much less than that emitted from the oil; (3) the CO concentration was less than that from oil and gas; (4) no sulfur compounds were emitted; (5) the amounts of aldehydes, acids, and unburned hydrocarbons produced were negligible; and (6) soot deposits in the furnace from previous oil firing were burned off with methyl fuel, thereby

allowing higher heat transfer rates and higher efficiencies.

- d. Problems in the Use of Methanol. The principal drawback to the immediate use of methanol is its availability. Even though the technology for initial production and use on a large scale exist, the past low prices of crude oil have not provided the incentives necessary to discontinue our reliance on petroleum fuels. As the price of crude oil accelerates, however, the use of methanol becomes more and more feasible.

The use of methanol in automobiles will require larger fuel tanks, since specific fuel consumption of methanol is higher on a weight and volume basis than gasoline. However, specific energy consumption per mile will be lower because higher compression ratios and simpler pollution controls can be used.

The storage of methanol mixed with gasoline may present some problems because methanol is much more soluble with water than is gasoline; where condensation will form in gasoline storage tanks (sometimes causing corrosion), methanol will absorb the water, keeping the tanks dry. Problems may arise in the storage of large quantities of methanol mixed with gasoline, unless the tanks are dried out prior to injection. Distribution systems for methanol fuels must also be more water-free than existing gasoline distribution systems.

A further problem is the corrosive effect of methanol upon some kinds of metals used in fuel distribution and storage facilities (including auto fuel tanks).

Regional Amplification: None.

Statewide Finding:

60. ENERGY STORAGE TECHNIQUES AND APPLICATIONS

a. Energy Storage Increasingly Important in Energy Systems Planning.

Energy storage is becoming increasingly important in planning energy systems that minimize the environmental impact of meeting energy demand. Energy storage techniques can be applied to enable longer periods of operation for base load power plants and thereby reduce the requirement for additional generating facilities; to change energy from one form to another for more economical, convenient, or environmentally clean transmittal or application; to make practically feasible such alternative energy sources as solar, wind, tidal, and thermal gradients, which produce energy inconsistently or at a very slow rate.

b. Pumped Hydro Storage an Old Idea with Modern Application.

Pumped hydro storage permits consistent and efficient high capacity operation of base load power plants, i.e., improves the load factor of such plants. At the same time, pumped hydro helps reduce the need for utilities to bring less efficient plants on line during peak demand periods, or to build additional fossil fuel plants specifically to provide for peak period demand increments. Pumped hydro storage is most frequently discussed for use in conjunction with large nuclear fission plants, and is expected to have a significant role in California.

c. Fuel Cells Becoming a Reality for Large-Scale Energy Storage and Conversion.

Fuel cells represent an energy conversion technique frequently included in "energy storage" discussions.

Energy is "stored" as the potential of chemicals to react to produce electrical energy. Fuel cells can produce electrical energy at higher efficiencies (40-50 per cent) than conventional fossil fuel fired power plants, and without the air pollution and waste heat problems presented by heat engines. Land use requirements will be far less than those of conventional plants. Numerous technologies for using fuel cells as central power stations are presently under investigation in the United States. Thirty pilot plant units have already been installed in various localities throughout the nation. Although the California Resources Agency reports that fuel cells are not expected to make a significant contribution to California's total energy market before 1985, Southern California Edison publicly reported in 1974 that, contingent upon successful testing of a pilot fuel cell in 1976 or 1977, it may have as many as 15 fuel cell units of 26 megawatts (Mw) capacity each on line by 1981.

d. Storage Batteries Important in Wind, Solar Energy Systems.

Storage batteries, like fuel cells, deliver electric power by electrochemical reactions. Research continues for ways to maximize storage capacity, the rate of energy delivery, and the length of battery life. Storage batteries are important aspects of wind and solar energy systems for individual buildings.

e. Flywheels May Have New Uses. Flywheels, which store energy in the form of mechanical energy, represent one of the oldest energy storage methods known to people. Advanced research on optimal design configurations for flywheels, and new developments in materials, have advanced the possibilities of using flywheels in a broad range of energy systems functions.

Engineers believe energy stored in flywheels could be used to power automobiles. The San Francisco Municipal Railway recently announced plans for construction and operation of two experimental buses that will operate entirely on energy stored in flywheels.

- f. Hydrogen an Excellent Medium for Storing Energy. Hydrogen is an easily transportable and convertible energy form and is an excellent medium for storing energy originally in other forms. Hydrogen gas can be transmitted over long distances in pipelines efficiently and inexpensively. Hydrogen is a fuel gas that can be burned directly with almost no pollution, so it might be used as a substitute for natural gas to fuel electric power generators, to power automobiles, or to produce heat for residential, commercial, or industrial purposes.

Regional Amplification: None.

Statewide Policy:

10. ENCOURAGE CONSIDERATION OF ALTERNATIVE ENERGY SOURCES AND ENERGY SELF-SUFFICIENT DEVELOPMENT

To insure adequate supplies of energy, while minimizing the adverse environmental impacts of conventional energy production and consumption and conserving fossil fuel resources:

- a. The agency designated to carry out the Coastal Plan shall require that every application for a major energy installation include detailed evaluation of alternative methods for providing the same amount of energy to customers.
- b. The State Legislature should enact laws providing tax incentives for building owners or developers to install low- or

non-fossil fuel energy systems, which might include solar-assisted water and space heating, solar-assisted cooling, nocturnal cooling, evaporative cooling, heat pumps, absorption refrigeration, photovoltaic electrical energy generation, total energy systems with waste heat recovery, anaerobic sewage generation of methane gas for energy use, windmill electric generators, fuel cells, energy storage systems, and other feasible alternative energy systems. Such tax incentives might include, for example, investment credits to owners of buildings equipped with such systems, or a reduced property tax rate on buildings so equipped. The aesthetics of visually prominent systems shall be attractive and in keeping with sound principles of appearance and design.

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast: Adopted recommended "guidelines" for energy conservation identical to amplifications presented below for South Coast.
4. South Central:
5. South Coast:
 - "c. So as to evaluate the long-term economics, as part of their submission, all proposed developments in order to qualify for the tax benefits shall be required to submit a life-cycle present-value cost analysis of their proposed alternative systems which indicates the internal rate of return, computed at an interest rate equivalent to the prime interest rate on the subject type of construction.
 - "e. This policy shall be implemented in coordination with any similar programs of the municipal energy utilities.

"f. A long-range phased program for converting existing structures to low- or non-fossil fuel using energy systems shall be formulated and implemented by the successor agency."

6. San Diego:

Statewide Policy:

11. IMPLEMENT USE OF SOLAR-ASSISTED HEATING AND SOLAR-ASSISTED AND NOCTURNAL COOLING *

To decrease fossil fuel and electrical energy consumption, and thereby reduce the need for large new energy supply facilities, the following measures are recommended to the State Energy Commission for its consideration in developing statewide programs for implementing alternative technologies:

- a. Solar-assisted water and space heating systems and solar-assisted or nocturnal cooling systems (where buildings require cooling systems) shall be required on all new or substantially remodeled single or multiple-unit residential structures; on commercial, institutional, and industrial structures; and on heating systems for such facilities as swimming and hydro pools. This policy shall go into effect statewide when the State Energy Commission has determined, after appropriate public hearings, that an effective delivery system exists in California—that is, that the professional expertise in design, manufacture, installation, and maintenance of solar-assisted heating systems or solar-assisted or nocturnal cooling systems capable of meeting at least 50 per cent of the building's projected heating or cooling needs with a high degree of reliability, exists in the State, and that the necessary hardware is commercially available. Such

* Asterisk denotes a policy that is primarily a recommendation to another agency.

a determination should take into account the varying meteorological conditions throughout the State.

- b. In conjunction with this policy, the State Energy Commission and the State Legislature should (a) set testing and certification standards for solar systems; (b) undertake a program that will lead to retrofitting with solar heating systems existing buildings and swimming or hydro pools that use gas and/or electricity, wherever technically and economically feasible; and (c) require that local government agencies adopt "sun rights" ordinances relating to building setbacks, heights, bulk, orientation, air rights, densities, and landscaping, to ensure that owners of buildings or property will have the benefits of free and clear access to sun radiation on existing or potential collector systems at all times of the year.

If for any reason a significant program for implementing solar-assisted heating and cooling, and nocturnal cooling, is not in effect statewide by January 1, 1977, then, because of the need to alleviate the adverse effects of new fossil fuel and nuclear facilities upon the coast, the agency designated to carry out the Coastal Plan ("the coastal agency") shall make the determination, after public hearing, as to whether an effective delivery system for the heating and cooling systems in question exists; and if such a delivery system is found to exist, the coastal agency shall apply the foregoing policies to all development proposed in its jurisdiction.

Until the Energy Commission or the coastal agency has determined that an effective delivery system does exist, the coastal

agency shall condition all new residential and commercial structures proposed in the coastal agency's jurisdiction by requiring that they (1) have the structural and design capability to later incorporate a flat plate or other type of solar collector system capable of reducing by 50 per cent the gas or electricity used for water and space heating; (2) be built according to site plans that guarantee solar collectors clear and optimum exposure to the sun; and (3) shall install the solar-assisted water and space heating systems upon the order of the coastal agency, after a public hearing where it has been determined that a solar-assisted system with a life-cycle cost lower than conventional systems is available; such solar systems shall include adequate energy storage capability to provide heat during periods of abnormally severe weather conditions, to prevent unnecessarily high peak loads on conventional generating facilities caused by use of conventional back-up systems.

In the case of solar-assisted heating and cooling systems, this policy shall not apply to any residential, commercial, or industrial building (i) where, because of the site conditions and adjacent existing or possible obstructions, over 50 per cent of the potential collector surface would be in shade between the hours of 10 a.m. and 2 p.m. on the Winter Solstice (December 22); (ii) where an applicant can show that a solar-assisted system could not be incorporated in his project within a reasonable period of time; or (iii) where an applicant can show that the best practical and available solar system will not provide a lower life cycle cost than the proposed conventional system at an interest rate equivalent to the prime interest rate on the subject type of construction.

Regional Amplification:

1. North Coast
2. North Central:
3. Central Coast: Same as South Coast, below.
4. South Central:
5. South Coast: "The Commission recommends that the State Legislature require that local governmental agencies adopt sun rights statutes to ensure that owners of buildings, or property upon which buildings could be built that could incorporate solar energy collection systems, will have the direct or be guaranteed the indirect benefits of free and clear access to sun radiation on their existing or potential collector systems at all times of the year.

"Sun rights statutes should amend ordinances of local governments relating to building setbacks, heights, bulk, orientation, air rights, densities and landscaping.

"The Energy Commission (AB 1575) should formulate model sun rights laws."
6. San Diego:

Statewide Policy:

12. DETERMINE POTENTIAL AND SPEED SOLUTIONS TO PROBLEMS OF GEOTHERMAL, WIND, SOLAR, SOLID WASTE, SEWAGE, AND METHANOL AS ENERGY SOURCES

To decrease consumption and demand for fossil fuel generated energy, and thereby lessen the impact of fossil fuel energy supply facilities on the California coast, the State Energy Commission, the California Public Utilities Commission, the State Legislature, and/or where appropriate, such State agencies as the Division of Oil and Gas, the Geothermal Resources Board, the Solid Waste Management Control Board, should (a) undertake a comprehensive research and development program to find early solutions to technological, environmental, economic, institutional, and legal problems presently hindering development of the large geothermal

resource present in California; (b) conduct research to determine the potential for large-scale commercial and single-building solar generation and to analyze the problems impeding early development of that potential, and actively promote development and implementation of solar conversion technologies; (c) conduct research to determine the potential for large-scale commercial and single-building wind generation in the coastal zone and to analyze the problems impeding early development of that potential consistent with other coastal policies, including Appearance and Design element policies and actively promote development and implementation of wind conversion technologies; (d) develop and implement an intensified program for funding research, development, and widespread implementation of projects for recovering energy and materials from the large amounts of solid wastes (including animal wastes) produced in California; (e) encourage recovery of the energy value of sewage; and (f) investigate the potential for utilizing methanol in a broad variety of applications as a more efficient, less polluting fuel form to substitute for other conventional hydrocarbon forms.

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast:
4. South Central:
5. South Coast:
6. San Diego: "Encourage Use of Methanol. To increase fuel efficiencies, reduce air pollutants and decrease the demand for additional petroleum production, the Commission shall:

- "a. Recommend that the Energy Resources Conservation and Development Commission investigate the feasibility of widespread use of clean fuels such as methanol and methods to promote their use;
- "b. Require applicants requesting new or expanded fossil fuel power plants to demonstrate that the plant's equipment is capable of easy conversion to such clean fuels as methanol, when they become available, or findings of fact that methanol fuel is not and will not be practical for use at the particular plant;
- "c. Require applicants of new or expanded refineries and major fuel marketing terminals to provide for the production and storage of methanol, unless it can be demonstrated that any problems which may occur from such a policy offset the added benefits of improved air quality and fuel efficiencies;
- "d. Recommend that the Legislature consider tax incentives to promote the use of methanol and or other clean fuels produced from renewable resources, and that appropriate means are provided to implement policies (b) and (c) on a statewide basis."

SECTION IV: POWER PLANT SITING

Statewide Finding:

61. NEED FOR POWER PLANTS

Fewer fossil fueled and nuclear power plants may be needed in the future if energy conservation programs are successfully implemented and alternative energy sources become commercially available. Under reasonable assumptions regarding demand growth and assuming 2,000-6,000 megawatts per site with some expansion at existing sites, 7-20 major new fossil or nuclear power plant sites may be needed by the year 2000 for California. With a particularly vigorous and successful effort to develop alternative energy sources and implement conservation measures, it is possible that as few as three to nine new fossil or nuclear power plant sites may be needed statewide (see Electricity Demand Findings). With successful electricity conservation measures, the lower ends of these ranges may prove attainable.

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast:
4. South Central:
5. South Coast: "Projected Need for Additional Coastal Power Plants. It is anticipated by the Commission that adopting the energy conservation policies for both the coastal zone and inland areas of Southern California will reduce the future growth in the consumption of electrical energy in the areas served by generating plants in the Region's coastal zone to such levels that little, if any,

additional base load generating capacity above that already approved for construction will be necessary to meet the requirements of consumers and industries in the coastal zone of the South Coast Region until at least 1985 or 1990."

6. San Diego:

Statewide Finding:

62. ALTERNATIVE ENERGY SOURCES WILL ALSO REQUIRE SITES

Development of alternative energy sources such as solar, geothermal, wind, etc., will also require sites for power generation facilities. However, only wind may require large-scale facilities sited on the coast. Solid waste processing plants could theoretically be sited in the coastal zone, but are not coastal-dependent. Geothermal and large-scale solar plants will be located inland. Large-scale wind generation units would present aesthetic and land use problems, though design specifications are uncertain at this time. Small-scale or building use of solar or wind energy in the coastal zone would occur as part of building construction, and present few significant adverse environmental impacts.

Regional Amplification: None.

Statewide Finding:

63. HISTORIC USE OF COASTAL LOCATION

Though a variety of factors influence siting decisions, power plants have traditionally been located near the coast in order to make use of the free, abundant and nondepletable waters of the ocean and to be close to the major load centers of the State.

Regional Amplification:

1. North Coast: "Proposed thermal power plants or power plant expansions in the 3-county area include the seasonal location of three 17 Mw mobile gasturbines at Eureka, the 10 Mw solid waste fueled steam generator at Eureka, and a 20 Mw wood residue fired steam generator planned for construction near Fairhaven by a lumber company.

"The State Energy Resources Conservation and Development Commission may exempt, from its power plant site and facilities certification procedures, thermal power plants with a generating capacity of up to 100 megawatts if such plants will not result in substantial adverse impact on the environment or energy resources, and if the added generated capacity is not substantially in excess of the Energy Commission's forecast of electrical energy demands. All or most of the above proposed power plants should qualify for such exemption.

"The Pacific Gas and Electric Company (PG&E) has not permanently withdrawn its proposal for a major nuclear power plant on its property near Point Arena."

2. North Central:
3. Central Coast:
4. South Central:
5. South Coast: "Use of Coastal Sites. Although a variety of economic and environmental factors have influenced past siting decisions, power plants have generally been located near the coast in order to make use of abundant and low-cost supplies of cooling water from the ocean and to be close to the major load centers in the Region. The environmental impacts of the existing coastal power plants on the air, water and marine life resources of the Region's coastal zone are substantial, as are the aesthetic impacts of the large plants. In addition, use of a coastal site for a power plant (particularly a nuclear power plant) constitutes, for all practical purposes, a major irreversible commitment of coastal zone resources generally inconsistent with section 27302(d) of the Act."
6. San Diego:

Statewide Finding:

64. POWER PLANT CONCERNS

Nuclear Power Plants. The major concerns involved in nuclear power plant siting on the coast are:

- a. Safety hazards resulting from the high potential for strong earthquake events in much of the coastal zone (see Geology Element) or from the potential for serious accident (e.g., loss of coolant) that could permit escape of radioactive materials.
- b. Proximity of nuclear power plants to population centers on the coast.
- c. Effects on the productive nearshore marine environment of entrainment and thermal or chemical discharges from the cooling systems.
- d. The impact of plant and associated structures, such as switchyards and transmission lines, on scenic natural areas.
- e. Alteration and permanent use of sizable quantities of land for the plant itself, cooling towers, switchyards, transmission lines, and transportation and storage facilities.

Fossil Fuel Plants. The major concerns involved in fossil fuel power plants on the coast are:

- a. Public health and safety hazards from air pollution and the transportation of volatile fuels.
- b. Effects on the marine environment, similar to those encountered with nuclear plants.
- c. Impacts on scenic and natural areas.

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast:
4. South Central:
5. South Coast: "Environmental Impacts of Power Plants. The environmental impacts of large-scale (more than 500 Mw) power plants are substantial. A partial listing of the major effects is:

"a. Nuclear power plants pose a safety hazard to population centers in the Region due to the danger of damage to the facilities and resulting release of radioactive material to the environment where biological magnification occurs caused by an operating accident, military or terrorist attack, or seismic activity. The transportation and storage of radioactive nuclear wastes can also result in radioactive exposure hazards to the public.

"b. Heated water discharged into the ocean has a disputed, and still somewhat unknown effect of marine organisms. The substantial numbers of marine organisms (including fish, fish and other larvae and eggs, and plankton) in the water taken into the plant may be killed or otherwise harmed. The available evidence indicates that the use of ocean waters to cool power plants could hinder the preservation and restoration of marine resources mandated by the Act. When the available evidence is inconclusive, it is the policy of the Commission to avoid any further commitments of coastal zone resources until reasonably conclusive evidence is available that indicates that the development is consistent with the objectives of the Act.

