

The Geothermal Handbook

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TABLE OF CONTENTS

	<u>PAGE</u>	
Section I	GEOTHERMAL ISSUES	
	Rainforest	I-1
	Land Exchange	I-3
	Land Rights	I-4
	Religion/Pele Worship	I-5
	Health/Safety Concerns	I-6
	Cost/Taxpayers	I-8
	Studies/Permitting	I-9
	Compensation	I-10
	Technology/Industrialization	I-11
Section II	POSITION PAPERS	
	State of Hawaii	II-1
	Senator Matsuura Letter	II-4
	ILWU-Big Island	II-7
	Ormat Energy Systems	II-11
	Estate of James Campbell	II-12
	True Geothermal	II- 21
Section III	HAWAII'S ENERGY ALTERNATIVES	
	Introduction	III-1
	Comparison Grid	III-2
	Oil	III-3
	Coal	III-4
	Hydropower/Hydroelectric	III-5
	Biomass	III-6
	Wind	III-7
	Photovoltaic (Direct Solar)	III-8
	Solar Thermal	III-9
	Ocean Thermal Energy Conversion (OTEC)	III-10
	Geothermal	III-11
Section IV	BACKGROUND	
	Current Energy Consumption	IV-1
	Proposed Well Locations	IV-2
	History	IV-2
	Technical Data	IV-2
	Investment Considerations	IV-3
	Court Actions	IV-3
	-Religious Rights	
	-Land Exchange	
	Geothermal Resource Subzone	IV-4
	Maps	IV-5-8

PAGE

Section V GEOTHERMAL PHONE LIST

State of Hawaii	V-1
County of Hawaii	V-3
Private Industry	V-4
Public Relations Firms	V-6
Chambers of Commerce	V-7
Key Media	V-8
Coalitions	V-9

SECTION I

GEOHERMAL ISSUES

Rainforest	I-1
Land Rights	I-3
Land Exchange	I-4
Religion/Pele	I-5
Health/Safety	I-6
Cost/Taxpayers	I-8
Studies/Permits	I-9
Compensation	I-10
Technology/Industrialization	I-11

GEOHERMAL ISSUES

OBJECTIONS

FACTS

RAINFOREST

-Wao Kele o Puna is the last lowland tropical forest in the United States and geothermal development will destroy it forever.

-The Wao Kele o Puna forest was selected, after considerable study of potential effects on native Hawaiian forests, as the site for geothermal development precisely because the forest is heavily overrun with non-indigenous plants. The State and Campbell Estate arranged an exchange of lands in 1985 to preserve the pristine forests of the upper Kilauea East Rift Zone and move geothermal development to its current site. Only 300 of approximately 60,000 acres of forest land in the East Rift Zone will be used for geothermal sites. (This represents only 6/100ths of 1% of the 500,000 acres of ohia forest land on the Big Island).

-The reason environmentalists are concerned about saving rainforests is to maintain a stable balance between the rain forests' production of oxygen and our oil-based industrial production of carbon dioxide. If we lose forests, global warming will accelerate.

-However, if 500 megawatts of electricity was generated by geothermal power, the reduction in carbon dioxide emissions from oil-fired generators would equal nearly half-a-million acres of trees. The trade-off is very beneficial for the environment.

GEOTHERMAL ISSUES

OBJECTIONS

FACTS

-The Wao Kele o Puna forest is not the last lowland tropical rainforest in the United States. There are nine lowland rainforests in the state of Hawaii. The most pristine parts of the Puna district lowland tropical rainforest have already been preserved as a consequence of the 1985 land exchange. The designated geothermal development subzone in Wao Kele O Puna in the middle East Kilauea Rift contains, in the southwest part of the subzone, small areas of pristine forest interspersed with recent lava flows. Current geothermal development is occurring in the northeast part of the subzone in areas which have already been heavily impacted by the presence of alien plants.

-It is anticipated that in the future, when development occurs in the western part of the subzone, the location of roads, well sites and power plants will be designed to avoid the small areas of pristine forest still remaining there. The total planned development within the 27,000-acre designated geothermal development subzone will involve clearing only about 300 acres (about 1.1% of the area) over a period of several years. Some of that will be in disturbed forest, some of it on very recent, still sparsely-vegetated, lava flows. Even that clearing will occur only after detailed study of the areas being cleared and follow-up monitoring of the cleared areas to avoid any further spread of weeds. Therefore, apart from the 1.1% of the land which will have been cleared, the environmental impact of geothermal development on Wao Kele o Puna is expected to be minimal.

GEOTHERMAL ISSUES

OBJECTIONS

FACTS

LAND RIGHTS

-Hawaiians have lost ceded land rights that provide use of the land to:

- *Support schools and other public institutions.
- *Better the conditions of the native Hawaiians.
- *Develop farm and home ownership and for public use.

-Exchange to Campbell cuts off traditional public access for gathering. Native tenants within an ahupua'a (a Hawaiian land division usually extending from the uplands to the sea) by statute have the right to enter undeveloped lands to gather materials for practicing native Hawaiian customs and traditions, such as firewood, house timber, aho cord, thatch and ti leaf.

-There has been no loss of land rights for Hawaiians. The ceded land rights were transferred in the land exchange. They now reside with the Kahauale'a lands. As a result, both the State of Hawaii and OHA have the opportunity to share in the income from geothermal development.

-Geothermal development may well provide the best return economically for much of the desolate, lava-covered land in the Kilauea East Rift Zone. This return will benefit Hawaiians where development is on Bishop Estate lands.

-Native gathering rights within the Wao Kele ahupua'a continue for residents of the ahupua'a. The only lands off-limits by state law are those under development. The rest of the forest (26,700 acres) will remain open and available to ahupua'a residents.

GEOHERMAL ISSUES

OBJECTIONS

FACTS

LAND EXCHANGE

-Transfer of ceded public lands in Wao Kele o Puna for Campbell Estate's Kahauale'a land was illegal.

