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**Draft Implementation Plan
for the
Hawaii Geothermal Project
Environmental Impact Statement**

**Prepared by
The United States Department of Energy
Conservation and Renewable Energy
Washington, D.C.**

**In Cooperation with
County of Hawaii
County of Maui
National Marine Fisheries Service
National Park Service
State of Hawaii
United States Army Corps of Engineers
United States Fish and Wildlife Service
United States Geological Survey**

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overland and submarine power transmission routes; sites reasonably suited to support project facilities in a safe and environmentally acceptable manner; and non-power generating alternatives, such as conservation and demand-side management.

1.1 PURPOSE OF THE EIS IMPLEMENTATION PLAN

DOE has prepared this draft Implementation Plan (IP) for two purposes: (1) to provide internal guidance for the EIS preparation, and (2) to record issues identified during the scoping process. To serve these purposes, this IP has been prepared in accordance with DOE NEPA Regulations (57 Fed. Regist. 15122, April 1992) (10 CFR 1021). The IP has been made available at this time to inform the public of DOE's approach in preparing the EIS and to document the results of the public scoping process. The IP is a "living document" in that it may be revised as needed throughout the preparation of the EIS to provide updated information regarding major changes in scope, methodology, or work plan. The draft IP will be given broad distribution by including individuals and organizations on a mailing list compiled by DOE to provide information about the preparation of the EIS. In addition, the draft IP will be placed in all DOE Reading Rooms (see Attachment 2 to Appendix A for a list of Reading Rooms). Section 2 of this IP describes the treatment of alternatives. Section 3 discusses the scoping process, includes a discussion of the major issues identified through public scoping, and as appropriate states how these issues will be addressed in the EIS. Consultations with agencies, preparers of the EIS, significant EIS milestones, and related environmental documentation are described in Section 4. Section 5 contains references cited in preparing the IP. The seven appendices to this IP contain a summary of oral and written scoping comments, a

summary of agency scoping comments, a preliminary outline for the EIS, a glossary of terms used in the IP, a list of acronyms and abbreviations, copies of the Advance Notice of Intent and Notice of Intent, and the contractor disclosure statements. A working draft IP was prepared by DOE and reviewed with cooperating agencies (see Section 1.5) in July and August 1992. Comments by these agencies (Appendix B) are addressed in this draft IP.

1.2 BACKGROUND OF HAWAII GEOTHERMAL PROJECT

1.2.1 Purpose and Need for HGP

The purpose of the HGP is to develop Hawaii's indigenous geothermal resource for the production of electricity. The State of Hawaii has declared in its 1990 proposal to Congress, its 1991 State Integrated Energy Plan and its 1991 State Functional Energy Plan that geothermal energy is needed to help reduce the State's heavy dependence on imported oil. Currently, the State of Hawaii uses petroleum for approximately 90% of its energy, the highest percentage usage of all 50 states.

1.2.2 Description of HGP Phases 1 and 2

The HGP is the culmination of research and development efforts begun in the mid-1970s to explore the feasibility of using Hawaii's indigenous geothermal resource for the production of electricity. Geothermal exploration began in Hawaii in 1972 with funding from the National Science Foundation (NSF). A high-potential geothermal resource site was identified on the east rift of the Kilauea volcano on the Big Island. Subsequent exploratory drilling (also funded by NSF) between December 1975 and April 1976 resulted in a productive geothermal well at a depth of approximately 6000 ft. In 1976, the Energy Research and Development Administration (ERDA), a

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predecessor to DOE, funded the testing of the geothermal well, which was designated as the HGP-A well. In 1979, DOE funded the development of a 3-MW demonstration power plant at the HGP-A site. In 1986, the HGP-A facilities were transferred by DOE to the State of Hawaii to be used for further research. The State has referred to this early exploration and testing of the Big Island geothermal resource as Phase 1 of the HGP.

DOE also provided funds for the Hawaii Deep Water Cable Program (HDWC), which was initiated in 1981 and completed in 1991. The goal of the HDWC was to determine the technical ~~and economic~~ feasibility of constructing and operating a deep water submarine power transmission cable that would serve the Island of Oahu and would operate for a minimum of 30 years. This project demonstrated the feasibility of deploying and retrieving the deep water power transmission cable. The State of Hawaii referred to the HDWC as Phase 2 of the HGP.

Over an 11-year period, DOE has provided approximately \$33 million for geothermal and deep water cable research in Hawaii, which is about 80% of the HGP cost-shared effort.

1.3 PROPOSED ACTION

In its 1990 proposal to Congress, the State of Hawaii requested additional federal funding for what is defined by the State as Phase 3 of the HGP: resource verification and characterization. In 1990, Congress appropriated \$5 million (Pub. L. 101-514) for the State's use in Phase 3. Because Congress considered Phase 3 work to be research and not development or project construction, Congress indicated that this funding would not be considered a major federal action under NEPA which would typically require an EIS. However, because the project is highly visible, somewhat controversial, and involves a particularly sensitive environment in Hawaii, Congress

directed in 1991 (House Resolution 1281) that "...the Secretary of Energy shall use such sums as are necessary from amounts previously provided to the State of Hawaii for geothermal resource verification and characterization to conduct the necessary environmental assessments and/or environmental impact statement (EIS) for the geothermal initiative to proceed." In addition, the U.S. District Court of Hawaii, in litigation filed by several environmental groups (Civil No. 90-00407, June 25, 1991), ruled that the federal government must prepare an EIS for Phases 3 and 4 of the HGP before any further disbursement of federal funds was made to the State for the HGP.

1.3.1 DOE Decision

The decision being considered by DOE in its Record of Decision is whether or not to partially fund Phase 3 of the HGP, as defined by the State in its 1990 proposal to Congress, using any funds remaining from the \$5 million Congressional appropriation for Phase 3 after EIS expenditures. The funding for Phase 4 is currently uncertain.

The EIS will evaluate the activities to be conducted during both Phases 3 and 4 of the HGP as required by Congressional directive and U.S. District Court of Hawaii ruling. However, the DOE decision will be rendered only with regard to the disbursement of federal funds to the State to partially fund Phase 3 of the HGP.

1.3.2 Description of HGP Phases 3 and 4

The State of Hawaii considers the unknown extent of its geothermal resource as one of the primary obstacles to private investment and commercial development in geothermal energy production. State and private industry experts estimate that at least 25 commercial-scale exploratory wells would need to be drilled to verify the generating potential of the resource (these wells would

in turn be used in Phase 4). To that end, Phase 3 activities would include well drilling, logging of cores from holes, measuring temperatures, collecting and analyzing geothermal fluid samples, and making downhole geophysical and geochemical measurements. Information on the feasible locations for Phase 3 activity and details regarding the methods of analyses will be obtained from various sources including the U.S. Geological Survey (USGS), University of Hawaii, DOE, and developers. ^{A State of Hawaii}

Forecasts based on resource ^(per SOH-8 BCO) characterization to date indicate that between 10 and 20 separate geothermal power plants of 25 to 50 MW each could be developed. The actual number of plants would depend on the extent of the resource defined in Phase 3. Because the exact location of plants would not be known until Phase 3 was completed, the EIS will rely on best available data and information to encompass impacts at development sites. Further NEPA documentation may be required for specific projects and permits identified in the future. Based on the physical characteristics of the resource and contemporary geothermal energy development practice, the State estimated that about 125 production wells and 30 injection wells may be needed to produce 500 MW. The plants most likely would be connected by a network of roads, piping, and overland and underwater transmission lines (500 kV) would be constructed to transmit power to Oahu and other islands (see Figure 1.1). Section 2.1.4 contains a description of the transmission cable system.

For purposes of the EIS analysis, a typical geothermal power plant may be briefly described as consisting of a moderate size (~30 MW) single-flash, condensing cycle turbine coupled to a generator. Geothermal steam would pass from the wellhead through a separator and a demister, then to the turbine. The system would allow complete bypass of the turbine directly to the

condenser. A two-stage steam ejector would remove gases from the direct-contact type condenser. Non-condensable gases including hydrogen sulfide (H_2S) would be compressed, mixed with other spent geothermal fluids (brine and steam condensate), and then injected by surface pumps into the general vicinity of the geothermal reservoir. Steam condensate from the condenser would be cooled by a forced draft cooling tower. Power plant, transmission line, and submarine cable technologies will be further defined as the EIS progresses using information from various sources including the Hawaiian Electric Company (HECO), the State of Hawaii, USGS, the University of Hawaii, Puna Geothermal Venture, True Geothermal Energy Company, Mission Energy Company, Mid-Pacific Geothermal, Inc., Campbell Estate, and DOE. In addition, various development scenarios will be considered based on the extent of the resource and other factors. Because no specific plant design has been proposed for the HGP, a reasonable composite or typical design based on current information will be used to assess potential impacts.