"c. Power plants alter and visually impact natural scenes.

"d. With respect to the emissions of fossil fuel plants, the California Air Resources Board has classified the coastal zone of the South Coast Region as being in a 'critical air basin'.

"Any significant increase in any of these impacts would not be consistent with the objectives of the Act."

6. San Diego:

Statewide Finding:

65. AVAILABILITY OF COASTAL SITES FOR NUCLEAR POWER PLANTS

Very few coastal sites are suitable for nuclear power plants, compared to a much larger number of potential inland sites. The radiation hazard potential of nuclear power plants requires that the utmost care be exercised to site them away from areas of seismic risk and from population concentrations. Few coastal areas meet these criteria, while the areas of the State that offer the least seismic risk are located inland. Studies done by the Rand Corporation and the Environmental Quality Laboratory of the California Institute of Technology concluded that only about 50 miles of coastline are suitable for nuclear power plants. Using less conservative assumptions about safety, a study conducted for the California Resources Agency concluded that 140 miles of coastline might be suitable, but no coastal areas were considered optimal from the standpoint of safety compared to other areas of the State. The California utilities are presently considering about 12 new coastal sites for power plants between the present time and the year 2000.

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast:
4. South Central:
5. South Coast: "Coastal Site Availability. There are currently no potential coastal sites in the South Coast Region which...are suitable for the construction of large (greater than 500 Mw) new nuclear...power plants given the objectives of the Act.

- a. "There are no coastal sites in the Region which would currently meet the Atomic Energy Commission's population density standards except for the western portion of Malibu, which has already been found not to meet the AEC's seismic activity standards, and the Channel Islands, which are areas of particularly great biological significance to the Region. In the event that the AEC or successor regulatory agency revises in the future either its population density or seismic activity standards, or new, safer, technologies are developed, the successor agency should review the suitability of any areas then meeting AEC or successor regulatory agency standards to determine if they would also meet the objectives of the Act."

6. San Diego:

Statewide Finding:

66. ADVERSE IMPACTS OF FOSSIL FUEL PLANTS ON AIR QUALITY

Fossil fuel plants in California are expected to be primarily oil-fired in the future because of the decreasing availability of natural gas. Oil-fired power plants represent large stationary sources of oxides of nitrogen and sulfur, and the problem of sulfur dioxide emissions will become particularly severe if low-sulfur fuels become unavailable. Though significant research and engineering efforts to reduce air pollutant emissions are continuing, fossil fuel plants at present do have a significant adverse impact on air quality, particularly in critical air areas where pollution levels are already exceeded, and in areas especially sensitive to air pollution, such as specialty agricultural and coastal recreation areas (see Coastal Land Environment Plan Element).

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast:

4. South Central:

5. South Coast: "Coastal Site Availability. There are currently no potential coastal sites in the South Coast Region...which...are suitable for the construction of large (greater than 500 Mw)...conventional fossil fuel power plants given the objectives of the Act.

- a. "There are currently no coastal sites in the Region which would be suitable for large-scale oil or gas fired power plants given present emissions control technologies. If technologies can be developed to reduce air emissions to levels found to be consistent with the objectives of the Act, the successor agency may review the potential sites proposed by the utilities. Other factors mitigating against coastal sites for these plants which the Commission finds are significant are (1) the visual impact of the height and bulk of the plants, (2) the need to minimize the use of ocean water for once-through cooling purposes, and (3) the acceptably small increase in per kwh costs if the plant is located in an inland area away from the fragile marine ecosystem.
- b. "The 'combined cycle' generating system, or a plant similar to Scattergood, when combined with wet or dry tower cooling is consistent with the Act if the individual plants (1) do not exceed 500 Mw in capacity, (2) are located in industrial zones, (3) are located not less than three miles from an existing thermal plant of more than 500 Mw capacity, (4) are designed to minimize their visual impact, and (5) meet the prevailing APCD emissions standards. These conditions will increase the per kwh costs of the plants; however, the Commission finds that the increase in costs is more than offset by the benefits of the reduction in environmental impacts.
- c. "Addition of waste heat boilers, and the associated generating equipment, to existing generating plants should be permitted if the Commission finds the environmental impacts of the incremental equipment to be consistent with the Act.
- d. "Sites for the more promising alternatives to present electric utility generating systems will be given full consideration by the Commission as they become feasible.

"Storage Capacity. With natural gas expected to be virtually unavailable to electric generating plants, the utilities must develop additional oil storage and transportation facilities if they are to economically serve the coastal zone generating plants."

6. San Diego: "Power Plant Fuel Requirements. Residual and diesel oil comprised approximately 58 per cent of San Diego's power plant fuel requirements for 1973, the remainder being natural

gas and nuclear fuel. By 1974, SDG&E foresees oil comprising 70 per cent of the system's fuel requirements, and by 1979, oil will make up 96 per cent of the SDG&E system requirements. As the supply and power plant use of natural gas tapers off, fuel oil will continue to play an increasingly important role, until at least 1980, when the San Onofre Nuclear additions and the Kaiparowitz coal-fired plants are scheduled to begin operation. Dependence on fuel oil should then gradually decrease, comprising about one-half the system's total fuel requirements by 1984 and steadily decreasing thereafter.

"In 1973, the SDG&E system burned about 6 million barrels of oil in the production of electricity, or approximately one-quarter of the County's total annual oil consumption. By the peak power plant oil consumptive year, 1979, SDG&E estimates over 20 million barrels of oil will be consumed in the production of electricity, more than a three fold increase since 1973. This increase results from a continued decreasing dependence on natural gas, a continued increase in the system's total fuel requirements, and a failure to bring alternative power sources in line to make up the natural gas deficit.

"Fuel oil for the SDG&E's system is imported exclusively by ship. Crude oil comes from various locations, most notably from Hawaii and the Cook Inlet of Alaska. Alaskan oil is refined in Long Beach before being shipped to San Diego. Tankers offload offshore the Encina power plant, and to a lesser extent, in the San Diego Bay and SDG&E's 24th Street facility.

"The San Diego APCD is charged with enforcing the U.S. EPA air emission standards for stationary sources."

Statewide Finding:

67. ADVERSE IMPACTS OF POWER PLANT COOLING SYSTEMS

The cooling systems of both fossil and nuclear power plants can have adverse environmental effects. Once-through cooling systems, of the designs now used in all existing coastal power plants, have multiple impacts on the marine environment and have potential for ecological damage caused by increased water temperatures, entrainment of marine life, and other effects as described in the Marine Environment Element. Redesign may reduce those impacts.

Evaporative cooling towers consume 25-40,000 acre-feet of water per year per 1,000 Mw, and release heat directly to the atmosphere.

Evaporative cooling towers may cause localized atmospheric changes (such as fogging) and drift (fallout of particles carried in water droplets) which under some conditions could be adverse; but these problems can be minimized or eliminated by modern engineering and strategic siting. Evaporative cooling towers using saltwater are becoming more feasible as drift eliminators are improved, reducing the danger of contaminating the surrounding land area. Such towers would eliminate many of the concerns over impacts to the marine environment, but would present the added problem of generating concentrated brines requiring disposal.

Dry cooling towers, which operate like a car radiator, and dry/spray towers, which add an evaporative system in combination with dry towers, require little or no water but are larger and more expensive than evaporative towers. While dry cooling towers are technically feasible their commercial viability for use with large-scale power plants has not yet been established.

All cooling towers are large structures, with resulting visual impacts and they result in some efficiency penalties in the use of energy sources.

Regional Amplification: None.

Statewide Finding:

68. REACTOR TYPES AND COOLING SYSTEMS

Because of their lower efficiency in converting heat energy to electricity, nuclear light water reactors (LWRs) give off more waste heat than fossil fuel plants or other types of nuclear plants, and therefore require more cooling. The commercial feasibility of the

high-temperature gas-cooled reactor (HTGR), which has a higher efficiency and therefore requires less cooling than the LWR, has now been demonstrated. HTGRs using dry/spray or dry cooling tower systems appear to be well adapted for use at inland sites where water availability for cooling is a significant problem. While there is some loss in energy efficiency in the use of cooling towers, this energy cost may be necessary to reduce depletion of other resources.

Regional Amplification: None.

Statewide Finding:

69. INLAND SITING

There are many more potential power plant sites inland that meet seismic safety and population concentration standards than on the coast. The principal constraint on inland siting generally is the availability of adequate water for evaporative cooling towers and adequate restrictions on the disposal of blow down (water of high salinity concentrated by evaporation in the cooling tower). If sufficient cooling water is available, inland siting of nuclear power plants is both economically and technologically feasible; and indeed the California utilities have proposed such inland sites. Sufficient freshwater supplies are already allocated for cooling at a limited number of sites; but because of the importance of fresh water for agriculture and other uses, use of additional fresh water for power plant cooling has been challenged. Much of the cooling water requirement inland could be met by reuse of municipal and agricultural waste water (although agricultural waste water may ultimately

be usable in cultivating new halophytic crop strains, and may also have other beneficial uses, such as reducing saltwater inflow to the Delta, if nutrient and other water quality problems can be solved). This would necessitate the construction of waste water collection, treatment, and transportation facilities and adequate restrictions on the disposal of blow down to the waters of the State. The cost of such facilities could be defrayed by the electric utilities themselves. Energy conservation measures, and use of more efficient reactors such as the HTGR coupled with dry or dry/spray cooling towers, would minimize the pressures for developing additional freshwater water sources.

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast:
4. South Central:
5. South Coast: "Inland Areas Offer Siting Options. If additional large-scale power plants were to be required prior to 1985 or 1990, inland siting of either nuclear or fossil fuel (including coal-fired) power plants may be both technologically and economically feasible and preferable to coastal siting. Although they do escape some of the environmental constraints inherent in coastal sites, inland sites are dependent upon adequate amounts of water being available for cooling purposes until economical dry-tower systems have been demonstrated. In most inland areas of southern California, water is both scarce and in great demand for other purposes. However, possible sources of water for either the once-through or wet tower cooling system include diversions from State and local water projects and from municipal and agriculture waste water streams. In addition, further development of existing, low water use, cooling systems (including the dry tower cooling system) could serve to reduce, at acceptable costs, the overall water demand of an inland power plant to an insignificant level."
6. San Diego:

Statewide Finding:

70. UNDERGROUND SITING

Underground siting is technologically feasible but is more expensive than aboveground siting. The environmental benefits of underground sites are considerable because of reduced visual impact, possible safety advantages afforded by some types of rock formations, and the potential for multiple use of the land.

Regional Amplification: None.

Statewide Finding:

71. OFFSHORE NUCLEAR PLANT SITING

It now appears technologically feasible to construct offshore nuclear plants on floating platforms or artificial islands. However, this is much more likely to occur on the east coast, where the wide, shallow continental shelf permits mooring and breakwater construction at some distance from shore, than off of California, where the shelf drops off abruptly into deep waters. Although offshore siting would significantly reduce land use conflicts and the environmental effects of cooling systems, serious questions remain regarding visual impacts if located close to shore, the potential hazard to navigation and the likelihood that a major accident resulting in release of radioactive materials would cause immediate contamination of the biosphere.

Such hazards have not yet been adequately reviewed. Although two plants are being planned for sites offshore of New Jersey, no offshore plant has yet been licensed by the AEC. Siting concepts have also been developed for floating nuclear plants in manmade or dredged lagoons.

Regional Amplification: None.

Statewide Policy:

13. COASTAL AGENCY ROLE IN POWER PLANT SITING

Because the people of California have declared by their vote on the Coastal Initiative (Proposition 20) that the coastal zone is a distinct, valuable, and special resource, the agency designated to carry out the Coastal Plan should have permit authority over the land use and environmental aspects of power generation and transmission facilities proposed at sites located in whole or in part in the coastal zone and should have the right to review and comment at all preliminary stages and on all aspects of proposals for such facilities presented to the State Energy Commission. Such permit authority should be concurrent with the permit authority of the State Energy Commission; it should also include permit authority over new power plants or expansions proposed for the coastal zone that have been exempted by law from the State Energy Commission permit requirement. As is presently suggested in the Warren-Alquist Energy Act, in conducting these various regulatory reviews the coastal agency should work closely with the State Energy Commission in order to facilitate and expedite the administrative proceedings, including making its decision before the Energy Commission makes its final decision.

Regional Amplification: None.

Statewide Policy:

14. COASTAL COMMISSION ROLE IN ONGOING SITE IDENTIFICATION PROCESS

Because the State Energy Commission will be engaged in a continuous identification of possible sites and areas appropriate for new

power generation facilities, and because this identification process will involve consideration of inland versus coastal siting and will thereby affect the demand for sites in the coastal zone, the agency designated to carry out the Coastal Plan should be granted a substantial ongoing role in State Energy Commission statewide siting policy formulation and site identification processes. The role of the coastal agency in siting power plants should not be interpreted as an effort to exclude all power generation facilities from the coastal zone. Coastal siting decisions shall be determined by: the demonstrated need for such facilities measured within the context of a comprehensive conservation program; protection of inland as well as coastal resources; and full cooperation with all State, Regional and local interests.

Regional Amplification: None.

Statewide Policy:

15. MINIMIZE ADVERSE ENVIRONMENTAL IMPACTS ON COASTAL RESOURCES

Because the coastal zone represents a valuable, fragile, and finite resource, because power plants have major potential impacts on land use, air quality, and the marine environment, because virtually all of the State's major power plants are located on the ocean coast or the shores of San Francisco Bay and the Delta, and because studies have estimated that there may be need by 1990 for as many as 20 major new sites, which, if located primarily on the coast, could have significant adverse effects on coastal resources, new power plants should be approved in the coastal zone only when it can be demonstrated that:

- a. Energy conservation efforts including concerted efforts by the applicant within its service area, cannot reasonably reduce base load and peaking requirements sufficiently to eliminate the need for the proposed facility.
- b. Greater presently identifiable adverse environmental impacts would occur from utilizing obtainable alternative inland or coastal sites or alternative technologies. In evaluating alternative sites and technologies, in addition to the factors included in the Warren-Alquist Energy Act, consideration shall be given to evaporative, dry and dry/spray, and saltwater evaporative cooling towers, and the following potential water sources should be considered in evaluating the impact of providing cooling water at inland sites: (1) surplus freshwater supplies already allocated to power generation but not presently being used; (2) agricultural or municipal waste water; (3) freshwater supplies that can eventually be replaced by waste water; and (4) other freshwater supplies, if it is determined that there is sufficient water available after the reasonable needs of other users are met so as not to deprive inland or coastal areas of fresh water needed for agricultural production. To assist in evaluating alternative sites the utility or utilities proposing the coastal site shall submit a comprehensive evaluation of reasonable alternative coastal and inland sites and generating technologies, including the environmental reasons for rejecting them in favor of the proposed site, sufficiently in advance of a desired decision that an adequate and independent analysis can be made. The primary responsibility for the identification of such alternative inland sites should rest

with the State Energy Commission, and the identification or certification of such a site by that Commission demonstrates that such suitable alternative inland sites are available.

- c. In the case of a proposal for a new coastal site, the need for new capacity cannot or should not be met by plant expansion at an existing inland or coastal site which has been identified as suitable for expansion. The primary responsibility for the identification of such sites suitable for expansion should rest with the State Energy Commission, and the identification or certification of such a site by that Commission demonstrates that such suitable sites for expansion are available.
- d. The proposed power plant and the land use restrictions required by the State Energy Commission on the surrounding area as required by the Warren-Alquist Energy Act to protect public health and safety will not conflict with other existing or planned coastal-dependent land uses at or near the site.
- e. In the case of a nuclear power plant the proposed site is in an area of minimum seismic hazard in comparison to alternative sites reasonably capable of serving the utilities or utilities' service area or areas; the proposed plant is designed to safely withstand the effects of the most severe seismic activity thought possible in the site area; and the number of people and their distribution within the potential radiation hazard area meets AEC and State Energy Commission criteria, and the people can be readily evacuated in the event of an emergency.
- f. The generation and cooling systems proposed are the least environmentally damaging technologies projected to be available at the time of scheduled construction. The cooling system technology

employed shall satisfy the environmental protection requirements of the Marine Environment Element; and where a once-through cooling system is proposed, the project shall meet the standards set by the Marine Environment statewide policies 7(b), 7(c), 7(d), 7(f) and 7(g). Improvements in the cooling systems of existing facilities at the site may be weighed by the agency designated to carry out the Coastal Plan in determining compliance with this subsection.

- g. In the case of a proposed new coal- or oil-fired electric generating plant at a new site, or a proposed plant expansion at an existing site, the project will cause no significant degradation of air quality. The facilities shall be sited and designed to minimize the effects of pollutants for which there are designated Federal or State ambient air quality standards, and shall employ the least polluting technology to be available at the time the facilities are designed to go into operation. Such facilities shall not be built in areas of the coastal zone designated by the Air Resources Board as "critical air areas", or in areas where coastal resources such as health resorts or agricultural lands would be adversely affected, unless the agency designated to carry out the Coastal Plan determines that there is no alternative inland or coastal location where siting would result in less adverse environmental degradation. In no case shall expansion take place in a critical air area, or in an area where coastal resources would be adversely affected, unless there would be a net decrease in generating system emission of pollutants for which national or State ambient air quality standards have been established. Normally this require-

ment will apply to each individual plant for which expansion is proposed, unless it can be demonstrated that the emissions from two or more nearby plants affect the same geographic area in an equivalent manner. If such a determination can be made, then the plants involved can be treated as one unit for the purposes of this policy. Reduction in emissions may be accomplished by modernization or retirement of existing facilities.

- h. The plant will be set back from the shoreline to avoid adverse visual impact on the shoreline, and is designed and located to minimize adverse environmental effects, including but not limited to effects on fish and wildlife and their habitats, and on scenic, agricultural, and other resources of the coastal zone. The plant should not be located in a highly scenic area as defined in the Appearance and Design Element.
- i. A substantial area will be established for permanent public use and enjoyment of the coast and may include a substantial dedication of land to the public.
- j. As alternative, less environmentally damaging generating technologies become widely available so that some of the existing fossil fuel or nuclear generating facilities can be phased out and removed, priority shall be given to removal of those facilities which are in prime beach recreation areas.

Regional Amplification:

- 1. North Coast:
- 2. North Central:

3. Central Coast: "Prohibition of Once-Through Cooling. Coastal power plants...shall be prohibited from using once-through cooling in new or expanded facilities. The Coastal Commission or successor agency shall permit construction of new cooling facilities to replace once-through facilities and new water treatment plants designed to reduce the discharge of pollutants into the marine environment."