-Not an equal exchange: 27,000 acres in Wao Kele o Puna for 25,000 acres in Kahauale'a:

-Of the 25,000 acres in Kahauale'a:

- *15,000 are covered by lava.
- * 1,200 are wood-chipped.
- * 5,600 have been promised to Volcano National Park.

-The exchange was initially proposed by environmental activists from Volcano Village.

-The exchange was initiated by the State of Hawaii to preserve the more pristine Kahauale'a forest and to create a natural buffer around Volcanoes National Park. It was subsequently approved by the state legislature.

-The difference in acreage between the two parcels that were exchanged was based upon appraisals done by the State of Hawaii.

-Of the 25,000 acres at Kahauale'a, 4,100 were subsequently covered by lava and the 815 acres that had been wood-chipped are being reforested with the help of a U.H. reforestation study. The National Park is no longer interested in acquiring any of the acreage since it is now in State ownership.

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GEOTHERMAL ISSUES

OBJECTIONS

FACTS

RELIGION/PELE

-Geothermal development encroaches on Native Hawaiian religious practices.

-It is inappropriate for the developers and land owners to comment on others' religious beliefs. Because the issues are sensitive and complex, it is sometimes necessary to have the courts resolve disagreements involving religious practice. Such was the case with geothermal development on the Island of Hawaii. The courts have ruled that development may proceed. In the Dedman et al. vs. Paty case, the court ruled that the plaintiffs had never worshipped on the site of the proposed project. Nor had they presented substantial proof that drilling for steam is sacrilegious to Pele.

GEOHERMAL ISSUES

OBJECTIONS

HEALTH/SAFETY CONCERNS

-The project is dangerous in that it could be damaged by earth movements, lava eruptions and cracks.

-"We will be inundated by sulfide gases." -- Leilani Estates residents.

FACTS

-Geothermal plants can be engineered to withstand pressures and stresses associated with seismic activity. The Geysers plant in California was a mere 100 miles away from the epicenter of the recent San Francisco earthquake and the systems sustained no damage.

-State-of-the-art abatement systems can control plant emissions, including hydrogen sulfide. The developers plan to use the best available technology in their plants -- technology that has been developed over the past 60 years and is in operation in at least 16 countries around the world.

GEOHERMAL ISSUES

OBJECTIONS

HEALTH/SAFETY CONCERNS (CONT'D)

-"Unabated geothermal venting, which occurs during routine cleaning, releases into the air hydrogen sulfide (the stuff that smells like rotten eggs). At low levels the odor is annoying; at higher levels it can kill."

FACTS

-Modern geothermal technology has all but eliminated the release of hydrogen sulfide into the atmosphere. The gases will be controlled either through re-injection into the earth or use of "scrubber" systems, whichever is most appropriate for the composition of the fluids found at the Puna sites. Even if hydrogen sulfide were to escape into the air, it would be harmless at the concentration levels found in geothermal wells. It would have to be concentrated around 25,000 times more than it is to be considered dangerous.

GEOHERMAL ISSUES

OBJECTIONS

FACTS

COST/TAXPAYERS

-Taxpayers and consumers will pay the bill for geothermal development and the inter-island cable in the form of higher utility bills.

-By the time the last construction is completed after the turn of the century, the entire project -- geothermal wells, power plants and the inter-island transmission system -- will cost several billion in inflated dollars. However, any cost estimate you hear today is just that -- an estimate. The exact cost, however, is not yet known. Hawaiian Electric Company received proposals from five consortia and hopes to negotiate a power purchase contract with one developer by the end of 1990.

GEOTHERMAL ISSUES

OBJECTIONS

FACTS

STUDIES/PERMITTING

- An in-depth, least-cost energy study has not been performed.
- The State made it easy for developers to obtain permits.
- Environmental and archeological studies were not required.

- Many ongoing systems show that geothermal is feasible. Geothermal energy is now being used by 16 countries and has been used for the last 60 years. One of the most notable successes being The Geysers in California, which helps provide San Francisco with much of its electricity needs. Considering both initial capital costs and operating costs, geothermal compares favorably with all other resources (oil, coal, gas, nuclear, solar, thermal, wind, photovoltaic, hydroelectric, biomass, municipal waste, etc.)
- It took 8 years, 3 public hearings, 2 contested case hearings and numerous court cases before the conservation district use permit was issued to True/Mid-Pacific for the well being drilled on Campbell Estate Land.
- These studies were required and performed and included in the EIS for each development. Further studies and environmental monitoring will be performed on an ongoing basis as work progresses.

GEOHERMAL ISSUES

OBJECTIONS

FACTS

COMPENSATION

-There should be a provision for compensation and relocation for those negatively affected (by the geothermal development).

-During the early permitting mediation for the Puna Geothermal Venture project, a joint decision was made by officials from the Hawaii County government, the developers, various community organizations and the State to set up an "assets fund" for those negatively affected by geothermal development in Puna. The intent of the fund, which is still in the early stages of development, is twofold: One, the fund would help to temporarily or permanently relocate residents affected by development. The specifics of the compensation have not been decided upon and are fairly open-ended. The second intent of the fund is to give something back to the community. The players involved in the development of the fund are: Governor Waihee, Sus Ono, Libert Landgraf, Duane Kanuha, Maurice Richard, Ron Phillips and Russell Kokubun.

GEOHERMAL ISSUES

OBJECTIONS

FACTS

TECHNOLOGY

-The technological aspects of geothermal energy have not been sufficiently developed to warrant a large installation on the Big Island.

-Geothermal power generation is a proven technology widely used throughout the world. Much of San Francisco's electrical needs are met by geothermal. Today, the Philippines generates over 1800 MW of electricity from geothermal, enough to electrify the entire State of Hawaii and still have 400 MW left over. Geothermal electricity was first produced in Italy 80 years ago.

INDUSTRIALIZATION

-"Paradise will be industrialized"

-The development of geothermal power will not in itself accelerate or hinder development. Any other developments will be the result of a variety of factors, most of which have nothing to do with electrical power.