According to the State of Hawaii (DBED 1988), the 500 MW of electrical power was expected to be delivered to the Island of Oahu. A recent evaluation of transmission losses associated with high voltage direct current (HVDC) delivery of 500 MW from the Big Island to Oahu indicates a gross electrical generating capacity requirement of 520 MW, or a 4% total HVDC transmission system loss including converter station losses (Bonnet 1992). HECO indicated that it was interested in purchasing up to 500 MW of geothermally generated power. The Maui Electric Company (MECO) also has indicated some interest in whether a tap for 50 MW from the project's transmission system is technically feasible (HECO 1989). Other configurations of the HGP including more or less power production are possible,

HGP

discussed in Sections 3.3.1, 3.3.3, and 3.3.4. In general, support from FWS will include a literature review, native forest bird survey, vegetation community survey, survey of threatened and endangered species, wetland and floodplain inventory, assessment of non-native species introduction at existing geothermal facilities, and an invertebrate survey. Support from USGS will include a literature review, geothermal fluid characterization, determination of ~~background air quality~~ ^{[pauw] volcanic gas emissions}, groundwater resource evaluation, volcanic and deformation hazard analyses, seismic hazard analysis, estimation of the potential for undersea slides and turbidity currents, and estimation of the potential for induced seismicity. COE will provide a literature review, a wetland map unit legend, and delineation of wetland types.

It is important to note that the proposed FWS, USGS, and COE technical studies are being supported by DOE to satisfy CEQ requirements (40 CFR 1502.22) regarding "incomplete or unavailable information." CEQ states that "If the incomplete information . . . is essential to a reasoned choice among alternatives and the overall costs of obtaining it are not exorbitant, the agency shall include the information in the environmental impact statement." In addition, these studies are necessary to provide data and analyses sufficient for DOE to conduct effective consultations with agencies who have statutory and regulatory responsibilities (see Section 4.1, Tables 4.1 and 4.2). On the other hand, CEQ allows that if costs are prohibitive and/or the means to obtain information are unknown, an agency shall include within the environmental impact statement: (1) A statement that such information is incomplete or unavailable; (2) a statement of the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment; (3) a summary of existing credible scientific

evidence which is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment; and (4) the agency's evaluation of such impacts based upon theoretical approaches or research methods generally accepted in the scientific community."

2. TREATMENT OF ALTERNATIVES

2.1 ALTERNATIVES WITHIN THE PROPOSED ACTION

2.1.1 Development Scenarios

Forecasts based on resource characterization indicate that from 10 to 20 separate geothermal power plants of from 25 to 50 MW each could be developed under the State's original 1990 HGP proposal. The actual number of plants would depend on the extent of the resource defined in Phase 3. Because the exact location of plants will not be known until Phase 3 is completed, the EIS will rely on best available data and information to encompass the possible impacts at the development sites. Various development scenarios will be prepared for the EIS using information that has been collected over the years on the geothermal potential of the Kilauea East Rift Zone (KERZ) and energy demand ^[from HECO] forecasts provided by HECO and other ^{its} Hawaiian utilities, wholly owned subsidiaries ^{MECO and HECO}.

2.1.2 Geothermal Technologies

Alternative geothermal technologies will be described and considered in the EIS. Based on the physical characteristics of the geothermal resource and contemporary geothermal energy development practice, the State previously estimated that about 125 production wells and 30 injection wells may be needed to produce the 500 MW (DBED 1992). For the EIS, reasonably foreseeable geothermal technology options will be

pressurized cables, and low-viscosity, oil-impregnated, self-contained, oil-filled pressurized cables. Solid-dielectric cables present another option. Both aluminum and copper were examined as conductors, but only aluminum was found to be acceptable. Since those studies were performed, technologies have advanced and the bases for costing scenarios have changed. The EIS will review technology advances and review costing for the prior scenarios.

2.1.4.3 High Voltage DC vs High Voltage AC Transmission

Current plans for the submarine cable call for HVDC transmission. During scoping, several commenters suggested that if development is staged, then AC transmission over relatively short distances might be cost effective. This assumption will be examined and the relative environmental impacts of DC vs AC transmission will be discussed based on available literature and experience in other locations.

2.1.4.4 Land-Sea Transitions

Different land-sea transition configurations will be considered based on the need for oil pumping stations (to maintain pressure in the cables) and transformers. If a tap to the local system is required, a conversion station may also be necessary.

2.1.4.5 Multiple Uses of the Submarine Cable

Multiple uses of the submarine cable, once it is installed and operational, will be considered in the EIS. It has been suggested that the submarine cable could be used in a reverse mode to transport electrical power from Oahu to the other islands. For example, the EIS will consider

the use of residual fuel oil to produce power on the island of Oahu for use there and for possible export to the other islands via the cable. Commenters have suggested that this alternative may be justified in light of potential liabilities from continued inter-island shipping of residual fuel oil.

2.2 ALTERNATIVES TO THE PROPOSED ACTION

Utilities in Hawaii are currently preparing Integrated Resource Plans (IRPs); therefore, supply and demand options cannot be evaluated on the basis of specific projects at specific sites. Rather, alternatives to the HGP need to be evaluated in the context of various energy scenarios for Hawaii's economy for the next 30 years (i.e., the life of the HGP project). For example, a no-action alternative implies an energy scenario in which the conventional resource options now used on the island, that is oil- and coal-fired power generation plants, would continue to play a dominant role. Conversely, an alternative action involving investments in renewable energy resources and energy conservation would shift the resource mix to lesser dependence on conventional supplies. Thus, to assess the possible environmental and economic impacts of the proposed supply and demand alternatives, it will be necessary to consider alternative energy scenarios for Hawaii.

2.2.1 No-action

The no-action alternative is defined as "business as usual," that is, continued reliance on the existing and planned generating mix of resources, which is predominantly oil-fired capacity with some coal-fired capacity and renewable energy sources. Under the no-action alternative, the energy need for Hawaii, Maui, Molokai, and Oahu would be achieved using supply or demand-side options on each island.

2.2.2 Alternative Supply-Demand Options

In addition to no-action, two supply and demand alternatives will be evaluated in the EIS. The first is the development of up to 500 MW of geothermal power for exclusive use on the Big Island, with no inter-island transmission cable. The State of Hawaii's preferred alternative is development of the geothermal resource to meet the projected needs of the Big Island, and submarine cable to export some level of power at a later date if the geothermal resource and project economics justify the cost of a cable. Although a definite geothermal development scenario has not yet been proposed, the EIS will examine an alternative geothermal generating capacity of 100 MW or more (up to 500 MW) for the Big Island only. The lesser amount represents the geothermal capacity that is currently ~~licensed~~ ^{permitted} for development on the Big Island only. (S.H. 5450)

The second supply-demand option would consist of conservation and demand-side management (DSM) alternatives and a mix of currently feasible renewable energy sources (e.g., biomass, solar thermal, wind, geothermal, and photovoltaics). DSM refers to the reduction of demand for energy through electrical load management, energy conservation, and improvements in energy utilization to reduce energy demand.

All alternative supply-demand options will be compared and assessed within the framework of IRP using available data and methods developed for the State utilities' IRP, currently in progress. Where possible, the supply-demand options will be characterized in terms of their relative cost, fiscal impacts, and contribution to the State's overall energy demand.

2.3 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED CONSIDERATION

Although many alternatives were mentioned during the scoping process, only

those alternatives deemed to be viable and reasonably foreseeable within the time frame of the proposed action (i.e., 30 years) will be considered. In general, the alternatives that will not be considered in the EIS were either anticipated to be not technically feasible within the project time frame [e.g., ocean thermal energy conversion, wave and tidal power, and hydrogen as a carrier fuel] or technically feasible but extremely unlikely because of legislative or other impediments. As an example of the latter, the construction of a nuclear power plant in Hawaii is unlikely because of a State constitutional requirement for a two-thirds vote in each house of the Legislature for such an action (Act XI, Section 8).