This represents a stricter standard than is applied in the statewide Marine Environment Element. However, this Regional policy reflects the Regional Commission's concerns for protection of their unique marine resources.

4. South Central:

5. South Coast: The South Coast Regional Commission has adopted an approach toward power plant siting different from that recommended by the State Commission staff. The State staff has recommended a single analytical framework for evaluating both plant expansions and new major baseload sites; this framework generally requires an evaluation of inland alternatives to determine the least degree of environmental impact on a case-by-case basis. The South Coast, on the other hand, has specifically distinguished between the potential sites and environmental impacts of baseload and peaking units in their jurisdiction, and has determined under what circumstances each type of plant would be acceptable under the requirements of the Act. Thus, although the South Coast's analytical approach is not itself consistent with the approach in the recommended statewide policy, the staff believes that the result is essentially equivalent, and therefore would recommend adoption of the following regional amplification for application in the South Coast Region with the addition of "and are demonstrated to have less adverse environmental impact than inland alternatives" at the end of the first sentence in "Criteria for Approving New Peaking Plants to be Completed Prior to 1985":

"Siting of Baseload Power Plants in the South Coast Region. There are no sites in the Region which are presently suitable for new fossil fuel or nuclear power plants which are consistent with the objectives of the Act. Should new technologies become available, proposals for future power generating facilities at a new site in the South Coast Region shall demonstrate to the Commission that the facilities meet or exceed criteria, present or future, set down in all elements of the Plan concerning seismic, aesthetic, environmental, health, marine life, and safety matters.

"Criteria for Approving New Peaking Plants to be Completed Prior to 1985. The Commission shall consider proposals to construct new peaking facilities, such as combined cycle facility or a plant with emissions similar to Scattergood No. 3., in dispersed locations in the coastal permit zone provided such proposals incorporate the least environmentally damaging technologies practical at the time of scheduled construction. Factors which should be considered are whether the individual facilities exceed 500 Mw in capacity; are located in industrial zones; are located not less than three miles from an existing thermal plant site of more than 500 Mw

capacity (to hold down the local effects of the emissions to the air and water); are designed to minimize their visual impact; use once-through ocean water cooling systems; meet the prevailing APCD emissions standards and meet the prevailing water quality standards. The utilities may, however, propose peaking facilities to be located in the coastal zone producing no more air pollutants per hour than Scattergood No. 3 and having no greater impact on the marine environment than a facility meeting the above criteria. The Commission recognizes that this policy may increase operating costs somewhat; however, this cost increase is felt by the Commission to be justified given the objectives of the Act.

"Criteria for Approving Expansion or Modernization of an Existing Power Plant. The Commission and its successor agency, shall consider all applications for expansion (e.g., by adding waste-heat boilers) or modernization of existing power plants provided that the total air pollutant emissions into the South Coast Air Basin are not increased, meet prevailing APCD emission standards, meet prevailing Water Quality Board discharge standards, have cooling systems redesigned to eliminate adverse marine impacts, best efforts are made to utilize waste water treatment plant effluents, and the new facilities are designed to minimize their visual impact.

"Oil Storage and Transportation Facilities. The Commission, and its successor agency, shall expedite and approve all applications for new oil storage or transportation systems serving the Region's electric generating plants providing that the facilities incorporate the least environmentally damaging technologies practical at the time of the scheduled construction and that they are located on industrially zoned land."

6. San Diego:

SECTION V: PETROLEUM EXPLORATION AND PRODUCTION

Statewide Finding:

72. CALIFORNIA'S POTENTIALLY RECOVERABLE RESOURCES

California has three general areas of petroleum production: onshore, State waters offshore, and Federal waters offshore. Estimates as to how much recoverable oil remains in these areas vary greatly, and depend on assumptions as to:

- (i) The size of known reservoirs and reservoirs thought to exist because of favorable conditions but not yet verified; and
- (ii) The percentage of the oil in California reservoirs that might ultimately be recovered (average recovery efficiency).

Using reservoir data from publications of the California Resources Agency and the National Petroleum Council, and assuming that California's historical average recovery efficiency of about 25 per cent prevails, the following figures describe California's estimated potentially recoverable petroleum resources—proven reserves plus 25 per cent of the petroleum thought to exist based on geologic data, but not yet discovered (billions of barrels):

Onshore	10.0
Offshore	12.8
Total California	22.8

Using the same reservoir data, but assuming that increased oil prices and improved recovery technologies might result in an improved average recovery efficiency of up to 35 per cent, as some experts believe possible for California, the following figures

describe the estimated potentially recoverable petroleum resources (billions of barrels):

Onshore	19.8
Offshore	18.6
Total California	38.4

Regional Amplification: None.

Statewide Finding:

73. LOCATION OF FUTURE OIL AND GAS PRODUCTION

California's onshore petroleum resources are still very substantial, though the largest reservoirs have probably been discovered and substantially developed already, and most of the remaining undiscovered onshore resource may lie in smaller pools and at greater depths than the reservoirs that historically have accounted for much of California's oil production. Increased onshore production will depend on improved secondary and tertiary recovery techniques, and on rising oil prices that encourage increased exploration, deeper drilling, and secondary and tertiary recovery from discovered reservoirs. The offshore resources now offer the least expensive option for rapid production of large volumes of oil in California. Much of the California offshore resource is close to the shoreline, and therefore production facilities may be highly visible from the coast. Most of the oil offshore of California is believed to lie beneath Federal submerged lands beyond California's jurisdiction, as much as 65 per cent of it at water depths of 1,500 feet or more. The extent and cost of developing the Federal offshore resource will not be completely known until exploratory drilling occurs.

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast:
4. South Central:
5. South Coast: "Offshore Oil Production.
 - a. "Federal and State offshore areas comprise the likely new sources of local crude oil (and natural gas) production. In the Commission's view, however, these sources should remain untapped until their use is of proven necessity, after taking into consideration the three to five years after a lease sale before significant offshore production can be developed and the up to ten years before peak production will occur. This opinion is based upon the Commission's beliefs that oil from Alaska can meet the Region's requirements through 1985-1990 and that additional offshore oil production operations would offer the potential for significant pollution of the Region's marine environment. However, given sufficient incentives for the industry to use the best practical technologies and operating procedures, the ecological and aesthetic values of the offshore areas can be protected in a manner consistent with the 'sound conservation principles' mandated by the Act.
 - b. "Given that the decision is made by the appropriate state and/or federal agencies to lease lands offshore of the Region for petroleum exploration and production, those areas included in or within three miles of marine preserves or areas of special biological significance identified in the marine element shall not be leased.
 - c. "Since it takes from five to ten years to obtain significant commercial production from an offshore area after it is leased, the successor agency should carefully monitor trends in Regional oil demand and supply to determine if offshore leasing is fully justified by an expected future deficit."
6. San Diego: "San Diego's Lack of Petroleum Resources. San Diego's on and off shore petroleum resources and oil production operations are non-existent, with the exception of exploratory drilling activities occurring on the outer continental shelf over 100 miles west of San Diego, in the Tanner and Cortez Banks. The region's nearer-shore potential is undefined; however, no oil or gas has ever been found and little, if any, exploratory drilling or geophysical investigation is taking place. One reason for the lack of near-shore exploratory drilling activity is the fact that the entire County coastline lies in an existing State petroleum resources sanctuary. On shore, the potential also is lacking. Since 1900, 126 exploratory wells have been drilled in the region, but without success. To date, there has never been a commercially producing oil well south of the City of San Juan Capistrano."

Statewide Finding:

74. STATE OFFSHORE LEASES AND SANCTUARIES

Most present California offshore production comes from leases in the Santa Barbara Channel and offshore Wilmington and Huntington Beach reservoirs. According to 1971 data, there are over 1,800 actual producing wells on State-owned submerged lands between Point Conception and Huntington Beach. The State receives lease payments and royalties from any petroleum production on its submerged lands, which are managed by the State Lands Commission. The vast majority of the State's submerged lands have been made State petroleum resource sanctuaries in which no petroleum recovery activities are allowed. Laws creating additional petroleum sanctuaries have been proposed in the California State Legislature and the United States Congress. Coastal cities (e.g., Long Beach) also hold several leases and receive a portion of the petroleum revenues; the State Lands Division maintains operating authority on the leases.

In 1969, following the blowout on a platform in Federal waters off Santa Barbara, the State Lands Commission placed a moratorium on new drilling offshore in State waters. In December, 1973, the Lands Commission voted to permit drilling of new wells from already-built platforms on existing leases, subject to approval on a lease-by-lease basis. In late 1974, the Lands Commission granted approvals to several oil companies for such drilling, but then reversed these decisions in early 1975 pending further evaluation.

Regional Amplification: None.

Statewide Finding:

75. IMPENDING FEDERAL OFFSHORE DRILLING

The Department of the Interior has called for lease proposals from oil companies for petroleum drilling in huge areas of submerged lands offshore of Los Angeles County beyond the three-mile State jurisdiction, for lease proposals for large areas off central and northern California at a later date and for increased drilling on existing Federal leases in the Santa Barbara Channel. If the Department of the Interior decides to proceed with its lease-sale of the southern California area, the sale will occur in about July, 1975. Although these Federal activities may affect California's ocean water quality, marine life and scenic values, could possibly deplete oil reservoirs extending under adjacent State submerged lands, and may directly lead to significant onshore developments of refineries, tanker terminals, storage tanks and pipelines requiring permits from the Coastal Commission, California has no direct control over the Federal plans at this time.

Regional Amplification: None.

Statewide Finding:

76. DEFICIENCIES IN FEDERAL OFFSHORE REGULATION
AND SUPERVISION BEING REMEDIED

In the past, Federal regulations governing drilling and production procedures on Federal submerged lands, including requirements for depth of casing for blowout preventers and crew training and supervision, have been less stringent than California Division

of Oil and Gas regulations governing operations on State submerged lands, where there have been no significant spills resulting from offshore oil and gas operations. Deficiencies in Federal regulations led directly to the well blowout in Federal waters off Santa Barbara in 1969. Federal regulations, procedures, and regulatory staff are now being greatly upgraded. It is expected that when revision of Federal regulations for the Pacific Coast area are completed, they will be in substantial conformance with those of the State.

Regional Amplification: None.

Statewide Finding:

77. CALIFORNIA'S LOW RECOVERY RATE

The nationwide recovery efficiency of oil has steadily increased to approximately 31 per cent. California's 25 per cent recovery efficiency lags behind other major oil and gas producing regions due to:

- a. Generally high viscosity of much of California's oil, and the relatively low pressures affecting reservoir drive properties of associated natural gases and water;
- b. Complex geologic formations holding the petroleum, with many reservoir problems.

and to a lesser degree, to

- c. Lack of State regulation that might maximize ultimate recovery of oil and gas by regulating well completion and production practices.

Regional Amplification: None.

Statewide Finding:

78. REGULATION OF PETROLEUM DEVELOPMENT PRACTICES
LESS STRINGENT IN CALIFORNIA

Completion and production practices in many oil producing states, including Alaska, Louisiana, Texas, and Wyoming, as well as the Canadian province of Alberta are regulated by a State agency. California State laws do not provide for actual regulation of completion and production practices by the Division of Oil and Gas, and the California petroleum industry is allowed very wide discretion in production rates and such practices as simultaneous production from many pools, and optional ratios of gas/oil production which in turn can lead to low recovery efficiencies. Some other states also have requirements for public disclosure of exploratory data within some period of time after filing with the state regulatory agency, to increase geologic investigations, stimulate exploration, promote a more competitive industry, and increase oil production; and the Department of Interior has proposed regulations for OCS lease purchasers that would require public disclosure of geological and geophysical data following the purchase, to be made within six months. California has no such disclosure requirement.

Regional Amplification: None.

Statewide Finding:

79. METHODS OF IMPROVING PETROLEUM RECOVERY

Secondary and tertiary production methods offer the promise of increased efficiency in recovering oil and gas. California has

benefited from secondary recovery innovations and their applications. About 15 per cent of California's present oil production comes from secondary recovery operations. In some reservoirs, very little primary production is possible, but secondary recovery may increase production after primary recovery by 10-50 per cent of the original oil in place, and tertiary recovery may offer the potential for a total recovery of a 30-70 per cent. Substantial improvements in recovery efficiency will require improved technology, greater capital investments, higher well maintenance costs, and higher price for refined products. With a greatly increased effort at secondary and tertiary methods average recovery efficiency for California may ultimately go as high as 35-40 per cent of original oil in place.

Regional Amplification: None.

Statewide Finding:

80. DRILLING COSTS UP, EXPLORATION DOWN

The leasing of lands, exploration, drilling and production of petroleum is an expensive and risky process. Offshore exploration and production operations are generally much more expensive than onshore activities. Exploration for petroleum has generally decreased in California and nationwide, however, over the past 20 years. The success rate of finding and completing new petroleum fields has also steadily declined. Petroleum shortages, increased costs of extraction, and the need for technological research continually push the price of petroleum upward, which in turn should allow increased exploration and research toward technological advances.

Over the first six months of 1974 exploratory and drilling activity have increased.

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast:
4. South Central:
5. South Coast: "Petroleum Production Declining. Production of petroleum in the Los Angeles basin peaked in 1969; the same is true for production in the coastal area of the Basin. Exploratory drilling has been at historically low levels in both the onshore and offshore portions of the coastal area. Oil production and development drilling are both likely to continue to decline, although the increases in crude oil prices since 1973 may reduce the production decline rate below the approximately 10 per cent per year rate normally experienced by California oil wells. It is projected here that the average rate of decline in California production shipped to Los Angeles/Long Beach area refineries will be 4 per cent per year to 1985."
6. San Diego:

Statewide Finding:

81. INCREASED PRODUCTION FROM EXISTING WELLS,
CONSOLIDATION OF DRILLING SITES DESIRABLE.

Increased primary, secondary and tertiary production from existing wells will entail substantially fewer new developments and land use conflicts than exploration and drilling for virgin reservoirs, onshore or offshore. Unitization (the cooperative use of drilling and production sites by many companies) concentrates activity within smaller areas than does separate development by each petroleum company. Unitization is particularly desirable offshore—economically, environmentally, and aesthetically.

Regional Amplification: None.

Statewide Finding:

82. PLATFORMS PRESENTLY FAVORED FOR OFFSHORE DRILLING

Offshore petroleum operations are usually conducted from manmade platforms above the water's surface. Exploratory drilling and some production drilling are primarily accomplished from mobile platforms, whereas most production of oil and gas is controlled from a fixed platforms. Because of their size and the elevation of coastal lands, these platforms can be seen from the coast even when located at great distances (12-20 miles) from the shoreline; they are particularly prominent when located near to the coast. Many people feel that platforms have a severe adverse aesthetic impact on ocean vistas. The deepest platform production in the world is in 420 feet of water. Exxon Company U.S.A. plans to construct and operate a fixed platform in 850 feet of water in the Santa Barbara Channel.

Platforms seem to attract local fish populations. Both platforms and islands offer the opportunity for multiple public uses.

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast:
4. South Central:
5. South Coast: "It is very difficult to make the judgment that offshore oil drilling and production platforms are intrinsically at variance with the objectives of the Act. There has been some substantial objection by some segments of the public to their use, primarily on aesthetic grounds and with respect to navigational safety. Other segments of the public note with approval their beneficial effects on sport fishing.

"Criteria from the Recreation Element study for better defining recreation areas in local sections along the coast might be applied to justify a new island. Visual criteria for unobstructed seascape views might be equally applied to justify a negative decision on a new island, (and hence to possibly generate a positive decision on a subsea completion system). Because islands represent an irretrievable commitment of coastal zone resources, the decision to require construction of an island should only be made where very substantial recreational or other benefits are to be obtained.

"New offshore surface drilling platforms and islands should be given aesthetic design study to improve their visual impact. The existing designs apparently have large margin for improvement.

"Multiple Uses of Offshore Structures and Islands

- "a. Offshore oil drilling facilities, whether located on artificial islands or platforms, can provide public uses other than that of extracting oil. Under certain safety and aesthetic conditions, additional functions could be provided. This would likely require some engineering adjustments within sound principles of industrial and marine safety on the platforms.

- "b. With some structural changes to existing designs, drilling islands and platforms on the open coastal sea present opportunities for multi-functional public interest use that should be considered in the decision making process. Possible additional functions, which may be appropriate for some installations, are:
 - (i) Scientific and Educational Accommodations
 - . Marine Biology research and education
 - . Physical Oceanography research and education
 - . Aerology/Meteorology research and education
 - . Astronomical research

 - (ii) General Public Accommodations
 - . Observation of drilling operations (educational)

 - (iii) Governmental Agency Accommodations
 - . Coast Guard rescue station (and Marine Radar)
 - . U.S. Weather service station

 - (iv) Aqua-farming and Mariculture Accommodations

 - (v) Platform Self-sustaining Power Equipment
 - . Windmill electrical generator
 - . Wave power electrical generator"

6. San Diego:

Statewide Finding:

83. SUBSEA COMPLETIONS, SUBMERGED PRODUCTION SYSTEMS

As of mid-1974, approximately 40 individual wells in shallow water on State lands in the Santa Barbara Channel area had been completed entirely underwater rather than from permanent platforms, by using "subsea completion systems". Such systems still require support facilities on permanent platforms or onshore, but permit reduction in the number of platforms required for the development of the offshore resource. More sophisticated "submerged production systems", which would permit clustering of numerous wells completed subsea around a single subsea center that would in turn pump the oil and gas to facilities on platforms or onshore, would still further reduce the need for platforms. This would reduce both the aesthetic impacts of offshore development and the great expense of constructing platforms in deep waters. Actual experience with subsea completions and submerged production systems in deep water is still extremely limited. The difficulties involved in servicing or repairing such systems mean increased environmental risk. Such facilities need to be tested extensively by industry under operational conditions with full observation afforded to appropriate governmental agencies, before they are utilized in deepwater offshore activities.

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast:

4. South Central:

5. South Coast: "New Offshore Oil Drilling Rigs, Platforms, and Subsea Completion Systems. Several companies have developed underwater production devices called subsea completion systems. One is slated to be built by Shell Oil Corporation in the Gulf of Mexico. If additional offshore oil drilling is allowed to continue in the South Coast Region by the State Lands Commission or the Bureau of Land Management, then serious consideration should be given to this method of completing and operating the wells.

"The industry has not had extensive experience with subsea completions; hence, the operating safety of these systems has not been demonstrated to anywhere near the extent of that of platform or island systems. Although the available evidence indicates that subsea systems will have high reliability factors, requiring subsea completions does not appear to be warranted in all cases. Platforms probably should be required if the prevention of oil pollution is given a very high priority by the Commission. The higher costs of subsea completions should also be taken into consideration in evaluating the desirability of subsea completions.