SECTION II

POSITION PAPERS

State of Hawaii	II-1
Senator Matsuura Letter	II-4
ILWU-Big Island	II-7
Ormat Energy Systems	II-11
Estate of James Campbell	II-12
True Geothermal	II-21

I. ENERGY SELF-SUFFICIENCY

1. Hawaii's energy goal is twofold. First, to reduce our dependence on oil, because oil is a non-renewable, ecologically detrimental import. Second, to increase our energy self sufficiency, because it is critical to our security as an island people.

2. Energy conservation programs have made us more energy efficient. Since 1980 we have achieved an impressive 21% reduction in per-capita energy demand

3. The "Blueprint for the Environment - Advice to the President-Elect from America's Environmental Community" (a cooperative effort by national environmental organizations presented to President-Elect Bush) found that fossil fuels are "responsible for about half the greenhouse gases that are warming the earth" and that energy decisions must move towards the use of clean, renewable energy sources.

Indeed private and public sector action makes Hawaii world leaders in the variety of renewable energy sources which we use....from ocean thermal, to biomass, to wind, to photovoltaic, to solar, to geothermal.

4. Yet the people of Hawaii are the most oil-dependent in the United States. Imported oil fills 90% of energy needs. As a state we must spend 10% of all we produce to buy oil.

5. Geothermal energy has the best near-term potential to supply our baseload energy needs.

6. Geothermal power is cleaner than oil or coal. Oil-generating plants emit 13 times as many gasses and particulates as geothermal plants. Coal plants emit 40 times as much.

7. OUR CHALLENGE IS TO REDUCE OUR DANGEROUS DEPENDENCY ON OIL, IMPROVE OUR AIR QUALITY AND STABILIZE OUR ECONOMY THROUGH CONTINUED ENERGY CONSERVATION, RESEARCH AND DEVELOPMENT OF ALL RENEWABLE ENERGY RESOURCES AND THE USE OF GEOTHERMAL ENERGY TO MEET OUR NEAR-TERM BASELOAD NEEDS. WE MUST DECLARE ENERGY INDEPENDENCE AND TAKE ACTION TO ACHIEVE IT.

II. PRESERVING OUR FORESTS AND MORE

1. The State of Hawaii encompasses 4 million acres of land. Over 900,000 acres are State forest reserve, 270,000 acres are national park and wildlife refuges, and 46,000 acres private conserves under management of the Nature Conservancy. In fact, although Hawaii is the fourth smallest State in the country, it proudly ranks 7th highest in State-owned forest lands.

2. In the last two decades, Hawaii State has established model law and practice in: a) the Statewide Area Reserves System (NARS), which protects unique island ecosystems and b) the Conservation of Aquatic Life, Wildlife and Land Plants, which safeguards endangered species and promote conservation action.

3. Hawaii State has entered into partnership with the environmental organization, Nature Conservancy, for management of the Natural Area Reserves, with special funding to NARS of \$2 million per year.

4. State programs include a world-class endangered species captive propogation facility, development of the Hawaii Natural Heritage data base, and successful negotiations to dedicate private lands as permanent native forest wildlife habitat areas. Regarding the latter, just this year the Governor announced agreement by a private landholder for a new 462-acre forest preserve on Lanai, and is now undertaking action at the behest of environmental organizations for a 7-mile wildlife park on unique private lands on the west side of the Big Island.

5. The major threat to these environments are introduced species -- plant and animal. Government and private partnerships have stepped up resources for the control of noxious weeds and feral animals.

6. We are very serious about reforestration and tree planting. For example in the last two years, the State Department of Land and Natural Resources produced and distributed 900,000 tree seedlings, planted 850 acres of land, and prepared hundreds more for new planting.

7. The Department of Land and Natural Resources budget for natural conservation is \$15.4 million and includes a state of the art Endangered Species Captive Rearing Project. In addition, this year Hawaii beefed up its land-banking law with a \$20 million appropriation for the public acquisition of privately owned unique lands. Beyond the land, Hawaii is a national leader in "air and sea" resource conservation. Just this year we became the first State to pass a law limiting the sale of CFC-containing refrigerants to protect the ozone layer and passed tough laws forbidding drift gill-netting and prohibiting the use of nondegradable plastic connecting devices which trap sea life.

8. OUR PROGRAMS ARE NATIONAL MODELS, SPEAK FOR THEMSELVES AND WILL MOVE FORWARD. CORNERSTONES INCLUDE: FUNDS FOR FOREST PROTECTION AND WILDLIFE MANAGEMENT, NEGOTIATION FOR PRIVATE LAND ACQUISITION AND DEDICATION FOR WILDLIFE HABITATS, PARTNERSHIPS WITH NATURE CONSERVANCY AND CONCERNED ORGANIZATIONS AND CONTINUED RESEARCH ON BEHALF OF TROPICAL RESOURCE CONSERVATION.

III. BACKGROUND - THE GEOTHERMAL SUBZONE AND THE FOREST

While the wet forests and woodlands of Puna are not Brazilian rainforests, they are a great resource. To protect them, the State conducted lengthly public contested case hearings, including considerable input from environmentalist groups.

The result was an exchange which protects the higher elevation ohia forests known as Kahaualea, then owned by Campbell Estate, from all development. These lands are adjacent to the National Park, are a valuable habitat and are now public lands. By our action, we have created a State and Federal "mega-reserve", which virtually all parties agreed was a conservation achievement.

In exchange a portion of the lower lands known as Wao Kele O Puna were designated for geothermal use. Of these lands, a maximum of 400-600 acres will be used for geothermal development (roads, pads, power plant areas). Only specific parts of this acreage will be cleared.

IV. SUMMARY POINTS - GEOTHERMAL ENERGY

1. Increasing use of renewable energy over oil generated energy is a national policy endorsed by many environmental groups. Geothermal power is far cleaner than oil or coal and contributes to the reduction of global warming. Developing geothermal energy is good economic and environmental policy for the State of Hawaii.

2 Hawaii is proud of our conservation programs, land, sea and air. We have the cleanest natural environment in America and are national trend-setters with many of our laws and programs.

3. The land being used for geothermal development is part of a parcel exchanged with private landowners through opened and detailed hearings. In return the State received lands called Kahaualea, which are higher land forests with rich habitats. Adjacent to the National Park, we have now created a "mega-reserve" of immeasurable future benefit to nature and mankind.