During scoping, commentators recommended that the EIS consider transportation alternatives that would reduce petroleum (oil) consumption. One of the State's primary reasons for encouraging the development of Hawaii's geothermal resource was to reduce the State's reliance on imported oil. The EIS will address the reduction of oil consumption that would result from the development of geothermal capacity and other alternatives (i.e., the amount of oil replaced by the proposed geothermal power generation and other alternatives as part of the energy supply-demand scenarios); but because various transportation alternatives would not directly affect power generating capacity in Hawaii, they will not be evaluated in the EIS.

In addition to alternative supply-demand options that will not be considered in the EIS, there also are some alternatives to geothermal development and transmission systems that are beyond the scope of the EIS. For example, the GRS on Maui will not be considered as feasible because current geothermal information indicates that it has direct heat application only and is not believed to be economic for electricity production and is therefore not comparable to the GRSs on the Big Island. The EIS will also not address underground

TABLE 3.1.—*Information Exchange and Cooperating Agency Meetings*

<i>Information Exchange Meetings</i>	
October 1991	Puna Geothermal Ventures (included a site visit); Sierra Club Legal Defense Fund
November 1991	Blue Ocean Preservation Society; Campbell Estate; Coral Reef Foundation; Kaupo Ranch; Maui Tomorrow; Pele Defense Fund; Mayor's Energy Advisory Commission; Big Island Papaya Growers; Big Island Rainforest Action Group with Malu Aina; Citizens for Responsible Energy Development with Aloha Aina; Greenpeace Hawaii; Hawaii Island Geothermal Alliance; Kapoho Community Association; Lani Puna Gardens Association; Puna Community Council; West Hawaii Sierra Club; Native Hawaiian Legal Corporation; National Audubon Society; Natural Resources Defense Council; Oahu Rainforest Action Network; Rainforest Action Network; Sierra Club Legal Defense Fund; Hawaii utilities; Bishop Museum
March 1992	Native Hawaiian Organizations; Pele Defense Fund; Puna Geothermal Ventures (included a site visit); True Mid-Pacific (included a site visit)
July 1992	Pro-Geothermal Alliance; Hawaii Island Geothermal Alliance
<i>Cooperating Agency Meetings</i>	
September 1991	U.S. Department of the Interior (DOI); U.S. Geological Survey (USGS); U.S. Fish and Wildlife Service (FWS); National Park Service (NPS); U.S. Army Corps of Engineers (COE); National Marine Fisheries Service (NMFS); U.S. Environmental Protection Agency (EPA)
October 1991	Hawaii Department of Business, Economic Development, and Tourism; County of Hawaii; USGS; NPS; Hawaii Office of State Planning; Hawaii Department of Land and Natural Resources; Hawaii Department of Health; Hawaii Office of Environmental Quality Control; NMFS; FWS; COE; Hawaii Office of Hawaiian Affairs; Hawaii Office of State Planning
November 1991	County of Maui; County of Hawaii; NMFS; Office of Hawaiian Homelands; State Historic Preservation Officer; State Office of Consumer Advocacy
March 1992	County of Hawaii; USGS; DOI; EPA; County of Maui; Hawaii Department of Business, Economic Development, and Tourism; COE; NMFS; FWS
July 1992	Hawaii Department of Business, Economic Development, and Tourism; Hawaii Office of State Planning; Hawaii Department of Health; Hawaii Office of Hawaiian Affairs; Hawaii Department of Labor and Industrial Relations; Hawaii Department of Land and Natural Resources; Hawaii Department of Agriculture; EPA; USGS; Hawaii Department of Land and Natural Resources; COE; County of Hawaii; NPS; USGS; County of Maui; Hawaii Department of Business, Economic Development, and Tourism; NMFS; FWS; review of Working Draft Implementation Plan with cooperators

all

- Thermal and chemical contamination caused by reinjection;
- Impacts to the quality of nearby potable water catchment systems and deep wells;
- Dewatering of and/or reduced yield from groundwater resources which could impact availability and use;
- Transport of contaminants from HGP-related wastes and effects of drilling effluent brine impoundments, both into underground sources of drinking water;
- Erosion control during construction and operation of HGP-related facilities;
- Management of point and nonpoint contamination sources;
- Groundwater monitoring system requirements, including parameters to be monitored (both water quality and elevation of the water table surface);
- Mitigation plan to halt emanating groundwater contamination and/or water table declination detected by groundwater monitoring system;
- Complete geothermal fluid characterization;
- Identification and mapping of nearby potable water wells that could be affected by HGP-related construction and operation;
- Spill prevention, containment, and mitigation methodology;
- Source of water for well drilling during construction and well quenching during plant operation; and
- Well casing and hydrologic monitoring plan for both production and reinjection wells.

There is an interrelationship between water resources and geologic resources. Issues related to geologic resources are discussed in Section 3.3.3. Springs and thermal springs are included in the definition of water resources as used in this section; wetlands and anchialine ponds are discussed in Section 3.3.4.

Water resources are also vital to subsistence and religious practices of Native Hawaiians; cultural uses of water resources are addressed in Section 3.3.9. Marine water quality issues are discussed in Section 3.3.4.

Studies will be undertaken to obtain environmental baseline information that is not available in the open literature. Cooperating agency involvement will include the State of Hawaii, USGS, and the County of Hawaii. A water resource inventory that will be provided by the USGS, with input from the State of Hawaii and County of Hawaii will be included in the EIS (see Section 4).

The State of Hawaii is considering the status of its water quality designation in the geothermal subzone beneath the District of Puna. All analyses of environmental impacts will be based on the water quality designation in effect at the time of writing of the EIS.

The uses and water quality of surface and groundwater resources in potential development areas and the effects of the HGP on these resources will be discussed in the EIS. Hydrogeological data for the HGP site, and vicinity and HGP source terms for potential effluents and contaminants, will be used to assess the potential for contaminant deposition and transport. Results of these analyses will factor into health and ecological assessments (discussed in Sections 3.3.7 and 3.3.4, respectively). State of Hawaii and EPA approved underground injection regulations will be used as a basis for groundwater impact analysis. Although they are not presently applicable to catchment systems, Safe Drinking Water Act (Public Law 93-523, December 1974) standards will be the criteria used to gauge the significance of: impacts of atmospheric pollutant deposition in catchment systems. Permits issued by the State of Hawaii, as well as written agreements between the State of Hawaii, EPA, and current geothermal developers, will be used to assess

subsidence from routine withdrawal and reinjection of geothermal fluids during power plant operations. Finally, the USGS will assist DOE with groundwater resources characterization and geothermal fluid chemical characterization.

The HGP EIS will examine the potential for damage to geothermal facilities by fresh lava flows as well as effects of earthquake-induced phenomena such as excessive ground motion, surface rupture, liquefaction, and landslides. Environmental impacts of accidental release of geothermal fluids will be assessed (see Section 3.3.2). The effects of prolonged withdrawal and reinjection of geothermal fluids during plant operations also will be analyzed (see Section 3.3.2). If possible, reservoir engineering characteristics will be used to predict the nature of induced seismicity, subsidence, and geothermal reservoir depletion (the latter is addressed in Section 3.3.2). These analyses will depend on the availability and appropriateness of existing models. Analysis of routine operational impacts will be based on the assumption that automatic shut-off valves and blowout preventers function as intended and that other reasonable safety features (such as flexible joints between steam gathering lines on the surface and well heads) are included. Accident-driven impacts are discussed in Section 3.3.12.

Soils in the Puna District and on transmission line rights-of-way will be described from existing U.S. Soil Conservation Service (SCS) or equivalent surveys. Construction, operational, and accident-related impacts (erosion and contamination) to these soils will be assessed (see Section 3.3.6 and 3.3.4.3). Contamination from accidents and routine spraying (herbicides) of access roads, pipelines, plants, and transmission lines will be addressed. The SCS will be consulted (see Table 4.1).

Well completion designs and erosion and sedimentation control plans (ESCPs) will be assessed for compliance with existing State

regulations. In addition to the USGS, this assessment will require consultation with the Hawaii Department of Land and Natural Resources, the Division of Water Resources Management, and DOH. County governments will be consulted with respect to ESCPs. Effective monitoring of construction- and operation-related erosion and sedimentation is a regulatory requirement of an ESCP. In addition, NPS will be consulted during EIS preparation regarding volcanic eruption mitigation measures (see Tables 4.1 and 4.2).

3.3.4 Ecological Resources

A recurring concern expressed by commenters was the effect of HGP transmission corridors and cables on construction on ecological resources. A number of commenters cited the uniqueness and value of the Waialeale-O'ahu forest as an overriding concern. Commenters identified specific impacts related to effects of the transmission lines on the coastal zone and on the forest.