"A decision on whether the oil reservoir should be developed by a subsea completion system or by a platform operation should not be strictly a financial one. It should be a decision broadly based in the public interest, with the criteria specified in the Act to be given precedence over economic considerations.

"Whether the subsea, platform, or island system is to be required on a specific lease shall be clearly specified in the lease before it is put up for bid, as shall be all other provisions relating to protection of the environment. Such provisions shall be approved by the Commission or its successor agency."

6. San Diego:

Statewide Finding:

84. OFFSHORE DRILLING MORE HAZARDOUS THAN ONSHORE

Oil and gas leaks in offshore drilling or production are statistically rare, and steadily improving offshore drilling technology should still further reduce the incidence of occurrence. However, the draft programmatic Environmental Impact Statement prepared by the Bureau of Land Management for the nationwide accelerated Federal

offshore leasing program noted that major spills associated with OCS development are inevitable. The California offshore environment is relatively mild compared to the environment in offshore drilling areas elsewhere in the world, such as the North Sea and the Gulf of Alaska, and therefore presents somewhat reduced environmental risks. Nevertheless, even in California offshore drilling generally involves greater environmental hazards than onshore drilling because:

- a. People are at a logistical disadvantage in working in the offshore environment, whether on the surface or underwater. Response time to crisis is slower than onshore, and the ability to maintain equipment and receive supplies is constrained.
- b. Offshore facilities are subjected to more danger, including storms, vessel collisions, seawater corrosion, low temperature problems, water currents, seismic activity, and tsunami (seismic sea waves). Platforms can be designed and constructed to withstand known Pacific Coast phenomena.
- c. Leaks of oil and gas are more quickly diffused, and more difficult to plug.

Regional Amplification: None.

Statewide Finding:

85. BASIC SPILL CLEANUP TECHNIQUES

If an oil spill should occur, the substances must be confined and recovered quickly to minimize environmental damage. Present containment methods utilize floating booms or pneumatic curtains which confine the oil. Recovery methods include absorbing materials

(e.g., straw), suction devices, adhesive materials to remove the oil from seawater, and skimming mechanisms that remove oil from water. Oil may also be dispersed into the water column by the addition of chemicals, collected with gelling substances, forced to the sea floor by combining with sinking agents, or burned with combustion fluids. Use of sinking and burning agents are generally forbidden by the California Department of Fish and Game.

Regional Amplification: None.

Statewide Finding:

86. INADEQUACY OF CONTAINMENT AND CLEANUP TECHNIQUES

Since 1969 increased monies have been spent on improving oil spill prevention and containment programs and cleanup equipment. Although the technology for containment and recovery of offshore oil spills has improved since the Santa Barbara spill, no system is likely to be completely effective. Using presently available equipment, oil containment and recovery can be reasonably effective in calm waters; but moderate to stormy conditions (winds of 20 or more knots and wave heights over 5 feet) will seriously hinder deployment of equipment, and will spread the spill regardless of containment attempts. Such conditions will also act to disperse and degrade the spill. Most oil spill contingency plans, including the National Oil Spill Contingency Plan implemented under the guidance of the Coast Guard, and the State of California Oil Spill Contingency Plan have been tested under simulated conditions but have not yet been proven under actual crisis situations.

Regional Amplification:

1. North Coast: "Oil spills related to fuel barges are an occasional occurrence. One of these several years ago resulted in some waterfowl losses and tainting of shellfish. Tank truck accidents have resulted in stream pollution incidents from time to time. In addition to Federal and State oil and hazardous material spill contingency plans, the State Department of Fish and Game has an internal contingency plan, as does the State Department of Transportation. Del Norte County has a contingency plan, and there is a joint government-private supplier oil spill mitigation cooperative centered on Humboldt Bay. These plans apply to spills affecting streams as well as to marine spills. The Humboldt Bay spill mitigation cooperative can utilize its capabilities along much of the North Coast as well as in Humboldt Bay. The cooperative has an oil spill skimming vessel, booms for containment, and a stock pile of materials including cleansing agents suitable for use with waterfowl. There have been three spills on inland waters in the past three years of sufficient significance to activate an oil spill mitigation plan."
2. North Central:
3. Central Coast:
4. South Central:
5. South Coast:
6. San Diego:

Statewide Finding:

87. SPILLS AFFECT NEARSHORE ENVIRONMENTS MOST

There are differing reports on the environmental effects of oil spills. The effects tend to be more severe from refined products than from crude oil. Some species of organisms are highly vulnerable to petroleum; particularly where such a species is an "endangered" species, such as the sea otter, it could be eliminated by a major oil spill; other species seem to readily reassert themselves following an incomplete kill from a spill. Oil spills in nearshore areas are more hazardous than in deep water because estuaries, coastline, bays and harbors are affected sooner and with greater damage. There have

been few research projects on the sublethal effects of oil pollution, which may affect the long-term population of a species, or an entire ecosystem; the conclusions drawn have been conflicting. Oil seems to be absorbed by many bottom sediments and re-emitted for many months or years after a spill. Study of the effect of oil spills along the California coast is complicated by the presence of natural oil and gas seeps that regularly emit petroleum, with unknown effects on the marine environment. The Division of Oil and Gas has documented over 50 seeps and seep areas between Point Conception and Huntington Beach, and many more seeps probably exist; although oil and gas seeps have occurred near the sea in Marin and Humboldt Counties, there are no known offshore seeps north of Point Conception. Additional research on the sources and effects of oil in the ocean is being conducted by various groups in California.

Regional Amplification: None.

Statewide Finding:

88. SPILLS CAN HAVE HUMAN IMPACTS

Oil spills are aesthetically displeasing, and may have significant economic and psychological impact on human communities within the coastal zone. Recreation, commercial fishing, and water-related activities suffer the most severe direct damage, but can recover in the absence of further spills. Of all the existing or proposed Federal offshore production areas—on the Gulf of Mexico, Atlantic, and Alaskan continental shelves—only California's producing area is located close to a large human population (10 million plus) that

is directly affected by the environmental, aesthetic, psychological and economic effects of offshore production.

Regional Amplification: None.

Statewide Finding:

89. OFFSHORE PRODUCTION WILL ENCOURAGE ONSHORE DEVELOPMENT

Offshore petroleum production may encourage greater industrialization in certain areas of the coastal zone, will increase water and land transportation, and will necessitate construction of oil and gas pipelines and storage facilities. Offshore production off California could reduce the need for additional tanker terminal capacity along the coast.

Regional Amplification: None.

Statewide Finding:

90. DISPOSAL OF OIL FIELD BRINES

Inadequately treated oil field brines released at sea are highly polluting. In many instances, these brines can practically be disposed of by reinjecting them under pressure into oil producing zones. In addition to protecting water quality and decreasing odors associated with oil production, this practice can frequently help increase oil recovery from already-developed reservoirs. The Water Quality Control Board presently issues discharge requirements and the Division of Oil and Gas regulates any reinjection of brines.

Regional Amplification: None.

Statewide Policy:

16. NEED FOR OFFSHORE DEVELOPMENT SHOULD
BE CLEARLY DETERMINED

Because of the risk of oil spills, the adverse visual impact of oil platforms, and the need for related onshore facilities that would necessarily accompany development of the Outer Continental Shelf (OCS), new offshore oil and gas development of State or Federal lands, shall be permitted only after:

- a. A comprehensive analysis has determined the need for California offshore production in light of the anticipated inflow to California and PAD V of oil and other forms of energy from all other sources, including onshore oil production, Alaskan North Slope oil and gas production, production in other regions of Alaska, foreign oil and gas imports, and in view of California's projected capacities to refine and store the anticipated inflow of oil from sources other than new offshore production; or
- b. Development of the OCS off California has been clearly identified as an integral and priority part of a comprehensive, balanced national energy conservation and development program;
- c. And the agency responsible for implementation of the Coastal Plan determines that the impacts to onshore resources and possible impacts to the coastal zone marine resources as a result of OCS development are acceptable according to standards set forth in the Coastal Plan.

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast: "Maintain Oil Sanctuary Status of Tidelands in Central Coast Region. The current prohibition of oil exploration and drilling should be retained unless overriding National need is demonstrated. Any onshore or Outer Continental Shelf oil exploration and production should be permitted only where maximum safety standards and minimum aesthetic impact can be assured."
4. South Central:
5. South Coast:
6. San Diego:

Statewide Policy:

17. REQUIRE FULL EVALUATION OF OFFSHORE DRILLING PROPOSALS

To minimize the adverse effects of construction in offshore areas and development activities, applicants for drilling in State offshore lands shall be required at the time of the application for drilling to submit one, five, and ten year plans for exploration, production, and all related onshore and offshore development that might follow if drilling is successful, including platforms, submerged production systems, pipelines, separation and storage facilities, and refineries, to the State Lands Commission, the State Energy Commission and the agency designated to carry out the Coastal Plan. To the extent not already provided in the required California Environmental Impact Report, such development plans shall include the economic, environmental, and aesthetic impact on the immediate area and the entire coastal zone of offshore and on-shore facilities and operations including all transportation and

distribution facilities, and all measures to mitigate any environmental hazards of onshore and offshore activities, including alternatives to the anticipated facilities, programs for containment and recovery of potential oil spills, and improvements in marine traffic lanes, navigational equipment and traffic control. The adequacy of such measures shall be taken into account in approving or disapproving the application. Plans shall also include discussion of the contribution of the proposed petroleum production to State, regional, and national needs, and descriptions of how these needs might be met from onshore petroleum and other energy resources, as required in Policy 16. Such plans shall be recognized as being dependent upon the results of exploratory drilling and changing techniques, and, as such, flexible, but changes in such plans shall be justified by the applicant with full disclosure of supportive data.

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast:
4. South Central: "The contents of these plans shall include, but are not limited to, these evaluations:
 - "1. The need for onshore facilities, alternate locations for them, and the type of transport needed for the product distribution (e.g., marine terminals, pipelines, etc.) and its destination.
 - "2. All proven measures to mitigate any environmental, safety and aesthetic factors of offshore activities including:
 - a) improve traffic lanes, and navigational equipment
 - b) containment and recovery of potential oil spills

"3. All land use and growth inducing issues identified in the Intensity of Development Element.

"Plans should also include discussion of the contribution of petroleum production to State, regional, and national needs, and descriptions of how these needs might be met from onshore petroleum and other energy resources, as required in Policy 16 (State draft), the adequacy of which shall be taken into account."

5. South Coast:

6. San Diego:

Statewide Policy:

18. ALLOW OFFSHORE DRILLING ONLY WHERE SAFE

To minimize the risk of adverse environmental effects resulting from oil discharges, offshore drilling and production shall be permitted only where it can be demonstrated that:

- a. The most advanced state-of-the-art drilling and production technology is utilized.
- b. The geologic characteristics of the area have been adequately investigated and are consistent with safe drilling and production.
- c. The proposed well sites are the least environmentally hazardous and aesthetically disruptive sites feasible.

Regional Amplification: None.

Statewide Policy:

19. CONSOLIDATE DRILLING, PRODUCTION, AND PROCESSING SITES

To minimize construction in offshore areas and development of related onshore facilities, all petroleum-related development and

operations shall be unitized or consolidated (i.e., drilling, production, separation facilities, and support sites shall be developed and operated by a single company or a group of companies for the benefit of all interested companies, or shall be shared) to to the maximum extent feasible, unless it can be shown that unitization or consolidation will not reduce the number of facilities, or significantly reduce the number of producing wells or support facilities required to produce the reservoir economically and with minimal environmental impacts. For offshore facilities, unitization negotiations shall be entered into by all operators holding State leases covering one producing structure, and unitization of a new offshore field shall be carried out before commercial production is initiated. The unitization or consolidation requirements shall apply to all types of offshore platforms, submerged production systems, pipelines, storage facilities, separation facilities, and equipment and rights-of-way for transporting petroleum to refineries, whenever technically and economically feasible, and where legally permissible.

Regional Amplification: None.

Statewide Policy:

20. USE SUBMERGED COMPLETION AND PRODUCTION SYSTEMS
WHERE FEASIBLE AND ENVIRONMENTALLY SAFE

To reduce the visual impacts of offshore operations, subsea completion of wells and submerged production systems shall be used where environmentally safe, as demonstrated through adequate testing of equipment by industry, observed by the appropriate government

agencies, and where technically and economically feasible. In those areas where oil platforms or islands would have a substantial adverse environmental effect, including degradation of aesthetic values, no offshore drilling should be permitted unless and until subsea completions or submerged production systems are demonstrated to be environmentally safe.

Regional Amplification: None.

Statewide Policy:

21. PLATFORMS PREFERRED OVER ISLANDS; MINIMIZE IMPACT OF PLATFORMS

Where subsea drilling, completion, or production is found to be technically or economically infeasible, or environmentally unsafe, thereby making platforms or islands necessary to development of the resource; or where platforms are necessary to service subsea completions, or submerged production systems, the following policies shall obtain:

- a. Because manmade oil production islands are very difficult to dismantle when production is completed, and because construction of such islands therefore may constitute an irreversible commitment of coastal zone resources, platforms shall be preferred over islands wherever safety considerations permit;
- b. The number of offshore platforms shall be minimized by using each platform to drill as many wells, and/or to service as many subsea completion and production systems, as is technically and economically feasible, and environmentally safe;

- c. To minimize visual intrusions, the design and aesthetics of the platforms or islands shall be carefully reviewed by the agency designated to carry out the Coastal Plan and by the immediately landward local governments, and shall be consistent with general design criteria set forth in the Coastal Plan's Appearance and Design Element;
- d. The waters surrounding new platforms or islands shall be open to sport fishing, diving, and boating, consistent with boating safety rules and practices;
- e. Prior to actual construction of an artificial island, if an island is determined to be needed, full consideration shall be given to installation of multipurpose public interest uses, including but not limited to small-boat landing piers and amenity public recreation areas in a manner consistent with public safety; and if the State Lands Commission and the agency designated to carry out the Coastal Plan find them to be technically and economically feasible, they shall be required in the terms of the lease (or subsequently in the construction permit if not determinable at that time); and
- f. All oil islands shall be so designed that all water (including runoff from a substantial rainfall) contacting working surfaces shall be contained, and not allowed to drain in an untreated state into the ocean. Treatment shall be provided for the estimated maximum amounts of runoff water to make runoff essentially free of petroleum or chemical residues.

Recommended Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast:
4. South Central:
5. South Coast: "Improve the Use and Appearance of Offshore Oil Drilling Platforms and Islands. The operators of all new offshore oil platforms and islands shall be required to construct multi-use operations consistent with the public interest as defined in the Act. In this regard, the Commission recommends that the Legislature require the State Lands Commission to include in its lease provisions, at the time each lease is put up for bids, the following conditions:
 - "a. The waters surrounding new islands or platforms shall be open to sport fishing, diving, and boating to the fullest extent consistent with public safety. In addition, a program to increase underwater habitat attractive to fish and shellfish around the islands or platforms shall be undertaken at the operator's expense under the supervision of the Department of Fish and Game.
 - "b. With respect to new drilling islands, and following sound principles of industrial, marine and public safety, the lessee shall:
 - "(1) In adequately protected areas, the operator shall install one small-boat landing pier per island. The pier shall be sized to accommodate the equivalent of twenty, 20-foot craft or the equivalent.
 - "(2) Where a small-boat landing is provided, the operator shall install one landscaped amenity recreation area per island. This area shall be separated from the drilling operation area by a secure, pleasingly designed fence and be supplied with public restrooms and a picnic area."
 - "c. Where the State Lands Commission and the Commission or its successor agency find them to be technically and economically feasible, other facilities in findings 6a and 6b (listed below) shall be included in the terms of the lease.

"Lease or unit operators constructing new facilities shall reinject all oil field brines. Exceptions will be granted only after submission to the Commission or its successor agency of detailed plans providing for elimination of petroleum odors and water quality problems.

"d. All the facilities and accommodations required in the lease shall be completed on a predetermined schedule specified in the lease."

The following are the facilities that the South Coast specifically listed in its adopted findings 6a and 6b referred to in subsection (c), above:

- "(i) Scientific and Educational Accommodations: Marine Biology research and education; Physical Oceanography research and education; Aerology/Meteorology research and education; Astronomical research.
- "(ii) General Public Accommodations: Observation of drilling operations (educational).
- "(iii) Governmental Agency Accommodations: Coast Guard rescue station (and Marine Radar); U. S. Weather service station.
- "(iv) Aqua-farming and Mariculture Accommodations;
- "(v) Platform Self-sustaining Power Equipment: Windmill electrical generator; Wave power electrical generator."

6. San Diego:

Statewide Policy:

22. MINIMIZE IMPACT OF ONSHORE FACILITIES

All onshore drilling, production and onshore support facilities for offshore operations, including separation plants, pipelines, terminals and storage facilities, shall be designed and located to minimize their environmental impacts consistent with recovery of the resource. Prior to putting up leases for bidding, the State Lands Commission should submit its lease provisions relating to minimizing the environmental impact of anticipated associated facilities to the agency designated to carry out the Coastal Plan. Where such development would result in substantial adverse impacts to the resources of the coastal zone, it shall be permitted only upon a demonstration that there is a need for the project, as specified

in Policy 16, that alternatives would have a greater adverse environmental impact, and that there is little likelihood of improvement in technology that would substantially reduce such impacts in the immediate future (e.g., new technology for carrying out subsea production oil and gas separation, storage, and natural gas liquefaction that might reduce the need for large onshore facilities).

Regional Amplification: None.

Statewide Policy:

23. REINJECTION OF OIL FIELD BRINES

Lease or unit operators constructing new facilities shall re-inject all oil field brines into oil producing zones unless injection into other subsurface zones will reduce environmental risks. Exceptions to reinjection will be granted only after submission to the agency designated to carry out the Coastal Plan of detailed plans adequately providing for the elimination of petroleum odors and all potential fresh water or ocean water quality problems.

Regional Amplification: None.

Statewide Policy:

24. INCREASE OIL RECOVERY EFFICIENCY

To improve California's efficiency of petroleum production as a means of reducing both the need for petroleum imports and offshore production, and thus their impact on the coastal zone, the

California Legislature should:

- a. Enact legislation to require the California Division of Oil and Gas to regulate petroleum completion and production for individual wells, including setting of maximum efficient rates of production, as analogous government agencies do in other major oil producing states.
- b. Adopt a resolution calling for the Federal Energy Administration to encourage primary, secondary, and tertiary production from existing wells.