State Senator Richard M. Matsuura

Second District • State of Hawaii

January 27, 1990

Dear Friends:

I am taking the liberty of writing to you because I need your help. As you are aware, I am a strong supporter of the development of the geothermal resources in Hawaii, and I need your help to explain to your friends and relatives why we need to develop this resource.

There is a need for more electrical power generation in the State because of the large number of people coming to Hawaii to live and a growing economy. We burn about 800,000 dollars worth of fuel a day just to generate electricity for the State. The question is, should we build more power plants fueled by fossil fuel or build power plants run by geothermal energy?

The true environmentalist will say if the choice is nuclear, coal, diesel fuel or geothermal, the best source of energy is geothermal, and the worst is nuclear. Geothermal development is environmentally desirable and economically advantageous. The State of California has a 29 year history of generating electricity from geothermal resources. Today, 56 geothermal power plants are capable of generating about 2,595,000 kilowatts of electricity in the State of California. It is a proven and a tested technology.

Some of the advantages are: geothermal energy is produced within our State which contributes to our energy security and decreases our dependency on foreign energy sources, while saving petroleum for higher-priority uses. Geothermal power plants emit only minimum amounts of carbon dioxide per unit of energy produced.

Let me cite some of the economic effects that resulted in Lake County, California, from geothermal development. In FY 1988-1989, 5 of the 7 largest tax payers in Lake County were geothermal companies. 20% to 25% of the total property taxes in Lake County came from the geothermal industry. Whether it be jobs or economic development, California's experience with geothermal development has been good and positive.

Why are some of the people objecting to the development of the geothermal resources in Hawaii? Some say that it will pollute the atmosphere. These people don't realize

Friends of Senator "Dick" Matsuura

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that the amount of sulfur dioxide that goes into the atmosphere from naturally occurring vents on the Island of Hawaii is about 2,400,000 pounds a day. A 25 mega watt plant being proposed by Ormat will produce about 5 pounds of sulfur dioxide a day. The reason for the low number is because the geothermal plants being proposed will bring up the steam from the ground at a depth of about 6,000 feet, use the steam to power the turbines, and reinject the fluid back into the ground where it came from.

We had a problem with the demonstrational HGPS geothermal plant in Pohoiki because we did not reinject the fluid back to where it came from. Instead, the fluid was disposed of on the surface of the land. The decision not to reinject the fluid was primarily to cut the cost of the demonstrational geothermal project by about a million dollars.

Some caring people object to the clearing of about 500 acres of rain forest land for roads, drilling sites, power plant and electrical transmission lines. Their argument is that any destruction of any rain forest will contribute to the global warming. We know there has been an increase in the atmospheric temperature due primarily to the build up of carbon dioxide in the atmosphere. Since geothermal plants emit little carbon dioxide per unit of energy produced, it is an answer to the problem of carbon dioxide build up, rather than the problem.

What we do with the electrical power generated by geothermal energy will also address some of their concerns regarding the destruction of rain forest lands. The Island of Hawaii is blessed with abundant resources, such as 1) average daily rainfall of about 15 billion gallons of water; 2) because the Island of Hawaii has two snowcapped mountains, we have an agricultural environment capable of growing every known agricultural crop in the world. Unfortunately, most of this valuable agricultural land is not productive because it doesn't have water to grow the crops. This is where the geothermal energy comes into play. We can use that energy to move some of the 15 billion gallons of daily rainfall around the Island.

There is only one process known to man that can eliminate carbon dioxide from the atmosphere, and that process is called photosynthesis. The acres of rain forest land that are being cleared must be compared with 64,000 acres of new cultivated land that the 500 mega watt electricity will bring into production by the transport of water. That is a lot of carbon dioxide being removed from the atmosphere.

The bottom line is this. The geothermal developers have spent millions of dollars doing the environmental impact studies and pleading their cases in the court of law because of contested cases. When the State of Hawaii first

had a 3 mega watt demonstrational geothermal plant, the Philippines had none. Today, the Philippines generate over 1,800,000 kilowatts of electricity from geothermal energy, while we have none.

I am enclosing a self explanatory fact sheet titled "Hawaii's Energy Alternatives." Although I have not mentioned conservation as one of the solutions to the energy problem, it is of the highest priority.

I feel it is time for all of us, the silent majority, to lend a helping hand to the geothermal developers to support them in their endeavors to provide the needed energy for consumers throughout our State.

Mahalo!

Sincerely,



Senator Richard M. Matsuura

enc.

BIG ISLAND LABOR ALLIANCE VOTES UNANIMOUS SUPPORT FOR GEOTHERMAL AS "MOST ENVIRONMENTALLY SENSITIVE ENERGY"

HILO -- The Big Island Labor Alliance, which includes all public employee and private industry unions representing residents from every sector of Island life, today announced unanimous support for geothermal energy development.

"We want to clear the air after a haze of misinformation. We have followed geothermal for 10 years and have examined the environmental, social and economic issues. It is clear that geothermal is the most environmentally sensitive, dependable, responsible form of energy for Hawaii", said Herbert Perreira, president of the Labor Alliance.

"Hawaii's oil dependency is destructive to both our environment and economy. Geothermal is thirteen times cleaner than oil and 40 times cleaner than coal", said Perreira.

"We also have examined charges launched by the mainland-based, mainland-funded Rainforest Action Network that geothermal is destroying "the last low-land tropical rainforest in the United States". This is not true and our members and fellow Hawaii residents need clean information about geothermal", said Eusebio Lapenia, Big Island director of the 8,000-member ILWU.

Lapenia said: "Hawaii has more than 1.2 million acres of land in forest reserves, national parks, wildlife refuges and private reserves. Fewer than 350 acres of forest area have been approved for geothermal well drilling. The areas designated isn't pristine forest It is Class II and Class III forest "in decline" because it is infected with exotics such as strawberry guava spread by the wild pigs.