Ecological impacts of the HGP along marine cables and on the forested landing sites on O'ahu are described in the EIS. The HGP development and operation on the forested wetlands, floodplains, and marine environment are of special concern. Assessment will be conducted and studies conducted, including comprehensive (e.g., forest birds, endangered species, vegetation), a Hawaii forest ecosystem delineations. The collection is conducted in consultation with other State and Federal agencies, including the U.S. Fish and Wildlife Service, the U.S. Forest Service, and the U.S. Environmental Protection Agency.

- Potential to cause ciguatera (fish poisoning) as a result of cable construction, deployment, and maintenance in coastal reef areas.

3.3.4.1 Terrestrial Resources

Commenters asked that comprehensive surveys of rain forest species be completed and the results evaluated. Moreover, they thought that the EIS should fully investigate the potential short- and long-term impacts of the HGP to pristine environments, such as the rain forest in Hawaii, the southeast coast and Hana districts of Maui, much of Molokai, the marine environment (see Section 3.3.4.3), and other locations potentially affected by HGP.

The impacts on terrestrial ecosystems will be addressed in the EIS with particular emphasis on the rain forest, wetlands, cave ecosystems (e.g., lava tubes), vegetation, birds, threatened and endangered species, invertebrates, and ethnobotanical and medicinal species. These resources are extremely important to Native Hawaiians, whose culture and religion are closely tied to natural resources, (see Section 3.3.9). Potential impacts of invasion of non-native species as a result of HGP and power transmission corridors will be evaluated; and the impacts to terrestrial ecosystems as the result of controlling non-native plant species with herbicides within the project area will be considered. Associated risks of chemical vegetation control (i.e., the use of herbicides) on humans is considered in Section 3.3.7.

A Geographic Information System (GIS) data base for the project will be built from existing data bases and results from studies to be conducted by the FWS (e.g., vegetation community, native bird, threatened and endangered species, and invertebrate surveys) and the COE (e.g., wetlands). The GIS will be used to integrate the ecological resource data and analyze potential impacts on terrestrial ecosystems

and ecosystem components. Analyses include (1) fragmentation of the rain forest from natural occurrences (e.g., lava flows) and artificial occurrences (e.g., road building associated with HGP development); (2) non-native species invasion into disturbed and natural areas; (3) potential for the project to contribute to loss of native fauna and flora, including impacts from erosion as a result of construction and maintenance operations; (4) land area impact of (a) well pad size and number resulting from initial development and from expansion as the geothermal resource is depleted and (b) road length; (5) alternative locations of well pads and roads to minimize ecological disturbances; (6) interrelationships among biota, lava flows, and vegetation regeneration; and (7) effects of transmission line EMF on terrestrial fauna; and (8) other issues identified as appropriate during data collection.

The extent and type of wetlands within all land areas potentially involved in the geothermal resource area and along transmission corridors will be delineated and significance ascribed by COE. The EPA will also be consulted concerning wetlands (see Section 4.1). The COE will use the 1987 COE Wetland Delineation Manual to delineate wetlands. Wetland maps and supporting data will be provided to DOE for the purpose of performing wetlands assessments based on the practical alternatives analysis in accordance with Clean Water Act (Section 404(b)(1)) guidelines for dredging and filling. When wetlands are identified, a detailed assessment of the potential impacts on the wetland ecosystem will be made and approaches for minimizing or avoiding wetland involvement will be discussed. The assessment will include potential impacts on wetland functions, including water quality, hydrology, vegetation composition and structure, habitat for threatened and endangered species, and biological diversity.

these sources is essential in evaluating and describing various claims that sites within the project area are important for the perpetuation of particular traditional practices and will be necessary for predicting the probable distribution of historic sites in the various areas of potential impact. Where appropriate, the EIS will also address impacts to cultural resources not specifically identified as Native Hawaiian. The Hawaii State Historic Preservation Officer, the Office of Hawaiian Affairs, the Office of Hawaiian Home Lands, NPS, and the President's Advisory Council on Historic Preservation will be consulted as important sources of information and guidance in undertaking the required studies. These archaeological and cultural resource surveys will provide the basis for compliance with

pertinent federal legislation, including the National Historic Preservation Act of 1966 (as amended), Sections 106 and 110; the American Indian Religious Freedom Act of 1978 (amendments proposed); and the Native American Graves Protection and Repatriation Act of 1990. If the project would require placement of dredged or fill materials, DOE must also initiate Section 106 coordination with the Archaeological and Historic Preservation Act of 1974. Pertinent State legislation includes Hawaii State Constitution, Article 12, Section 7; Revised Statutes, Chapter 6E; and Section 306 concerning religious and historic preservation, and Section 307 concerning burial sites, respectively (see Section 3.3.1).

Impacts of Native Hawaiian issues will be addressed in the scope of the EIS; these include, for example, the potential loss of identity. Other issues will be addressed to the extent that they relate clearly to impacts generated by HGP. For example, a lawsuit involving Native Hawaiian claims is beyond the scope of the EIS. DOE intends to consult and coordinate with Native Hawaiians through

mutually recognized expert consultants and Native Hawaiian organizations that represent various Native Hawaiian viewpoints and concerns, including but not limited to Hui Malama I Na Kupuna O'Hawaii Nei. DOE also intends to consult with the Office of Hawaiian Affairs, an agency in Hawaii charged with representing Native Hawaiian interests and managing ceded lands. By establishing these contacts, DOE seeks to ensure that the EIS accurately reflects to the extent practicable the concerns and issues that Native Hawaiians regard as significant. In addition, DOE will promote wherever possible community access to the results of cultural studies. To the extent possible, consultations on these surveys will extend directly to affected Native Hawaiian communities.

3.3.10 Aesthetic Resources

Commenters stated that the EIS should address the aesthetic impacts of HGP on all islands, including impacts to natural and agricultural landscapes, beaches, and recreation areas. Specific issues that were identified in the scoping process include:

- Visual impacts of clearing land in the Wao Kele O Puna rain forest;
- Visual impacts of transmission lines, cable facilities, and increased erosion, particularly in established scenic areas, near park and reserve lands and near recreation areas;
- Visual impacts of an industrial facility in a residential and/or rural environment;
- Aesthetic impacts to the Puna District and along transmission line corridors because of HGP-related noise, odor, and night lighting, including potential nuisance impacts of noise (see Section 3.3.5);
- Proximity of HGP facilities to the HVNP in consideration of visual impacts (e.g., night lighting); Air-Quality-Related Values under the Clean Air Act; and

- Off-grid electric power systems (e.g., solar hot water, synthetic natural gas/propane for cooking, wind, etc.) should be considered where possible in assessment of alternatives.

From 1985 through 1989, the State had envisioned a large-scale, 500-MW geothermal/inter-island submarine cable project (the HGP) as an alternative to the State's 90% dependence on imported oil for electricity generation. However, as of January 1990, the State has redefined its geothermal goal to a planning level that seeks to have geothermal development first meet the requirements of the people of the Island of Hawaii. This downsized project does not include an inter-island submarine cable system. If this goal is successful, only then would the State consider a large-scale geothermal and inter-island cable project.

Alternatives to the proposed DOE action (partially funding Phase 3) and reasonably foreseeable actions by others (such as Phase 4, the proposed construction and operation of HGP) will be addressed in the EIS. These alternatives will include the no-action alternative of not partially funding Phase 3. In addition, reasonable alternatives within the proposed HGP, both supply and demand supply, as well as design and location alternatives will be considered. The criteria for evaluating alternatives will include and consider the energy objectives and policies of the 26-18, HRS, of the Hawaii State

The HGP will be evaluated to determine if alternatives have the potential to meet similar objectives. The main consideration will be in determining the proposed HGP's contribution to meeting Hawaii's generation needs and Hawaii's energy goal of reducing reliance on imported oil. The determination will be based in part on the projections of electric generation capacity and plans to meet these needs. Transportation actions that potentially reduce dependence on oil

will not be considered as alternatives to the proposed action. Although these actions have been mentioned during scoping meetings as possible alternatives because they could potentially accomplish one of the proposed action's primary objectives, that is reduce Hawaii's dependence on imported oil, they do not achieve the crucial HGP objective of supplying electric power. Therefore, this alternative is not considered comparable to the proposed action. The EIS will consider, however, the amount of oil displaced by the use of up to 500 MW of geothermal energy and other supply-demand alternatives.