Regional Amplification: None.

Statewide Policy:

25. EXPLORATION AND PRODUCTION DATA SHOULD BE DISCLOSED

To increase public access to data essential to the discovery of petroleum accumulations, to improve the recovery efficiencies of existing fields as another means of reducing the impact of petroleum imports and production in the coastal zone, and to allow public agencies to have a fuller data base upon which to make public policy decisions relating to energy production, the Legislature should enact legislation requiring that all original exploratory and production data from surveys or drilling of wells (including all logs, complete well histories, cores, drill cuttings, water samples, chemical analyses, pressure and temperature measurements, etc.) shall be submitted within 60 days after finishing to the Division of Oil and Gas with appropriate assurances of strict confidentiality, and shall be made public information one year

after submittal, except that where such public disclosure would result in severe inequity to a well operator, year-to-year extensions of confidentiality might be granted by the Division of Oil and Gas.

Regional Amplification: None.

Statewide Policy:

26. OIL SPILL LIABILITY FUND

To encourage maximum care and use of highest state-of-the-art technology in offshore petroleum exploration and production operations and in tanker and tanker terminal operations, and to guarantee immediate availability of funds for cleanup operations and for prompt compensation of damages resulting from oil discharges until adequate Federal legislation is available, the California Legislature is urged to enact legislation as follows:

- a. Prior to leasing, each applicant for permission to drill on State tide and submerged lands should be required to show the State Lands Commission evidence of secured financial responsibility in the amount of \$20 million for each individual lease;
- b. All drilling applicants and all owners and operators of tankers operating in California waters shall register with the California Secretary of State for service of process;
- c. An Oil Spill Liability Fund, to be administered by the Secretary of the California Resources Agency, should be established to provide for all cleanup costs and to compensate all damages caused by oil discharges in any California or Federal navi-

gable waters or reaching the shoreline thereof, resulting from any drilling, production, processing, or transport associated with development of the offshore resource or with operation of any tanker or tanker terminal, without regard to the cause of the discharge, except that the Fund should not be liable for any discharge caused solely by an act of war. The Fund shall recover from offshore owners and operators, tanker and tanker terminal owners and operators, or other parties, any monies it expends for cleanup operations or for damage compensation, as described below in subsection (d) of this policy. A part of the Fund should go annually toward further development of oil spill containment and cleanup technology, technology and surveillance programs for identifying the sources of oil spills, and operating expenses of State and Federal Oil Spills Disaster Contingency Plans.

The Liability Fund should be created and maintained by levy of a two cent fee on each barrel of petroleum produced from a well on State lands, on each barrel of petroleum produced from a well on Federal lands that enters California for treatment, processing, or delivery, and on each barrel of petroleum loaded or unloaded at California tanker terminals. The Liability Fund should have a standing limit of \$100 million. Fees should be levied only at times when the Fund contains less than that amount, or when claims against the Fund exceed \$100 million.

- d. Except when an offshore lessee or operator, or the owner or operator of any tanker, tanker terminal, or equipment or facility used in the production, processing, or transportation

of oil can prove that an oil discharge from its operations was caused solely by an act of God, an act of war, negligence by the U.S. Government, or the act or omission of a third party, it shall be liable to the Liability Fund for cleanup costs and damages resulting from such discharge and paid by the Fund. Such liability shall not exceed \$20 million per incident for individual owners and operators of offshore equipment, tankers, or other equipment or facilities used in the production, processing, or transportation of oil, and \$100 million per incident for individual terminal owners and operators, unless it can be shown that such discharge resulted from the gross negligence or willful misconduct of the owner or operator, in which case liability shall be for the full amount of all cleanup costs and damages.

It is recommended that the California Legislature and the California congressional delegation support Federal legislation creating a single national oil spill liability fund, covering oil discharges from all sources related to production, processing, or transportation of oil, incorporating the measures proposed in subsections (a), (c), and (d), above, and eliminating the need for individual states to enact separate measures. In the event such Federal legislation is enacted, any unilateral California legislation on this subject should be repealed.

Regional Amplification: None.

Statewide Policy:

27. PROTECTION AGAINST ANY ADVERSE IMPACT OF
FEDERAL OUTER CONTINENTAL SHELF (OCS) DEVELOPMENT

To insure that protection of petroleum from Federal areas more than three miles off the California coast has minimum substantial adverse impact on the California coastal zone, and that Federal OCS development and related activities are compatible with goals set forth in this and other elements of the Coastal Plan, the Coastal Commission or the agency designated to carry out the Coastal Plan, the California Legislature, the California congressional delegation, the State Lands Commission the Division of Oil and Gas, and all other concerned agencies should seek agreement from the Department of the Interior and other Federal authorities that no Federal OCS leases will be approved by the Department of the Interior unless:

- a. Need for Federal OCS development off California has been clearly determined as required in Policy #16;
- b. Opportunities for effective review of proposed OCS development plans are provided for the general public, interested units of State, regional, and local government, and other segments of the communities most immediately effected by OCS development activities;
- c. One, five, and ten year plans for petroleum production and all related development as described above in Policy #17, and their impacts on the California coast, are fully developed and disclosed;
- d. The leases in question are clearly separated from State petroleum sanctuaries to prevent drainage of oil and gas reservoirs that may lie partially on State submerged lands;

- e. Petroleum production under Federal jurisdiction off the California coast is made subject to safety standards at least as stringent as those for production on State-regulated offshore areas (i.e., those contained in the California Division of Oil and Gas regulations and the manual of procedures of the State Lands Division);
- f. The possibility of unitization or consolidation of all operations and facilities has been fully evaluated and required where feasible, as described in Policy #19;
- g. The possibility of use of submerged drilling, completion, and production systems that have been adequately tested to meet rigid environmental safety standards has been fully evaluated as a partial alternative to platforms;
- h. The Federal government has agreed to provide monies to California (and to other states) prior to leasing, with the funds to be reimbursed either through a fee related to production volumes, or by making available a portion of its revenues from OCS lease sales or production royalties, or by granting funds from some other source, to assist the State and local governments in planning for and overcoming or mitigating any adverse impact of this production (e.g., planning for transportation terminals, additional refineries, pipelines and storage areas, and other support facilities in a way that minimizes environmental impacts), and to assist the State and local governments to purchase land for recreation or provide other amenities along the coast to help offset the impact of OCS development;

- i. Sites and tracts should be designated as sanctuaries if they are unusually subject to the risk of oil spills due to geological seismic disturbance; or if the local economy is particularly dependent upon the protection of coastal aesthetic assets. Portions of the Santa Barbara Channel, Monterey Bay, and Santa Monica Bay would appear to be candidates for sanctuary status.

Regional Amplification: None.

SECTION VI: TANKER TERMINALS

Statewide Finding:

91. THE GROWTH IN PETROLEUM IMPORTS AND TANKER SIZE

As California has increased its importation of crude oil and refined products over the past 20 years, tanker size and numbers have increased to handle the expanded import volume. The search for improved efficiencies and economies in transporting large volumes of crude oil has led to the development of supertankers (tankers over 100,000 deadweight tons) and Very Large Crude Carriers ("VLCCs", i.e., tankers larger than 200,000 dwt). Supertankers now use some of the State's tanker facilities, but the deep drafts of Very Large Crude Carriers cannot be accommodated in California tanker terminals. The need for more tankers and any new tanker facilities will be based on future import levels to meet the State's refinery needs and utility company imports.

Variables that will affect tanker import levels are:

- a. General economic conditions in California and the West;
- b. California's in-State petroleum production;
- c. Possible reduced petroleum demand through energy conservation and increased prices;
- d. Possible reduced petroleum demand through development of alternative energy sources;
- e. Energy export and import levels to and from other states (i.e., oil and gas to the Midwest, electricity from Four Corners, natural gas from Alaska, etc.); and
- f. Federal energy policies affecting OCS production, import levels, interstate shipment of oil, and siting of tanker terminals.

All of these factors will combine to determine the need for importation of petroleum by tankers.

No single State agency oversees and coordinates the siting of tanker terminals in order to maximize efficient siting and minimize environmental risks and impacts.

Regional Amplification: None.

Statewide Finding:

92. CALIFORNIA'S REGIONAL AND NATIONAL
ROLES IN PETROLEUM SUPPLY

At present California plays a regional role in receiving and supplying oil and petroleum products to other states in the Petroleum Administration for Defense District Five ("PAD V"—California, Arizona, Nevada, Oregon, Washington, Alaska, and Hawaii). In recent years, California's role in supplying these other states has declined, as the Pacific Northwest and Hawaii have developed their own terminal and refinery capacities. Some experts have forecast that by 1985 exports from California to other PAD V states will cease entirely, and that California's "regional role" will be, in effect, to supply its own very large demand. It is more likely, however, that California will continue to account for some relatively small amounts of petroleum exported to other states in the region, and other nations planning for tanker terminals should reflect this fact.

In recent months, at least two major oil companies have begun to consider plans to ship Alaskan oil to California terminals for

subsequent pipeline transshipment to the Midwest. Despite oil industry assertions that planning for tanker terminals in California should accept this State's national role in supplying energy, such a possible role has not yet been clearly defined by any Federal agency as a part of any comprehensive national program for energy conservation and development.

Regional Amplification: None.

Statewide Finding:

93. TANKER TERMINALS CAN BE SITED AWAY FROM
REFINERIES AND METROPOLITAN AREAS

Tanker terminals have usually been sited in close proximity to refineries and power plants, which in turn have been located near product markets (metropolitan areas). Extensive pipeline systems are capable of reducing the need for this traditional clustering, power plants, and product markets. For example, Standard Oil of California's proposed Estero Bay terminal would require about 280 miles of pipeline.

Regional Amplification: None.

Statewide Finding:

94. TANKER TERMINALS MAY REQUIRE DREDGING AND FILLING

Harbor or nearshore tanker facilities may require dredging and filling for both the berthing area and land storage tanks, with potential for significant adverse associated environmental effects on

marine life and tidal action (as discussed in the Marine Environment Planning Element).

Regional Amplification: None.

Statewide Finding:

95. TANKER TERMINALS CAN HAVE GROWTH IMPACTS

Tanker terminals and related onshore facilities do not themselves require large amounts of coastal land except for tank farms, but they can encourage related development that need not be situated near the coast. The presence of major refining capacity frequently leads in turn to the development of associated secondary industries (e.g., petrochemical, plastics) in the same immediate area. Tanker terminals that encourage refinery construction nearby onshore could, therefore, promote the use of valuable coastal land for purposes accomplished just as well at inland sites, could contribute indirectly to increases in air pollution in coastal areas, and could also induce growth of related commercial and residential areas. Tanker terminal siting strategies can be effectively coordinated with broad regional or State planning for growth.

Regional Amplification: None.

Statewide Finding:

96. ECONOMIC FACTORS OF SUPERTANKERS

Supertankers reduce the transportation costs of crude oil roughly in proportion to the size of the ship and distance traveled. While the transportation costs to shippers may be substantially reduced

through use of larger vessels (e.g., tankers of between 70,000 dwt which carry about 450,000 barrels of crude oil, and 200,000 dwt, which carry about 1.5 million barrels of crude oil), particularly over very great distances such as between the Middle East and California, the price difference accruing to consumers is relatively much less significant (e.g., less than one cent per gallon of gasoline from Alaskan oil, and about two and a half cents per gallon of gasoline from Middle Eastern crude, with no guarantee that industry's cost savings will be passed on to consumers). Some of the savings from use of larger vessels result from reduced tanker fuel consumption per unit of oil transported.

Regional Amplification: None.

Statewide Finding:

97. PROPOSED PLANS FOR TERMINALS FOR SUPERTANKERS OR VERY
LARGE CRUDE CARRIERS (VLCCs) IN CALIFORNIA

Oil companies and utilities must by economic necessity look beyond the immediate future when investing millions of dollars for future tanker terminals. To reduce transportation costs, several oil companies propose to use VLCCs ranging from 200,000 to 400,000 dwt (water drafts of 60-90 feet) to ship crude oil to California from the Middle East, and Indonesia. No existing California terminal facilities can accommodate tankers of these dimensions. However, unless foreign imports into California from places similarly distant, are very high, the frequency of use of a California deepwater

terminal might be insufficient to justify the cost of terminal construction and the commitment of coastal zone resources to such a project. If such imports totaled 170,000 B/D, for example, all brought in supertankers of about 200,000 dwt, a supertanker terminal facility would be in use only about one-sixth of the time.

To meet their projected needs for increased volumes of oil from outside California, oil companies and utilities have proposed new or expanded tanker facilities at Estero Bay (up to 400,000 dwt, Standard Oil of California), Moss Landing (up to 130,000 dwt, Pacific Gas & Electric), and Long Beach or Los Angeles Harbor (less than 200,000 dwt, Standard Oil of Ohio), with further proposals likely to follow. Standard Oil of Ohio has proposed to ship Alaskan crude oil to the Los Angeles area in 165,000 dwt tankers for subsequent transshipment to the Midwest through a yet-to-be-approved-or-constructed pipeline. ARCO is considering a similar plan, probably using tankers of up to 150,000 dwt. Presumably such transshipment proposals would be economically feasible only if there were a surplus of crude oil available in California.

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast:
4. South Central:
5. South Coast:
6. San Diego: "Potential Deep Water Port Development in the San Diego Region. Encina is the only location in San Diego County the Army Corps of Engineers considered for potential deep water

port development. However, because serious environmental problems are anticipated with an Encina port, which tends to make other alternatives more plausible, it was eliminated from detailed consideration."

"Among problems identified with the Encina deep water port site are: (1) the proliferation of oil holding tanks which would commit significant portions of limited coastal space with accompanying adverse impacts on aesthetics and air quality; (2) the adverse consequences of additional pipelines which would follow the railroad right-of-way and cross a number of lagoons and inlets--this pipeline would not only increase the chances of an oil spill in or near one of the fragile lagoons, but would virtually guarantee long term presence of the existing railroad right-of-way; and (3) the potential long-lasting impact of an oil spill from a tanker transfer operation, which could severely impact the lagoons' natural habitat, bird life, and shallow water and intertidal organisms."

Statewide Finding:

98. RELATIONSHIP OF OIL SPILLS TO TANKER SIZE

A major study for the Army Corps of Engineers concludes that "although larger tankers are, per unit of oil transported, lesser sources of pollution through casualties, it is also undoubtedly true that the potential for an incident of higher severity exists." Regarding terminal operations involving supertankers, the same report concludes that "although the frequency of terminal spills may decrease with the use of larger vessels, the severity will likely increase in proportion and the total net discharge will not be significantly changed." Definitive comparisons of tanker size to operational safety may be premature, however, until more data becomes available. Other factors directly related to frequency and size of oil spill are vessel age, design, single or double hull construction, and degree of compartmentalization; prevailing weather conditions, and regulations governing operations in severe weather; and degree of a crew's operational experience in particular waters or harbors, among other human factors.

(See Findings 85-88 /or conclusion regarding oil spill containment, clean-up, and damage potential.)

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast:
4. South Central:
5. South Coast: "Environmental Impacts of Tanker Size. The environmental impacts of using greater than 150,000 dwt tankers versus those impacts of smaller tankers are debatable. It has been postulated that larger tankers would reduce the number of oil spills because the number of collision possibilities is reduced and fewer cargo transfer operations are required. On the other hand, using larger tankers increases the potential of larger spills occurring. Within the Region's existing ports, smaller spills are more likely to be contained and cleaned up with only minimal short term environmental impacts. The criteria specified in the Act require, therefore, that the Commission favor smaller, rather than larger, tankers received within existing ports, rather than at an offshore buoy facility."
6. San Diego:

Statewide Finding:

99. ALASKAN OIL MAY COME IN TANKERS UP TO 150,000 DWT; EXISTING CALIFORNIA TANKER TERMINALS ARE BELOW 150,000 DWT CAPACITY

It appears that California's increased petroleum import needs may be met by Alaskan crude oil when the Alyeska pipeline begins operation in late 1977 or 1978. Because export of Alaskan crude oil to Japan is prohibited by the Alaskan pipeline bill unless mandated by presidential proclamation; the Alaskan North Slope crude is expected to be transported by ship to the Pacific Northwest and California. Most oil companies report that the vast majority of the 1.2 to 2.0

million barrels per day volume of Alaskan oil expected to come to California will be transported in tankers under 150,000 dwt.

Low sulfur crude oil will probably continue to be imported from foreign sources but with an associated minimal increase in consumer prices this oil can be transported to California in conventional draft tankers of about 150,000 dwt or less. Increases in desulfurization refining capacity will reduce the amount of low sulfur crude oil imported.

No existing California tanker terminal can accommodate conventional tankers larger than 138,000 dwt, although with only minor dredging and expansion of onshore pipelines and storage tank facilities, this limit could be increased to about 150,000 dwt for ships of conventional draft. With some modifications to existing facilities the Port of Long Beach could berth three tankers of up to 200,000 dwt of the wide beam configuration now being proposed: or tankers up to 138,000 dwt of conventional draft. The Port of Los Angeles facilities can accommodate loaded tankers of about 90,000 dwt. And El Segundo offshore buoy systems can serve tankers of about 130,000 dwt. San Francisco Bay facilities at Richmond allow berthing of light-loaded tankers of 130,000 dwt. Although under unusual conditions a fully loaded 104,000 dwt tanker was able to cross the sand bar outside the Golden Gate, the bar normally prohibits the entry of any fully-loaded tankers larger than 85,000 dwt.

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast:
4. South Central:
5. South Coast: (See South Coast Regional Amplification for Finding #101, below)
6. San Diego: "Regional Tanker Operations. Only two locations in the region, Encina (Carlsbad) and San Diego Bay, can accommodate tankers. The Encina Mooring, located 3,500 feet offshore, permits transfer of fuel oils for eventual burning in one of the region's four fossil steam power plants.

"No significant oil spills have occurred in Encina's 17 years of operation, although the projected three fold increase in power plant fuel oil usage by 1979 will obviously increase oil transfer operations, and, therefore, increase the chances of an oil spill incident. About three tankers per month currently offload at Encina, but with the increased use of fuel oil, about five tankers per month, with larger cargoes, are anticipated. If the Carlsbad refinery is built, the Encina marine operations are expected to increase to about six tankers per month.

"Other than the Encina facility, regional tanker operations are limited to the San Diego Bay. SDG&E occasionally brings small tankers, which draw less than 30 feet, directly into the Bay; however, normally barges bring its power plant fuel down the coast from Encina. Over half of the oil now imported at Encina is barged to SDG&E's 24th Street storage facility for use in the South Bay, Silvergate and Station B plants.