"This forest area has also been logged. The area was designated for geothermal drilling only after a land swap occurred at the suggestion of geothermal opponents to protect another area that really is prime Class I forest close to Volcanoes National Park. And finally, careful rules have been set up to involve botanists in researching and monitoring the forest area to control further spread of exotics."

"We are impressed with the controls and management plan that is being monitored by State and County planners and members of the Department of Land and Natural Resources.

We respect the concerns of immediate neighbors and appreciate the need for good communication by all concerned parties. We think the newly established asset fund to mitigate impacts is an important tool established by the Hawaii County Planning Commission. Our support is based on these kinds of good planning and responsible management efforts because we know for a fact that on the mainland and elsewhere around the world, geothermal is a highly valued good neighbor.

Hawaii's ties to oil are many times more degrading to our environment than geothermal.

There is no question that we all need to be more conservation-minded, but conservation alone won't fulfill our state's energy needs and allow our residents to improve their quality of life. We think that the natural renewable energy provided by Hawaii's volcanoes is a gift, not a curse. With care and cooperation, it can be good for the immediate community and the entire island and State.

We believe our members already support geothermal, but we play

to meet with them again to tell them about the intense campaign against geothermal by the mainland-based, mainland-funded Rainforest Action Network. We want to talk to our members about why this group is boycotting Hawaii products.

We are concerned about the motives behind the ads that this group is running on the mainland. The ads urge people across the country not to come here and not to buy Hawaiian sugar, macadamia nuts, coffee, etc.

Ads by the Rainforest Action Network say "Kiss Your Nuts Good-bye -- macadamia nuts, that is". Then they mispresent the facts about geothermal and slam every Hawaii agricultural and visitor industry worker. The ads are mean, unfair, even vulgar.

Ironically, the effect of their ad campaign is to promote the burning of oil for energy, which is much more destructive to the ozone and warming of the earth than clean geothermal energy. These can't be environmentalists; we wonder about their real motives", Lapenia said.

"They're giving Hawaii a black eye for using totally false information. This hurts every single one of our members personally in the pocketbook. We cannot stand by and let outsiders use their wealth to take jobs and homes away from our island families.

We are meeting with community and elected leaders to set the facts straight. We cannot let outsiders blackmail us into polluting Hawaii by forcing us to continue to burn oil. We won't be scared away from geothermal by outsiders with strange motives," Lapenia said.

ORMAT'S CONTRIBUTION TO THE BIG ISLAND'S
ENERGY SELF RELIANCE
AND
AIR QUALITY IMPROVEMENT

Twenty-five years ago Ormat committed itself to the use of alternative energy to solve problems in the real world. This commitment included the use of solar energy in applications ranging from pumping water in sub-equatorial Africa to running a food processing plant in Texas.

In the use of geothermal energy, Ormat's technology has fully realized the goal of producing commercial electricity and economically displacing the use of oil. For example, the 25 MW Ormat plant for Puna will save 20 million gallons of oil per year without environmental impact (all the geothermal fluids are reinjected and air is used for cooling).

Twenty million gallons that do not have to be used means that 20 million gallons each year do not have to be transported from one environmentally sensitive area to another. Twenty million gallons is almost twice the amount recently spilled in Alaska (11 million gallons). The sulfur dioxide emission will be reduced by 2 million pounds per year and carbon dioxide by 250 million pounds per year.

The total installed capacity on the Big Island is 140 MW (120 MW used during the day and 50 at night). Ormat's contract is without curtailment, so the plant will be the first 25 MW used or the last 25 MW cut out and therefore, the Ormat plant, will cause a reduction of the pollution from the existing fossil fuel-fired power plants by 20% during the day and 50% during night.

Over its 30-year lifespan, this first 25 MW plant will cause:

- * A reduction of the oil dependency by 14 million barrels;
- * A reduction in the oil import outlay by more than \$200 million; and
- * A reduction of the clean air deficit by 7 billion pounds of CO₂ and 60 million pounds of SO₂.

WHY GEOTHERMAL?

A Presentation by

Oswald Stender
Senior Advisor to the Trustees
Estate of James Campbell

to

The Mayor's Geothermal Advisory Committee
County of Hawaii

January 8, 1990

Thank you for the invitation to speak with you today. We value the opportunity to discuss geothermal development from Campbell Estate's perspective and to clear up some of the misperceptions that have resulted from the public debate over the issue.

I plan to discuss the following topics today:

1. Hawaii's energy alternatives,
2. The location of current operations,
3. The relationship between Campbell Estate and True/Mid-Pacific,
4. Some of the more important issues,
5. And finally, answer your questions.

But first, let me introduce the people who are accompanying me today (representatives of Campbell Estate and True/Mid-Pacific).

HAWAII'S ENERGY ALTERNATIVES

On the screen is a chart (attachment #1) showing the major energy alternatives available to Hawaii. We've laid them out along with some of their key attributes as a means of comparing the positive and negative factors of each.

Hawaii's state government and energy utilities started pursuing alternative energy sources in earnest after the 1973 Arab oil embargo found us with long gas lines and short tempers. The quest was on to find ways to make Hawaii more energy self-sufficient. A lot of work has been done since then, and this chart illustrates some of what we've learned.

Hawaii is currently 90% dependent on oil for its energy needs. **Oil** is shipped in primarily from foreign countries, and there are no guarantees that another man-made or natural disaster could not cut off our supplies and seriously harm our economy. Oil also presents environmental problems in its transport, storage and combustion.

Coal has a lot of the same environmental and shipping problems as oil. In fact, burning it creates more pollutants than oil does. They both contribute significant amounts of carbon dioxide to the global warming problem.

Hydroelectric power would be great if Hawaii had major rivers, but it doesn't. It can never be a major source of power here.

Biomass burning puts out about as much carbon dioxide and pollutants as oil. It's been proven feasible at Hawaii's sugar plantations, but it has serious constraints when it comes to large scale power generation.

Wind, photovoltaic and solar thermal technologies are all new and promising, but they lack the full-time reliability required. Until large scale power storage systems are developed, these technologies will require backup generation systems that can take over at night or when the wind won't cooperate.