Alternatives that will be considered include: alternative geothermal technologies, sites, and capacities; alternative supply-demand options, such as no-action, geothermal on the Big Island only, and conservation and DSM plus renewable energy supply sources; alternatives associated with the overland transmission routes; and alternative submarine cable routes and technologies. Alternatives to the proposed submarine cable system will include various cable routes and cable materials, such as solid dielectric or oil-filled submarine cables, operation at either HVAC or HVDC, and alternative methods of land-sea transition. Each of these alternatives will be evaluated based on their economic and technical viability. The potential environmental and economic impacts for each energy supply-demand option will be identified, examined, and compared to the impacts of the proposed action.

3.3.11.1 Alternatives Within the Proposed Action

3.3.11.1.1 Development Scenarios

During scoping, several commenters questioned the need for power-generating capacity where geothermal-derived energy was being planned to be delivered. Because the geothermal resource is not yet

1 commercially defined, various geothermal
 2 development scenarios will be proposed
 3 using available information on (1) the
 4 geothermal resource potential that may be
 5 ~~from HECO~~ commercially available and (2) the energy
 6 demand forecasts provided by HECO and
 7 ~~its wholly owned~~ other Hawaiian utilities. These scenarios will
 8 ~~subsidize~~ allow for a staged development of
 9 ~~MECO and~~ geothermal resources to meet the energy
 10 ~~HECO~~ demands projected by the utilities.

3.3.11.1.2 Geothermal Technologies

11
 12
 13
 14 Alternatives to the proposed 500-MW
 15 HGP will include various power-generating
 16 strategies and power-generating technologies
 17 (e.g., total reinjection and in situ heat
 18 exchange). Technology alternatives will be
 19 selected from the best available information
 20 from the State of Hawaii, geothermal
 21 developers, utilities, and other experience
 22 with geothermal development.

3.3.11.1.3 Alternative Sites

23
 24
 25
 26 In response to scoping comments about
 27 the location of geothermal facilities,
 28 alternative sites will also be considered in
 29 the EIS. Because the basis for site selection
 30 will be the availability of adequate
 31 geothermal resources, the EIS will rely on
 32 best available information regarding the
 33 development potential of the KERZ.
 34 Geothermal development on Maui will not
 35 be included because the resource is not
 36 expected to be economical for power
 37 generation.

3.3.11.1.4 Overland Transmission Routes

38
 39
 40
 41 The scoping process identified the need
 42 to consider alternative overland transmission
 43 routes and technologies. Potential overland
 44 routes, based on configurations described
 45 previously in HECO (1989) and discussions
 46 with the State and County of Hawaii, will be
 47 defined and will be discussed in the EIS in
 48 terms of impacts to land use, ecological

resources, health and safety, socioeconomics,
 cultural resources and Native Hawaiian
 concerns, and aesthetics. The EIS will not,
 however, consider underground transmission
 systems because the costs of such would be
 prohibitive.

3.3.11.1.5 Submarine Cable Routes and Technologies

The concerns identified as environmental
 (see Section 3.3.4.3), socioeconomic and
 recreational (see Section 3.3.8), and cultural
 (see Section 3.3.9) regarding the marine
 environment will be addressed for each of
 the alternative cable scenarios.

Cable Routes. The preferred route is at
 present only roughly defined. Therefore
 factors relating to competing uses, impacts
 to water quality and marine ecology
 (particularly to threatened and endangered
 species), economics, impacts to cultural
 heritage, and risks of credible accidents (see
 Section 3.3.12.2) will be important in
 defining the preferred routes and viable
 alternatives.

Alternative cable materials and configurations. When the HDWC program
 analyzed the many possible configurations,
 an oil-filled cable was considered technically
 and economically the preferred alternative.
 Those cables that were found to be
 technically feasible (HDWC 1985a) will be
 reexamined from an environmental
 perspective, as will solid dielectric cables, if
 they are demonstrated to be reasonable from
 a technical and cost basis.

HVDC vs HVAC transmission. The
 preferred technological alternative for the
 submarine cable is HVDC. If HVAC is
 found to have sufficient technological merit
 that it can be considered a reasonably
 foreseeable alternative, then its potential
 environmental impacts will be considered. Of
 particular concern is the EMF associated
 with AC, which is considerably greater than
 that observed for the same power rating
 with DC current.

TABLE 4.1.—Agency Consultations

<u>Subject Area</u>	<u>Legislation</u>	<u>Agency</u>
Endangered species	Endangered Species Act of 1973, as amended; state laws	U.S. Fish and Wildlife Service, National Marine Fisheries Service, State agencies ^{NAS}
Migratory birds	Migratory Bird Treaty Act	U.S. Fish and Wildlife Service, ^{NPS}
Archaeological, historical, and cultural resource preservation	<i>[P4 1985]</i> <i>NPS</i> <i>Federal Agencies</i> Federal: National Historic Preservation Act of 1966; Archaeological Resources Protection Act; American Indian Religious Freedom Act; and Native American Graves Protection and Repatriation Act; State: Hawai'i State Constitution, Article 12, Section 7; Hawai'iian Historic Preservation Law [Haw. Rev. Stat. 6E-1 (1985)]; Hawai'iian Burial Law [Act 306 (Session Laws 1990)]; County: Ordinance No. 1941: "A Bill For An Ordinance Establishing A New Chapter In Title 2 Of The Maui County Code Creating A Cultural Resources Commission; Maui County Code, Title 2: "Administration and Personnel," Chapter 2.88, "Cultural Resources Commission"	State Historic Preservation Office, President's Advisory Council on Historic Preservation, Native Hawaiian Groups, Office of Hawaiian Affairs, Maui County Cultural Resources Commission, State Department of Hawaiian Home Lands
Discharge of pollutants to water	Clean Water Act; Safe Drinking Water Act	U.S. Environmental Protection Agency, National Marine Fisheries Service, State agencies
Work in navigable waters of the United States	<i>Section 10</i> Section 404 of Clean Water Act; Rivers and Harbors Act	Corps of Engineers, National Marine Fisheries Service

HGP

Implementation Plan

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TABLE 4.1.—Agency Consultations
(continued)

<u>Subject Area</u>	<u>Legislation</u>	<u>Agency</u>
Prime and unique farmlands	Farmland Protection Policy Act of 1981	Soil Conservation Service
Floodplains	Executive Order 11988; Fish and Wildlife Coordination Act [per COE]	Federal Agencies Corps of Engineers, U.S. Fish and Wildlife Service, State agencies
Wetlands	Executive Order 11990; Fish and Wildlife Coordination Act; Section 404 of Clean Water Act [per COE]	Corps of Engineers, U.S. Fish and Wildlife Service, National Marine Fisheries Service, State agencies, U.S. Environmental Protection Agency
Water body alteration	Fish and Wildlife Coordination Act Section 10 of Rivers and Harbors Act Section 404 of Clean Water Act [per COE]	U.S. Fish and Wildlife Service, National Marine Fisheries Service, State agencies ; Corps of Engineers
River status	Wild and Scenic Rivers Act; Anadromous Fish Conservation Act; Hanford Reach Study Act	U.S. Department of the Interior
Air pollution	Clean Air Act	U.S. Environmental Protection Agency, State NPS and local agencies [per NPS]
Water use and availability	Water Resources Planning Act of 1965; Safe Drinking Water Act; Primary and Secondary Drinking Water Standards; others	U.S. Environmental Protection Agency, Office of Water Policy, State agencies

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Hawaii Geothermal Project EIS

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TABLE 4.1.—Agency Consultations
(continued)

<u>Subject Area</u>	<u>Legislation</u>	<u>Agency</u>
Noise	Noise Pollution and Abatement Act of 1970; Noise Control Act of 1972	U.S. Environmental Protection Agency, ^{NAS} State agencies
Siting and planning	State and County legislation	State and County agencies
Waste management and transportation	Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act and the Hazardous and Solid Waste Amendments of 1984; Comprehensive Environmental Response, Compensation and Liability Act; Emergency Planning and Community Right to Know Act	U.S. Environmental Protection Agency, U.S. Department of Transportation, State agencies
Coastal zones	Coastal Zone Management Act; State and County legislation	Office of State Planning, County Planning Department

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**TABLE 4.2.—Government Agency Permit Consultation List
(continued)**