"The military is recently bringing in almost one-half of its fuel requirements by ship—over 2.1 million barrels in fiscal 1973-74, and the remainder by pipeline.

"Federal Government oil arriving by tanker is offloaded at Navy's Point Loma Fueling Station for storage and distribution. Most of the oil which supplies the San Diego Fleet is then harbor barged to the individual ships or to the North-Island storage tanks.

"The Point Loma Station can accommodate tankers drawing up to 36 feet, which generally limits the facility to tankers of the T-2 classification, or approximately 36,000 dwt.

"The military has recently imported greater quantities of their oil requirements by ship than in preceding years, primarily because sufficient quantities were not available in Los Angeles for pipeline transmission. The amount of oil available through the Los Angeles pipeline directly affects the extent of Navy tanker operations in San Diego Bay."

Statewide Finding:

100. MULTI-COMPANY SHARING OF FACILITIES

Most existing tanker terminals are owned and operated by single companies or port jurisdictions that lease specific berths to single companies. Multi-company sharing of tanker facilities would reduce the need for new or expanded tanker terminals. Terminal efficiency (e.g., maximum volume with minimum waiting time and high use of facilities) increases with the number of berths available to any ship. Thus, with multi-company use, more volume could be handled by existing facilities reducing the need for new or expanded facilities for deep draft vessels. Such "common carrier" practices are being analyzed by the anti-trust division of the Justice Department.

Regional Amplification: None.

Statewide Finding:

101. EXISTING TANKER FACILITIES CAN ACCOMMODATE
ADDITIONAL IMPORT VOLUMES

Existing tanker facilities are under-utilized, largely because many of them are operated by single companies which do not fill berth capacity. If terminal facilities were utilized to their maximum extent, it appears that California's petroleum needs could be

accommodated in existing facilities for some time, given the following conditions:

- a. California receives and refines the vast majority of Alaskan crude oil production;
- b. California's demand for petroleum does not exceed projected levels and California does not become a major exporter of crude oil to states outside of the region;
- c. Tanker size does not exceed about 150,000 dwt of conventional draft, with some existing facilities expanding to accommodate such tankers where only minor dredging is required; and
- d. Minor expansion of onshore pipelines and storage facilities occurs.

A representative of the U.S. Army Corps of Engineers has stated:

"We agree that existing tanker facilities can accommodate Alaskan import volumes not only until at least 1985, but possibly to the year 2000. However, this alternative, where feasible, may not be the most economical. The need for deepwater terminals is a relative need and not an absolute need. The consequences of deferring offshore deepwater terminals could mean the loss of economic advantages and a greater environmental hazard due to increased traffic at inshore harbors."

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast:
4. South Central:
5. South Coast: [It is the State Commission staff's understanding that the reference to specific harbors in the South Coast finding below is an observation only, is not intended as any commitment to specific expansion proposals unless they can be accomplished with minimal dredging, filling, or landform construction as provided in the Coastal Plan policies.]

"Existing South Coast Terminals.

- "a. The upper limit of present terminal facilities, with minimum dredging, in the South Coast Region is loaded tankers of approximately 150,000 dwt of conventional draft, which is the maximum size to be used on the Alaskan routes to the Region. An additional six berths in Long Beach and four in Los Angeles Harbors are presently available which could be developed to handle these tankers. These berths could handle the oil requirements of all refineries in the Region.
- "b. Since larger tankers reduce the cost of moving crude oil, particularly for long distances, such as from the Middle East, there are definite economic advantages to using larger tankers. The very large crude carrier (or VLCC, a ship over 200,000 dwt) tanker require berth depths beyond those economically attainable given the present port configurations. According to the Army Corps of Engineers, an offshore monobuoy system could be installed to handle VLCC tankers serving the Region's refineries.

"Future Terminal Needs. The existing offloading and berthing facilities in the South Coast Region, with possibly some expansion and modernization, can more than likely accommodate the projected 1985 imported crude oil volume of Los Angeles/Long Beach refineries. In 1971, over 400,000 b/d of imported and domestic crude oil and products were handled by ports in the South Coast Region.

"Sources of Future Oil Imports into the Region. It is projected that approximately 925,000 b/d of crude oil and products will be received at ports in the Region by 1985. A substantial portion of the projected differential between Southern California consumption and the available California crude oil production can be supplied from Alaskan sources until at least 1985. Until that time, economic benefits of large or VLCC are unlikely to be substantial and sufficiently large to offset the environmental impacts on the marine environment of constructing additional facilities to handle tankers of more than approximately 150,000 dwt displacement of conventional draft. The relatively small proportion of crude oil likely to come from the Middle East during this time period (1974-1985 or 1990) would not justify building facilities for VLCC tankers in the Region."

6. San Diego:

Statewide Finding:

102. FACTORS IN SITING NEW TANKER TERMINALS OFFSHORE

California may eventually require expanded tanker terminal capacity to accommodate increased crude oil imports. The environmental siting considerations for new or expanded facilities offshore are:

- a. Offshore versus Nearshore Areas. New offshore areas with naturally deep water would entail only minimal dredging for pipelines, could locate the tankers away from areas of critical biological concern in nearshore areas, and could be sited away from busy vessel traffic lanes so as to minimize the risks of oil spills. Offshore facilities, however, would be subject to greater wind and wave action and spills that occur would be more difficult to contain. New or expanded tanker facilities in nearshore areas would most likely involve more environmentally damaging dredging and filling, and pose greater risks of oil spills that could affect vulnerable marine life. Harbors, however, are sheltered from wind and waves and can provide better spill containment capability.
- b. Physical Constraints to Siting. Tanker terminals must be sited with careful attention to meteorological (wind, fog, storms), hydrographic (waves, tides, tsunami), and oceanographic (bathymetric and distance to shore) factors that will dictate the optimal sites available to serve onshore areas.
- c. Offshore Offloading. VLCCs can be unloaded into smaller "shuttle" tankers while remaining in deepwater areas offshore. This practice has already been used off California, but involves increased

congestion of smaller tankers near onshore facilities and appears to present greater risks of operational oil spills. When done under benign weather conditions, this practice can be done with little additional risk, however, the lack of experience with this practice precludes any complete risk analysis based on operational experience.

- d. Monobuoys versus Conventional Buoy Systems. Tanker facilities used throughout the world include piers, floating barges, platforms, island, and offshore conventional buoy mooring systems and monobuoys (single point mooring systems). Offshore sites in California employ pier berths or conventional buoy systems (usually five to seven buoys) which have thus far proven satisfactory for tankers up to 130,000 dwt, although several tanker terminal proposals now advocate using monobuoys. Monobuoys allow a tanker to freely swing around the berthing facility and appear to involve less environmental hazards than conventional buoy systems, which hold tankers rigidly exposed to wind, wave, and current action. Maintenance of hose lines is particularly important in these offshore systems that are exposed to wind and wave action.

Regional Amplification: None.

Statewide Finding:

103. UPGRADED DESIGN CRITERIA FOR TANKERS

Tanker design, equipment, and operational procedures have steadily improved over the past 20 years, allowing larger volumes of petroleum to be shipped, and reducing the risks of oil spills. Such improvement is due in substantial part of the work of classification

societies, international conventions, and the U.S. Coast Guard, which set minimum standards for structural strength, machinery design, maximum load, and equipment requirements, and which promulgate regulations that address pollution control, vessel safety, and vessel design and operation. Such regulation notwithstanding, oil spills have consistently occurred that might have been prevented or mitigated had the vessels had the safest tanker design features now available. Such features are still not fully implemented in all new tankers, primarily because industry questions whether they are "cost effective". They include: design features that aid "load-on-top" procedures, which allow oil and water to be effectively separated and reduce the flushing of oil into the ocean; segregated ballast configurations provide separate oil tanks and water ballast tanks; twin propellers and twin rudders for added maneuverability and operational backup; and auxiliary power systems (e.g., boiler or diesels) to propel the vessel if the primary system fails. Development by the U.S. Coast Guard of minimum performance standards for maneuverability and stopping capability would further encourage safe tanker design. Coast Guard studies indicate that double bottoms reduce the overall risk of spills. Standard Oil of California is building tankers with double bottoms for use in the coastal trade.

Regional Amplification: None.

Statewide Finding:

104. EXISTING OIL LIABILITY MEASURES FOR OIL
SPILL DAMAGES INADEQUATE

California has suffered several oil spills off its coast, primarily from tanker mishaps and deballasting of fouled water. The State itself has no funding to pay the costs of oil spill damages, but relies instead on the State Attorney General to file suit against the appropriate contingency or compensation funds or against other parties for cleanup costs and damages incurred by the State. Other individuals damaged by oil spills must seek their own relief.

The Federal Water Pollution Control Act makes a tanker owner or operator liable for cleanup costs up to \$14 million, and a terminal operator liable for up to \$48 million. Liability is unlimited if there is willful negligence or misconduct; but there is no liability if the discharge was caused solely by an act of God, act of war, negligence by the U.S. Government, or the act or omission of a third party. There is also a National Contingency Fund of \$35 million, provided by the U.S. Treasury, for use of the Coast Guard or EPA in cleaning up spills, or for reimbursement to states of their costs incurred in cleanup. These laws apply to cleanup liability, but do not provide for compensation of damages.

Two international industry voluntary compensation funds, TOVALOP and CRISTAL, provide oil pollution liability coverage for participating companies of \$10 million and \$30 million, respectively, for cleanup and third-party damages. In addition, two international conventions that would establish civil liability, with limits, and an international

compensation fund, have been proposed, and are being circulated for ratification; they would become effective only if ratified by the U.S. Senate and by a sufficient number of other nations.

The Deepwater Port Licensing Bill, passed into law in late 1974, to govern deepwater port development in Federal waters, creates a deepwater port liability fund of \$100 million by levy of a 2 cent per barrel tax on oil that is loaded or unloaded at the terminal. The bill makes owners and operators of vessels liable, without regard to fault, for discharges and damages up to \$20 million; and makes deepwater port licensees liable, without regard to fault, for up to \$50 million; costs and damages not actually paid by the vessel owner/operator or port licensee would be compensated by the liability fund. A draft Senate bill relating to OCS development proposes a similar scheme to cover spills caused by drilling and production activities offshore. The Council on Environmental Quality has proposed creation of a single national liability fund to cover spill clean-up costs and damages from all sources in State or Federal Waters.

Except for the liability provisions of the Deepwater Port Licensing Bill, the existing liability programs are inadequate for a variety of reasons: some provide only for cleanup costs, and not for damages; all provide dollar amounts that may be inadequate in the event of a major spill; all leave a very heavy burden upon states and individuals to litigate for compensation of damages; all leave the question of liability to the law of ordinary negligence, rather than to strict liability. The proposed alternative programs would variously remedy these deficiencies. Enforceability of liability laws may be greatly facilitated by development of techniques for tracing spills to their sources.

Regional Amplification: None.

Statewide Policy:

28. TANKER TERMINAL PLANNING SHOULD BE SENSITIVE TO
NATIONAL ENERGY NEEDS WHERE IDENTIFIED

Planning for tanker terminal facilities in California should be sensitive to national energy needs. However, until the nation's energy needs and supply and distribution policies have been clearly defined, and California's role in a comprehensive national energy conservation and development program is precisely identified, planning should proceed, as before, on the basis of the petroleum needs of the Fifth Petroleum Administration for Defense District (PAD "V": California, Arizona, Nevada, Oregon, Washington, Alaska, and Hawaii). Where necessary to meet needs elsewhere in the United States, oil companies should exchange volumes of crude oil instead of shipping it through California (e.g., exchange Middle Eastern oil formerly destined to California for Alaska oil to be marketed in the Midwest).

Regional Amplification: None.

Statewide Policy:

29. MAXIMIZE USE OF EXISTING TANKER FACILITIES

To reduce the need for new or expanded tanker terminals in California and to minimize both the environmental risks associated with tanker operation and the proliferation of onshore facilities

related to tanker terminal operation:

- a. Existing facilities should be utilized at maximum feasible berth occupancy and multi-company use of existing facilities shall be encouraged, except where increased tanker operations and associated onshore development would be incompatible with land use and environmental goals for the area.

For the purposes of this policy, maintenance dredging may be allowed to the extent of previously constructed channels or to bottom configurations existing on November 8, 1972.

Regional Amplification: None.

Statewide Policy:

30. CONSTRUCT ADDITIONAL TANKER TERMINAL CAPACITY ONLY AFTER STRONG SHOWING OF NEED AND SETTING OF ENVIRONMENTAL SAFEGUARDS

Because the expansion and construction of tanker terminals and associated onshore facilities involves significant adverse environmental impacts, and in view of (1) the possibility that the demand for petroleum imported into California from foreign nations may decrease as a result of Alaskan imports and Project Independence, and (2) the expectation that the tankers used in the Alaskan trade will not exceed about 150,000 dwt of conventional draft, new tanker terminals (or expansions) should be permitted only when it can be demonstrated that:

- a. There is a need for new capacity that cannot be met elsewhere with less risk of adverse environmental impacts through more effective use of existing terminal sites and facilities;

- b. Smaller tankers than about 150,000 dwt of conventional draft could not feasibly be used;
- c. The proposed project will minimize significantly the total volume of oil spilled in normal and accidental operations;
- d. The location, design and construction of the new capacity minimize the risks of other adverse effects to the environment; and
- e. The onshore expansion of pipelines and of storage and pumping facilities associated with the new capacity is not incompatible with local land use and environmental goals, and is carefully designed to minimize adverse environmental impacts.

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast:
4. South Central:
5. South Coast: The South Coast Regional Commission evaluated its Regional needs and facilities and determined that existing facilities could accommodate demand for some time in the future with expansions involving only minor dredging to handle up to 150,000 dwt tankers. The South Coast Commission also developed a basic criterion for determining when facilities should be provided for vessels larger than 150,000.

"Maximize Use of Existing Tanker Facilities. In order to reduce the need for new or expanded tanker terminals in the South Coast Region, minor dredging and modifications to berthing capacity, and construction of additional storage capacity, should be carried out as they are required to accommodate tankers of up to about 150,000 dwt of conventional draft. In addition oil companies should pursue the practice of jointly utilizing terminals that can handle this size of tanker. Onshore expansion of pipelines and storage facilities should be permitted where the result is to increase the efficiency and capacity of existing tanker terminals. The Commission, and its successor agency, shall exercise great care in ensuring that any expansion or modernization will be designed to minimize its impact upon the marine environment.

"Withhold VLCC Terminal Development. New or greatly expanded terminals for ships larger than about 150,000 dwt of conventional draft should not be allowed until Southern California petroleum imports from Indonesia and the Middle East are expected to rise to more than one million b/d within the period of time necessary to construct such terminals. Shipments from Alaska are acceptably low cost in the 150,000 dwt tankers of conventional draft which can be accommodated by the existing port facilities in the Region."

6. San Diego:

Statewide Policy:

31. CONTROL TANKER TERMINAL CONSTRUCTION

To guarantee the optimal siting, construction, and operation of major new tanker terminals, and to minimize the threat of environmental damage from dredging and from oil spills, major new California tanker terminals should:

- a. Be sited in deepwater areas (greater than 80 feet) sufficiently far offshore and so situated as to avoid risks to areas of critical biological concern;
- b. Be sited well out of vessel traffic lanes;
- c. Be owned and operated as multi-company use facilities;
- d. Have ready access to the finest state-of-the-art containment and recovery equipment for oil spills;
- e. Where appropriate, and unless an alternative type of system can be shown preferable for a specific site, use monobuoy offloading systems;
- f. Where operationally required, have onshore deballasting facilities to receive any fouled ballast water from tankers.

Regional Amplification: None.

Statewide Policy:

32. ENCOURAGE USE OF MOST MODERN TANKER TERMINAL
TECHNOLOGY AND OPERATING PROCEDURE

Because modern tanker technology and operating procedure can significantly reduce the probability and size of oil spills, the California Legislature should petition Congress and the U.S. Coast Guard to:

- a. Strictly enforce load-on-top design and operation on all petroleum tankers entering U.S. waters;
- b. Require that all tankers carrying crude oil and refined product to U.S. ports have segregated ballast tanks; double bottoms; twin propellers and rudders unless it can be demonstrated that a substitutable design feature provides better maneuverability and operational back up; auxiliary power equipment (e.g., double boilers) for propelling the vessel in case of engine breakdown; state-of-the-art navigational aids maintained in functional condition; and, ultimately, that all tankers meet performance standards requiring optimum maneuverability and operational back up. The Coast Guard should strictly enforce such requirements, by increasing the number of vessels it actually visits for inspection.
- c. Require radar control by the Coast Guard over vessels in U.S. coastal waters.

Regional Amplification: None.

SECTION VII: REFINERY SITING

Statewide Finding:

105. EXISTING REFINERIES NEAR CITIES AND THE COAST

Of the 34 existing California refineries totaling 1.8 million b/d capacity, 15 refineries are in the Los Angeles area (1,012,000 b/d), 6 refineries in the San Francisco Bay Area (625,000 b/d), 9 in Bakersfield (141,000 b/d), and the remaining 4 at scattered sites (30,000 b/d). These sites were chosen by the oil companies primarily to accommodate the large market areas (major cities), but also, in part, to be close to supplies of crude oil (both inland and waterborne). Most of the Los Angeles and San Francisco plants refine both in-State crude production and crude imports carried by tankers. No State agency oversees the siting of refineries to maximize the efficient and safe location of facilities and minimize the environmental impacts.

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast:
4. South Central:
5. South Coast: "Fifteen refineries, with a total capacity of 1,012,000 b/d, are located in the Los Angeles area. Of this number, ten refineries are located within the five-mile coastal planning area. These sites were chosen to supply at minimum costs the large Southern California market and the District V markets for the products not required in Southern California. The facilities were also close to the local supplies of crude oil and to waterborne shipments from other producing areas."

6. San Diego:

Statewide Finding:

106. CALIFORNIA LACKS ADEQUATE DESULFURIZATION REFINING
CAPACITY

California presently lacks sufficient direct residual fuel oil desulfurization refining capacity to meet demand for low sulfur fuel oil, which has increased greatly in the past two years with the decrease in availability of natural gas for use in power plants. (Low sulfur fuels or natural gas must be burned in fossil fuel-powered electricity-generating power plants in order to meet air pollution emission standards.) California has therefore had to rely on importing large volumes of low sulfur crude oil and residual fuel oil, both of which are expensive and hard to obtain on the world market. If desulfurization capacity is constructed in California, refinery costs will be significantly increased. The import requirements for hard-to-get low sulfur crude oil, however, will decrease, and although the total volume of crude oil needed in California will not be reduced, the ability to utilize high sulfur fuel oil will provide greater supply flexibility and reduce crude costs. New desulfurization refining capacity is now under construction at the Richmond and El Segundo refineries (Standard Oil of California); and a new refinery proposed near Carlsbad (Macario Independent Refinery) would also have direct residual fuel oil desulfurization capability.