Nuclear is environmentally controversial, to say the least; and as I understand it, economically infeasible for a power grid as small as Hawaii's.

OTEC is still experimental. It is feasible; the question now is whether it is practical on a scale that will justify the investment in large scale development.

Geothermal gets some of the best marks across the board. The only unknown here in Hawaii is the feasibility and cost of an interisland transmission system for large scale applications. Otherwise, it has gotten good grades in other parts of the world where it has been operating for over half a century.

SITE LOCATION

Next, I would like to be sure we all understand the location and size of the Wao Kele O Puna geothermal site. This first map (attachment #2) shows the 27,000-acre Wao Kele O Puna rain-forest in relationship to Kilauea Crater and near-by communities. The large dot in the right-hand corner of the forest is the site of current drilling operations.

This second map (attachment #3) shows the forest location in more detail. It also shows the 25,000-acre Kahauale'a forest which we exchanged with the State of Hawaii to acquire Wao Kele O Puna. You can see how the Kahauale'a forest butts up against the northeastern boundary of Volcanoes National Park, providing a good buffer for it.

The last map (attachment #4) shows our current drill site, the road leading to it, and the State-designated geothermal subzone within the Wao Kele O Puna forest. Any geothermal development that occurs at Wao Kele O Puna must take place within the boundaries of the designated subzone.

CAMPBELL & TRUE/MID-PACIFIC

While we're establishing a factual base for a discussion of the issues surrounding geothermal development, I'd like to define the roles being played by Campbell Estate and True/Mid-Pacific Geothermal.

Campbell Estate is the landowner. True/Mid-Pacific is the lessee and developer. As the landowner we are involved in some of the permit approval processes, but we are not the developer. That is True/Mid-Pacific's role. They will be doing the drilling and construction of all facilities.

As the landowner, however, we have decided to take a strong role in the issues surrounding the current and future uses of the land at Wao Kele O Puna. As a result, we also have become involved in and knowledgeable about the other geothermal issues.

GEOTHERMAL ISSUES

So let's run through some of them, and clear away some of the mystery and myths.

The **land exchange** with the State involving Wao Kele O Puna and Kahauale'a has been described a number of ways -- many of them inaccurate. The 1985 land swap was not instigated by Campbell Estate, but was suggested by community residents who wanted the more pristine Kahauale'a forest preserved. The State and National Park Service also favored it as a way of creating a natural buffer for the National Park.

The exchange was actually initiated by the State. The difference in the sizes of the two parcels (25,000 vs. 27,000 acres) was based on the State's appraisals, and the entire deal was approved by the State Legislature.

Ceded land rights were transferred in the land exchange. This means that the State government and the Office of Hawaiian Affairs will benefit directly from geothermal development. The State should get 10 percent of the gross revenues earned at Wao Kele O Puna, and one-fifth of that 10 percent should go to OHA.

Native gathering rights also have not been damaged by the exchange. The law has always stated that gathering rights were to be extended to residents of the ahupua'a. These rights still exist. The only limits are for those who are not residents of the ahupua'a and for access to the specific lands under development. The latter is not only legal, but appropriate for safety reasons.

The claim that geothermal development should not proceed because it violates the **religious rights of Pele worshippers** is not as clear cut. That's why it had to be settled in court. The courts found that there was no proof of prior religious practices on the land in question and no proof of harm to Pele. The original case was heard in State Court, and the decision appealed to the U.S. Supreme Court which refused to hear the case.

The claims about destruction of the "**last lowland rainforest in the United States**" are truly out of proportion to reality. No one is going to destroy an entire rainforest. At the most, 300 of the 27,000 acres of Wao Kele O Puna may be affected. That's 6/100ths of 1% of the 500,000 acres of Ohia forests on the Big Island.

In fact, Wao Kele O Puna is not the "last lowland rainforest in the United States." Similar forests exist in Ka'u, South Kona, South Hilo and North Hilo. Furthermore, the forest is not pristine, but heavily overrun with non-indigenous plants. That is one of the very reasons the Kahauale'a/Wao Kele O Puna land exchange occurred -- so drilling could occur in an environmentally less desirable area. Even at that, the permits granted by the State require that the forest environment be managed, and we fully intend to honor that obligation.

As for any doubts being cast on the **technology** being used in geothermal plants today, one must remember that this is a technology that has been developed over the past 60 years. It is in operation in 16 countries, and modern technology is nothing like the eight-year-old HGP-A plant that was recently shut down. Today's plants control the geothermal fluids and gases using technology

that was not available when HGP-A was built -- technology that is continually improving. In addition, the State is requiring close environmental monitoring through each stage of development and operation.

It took a total of 8 years, 3 public hearings, 2 contested case hearings and several court cases before True/Mid-Pacific was allowed to begin its current drilling. Exhaustive EIS and archaeological studies were completed as part of the permitting process. Further studies will be done on an ongoing basis.

And for those who fear geothermal plants won't be able to withstand the regular moderate earthquakes the Big Island experiences, they should know that the Geysers geothermal field in California is just 100 miles from the epicenter of the recent earthquake that hit the San Francisco Bay Area so hard. The plant came through that experience unharmed. Plants here would be built to similar tolerances.

SUMMARY

Those of us with Campbell Estate and True/Mid-Pacific are fully aware that the impact of geothermal development on Puna and the Big Island will be different than anywhere else in the state. The concerns of Big Island residents are entirely understandable.

However, the anti-geothermal forces have distorted many of the facts surrounding geothermal development, the rainforest and the community.