<u>Permit Abbreviation</u>	<u>Permit Title or Type</u>	<u>Cross-Reference to Related Permits/Permits Delegated to Other Agencies</u>
DLNR 18	Dams and Reservoirs Construction Approval	COE 2
DLNR 19	Geothermal Exploration Permit	
DLNR 20	Geothermal Resource Subzone Designation	
DLNR 21	Geothermal Plan of Operations	
DLNR 22	Geothermal Well Drilling or Modification Permit	
State of Hawaii Department of Health		
DOH 1	Notification of Hazardous Waste Activity	EPA 1
DOH 2	Hazardous Waste Treatment, Storage and Disposal (TSD) Permit	EPA 1
DOH 3	Underground Storage Tank (UST)	
DOH 4	Underground Injection Control (UIC) Permit	EPA 3
DOH 5	Water Quality Certification (WQC) Army Corps of Engineers Section 401 Permit	
DOH 6	Authority to Construct (ATC) a Potential Air Pollution Source	EPA 2
DOH 7	Permit to Operate (PTO) a Potential Air Pollution Source	EPA 2
DOH 8	Prevention of Significant Deterioration (PSD)	EPA 2

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Implementation Plan

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TABLE 4.2.—Government Agency Permit Consultation List
(continued)

<u>Permit Abbreviation</u>	<u>Permit Title or Type</u>	<u>Cross-Reference to Related Permits/Permits Delegated to Other Agencies</u>
CCH 2	Special Management Area Use Permit (SMP)	
CCH 3	Shoreline Setback Variance	
	U.S. Navy	
NAV 1	Notification Regarding Surface and Subsurface Plans	
	U.S. Army Corps of Engineers	
COE 1	Permits Under Sections 9 and 10 of the Rivers and Harbors Act of 1899 for Structures or Works in or Affecting Navigable Waters of the United States	NMFS 2, OSP 1
COE 2	Permits Under Section 103 of the Marine Protection Research and Sanctuaries Act of 1972 for Ocean Dumping of Dredged Material	FWS 1, NMFS 7, EPA 4 OSP 1
COE 3, 4, and 5	COE 3: Permits Under Sections 404 of the Federal Water Pollution Control Act of 1972 and Amendments for Discharges or Dredged or Fill Material into Waters of the United States; COE 4: Water Quality Certification from the State of Hawaii Department of Health; COE 5: Coastal Zone Management Consistency Certification from the State of Hawaii	EPA 1, FWS 2, NMFS 1 OSP 1, DOMS
	<p><i>consultation with applicable agencies on</i></p> <p>The Corps permit may also involve endangered species and historic sites.</p>	

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Hawaii Geothermal Project EIS

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**TABLE 4.2.—Government Agency Permit Consultation List
(continued)**

<u>Permit Abbreviation</u>	<u>Permit Title or Type</u>	<u>Cross-Reference to Related Permits/Permits Delegated to Other Agencies</u>
NMFS 3	Clean Water Act Section 401, Water Quality Certification Application Review	COE 4, FWS 2, EPA 1
NMFS 4	Federal Coastal Zone Management Consistency Determination Review	OSP 1, COE 5
NMFS 5	Marine Mammal Protection Act (MMPA) Exemption	
NMFS 6	The Endangered Species Act (ESA) Section 7, Consultation Process	FWS 1
NMFS 7	Marine Protection Research and Sanctuaries Act of 1972, Section 103 Permit Review	COE 2
NMFS 8	National Environmental Policy Act, EIS preparation and review	
NMFS 9	Fish and Wildlife Coordination Act	FWS 4
	U.S. Environmental Protection Agency	
EPA 1	Permits and Licenses Under Section 402 of the Federal Water Pollution Control Act of 1972 and Amendments	DOH 1, DOH 2, FWS 2, COE 3
EPA 2	Permits and Licenses Under the Clean Air Act	DOH 6, DOH 7, DOH 8
EPA 3	Underground Injection Control (UIC) Permit	DOH 6
EPA 4	Ocean dumping permits under Sect. 102(a) of the Marine Protection Research and Sanctuaries Act of 1972	COE 2

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Hawaii Geothermal Project EIS

PA HERO

HGP

ATTACHMENT 1 — DOE Reading Rooms with Copies of the
HGP EIS Public Scoping Meeting Transcripts

Hawaii

Hawaii Energy Extension Service
Hawaii Business Center
99 Aupuni Street, Room 214
Hilo, HI 96720
Contact: Andrea Beck
Telephone: (808) 933-4558
Fax: (808) 933-4602

Hilo Public Library
300 Waianuenue Avenue
Hilo, HI 96721-0647
Contact: Claudine Fujii
Telephone: (808) 935-5407
Fax: (808) 933-4658

Kailua-Kona Public Library
75-138 Hualalai Road
Kailua-Kona, HI 96740
Contact: Irene Horvath
Telephone: (808) 329-2196
Fax: (808) 326-4115

Mountain View Public and School Library
Highway 11
Mountain View, HI 96771
Contact: Evelyn Garbo
Telephone: (808) 968-6300
Fax: (808) 968-6056

Pahala Public and School Library
Pakalana Street
Pahala, HI 96777
Contact: Lisa Cabudol
Telephone: (808) 928-8032
Fax: (808) 928-6199

Pahoa Public and School Library
15-3038 Puna Road
Pahoa, HI 96778
Contact: Laura Ashton
Telephone: (808) 965-8574
Fax: (808) 965-7170

State of Hawaii

Department of Business, Economic
Development & Tourism
Hilo Office
99 Aupuni Street, Room 212
Hilo, HI 96720
Contact: Michelle Wong-Wilson
Telephone: (808) 933-4600
Fax: (808) 933-4602

Kauai

Kauai Office of Economic Development
4444 Rice Street, Room 230
Lihue, HI 96766
Contact: Glenn Sato
Telephone: (808) 245-7305
Fax: (808) 245-6479

Lihue Public Library
4391-A Rice Street
Lihue, HI 96766
Contact: Karen Ikemoto
Telephone: (808) 245-3617
Fax: (808) 246-0519

Mau

Hana Public and School Library
Hana Highway
Hana, HI 96713
Contact: Jeremy Kindred
Telephone: (808) 248-7714
Fax: (808) 248-7438

Kahului Public Library
90 School Street
Kahului, HI 96732
Contact: Lani Scott
Telephone: (808) 877-5048
Fax: (808) 871-9032

Lanai

Lanai Public and School Library
Fraser Avenue
PO Box A-149
Lanai City, HI 96763
Contact: Peggy Fink
Tel: (808) 565-6996
Fax: (808) 565-6171

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~~Planning Department~~
 Maui Energy Extension Service
 250 200 South High Street
 Wailuku, HI 96793
 Contact: Kalvin Kobayashi
 Telephone: (808) 243-7832
 Fax: (808) 243-7870 7634

Molokai

Molokai Public Library
 Ala Maloma Street
 Kaunakakai, HI 96748
 Contact: Sri Tencate
 Telephone: (808) 553-5483
 Fax: (808) 553-5958

Oahu

Hawaii State Library, Document Center
 Unit, 634 Pensacola Street
 Honolulu, HI 96814
 Telephone: (808) 586-3535
 Fax: (808) 586-3584

Kahuku Public and School Library
 56490 Kam Highway
 Kahuku, HI 96731
 Contact: Jean Okimoto
 Telephone: (808) 293-9275
 Fax: (808) 293-5115

Pearl City Public Library
 1138 Waimanalo Home Road
 Pearl City, HI 96782
 Contact: Marilyn Van Gieson
 Telephone: (808) 455-4134
 Fax: (808) 456-4407

State of Hawaii, Department of Business,
 Economic Development & Tourism
 Energy Division, Publications Section
 335 Merchant Street, Room 110
 Honolulu, HI 96813
 Contact: Maurice Kaya
 Telephone: (808) 547-3800
 Fax: (808) 587-3820

State of Hawaii
 Department of Business, Economic
 Development & Tourism
 Geothermal Office
 Financial Plaza of the Pacific
 130 Merchant Street, Suite 1060
 Honolulu, HI 96813
 Contact: Dean Nakano
 Telephone: (808) 587-3812
 Fax: (808) 587-3820

State of Hawaii
 Department of Business, Economic
 Development & Tourism
 Information Office
 220 South King Street, Suite 1100
 Honolulu, HI 96813
 Contact: Marsha Anderson
 Telephone: (808) 586-2405 or 586-2406
 Fax: (808) 586-2427

State of Hawaii
 Department of Business, Economic
 Development & Tourism, Library
 220 South King Street, Fourth Floor
 Honolulu, HI 96804
 Contact: Anthony Oliver
 Telephone: (808) 586-2425
 Fax: (808) 586-2452

U.S. Department of Energy
 Pacific Site Office
 Prince Kuhio Building
 Room 4322
 300 Ala Moana Boulevard
 Honolulu, HI 96813
 Contact: Eileen Yoshinaka
 Telephone: (808) 541-2563
 Fax: (808) 541-2562

Waimanalo Public and School Library
 41-1320 Kalaniana'ole Highway
 Waimanalo, HI 96795
 Contact: Nina O'Donnell
 Telephone: (808) 259-9925
 Fax: (808) 259-8209

This appendix summarizes written scoping comments that were received from federal, State, and County agencies concerning the HGP EIS.