California could also benefit from additional refinery desulfurization capability for production of low sulfur gases and distillate fuels.

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast:
4. South Central:
5. South Coast: "Need for Modernizing Refineries to Produce Higher Quality Products."

"a. At the present time, two refineries in the South Coast Region are adding desulfurization capacity. Without this desulfurization capacity, South Coast Region and California power plants will need to rely more heavily on imported low sulfur crude oil and residual fuel oil in order to meet air pollution emission standards. Since adequate volumes of natural gas are unlikely to be available, these power plants will have to burn high sulfur fuels requiring stack gas scrubbers to meet present air quality standards. Increasing the Region's desulfurization capacity will decrease import requirements of foreign low sulfur fuel.

"b. The gasoline quality requirements of the EPA generally require an upgrading of downstream refinery processing facilities, including the construction of catalytic reformers and cracking units. These refinery processes likely will produce some increase in air and water emissions at the refinery; however, they are in the public interest as defined in the Act if, on balance, they substantially reduce total emissions into the South Coast Air Basin when the reduced emissions of the users of the fuels are taken into consideration."

6. San Diego: "Refinery Proposal." No refineries currently exist in the San Diego region, although a new 100,000 barrel per day refinery is proposed for Carlsbad which would produce low sulfur fuel oils for the production of electricity in the region's fossil fuel steam plants. Intermediate sulfur content crude oil, presumably from the Alaskan North Slope, would be imported exclusively by tanker using the existing offshore mooring at Encina. No expansion or change to the offshore mooring or pipelines is anticipated.

"In addition to producing low sulfur fuel oil, the refinery would be designed to produce either 100 million cubic feet per day of synthetic natural gas, which would amount to 60 per cent of the region's gas requirements by 1978, or 21,000 barrels per day of gasoline (22,000 BPD of Naphtha), and would require approximately 4 million barrels additional storage capacity. Land use, water supply and discharge, air emissions, and the need for low sulfur fuel oil and increased natural gas supplies are all expected to weigh heavily in the environmental analysis of the refinery proposal."

Statewide Finding:

107. REMOTE SITING OF REFINERIES POSSIBLE WITH INCREASE
IN PRODUCT COSTS

Primarily because refined products must be kept segregated during shipping and storage operations, the transportation of refined products is more costly than transportation of crude oil; therefore, proximity of refinery sites to market areas is a greater industry priority in siting decisions than proximity to tanker terminals. For example, Standard Oil of California is willing to pipe crude oil a distance of 277 miles from its proposed Estero Bay superport to its Richmond refinery; but no major California refineries are presently located at a similar distance from metropolitan areas. Added transportation costs resulting from remote siting would presumably be passed on to consumers in the form of increased product prices. Other factors that must be addressed in remote siting considerations are the availability of properly zoned land, pipeline easements, fresh water for cooling, and net energy and materials requirements. Siting of refineries away from market areas (in California, away from critical air areas) is feasible, and would help restore critical air areas; but it would raise the cost of refined products by as much as one to three cents per gallon.

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast:
4. South Central:

5. South Coast: "Economics of Refinery Siting. Crude oil is lower in cost to ship in pipelines than is the shipment of refined products. Judged on this basis, the proximity of refineries to tanker terminals is not as critical as is the proximity of refineries to market areas. Refineries, therefore, are not dependent on coastal locations. For example, of twelve projects proposed for increased refinery capacity in California, only three sites are located in the coastal zone. Other economic factors, including location of water sources, waste disposal sites, manpower, transportation, etc., must also be considered on a site-by-site basis."
6. San Diego:

Statewide Finding:

108. AIR QUALITY CONCERN AFFECTS REFINERY SITING

Petroleum refining produces emissions of particulates, sulfur oxides, nitrogen oxides, olefins (reactive hydrocarbons), aldehydes, ammonia, hydrogen sulfide, and carbon monoxide. The type of emissions and emission levels from any particular refining operation will depend on the type of process units the refinery employs, among many other variables. Refinery air pollution emissions have been decreased in modern refineries by improved combustion technology, better operating procedures, and more conscientious control efforts, but they have not been eliminated.

In administering the Federal Clean Air Act, the Environmental Protection Agency, State agencies (Air Resources Board) and local Air Pollution Control Districts (APCDs) control the allowable levels of some pollutants from single stationary sources (e.g., refineries) and also set standards for ambient air quality.

Under the Clean Air Act, major new stationary sources are to be prohibited if they would interfere with the attainment or maintenance of ambient air quality standards. It is possible that a new refinery

might be capable of meeting the stationary source emission standards, but not be permitted because it would interfere with attainment of national ambient air standards or with other more rigorous air quality goals. In California, existing refineries generally do not exceed ambient or stationary source standards for emissions of sulfur oxides, nitrogen oxides, particulates, and carbon monoxides during normal operations.

Of particular concern are refinery hydrocarbon emissions. Hydrocarbons combine with oxidants and sunlight in a photochemical reaction to produce photochemical oxidants. The Federal ambient hydrocarbon standards are a guideline to help achieve the ambient photochemical oxidant standard. At least one major study, however, disputed by the oil industry, questions the technological ability of any refinery to meet the Federal standards for hydrocarbon emissions, and cites the need for further study of this critical issue.

While even the most modern refineries will produce some emissions, the production of "cleaner" petroleum products can result in a net reduction of air pollutant emissions in an area. This can occur when these "cleaner" products replace more highly polluting products presently in use. Maximum restorative benefit to an area that already has air quality problems can be achieved by siting the refinery outside of the problem air area, while utilizing the cleaner products within the area. The degree to which states can allow air quality to be "degraded", even if it would still meet Federal ambient air quality standards, is presently being contested in courts. Future refinery capacity may be forced to move outside critical air basins if it interferes with attainment of air quality goals; but, on the other

hand, refineries may not be permitted to "significantly" deteriorate the air quality of pristine areas. Air quality regulations and their implementation are extremely controversial, and are presently still in a state of flux.

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast:
4. South Central:
5. South Coast: "Air Quality Factors Affecting Refinery Siting. Refineries emit air pollutants, including particulates, sulfur and nitrogen oxides, olefins (reactive hydrocarbons), and other chemicals into the highly polluted South Coast Basin. Refineries contribute to the deterioration of the overall air quality of the air basin unless they meet the criteria specified in point 5b." [See Finding #105, Regional Amplification.]
6. San Diego:

Statewide Finding:

109. POSSIBLE EFFECTS OF REFINERY POLLUTION

Two recent studies by the National Academy of Sciences and the University of Southern California School of Medicine suggest a relationship between hydrocarbons emitted by certain refinery processes and a higher incidence of lung cancer mortality in populations exposed to the hydrocarbon in question. The authors of the studies have very carefully cautioned against improper interpretation or use of their extremely tentative conclusions as a basis for policy formulation prior to further development of their data base. The

studies do not definitively establish any causal link between the presence of the refineries and the higher observed lung cancer mortality in the near area.

Refineries can, however, contribute to the deterioration of the overall quality of an air basin, which in turn can cause eye and lung irritation and aggravate respiratory and cardiac ailments. There are presently no comprehensive State or local regulations governing the residential use of land within the "health-effect distance" range of refineries.

Refineries can also have adverse effects on agricultural activities, property, and flora generally.

Regional Amplification: None.

Statewide Finding:

110. RELATIONSHIP OF REFINERY SITING TO GASOLINE CONSUMPTION

Gasoline combustion for transportation is the primary cause of air pollution. The reduction of refinery emissions or the remote siting of new refineries would contribute to the restoration of the air quality of metropolitan areas; but only substantially reduced burning of gasoline in automobiles can lead to actual attainment of the ambient air quality necessary for the protection of public health in critical air basins. The slightly increased costs of siting refineries outside of critical air basins would not suppress demand for gasoline.

Regional Amplification: None.

Statewide Finding:

111. PHYSICAL SITING CRITERIA FOR REFINERIES

Because of the relationships among refineries, sources of crude oil imports, and population concentrations near the coast, there are economic advantages to siting refineries near the coast; but refineries can feasibly be sited inland, and as such they are "coastal related", but not "coastal dependent".

Wherever a refinery is sited, it will have a very substantial impact on the locale. Although small refineries can be built on tracts no larger than 200-300 acres in size, major new refineries typically require as much as 500-1,500 acres of land, including a surrounding greenbelt. They require water supplies adequate for cooling, and treatment facilities adequate to handle large waste volumes. They are large-scale, visually intrusive industrial developments. Even the most modern refineries may occasionally emit noise and odors, and represent significant single sources of air pollutants.

Refineries can encourage the nearby construction of petroleum-associated industries (petrochemical, plastics), which can lead to rapid industrial growth and increased population. In the short-term, refineries enlarge the tax base of the host community; in the longer term, they very substantially increase municipal services requirements, and may ultimately lead to a decline in residential and commercial property values. Many of these potential impacts can be mitigated by rigorous planning and new technology; but they cannot be eliminated.

Refineries have a large fire and explosion potential. State and Federal regulations and the considerable efforts of refinery owners

can minimize this potential. Optimal safety considerations require siting refineries away from seismic areas, and separating them from surrounding populations by a buffer area.

Of the 11 projects proposed in California for additional refinery capacity, only 3 are at sites in the coastal zone. The one major coastal zone site expansion—El Segundo—was approved by the Commission in June, 1974. The 2 other projects are a 100,000 b/d new refinery proposed near Carlsbad, set back 1-2 miles from the coast and designed primarily to provide low sulfur fuel oil to San Diego Gas and Electric's Encina power plant; and a 60,000 b/d new refinery proposed near Ventura.

Regional Amplification: None.

Statewide Finding:

112. WATER QUALITY AND SOLID WASTE DISPOSAL FACTORS
AFFECTING REFINERY SITING

The EPA has identified a wide range of water pollutants which are emitted by oil refineries in either their process or cooling water streams. Modern water treatment technologies can reduce these emissions, and once-through cooling systems, sometimes used to dilute pollutants to meet discharge standards, can be eliminated. At presently used levels of treatment, additional oil refineries discharging wastes to the marine environment would degrade the waters of the coastal zone to a degree not consistent with the objectives of the Act, unless it could be shown that a proposed expansion project would substantially reduce the total discharge load to receiving waters.

Removal of pollutants from the air and water discharges from refinery systems will result in accumulations of solid or semi-solid waste products, for which proper disposal must be provided.

Regional Amplification: None.

Statewide Policy:

34. MINIMIZE REFINERY CONSTRUCTION ALONG THE COAST

Because refineries are not dependent on coastal siting, involve significant consumption of land and adverse aesthetic impact, and encourage construction of petroleum-associated industries and commercial and residential growth, new refineries or expansions of existing refineries shall be permitted in the coastal zone (as defined in Public Resources Code Section 27100) only when it can be demonstrated that:

- a. There is a public need for such facilities, the determination of which is coordinated with the determinations of need for OCS production in Policy 16 and tanker terminals in Policy 28;
- b. The refined products will significantly assist in reducing air pollution by users of the products;
- c. The site is not in a highly scenic area, as defined in the Appearance and Design Element;
- d. There is no less environmentally damaging site available. If the State Energy Commission is given authority for statewide refinery siting, it shall make the determination as to availability of preferred alternative sites inland, and the agency designated to carry out the Coastal Plan should be given

concurrent jurisdiction over alternative sites in the coastal zone. In the absence of Energy Commission refinery siting authority, the coastal agency shall make the determination.

- e. The project is designed and located to minimize any adverse environmental effects;
- f. The proposed site provides a sufficient buffer to minimize impacts to surrounding property;
- g. No significant degradation of local air quality will result; and
- h. The proposed project is consistent with all other adopted coastal policies.

The agency designated to carry out the Coastal Plan should coordinate with other agencies such as the State Energy Commission in any future refinery siting studies and policy development.

Regional Amplification: None.

Statewide Policy:

35. RESTRICT REFINERIES IN CRITICAL AIR AREAS

Because a refinery represents a significant single stationary source contributing to air pollution, because air quality in critical air areas (as defined by the California Air Resources Board) should be subject to an active policy of maximum restoration in order that health-based standards may be met, and because it is feasible to site new refineries outside of critical air areas, while furnishing the cleaner products for use in the critical air areas:

- a. No new refineries should be permitted in critical air areas (as defined by the Air Resources Board) unless it can be shown

that their negative impacts upon water quality and air quality are more than fully offset by reductions in the water discharge and gaseous emissions into the area by the users of the fuels. In no event shall a new oil refinery be permitted on any of the Channel Islands or near an area of special biological significance as identified in the Marine or Coastal Land elements; and

- b. Existing refineries in critical air areas should be permitted to expand capacity or be replaced only if the best available technology for reducing emissions is utilized and total site emission levels and site levels for each emission type for which national or State ambient air quality standards have been established (i.e., hydrocarbons, sulfur dioxide, oxides of nitrogen, carbon monoxide, and particulates) do not increase.

Regional Amplification: None.

Statewide Policy:

36. SITE AND DESIGN REFINERIES SO AS TO PROTECT PUBLIC SAFETY

Because refineries have the potential for large fires and explosions, refineries should be sited and designed to minimize exposure of surrounding property and population to the consequences of such events, and should be sited away from areas possessing a substantial degree of seismic risk.

Regional Amplification: None.

Statewide Policy:

37. CONSTRUCTION OF DESULFURIZATION CAPACITY

To reduce the need for imports of low sulfur crude oil and residual fuel oil, while continuing to make these fuels available to electricity-generating utilities and industry, and to encourage production of other forms of low sulfur fuel, applicants for additional refinery capacity in California, but not necessarily in the coastal zone, should maximize the addition of desulfurization capacity designed to produce these low sulfur fuels, unless the Energy Commission determines some greater public need outweighs the advantages of such a requirement. Consideration should be given to providing for the production and storage of methanol.

Regional Amplification: None.

Statewide Policy:

38. MINIMIZE USE OF ONCE-THROUGH COOLING

Because of the potential for damage to the marine environment from use of once-through cooling systems, new or expanded refineries should minimize the need for once-through systems by maximizing use of air-cooling, and by using treated waste waters from in-plant processes for cooling tower make-up. Once-through systems in new or expanded refineries shall be permitted only according to the standards set by the Marine Environment Statewide Policies 7(b), 7(c), 7(d), 7(f), and 7(g). Construction of new cooling facilities to replace once-through facilities and new water treatment plants

designed to reduce the discharge of pollutants into the marine environment shall be permitted.

Regional Amplification: None.

SECTION VIII: LIQUEFIED NATURAL GAS (LNG)

Statewide Finding:

113. IMPORT OF LNG WILL REQUIRE SHIP TERMINALS
AND ONSHORE FACILITIES

Natural gas is considered to be the cleanest burning and most efficient fossil-fuel for heating purposes. The most significant potential sources of natural gas for California are primarily in Alaska and overseas. To be transported economically by ship, natural gas must first be liquefied by cooling it to -259°F . to reduce its volume by a factor of 600. After shipment to areas near existing markets or pipelines, liquefied natural gas (LNG) is stored in large tanks and vaporized in a plant as it is needed. Terminal and associated facilities for LNG must unavoidably be situated on the coast with present technology.

Regional Amplification: None.

Statewide Finding:

114. THREE COASTAL SITES ALREADY IDENTIFIED BY GAS
COMPANIES FOR LNG DEVELOPMENT

Western LNG Terminal Co., a subsidiary of Pacific Lighting Co., is already seeking Federal Power Commission approval for an LNG terminal and facilities at Oxnard (Ormond Beach) to handle LNG from Indonesia; it is developing a second proposal for a terminal and facility in Los Angeles Harbor to handle LNG from southern Alaska; and a third proposal for a terminal and facility at Point Conception for LNG produced as gas on the Alaskan North Slope and piped to Southern

Alaska for liquefaction. The Point Conception proposal is an alternative to a pipeline proposed through Canada, which would serve California along with the western and midwestern U.S., and eastern Canada; a decision by the FPC is pending on the choice of the alternatives, but reportedly will not be forthcoming before July, 1975 at the very earliest. Final FPC action on the three Pacific Lighting proposals is not expected prior to late 1975—early 1976.

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast:
4. South Central:
5. South Coast: "Three Sites of LNG Development Already Identified. Western LNG Terminal Company, a subsidiary of Pacific Lighting Corporation is seeking Federal Power Commission approval for three sites, each of which could receive as much as four billion cubic ft./day of LNG; Los Angeles Harbor, Ormond Beach (Oxnard), and Point Conception. The latter two sites are in the South Central Region. Target completion date for the Los Angeles harbor facility is 1978, when the ships to transport the LNG will be completed. El Paso Natural Gas is proposing to use the LNG facility to be located at Point Conception as an alternative to a trans-Canada gas pipeline. The El Paso proposal is now under consideration by the FPC. Subject to FPC approval, the initial Los Angeles facility would receive up to 400 million cubic feet per day from South Alaska."
6. San Diego: "San Diego's LNG Potential. To augment normal supply and meet peaking requirements, San Diego Gas and Electric Company owns and operates two LNG liquefaction plants at their single site in Chula Vista, with a combined vaporization rate of 240 MMcf per day and a total storage capacity of 1,812 MMcf. The LNG plant site is not currently equipped to receive LNG from seagoing tankers, although such marine operations may be potentially desirable if regional demands for gas exceed conventional methods of supply, and if LNG marine imports, particularly from Alaska, become economically competitive.

Expanded LNG capability to meet base load requirements would necessitate not only increased storage capacity, but faster and more advanced liquefaction capability.

"San Diego has recently begun receiving LNG deliveries equivalent to 1.9 MMcf per day from the Tioga Wells Corporation in Merced. This presently constitutes the only gas SDG&E imports which is not dependent on the Southern California Gas Company—approximately 1 per cent of the total gas used in the region. The Tioga Wells gas is liquefied in Merced, as part of a process to remove nitrogen to make the gas commercially usable, and is delivered daily by cryogenic road tankers to San Diego's existing LNG storage facilities."

Statewide Finding:

115. LNG A VERY HAZARDOUS SUBSTANCE

LNG is difficult to handle because (a) the extremely low temperature at which natural gas is liquefied causes unique stresses on normal containment materials, and requires special alloys to avoid such stresses; and (b) in the event of an escape of LNG, there is very rapid formation of a vapor plume, which the low temperature causes to hang close to the ground until its temperature increases to make the gas lighter than the air. Unconfined, the vapor mixed with air is not explosive, but in a ratio of 5-15 per cent vapor to air it is highly flammable. Within enclosed spaces, if thus mixed with air in the presence of an ignition source, it can explode. The primary danger present in a large-scale LNG spill is a very intense fire at the spill site; a remote hazard is that the vapor plume could drift into enclosed spaces adjacent to a spill site and explode or catch fire.