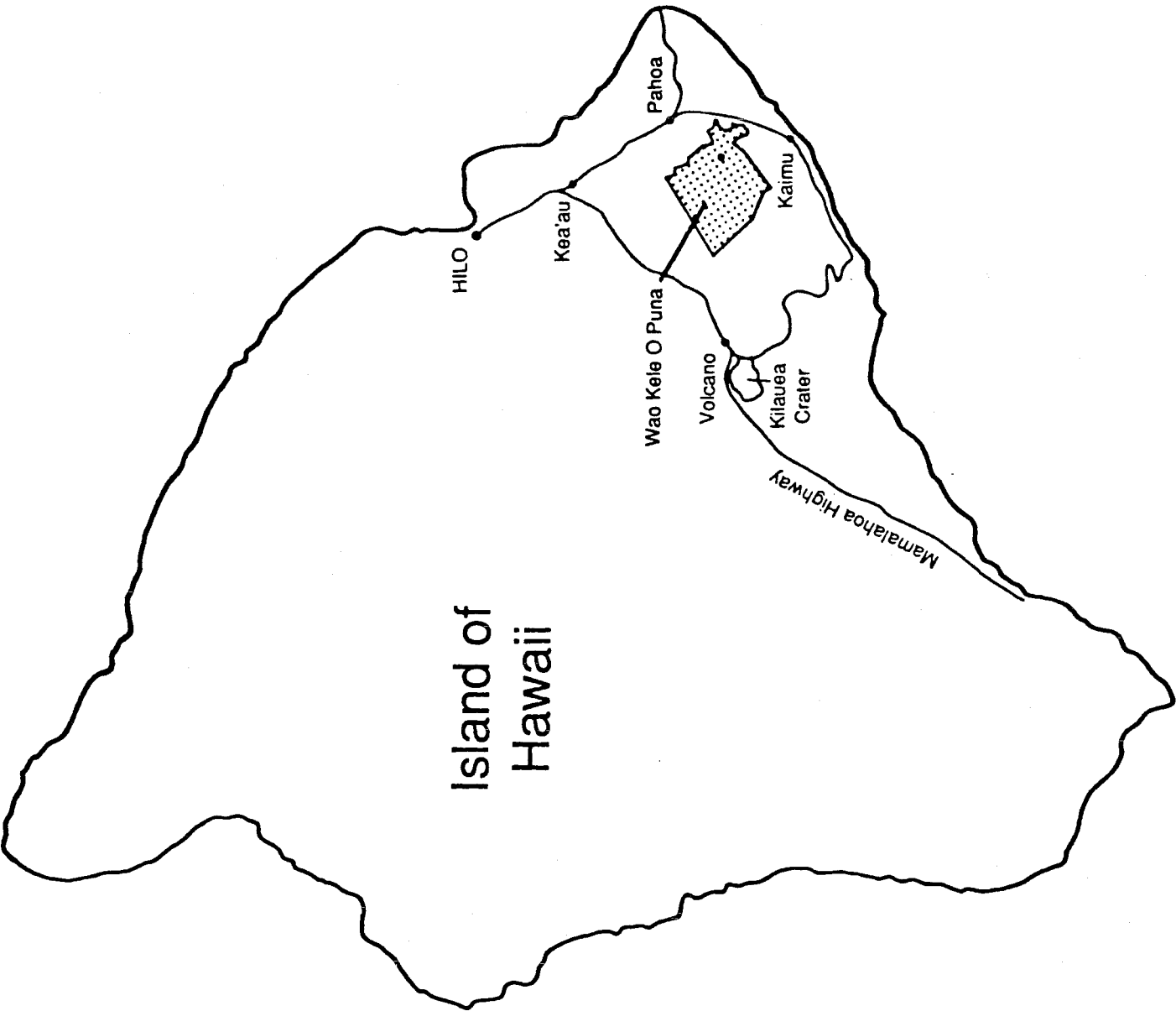
Geothermal is a clean, reliable and proven source of energy that makes both practical and environmental sense. Hawaii needs it, and from an environmental standpoint, so does the world.