COUNTY AGENCIES

County of Hawaii

In a March 6, 1992 letter accepting cooperating agency status and in an August 3, 1992 review of the working draft Implementation Plan, the County of Hawaii requested that the following issues be considered in the EIS:

Socioeconomics. Impacts of industrialization of the Island of Hawaii (resulting from geothermal development and power availability) should be investigated in the EIS. An analysis of project costs should ~~included~~ ^{include} consideration of relocating nearby residents and insurance costs during construction and operation. Utility rates with geothermal development should be compared to rates from alternatives.

Air Quality. The EIS should assess air quality effects of venting during power outages (grid failure) and consider problems associated with fixed monitoring systems.

Health and Safety. The EIS should consider effects from hydrogen sulfide and other pollutants at various concentrations and from possible synergistic effects of pollutants.

Ecological Resources. Impacts of emissions on species other than humans should be considered.

Water Resources. The "fate" (i.e., migration) of reinjected fluids and the impacts thereof should be examined in the EIS. Sources and amounts of well-quenching water should be identified.

Land Use. The EIS should assess impacts of incompatible land uses.

Policy. Federal liability in federally funded projects should be discussed.

Other. The EIS should investigate the interconnection of the Island grid and the

interisland grid and discuss priorities under various load shedding scenarios.

County of Maui

In letters of October 1, 1991 and April 13, 1992 and in responses to the working draft Implementation Plan, the County of Maui requested that the EIS consider all potential impacts associated with the overland transmission corridor, including possible effects on land use, ecological resources, water resources, scenic resources, cultural and archaeological resources, health and safety particularly as related to the electromagnetic field, and economic issues, particularly effects on property values. If cable landing on Lanai is a reasonable alternative, the EIS should consider these issues as they relate to Lanai.

The EIS should consider the underwater cable's potential economic, cultural, archaeological, and ecological impacts on the reef and fishpond resources along the south shore of Molokai. Lastly, the EIS should reflect recommendations made in the community plans.

STATE AGENCIES

State of Hawaii

The State of Hawaii offered comments in response to the ANOL, the NOI, the invitation to become a cooperating agency, and in reviewing the working draft Implementation Plan. The communications are from the Office of State Planning, the Department of Business and Economic Development, the Office of Hawaiian Affairs, and the Division of Consumer Advocacy and are dated September 26 and September 30 of 1991; March 2, March 23, April 2, April 8, and July 24 of 1992.

Energy Policy. The state of Hawaii would like recognized in the EIS that its current plan to develop a smaller geothermal plant to focus to support small scale geothermal development.

(1) The EIS should discuss permitting for these projects and their supporting infrastructure that documents the state can't not put it, satisfy only the Island of Hawaii's power needs differs from the proposed action in the EIS. The EIS should address the state's goal of achieving dependable, efficient, and economic statewide energy system and reducing its dependency on oil.

Federal, state, and local governments and geothermal developers. The state recommends a discussion of the relationship between Phases 3 and 4 and existing geothermal projects be included in the EIS. The EIS should also include information about relations between the federal, state and local governments, developers, and citizens.

(2) The EIS should address the purpose and objectives of the state statute on geothermal resource, subsidies and competition with existing land use. **Land Use.** The EIS should at least estimate the amount of land area that would be required for such a large operation. The discussion should indicate whether the total acreage needed will be concentrated in one central area or scattered throughout the Island of Hawaii. Also, a map should be included to show possible sites for power stations and the geothermal wellfields. Other concerns are the implications of land use after the plant is closed. The EIS should explain what will happen to the sites after the plants have surpassed their energy generating capacities and when that is likely to happen. The EIS should examine the compatibility of geothermal development with existing and planned land uses. (3)

(2) The relative air quality impacts of geothermal compared to those of possible alternative energy technologies need to be addressed. **Air Quality.** The EIS should also discuss the effects of wellfield construction, well venting, accidents, smell of hydrogen sulfide and other gases. Although the volcano produces hydrogen sulfide and causes acid rain effects, hydrogen sulfide concentrations may be higher in localized areas near the plants. A monitoring and remediation program should be described. A map should also be included to indicate what areas and communities are likely to be impacted. People may be able to detect hydrogen sulfide levels below instrument detection. (2)

(2) The relative air quality impacts of geothermal compared to those of possible alternative energy technologies need to be addressed. **Water Resources.** The EIS should evaluate the effects of hydrogen sulfide and other airborne emissions, not just solid and liquid wastes as proposed in the prep notice, on

groundwater and surface water (fresh and marine). Water catchment systems should also be considered a potentially affected resource and the effects of well venting and accidents on them should be determined. The nonpoint source pollution impacts on water quality should also be described. And the proposed monitoring and remediation program should be included and described.

Ecological Resources. The effects from the cable on all marine fauna (not just benthic) including Hawaiian monk seals need to be evaluated. There may be water column impacts, fisheries impacts, impacts on surf sites, swimming and boating. Reefs, beaches and other natural resources such as limu, may be affected. A monitoring program should be developed to evaluate effects on ecological resources on an ongoing basis throughout the duration of the project. Baseline studies and stress indicators should be identified for monitoring. The EIS should also include a description of the impacts on endemic flora and fauna. Acid rain effects on ecological resources should be considered.

Geological Resources. The EIS should evaluate shoreline and nearshore impacts from the cable, including shore erosion, interference with currents and sand transport, reefs and surf sites. Impacts from the long-term presence of the cable should be included and not be limited to placement and construction activities.

Noise. The EIS should evaluate long-term effects on flora and fauna and their habitat, as well as on nearby residential communities.

Health and Safety. The EIS should also include long-term health effects due to chronic exposure to noise, air pollution, water pollution, electromagnetic field and psychological stress incurred from evacuations and the threat of evacuations. The physical and psychological welfare of residents in nearby communities must be evaluated. Public health monitoring should be provided.

Socioeconomic. The effects of lifestyle changes and disruption need consideration. Frequent evacuations and the threat of

evacuations have socioeconomic impacts on neighboring communities. The EIS should also include a cost/benefit study which analyzes the likelihood of disruption or destruction of facilities by volcanic activity. Effects on utility and tax rates should be examined, as should impacts on farm employment resulting from loss of farm workers in industrial and tourism sectors.

Cultural Resources. A discussion of the impacts the project may have on the Native Hawaiian religion should be included.

Scenic and Visual Resources. The EIS should evaluate the appropriateness and compatibility of the plants, roads, transmission lines and cable with the surrounding environment. A view plane study may be helpful in illustrating the impacts on the scenic and visual resources of the area.

Alternatives. Clear definitions of alternatives should be provided in the EIS. Geothermal energy for the Big Island only should be one alternative. A thorough evaluation of all other available alternative energy technologies and their feasibilities should be done, including consideration of an aggressive conservation program. The EIS should examine impacts of alternative methods of disposing geothermal fluids, including reinjection, surface impoundment, and discharge to surface water bodies.

A summary of all new field studies conducted for the EIS and other studies contributing to the EIS, and a comprehensive review of the Phase 4 impacts at all of the possible sites should be included in the EIS.

One state office said that too much of our natural environment, culture, and socioeconomic future may be sacrificed for the vague promise of energy self-sufficiency.

Identify as only OHA VIEW
(PERSON DDED)

FEDERAL AGENCIES

National Marine Fisheries Service

In a March 6, 1992 letter and in comments on the working draft

Implementation Plan, the National Marine Fisheries Service (NMFS) characterized issues related to the underwater cable as important and sensitive. Two specific issues were identified for consideration in the EIS: impacts of the electromagnetic field on marine biota and impacts from trenching and laying transmission lines on nearshore marine habitats, including coral reefs.