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast:
4. South Central:
5. South Coast: "LNG a Hazardous Substance. Natural gas is liquefied at -259° F.; therefore, the containment of LNG requires special materials. If LNG is not confined, it will evaporate yielding a plume of vaporized gas. Where methane constitutes 5-15 per cent of the air-vapor volume, the resulting mixture is highly flammable. If a continuous "plume" of vapor is ignited before it has warmed sufficiently to disperse, the fire would burn back along the plume to the spill source which could set fire to the LNG tanker or storage tank. Another, even more remote, hazard is that the vapor plume could drift into enclosed spaces where a source of ignition is present near a spill site and explode."
6. San Diego:

Statewide Finding:

116. MOST SIGNIFICANT HAZARD IS LNG SPILL ON WATER

The greatest danger of serious fire or explosion would occur following a major spill of LNG on water; the consequences would be most serious in an active harbor area. The heat of the seawater and large spill surface area result in very rapid vaporization. The FPC staff has stated that if in a "worst case accident" an entire shipload of LNG were released instantaneously without being ignited, it would evaporate in about 37 minutes, forming a very large, cold, dense vapor cloud. Under conditions of very light winds (5-10 knots) and stable air, the flammable cloud could extend as far downwind as three miles. Experts believe

it very unlikely that a vapor cloud of even this size could form and drift very far without encountering an ignition source and causing a fire that would burn back to the site of the spill. (The most likely such ignition source would be the collision itself.) The chances of an accident causing any spill can be reduced by special safety design features for LNG carriers, and by the Coast Guard's use of strict traffic control procedures during passage of loaded carriers into a harbor.

Regional Amplification: None.

Statewide Finding:

117. SAFETY MEASURES NECESSARY TO MINIMIZE RISK OF LNG
SPILL ON WATER NEAR SHORE

Because of the potentially disastrous effects of a large-scale LNG spill on water, particularly near a developed area, the Coast Guard prescribes and implements measures to ensure safe passage of LNG carriers into berthing facilities. The Coast Guard determines what safety measures are required by conditions at each particular site. Measures presently prescribed and implemented by the Coast Guard for bringing LNG carriers into New York and Boston Harbors, for example, include: near-harbor escort of the LNG carrier by a Coast Guard vessel; control of or halting other marine traffic in the area during loaded LNG carrier operation depending on the circumstances; use of tug boats; special arrival notifications; and restrictions on proceeding under specified visibility conditions.

Regional Amplification: None.

Statewide Finding:

118. DANGERS ASSOCIATED WITH LNG OPERATIONS ON LAND

The most significant potential for serious fire at LNG facilities on land would occur following complete or partial failure of a storage tank. This potential can be minimized by use of the highest quality structural and insulating materials, proven tank operating and rigid maintenance procedures, use of proven technology for tank venting, and construction of a containment around each tank sufficient in capacity to hold the entire tank volume in the event of complete failure. Where containment is filled with spilled LNG, a relatively small amount of LNG surface is exposed, and rapidly frozen ground acts as an insulator against a continued flow of ground heat; therefore vaporization occurs much more slowly than in the case of a spill on water. Under conditions of light wind and stable air, flammable vapor mixtures may initially extend as far downwind as a mile. Proponents believe that in most instances, after the initial period of "flash" vaporization, the flammable zone will be as little as 200-400 feet downwind; and that if the containment is a high dike around each tank, as planned for facilities near populated areas the flammable plume will be confined within the facility's property limits even under worst case conditions. If the vapor is ignited, the flame will burn slowly back to the LNG pool, where the resulting fire could create intense radiant heat capable of igniting combustible materials within 500 feet, and endangering exposed personnel within 2,000 feet (with high dikes, these distances can be substantially decreased). Automatic and individually activated remote control devices around the plant site that release appropriate materials can help control LNG vapors and extinguish LNG fires.

Regional Amplification: None.

Statewide Finding:

119. PROBABILITY OF SERIOUS ACCIDENT IS LOW BUT
SOME RISK WILL ALWAYS REMAIN

Statistically the probability of a very large accident involving LNG is very low. Except for its cryogenic temperatures and propensity to form a flammable vapor cloud that can drift downwind, the problems and risks connected with LNG handling and storage are thought to be similar to those associated with handling and storage of such accepted hydrocarbons as gasoline and liquid propane. Improved LNG technology can now address the normal safety problems; however the potential for serious accident caused by human errors, or by such events as earthquake, tsunami, disaster at a neighboring facility, a major act of war, sabotage, or airplane crash can be partially designed against, but not entirely eliminated.

Regional Amplification: None.

Statewide Finding:

120. EFFECT OF LNG SPILL ON WILDLIFE AND MARINE POPULATIONS

Plants and animals subjected to a dense cold vapor cloud of LNG would probably be killed. Birds might be able to evade the vapor cloud. The effects on marine populations of a LNG spill on water are not well known. The thermal shock caused by chilling of the surface water would presumably cause some measure of mortality, but most likely would not have significant long term effects on marine populations.

Regional Amplification: None.

Statewide Finding:

121. GASIFICATION OF LNG HAS POTENTIAL ADVERSE
EFFECTS ON MARINE LIFE

Regasification at a receiving facility is typically carried out in one of two ways: (1) using gas-fired vaporizers; or (2) using seawater at ambient temperature as a heat source for vaporization. The disadvantages of gas-fired vaporizers for baseload use are that one to two percent of the plant's output would be used to fire the vaporizers; and that there would be continuous air pollution emissions necessitating regulation.

In the process planned for use at all three LNG facilities proposed for California, large amounts of seawater are pumped through heat exchangers in the vaporization facility. In the process, the seawater is cooled; it is returned to the ambient waters at temperatures as much as 12^oF. below ambient temperatures. Although it is known that reductions in water temperature can be fatal to marine organisms, little specific data has ever been developed on the effects of continuous negative thermal discharge on marine ecosystems. There is reason to suspect that ambient temperature reduction has a particularly severe effect on embryonic and fetal development. Entrainment of marine life in the system may present many of the same types of problems presented by power plant cooling systems. Because the problem has not heretofore presented itself, the State Water Resources Control Board has not developed limits on cold water discharge analogous to those for thermal effluents. Under existing rules and procedures, the Regional Water

Quality Control Boards would regulate such discharges on a case-by-case basis to prevent adverse effects on beneficial uses of the receiving waters.

Chemical biocides periodically added to the seawater for defouling of the water pipes have the potential to adversely affect marine life if they are not neutralized. This process would also be subject to regulation by the Regional Water Quality Control Boards on a case-by-case basis to prevent adverse effects on beneficial uses of receiving waters.

Regional Amplification:

1. North Coast:
2. North Central:
3. Central Coast:
4. South Central:
5. South Coast: "Gasification of LNG Also Has Environmental Impacts. Regasification of LNG at the receiving facility is carried out in two ways: (1) using seawater as a vaporizer heat source or (2) using gas-fired vaporizers. Gas-fired vaporizers for baseload volumes of LNG would continuously emit residuals (gases, particulants) into the air. Seawater vaporizers would not emit air pollutants. Associated trim heaters, where used, would emit only minor amounts of air pollutants. The outgoing water will be as much as 12° cooler than the ambient water temperature, and may contain biocides used to keep marine organisms from fouling the system. The biocides must be neutralized before discharge. In a location such as Los Angeles Harbor, such water would need to be discharged in such a manner as to avoid negative impacts on the indigenous marine populations. The impact of the discharged water on marine animals living outside the harbor remains to be fully investigated."
6. San Diego:

Statewide Finding:

122. PHYSICAL CONSIDERATIONS IN LNG FACILITY SITING

Selection of a site best-suited physically to accommodate LNG port and plant facilities involves at least the following considerations:

- a. Facilities should be situated so as to minimize the exposure of population and property to the possible effects of a major accident. Land use controls, including purchase of surrounding lands, should be sufficient to prevent new development within the hazard zone around the LNG plant in the future.
- b. Facilities should be situated away from areas of significant seismic hazard, and wherever sited, should be designed to withstand fully the maximum credible seismic risk at the site.
- c. Port facilities should offer navigable waters deep enough to accommodate LNG carriers (40 feet or greater draft) and sufficiently sheltered for year-round operation. Significant dredging might be required.
- d. Land facilities should provide sufficient acreage for: storage tanks up to 125-150 feet high and 240-270 feet in diameter; space between tanks to permit dikes, runoff, and catch-basin facilities; additional space to reduce the potential for radiant heat from a fire at one tank igniting another tank; and space for vaporization facilities capable of regasifying peak loads at rates of as much as five billion cubic feet or more per day. Total acreage for land facilities may be as much as 100-200 acres.
- e. Land and port facilities need not be all in one contiguous parcel and the land facilities need not be immediately adjacent to the port; however, it is extremely expensive and increases exposure

to others to pipe gas in its liquefied form outside of the facility. There are also economic advantages in siting LNG facilities near major market areas, although piping the regasified natural gas relatively long distances is clearly feasible.

f. Facilities must have adequate gas transmission systems.

Regional Amplification: None.

Statewide Finding:

123. POTENTIAL SITING ALTERNATIVES

Very generally stated, a site selected in a rural area will pose the greatest impact upon the natural environment, but in the event of a major accident would expose a minimum number of people to the danger. Siting in a rural area could open the area to further port and industrial development, which in turn could encourage the growth of new residential communities. Industrial locations in developed harbors would tend to have a minimum impact on the natural environment, but would pose greater risk to human safety in the event of an accident. Harbors—particularly those with large industrial areas—will have heavier ship traffic control, calmer waters, and less exposed berths. Location near a residential area will have a moderate impact on the natural environment, could present social and economic impacts on the community, and would expose the population to the risks, however slight, of a major accident.

Regional Amplification:

1. North Coast:
2. North Central:

3. Central Coast:
4. South Central:
5. South Central: "Potential Siting Alternatives. Generally speaking, LNG facilities would need to be sited near calm waters with good traffic control so that collision risk to the LNG carriers would be minimized. Location of LNG facilities in presently industrialized areas would significantly reduce the impacts upon the natural environment that such a plant would present in rural areas. LNG facilities in industrialized and/or densely populated areas could be considered a liability from a safety standpoint, unless the site has superior traffic control to reduce the risk of ship-to-ship collisions, low-exposure berths, adequate containment structures for both storage and spillage entrapment, and other necessary or applicable safety equipment and design. An important factor is that the Coast Guard has been assigned responsibility for port safety, including any special traffic control measures for LNG ships it considers appropriate under the U.S. Ports and Waterways Safety Act of 1972."
6. San Diego:

Statewide Finding:

124. MULTIPLE REGULATION OF LNG FACILITIES

The Federal Power Commission (FPC) must approve projects for LNG imports from other states or foreign nations. It is the lead agency for such projects, and is responsible for preparation of environmental impact statements under NEPA. It is not yet clear whether FPC jurisdiction will preempt the right of State and local agencies to regulate the site location aspects of LNG facilities. Safety aspects will also be regulated by the Coast Guard (shipping-related), the Office of Pipeline Safety (land facilities), the Occupational Safety and Health Agency and the State Division of Industrial Safety (employee safety), the Federal Aviation Agency (aircraft safety), and the applicable local fire, harbor, and building and safety departments. Other environmental aspects will also be the concern of the designated lead agency under CEQA, the Army Corps of Engineers (marine facilities),

the RWQCB and the local APCD. The NEPA and CEQA environmental impact review, and the RWQCB review, will also include review by other interested agencies as applicable.

Regional Amplification: None.

Statewide Policy:

39. SOME LNG FACILITIES MAY BE ACCOMMODATED IN THE COASTAL ZONE

Because natural gas is a desirable fuel, the import of LNG by ship into California seems unavoidable if growing natural gas requirements are to be met and if major new natural gas sources in Alaska and abroad are to be used, it may be desirable to locate some LNG facilities in the California coastal zone.

Regional Amplification: None.

Statewide Policy:

40. GENERAL CRITERIA FOR SITE SELECTION

LNG facilities should be sited in areas with existing but minimal port or industrial facilities to limit exposure of life and property while avoiding pristine natural areas until such time as it can be conclusively demonstrated on the basis of experimental data that engineering and operational practices can eliminate undue risk, at which time such facilities should be sited in industrialized ports. New port facilities required should not involve dredging or filling of productive wetland areas.

Regional Amplification: None.

Statewide Policy:

41. NUMBER OF LNG FACILITIES

To minimize the adverse environmental impacts of LNG facilities and to permit experience to be gained in the operation of LNG facilities, only one LNG marine terminal may be permitted in the coastal zone until such a demonstration of safety can be made as specified in Policy 40 or until guaranteed supplies of LNG substantial enough that a conclusive demonstration can be made that an interruption of service from one LNG facility will cause substantial public harm.

Regional Amplification: None.

Statewide Policy:

42. MINIMIZE ADVERSE ENVIRONMENTAL IMPACTS OF LNG FACILITIES

LNG facilities may be considered only if located and designed to minimize adverse environmental effects in the coastal zone consistent with the criteria otherwise specified herein. To assist in evaluating alternative sites, the applicant for an LNG marine terminal and onshore facilities shall submit a comprehensive evaluation of alternative coastal sites, including the environmental, economic, and operational reasons for rejecting them in favor of the proposed site, sufficiently in advance of a desired decision that an adequate and independent analysis can be made, and such material should be included in any environmental impact report required.

Regional Amplification: None.

Statewide Policy:

43. AVOID ADVERSE EFFECTS OF VAPORIZATION
PLANT COOLED WATER DISCHARGE

Because the chronic discharge of cooled water associated with use of seawater for heating in LNG vaporization plants may have substantial adverse environmental effects:

- a. Where feasible, vaporization plants should be required to use heated effluents from nearby power plant or other industrial operations, rather than seawater at ambient temperatures, for a heat source;
- b. Cooled water discharges should be permitted only where rapid return of water to normal ambient temperature can be assured and where best available mitigation measures have been incorporated as necessary to minimize effects on marine life, as set forth in Marine Element Policy 7(e), such as deepwater, offshore discharge out of sensitive biological areas.
- c. Seawater intake systems should utilize the best available technology and the best potential location to minimize the intake and mortality of all forms of marine life, as set forth in Marine Element Policy 7(d);
- d. Cooled water discharges into coastal wetlands, marine reserves, wildlife refuges, education and research reserves, or in the vicinity of kelp beds shall be prohibited unless it can be conclusively demonstrated that there will be no significant adverse impacts, as set forth in Marine Element Policy 7(f);
- e. Independent baseline studies of the existing marine system shall be conducted and evaluated at all potential sites at the applicant's expense several years in advance of the proposed

construction of LNG vaporization facilities proposing the direct use of seawater for a heat source; and any new cooled water discharge should be periodically monitored by independent researchers or a State agency, and appropriate mitigation measures or alternative heating systems should be required where significant adverse impacts are discovered, as set forth in Marine Element Policies 7(c) and (g);

- f. A State agency should be adequately empowered and funded to direct and coordinate research on the effects of entrainment in seawater heating systems, cooled water discharge and anti-fouling biocides on the marine environment, as set forth in Marine Element Policy 7(a).

Regional Amplification: None.

Statewide Policy:

44. SAFETY MEASURES REQUIRED TO REDUCE RISK
OF ACCIDENTS DURING MARINE OPERATIONS

Because of the potential severity of an accident involving a large-scale spill of LNG on water, all possible measures shall be taken to maximize the safe passage of LNG carriers into berthing facilities. Such measures shall include, where appropriate, application of measures presently used for LNG carriers in New York and Boston Harbors with particular care exercised during inclement weather conditions: control or halting other marine traffic by the U.S. Coast Guard during loaded LNG carrier operation, near-harbor escort of LNG carriers by a Coast Guard vessel, and use of tug boats in harbor areas. Demonstration of an adequate traffic control system

and safely designed berthing facilities sufficiently removed from other traffic flows and of sufficient size to permit maneuvering shall be required.

Regional Amplification: None.

Statewide Policy:

45. SAFETY MEASURES REQUIRED TO REDUCE RISK OF
ACCIDENT AT ONSHORE FACILITIES

To minimize the likelihood and the consequences of an accident involving LNG spillage or major fire at storage facilities, or along LNG pipelines, the following measures should be part of any LNG project on the coast:

- a. The highest state-of-the-art engineering design and technology, and proven alloys, should be used in construction; each storage tank should have the double-wall construction now standard in the industry;
- b. Storage tanks should be equipped and operated to avoid sudden evolution of a large quantity of vapor that cannot be adequately vented by the pressure relief valve system.
- c. Each storage tank should be surrounded by sufficient containment for the entire contents of the tank with a minimum surface area pool. At sites near populated or developed areas the containment should include a dike designed to reduce vapor plume travel as much as possible. The dike should also be designed to give protection to the tank against severe weather or radiant heat from adjacent tanks in the event of a major fire, and to give protection against airplane crash or sabotage attempt. Storage

tanks and dikes should be designed to withstand the maximum credible seismic event for the area.

- d. Storage tanks should be sufficiently far apart to minimize the possibility of an accident at one tank affecting another tank.
- e. Storage tanks should be equipped with the best available fire protection and fire-fighting technology, and the developer should be required to demonstrate the adequacy of fire fighting plans, equipment, and personnel to control major fire at all times.
- f. Exposed LNG pipelines should be surrounded by dikes or other containment structures capable of containing the maximum credible spill that might occur in a major rupture before shutdown of the entire pipeline system could be effected. The developer should be required to demonstrate adequate and continuous monitoring, alarm, process shutdown, and fire response plans for a pipeline and storage tank rupture.
- g. An independent standby power system should be provided to maintain essential operational and emergency systems during a power failure.

Regional Amplification: None.

Statewide Policy:

46. LIABILITY FOR ACCIDENTS

The State Legislature should consider legislation establishing strict liability for damage occurring as a result of LNG shipping or plant operations, except acts of war, and consider creation of a safety indemnity fund, financed by levy of a fee on LNG imports, to ensure that all damages and costs resulting from a LNG accident

are quickly compensated. The Legislature, the Public Utilities Commission, and the Energy Commission should make certain that sufficient research and development pertaining to LNG safety issues is carried forth to fully justify development of LNG import projects in California.

Regional Amplification: None.

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Regional Amplification: None.

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