National Park Service

In letters of February 24, 1992 [Hawaii Volcanoes National Park (HVNP)], February 28, 1992 [Pacific Area Office (PAO)], April 14, 1992, and in Implementation Plan reviews of July 14, 1992 (HVNP) and July 17, 1992 (PAO), the National Park Service offered the following comments.

The EIS should address potential impacts to HVNP, a Prevention of Significant Deterioration (PSD) Class I area. The Park is concerned about the potential for air contamination which might affect native plants and animals or might adversely affect the health of visitors and employees. An unbiased analysis of point source emissions and an evaluation of impacts resulting from emissions of hydrogen sulfide and criteria and non-criteria air pollutants and particulate emissions should be conducted. Cumulative and long-term effects of emissions and electromagnetic fields should be considered.

The EIS should analyze potential loss of Air Quality Related Values (AQRV), including vista degradation, noise, and odors, which are important to the Park's mandate to manage the backcountry for wilderness values. Light contamination should be considered, as should cumulative impacts of noise (including that generated by scenic tour aircraft). Mitigation measures should be discussed.

The NPS expresses concern over the introduction of industrial land use in a region characterized by conservation, agricultural and rural land uses. The EIS should include

regional land use issues, including maintaining buffers around state and national protected areas.

Impacts to the threatened Newell's Shearwater, recently spotted near HVNP, from lights, noise, drill rigs, overhead wires, fences, and emissions should be considered.

The NPS reports that emergency remedies to thwart lava flow are not allowed in HVNP.

The NPS requests that energy conservation be considered as an alternative.

U.S. Army Corps of Engineers

In its August 26, 1992 review of the working draft Implementation Plan, the Corps noted that it has no plans to do any work on describing the rainforest and will not develop a GIS base for wetlands. In addition, the Corps raised the following points:

- COE*
it is
its responsibility
carry out
the
regulation
- COE will not consult with DOE, SCS, USGS, or FWS in the wetland delineation efforts and will not consult with those agencies regarding wetland significance or values. DOE will make a detailed assessment to satisfy 404(b)(1) guidelines for the discharge of dredged or fill material. DOE should also be aware that the 404(b)(1) sequence involves avoiding fill, minimizing fill, and mitigating for fill.
 - DOE must initiate Section 106 Historic Coordination for any discharge of dredged or fill material, as well as for the geothermal development.
 - In Table 4.2 of the Implementation Plan, EPA should be added to COE 2; and USFWS, NMFS, and ACHP should be added to COE 6. The Corps permit may also involve endangered species and historic sites.
 - The EIS milestone schedule is very tight. Our experience indicates that 18 months from start of writing to decision point is very fast. COE may not be able to perform with any accuracy with this schedule.

U.S. Environmental Protection Agency

EPA responded on April 15, 1992 to the NOI with a three-page letter with nine pages of comments covering nearly the full range of technical issues expected to be addressed in the EIS. Generally, EPA's recommendations about the topics to be covered in the EIS are consistent with DOE's. EPA also raises several issues — primarily regarding procedures and alternatives — which relate to DOE policy. Additional comments were made in their August 18, 1992 review of the working draft Implementation Plan.

Policy

1. EPA requests that DOE publish a notice of a draft IP and solicit comments on the decisions DOE considers to be within the scope of the EIS. This procedure will provide a chance for public comment prior to the DEIS. EPA believes that DOE intends to use the IP process to make substantive decisions regarding preparation of the DEIS. Further, EPA states that making the final IP available in public reading rooms would eliminate any further public input into DOE decisions until the DEIS is published, scheduled for early 1993.
2. DOE should be ready to prepare a supplemental environmental document if the decision about specific plant locations is made after the EIS is completed and the decision makes substantial changes in the proposed action or if the decision is relevant to the environmental concerns of the action or its impacts. The EIS should acknowledge the need for environmental documents for specific plants and include plans to prepare them in the EIS.
3. An EIS completion date of "early 1993" should not be cast in concrete; doing so may preclude important studies. Time should be allowed for essential studies to go forward.

This appendix presents an outline of the *Environmental Impact Statement for the Hawaii Geothermal Project*. The outline is subject to change as preparation of the EIS progresses.

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APPENDICES

WETLANDS ASSESSMENT
FLOODPLAINS ASSESSMENT
BIOLOGICAL ASSESSMENT
MITIGATION ACTION PLAN(S)
AIR QUALITY MODELLING
ARCHAEOLOGICAL ASSESSMENT
ETHNOGRAPHIC ASSESSMENT

<i>indigenous</i> —having originated in or naturally occurring in a particular region or environment.	<i>rain forest</i> —a tropical woodland with an annual rainfall of at least 100 inches and marked by lofty broad-leaved evergreen trees forming a continuous canopy.	1 2 3 4 5
<i>injection well</i> —a well into which water, spent brines, or gases are pumped in order to maintain subterranean pressure or to dispose of waste fluids.	<i>reinjection</i> —the return of water, spent geothermal brines, or gases via an injection well after use in a power plant.	6 7 8 9
<i>integrated resource planning (IRP)</i> —attempts to find the lowest cost for meeting energy demand through increasing supply or improving end use energy efficiency.	<i>renewable energy</i> —nondepletable energy (e.g., solar, wind.)	10 11 12
<i>invertebrate</i> —species that lacks a spinal column, includes insects, worms, and the like.	<i>rift</i> —(geology)-1) the boundary between crustal plates that are separating from one another; and 2) fissures that radiate outward from a volcano into which magma (lava) is injected.	13 14 15 16 17 18
<i>megawatts</i> —1,000,000 watts (1 million watts).	<i>scoping process</i> —refers to the methods by which public and agency input are solicited regarding environmental issues to be addressed in an environmental impact analysis.	19 20 21 22 23 24
<i>meteorological</i> —of or relating to the science that deals with the atmosphere and its phenomena.	<i>seismic</i> —pertaining to energy released by ground motion.	25 26 27
<i>milestone</i> —a significant point in development with the passage of time.	<i>silicates</i> —common minerals in the earth's crust consisting of silicon and oxygen in ratios varying from 1:2 to 1:4.	28 29 30 31
<i>mitigation</i> —refers to measures implemented to reduce an environmental impact to acceptable levels.	<i>socioeconomics</i> —relating to or involving a combination of social and economic factors.	32 33 34 35
<i>non-native species</i> —a species that does not occur naturally where it is found.	<i>solid dielectric cable</i> —one whose insulator is one of several solid materials such as ceramic, mica, glass, plastic film, or paper.	36 37 38 39
<i>particulate</i> —fine solid particle that remains individually dispersed in gases and stack emissions.	<i>stagnation</i> —absence or cessation of movement, growth, or activity.	40 41 42
<i>petroleum refining residuals</i> —high boiling fraction remaining after removal of more volatile liquids.	<i>subsidence</i> —(geology) lowering of the landsurface by withdrawal of fluids from below. <i>usually [per USGS]</i>	43 44 45 46 47
<i>potable</i> —refers to water that is suitable for human ingestion.		
<i>production well</i> —a well from which geothermal brines or steam is extracted.		

subsistence—the condition of remaining in existence; the minimum (as food or shelter) necessary to support life.

subzone—GRS-Geothermal Resource Subzone (there are 3 subzones: upper, middle and lower) in Kilauea's east rift geothermal resource zone.

synergistic effects—an action where the total effect of two or more components in a mixture is greater than the sum of their individual effects.

tephra—denotes all rocks composed of fragmented volcanic products ejected during eruption. Used in this EIS to denote the portion of lava released airborne during eruption.

transport pathways—the paths (routes) that contaminants take between contaminant sources and receptors; these contaminant paths may be air-borne, water-borne or groundwater borne.

tsunami—a long-period sea wave produced by an earthquake, submarine volcanic eruption or other submarine disturbance.

vog/volcanic smog—a natural aerosol containing a mixture of volcanic dust particles and volcanic gases, mainly water vapor, carbon dioxide, and sulfur dioxide.

volcanic dike—a tabular body of rock, congealed from magma (lava) injected into fissures or rift zones.

well blowout—uncontrolled venting of liquids and/or gases from a well.

well casing—tubing inserted into a drill hole to serve as a ~~linear~~ *liner*.

well quenching—introducing cool water into a well that is out of control to reduce the production of steam, thereby bringing the well under control.

well venting—release of well fluid to the atmosphere, either controlled or uncontrolled.

wetlands—areas such as swamps, marshes, bogs and estuaries; to be considered under the "wetlands" Army Corps of Engineers legal definition, an area must possess three characteristics: hydrophytic vegetation, hydric soils, and wetland hydrology.