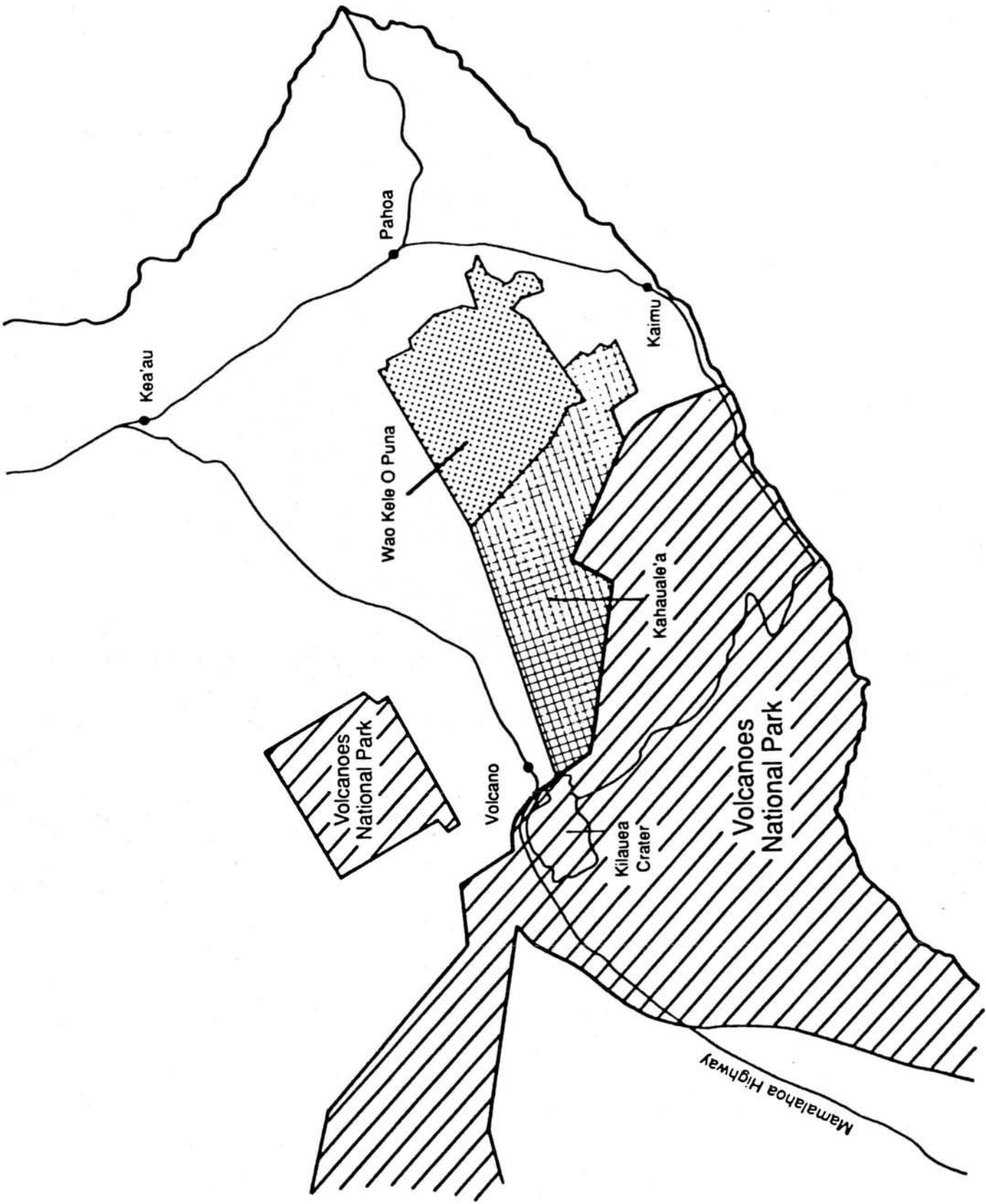
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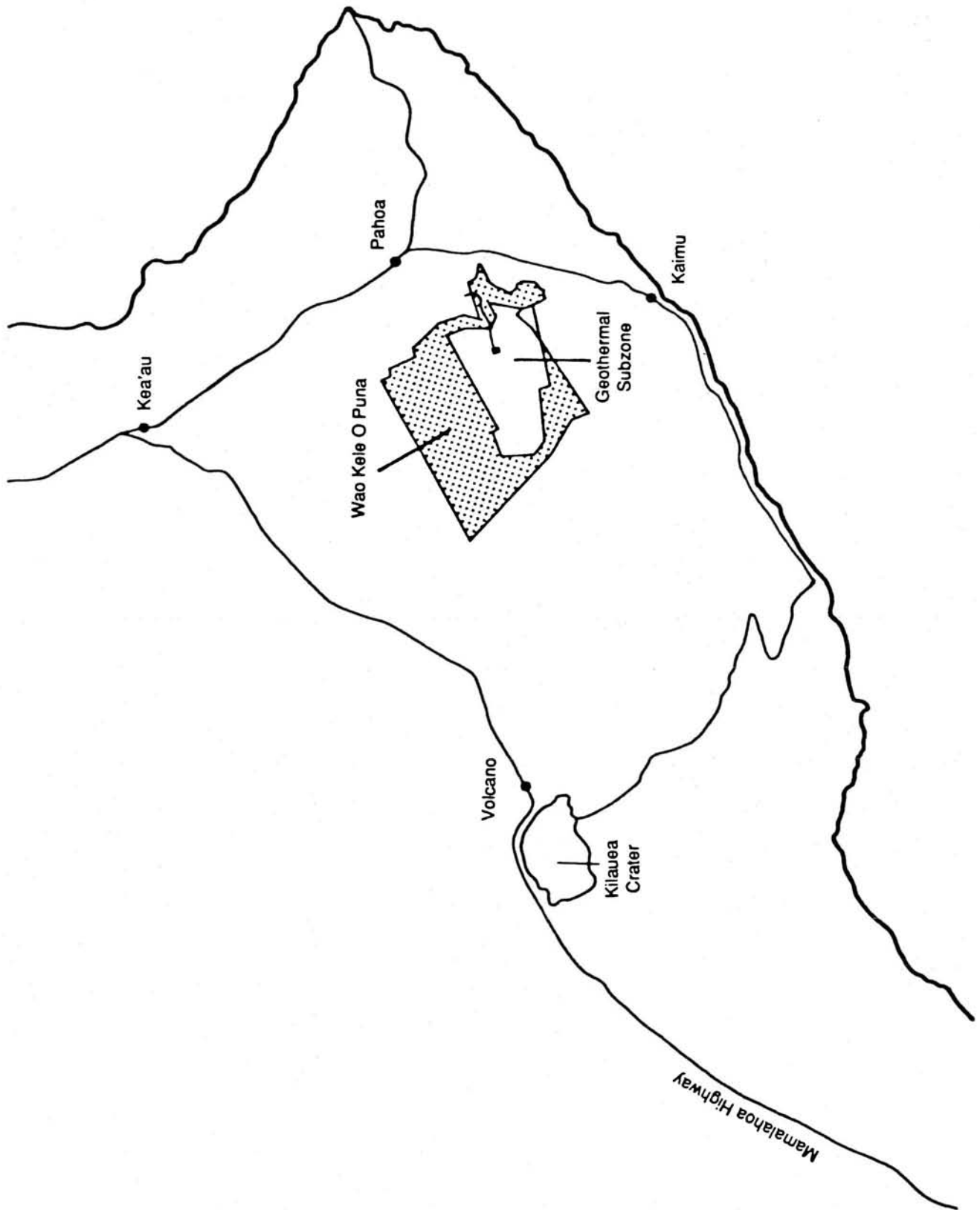
Hawaii's Energy Alternatives

Type of Energy	Environmental Effects?	Reliability?	Availability in Hawaii?	Renewable?	Proven Technology?	Large Scale Power Generation?	Cost?
Oil	-	+	-	-	+	+	?
Coal	-	+	-	-	+	+	+
Hydropower	+	+	-	+	+	-	+
Biomass	-	+	+	+	+	-	+
Wind	+	-	+	+	-	-	-
Photovoltaic	+	-	+	+	-	-	-
Solar Thermal	+	-	+	+	+	-	-
Nuclear	-	+	-	-	+	+	-
OTEC	-	-	+	+	-	-	-
Geothermal	+	+	+	+	+	+	?

HOW GEOTHERMAL COMPARES -- This chart graphically illustrates the comparative pluses and minuses of various alternative energy sources. When compared to Hawaii's other alternatives in seven key areas, geothermal energy gets good marks







Ozone
Friendly



TRUE
Geothermal Facts

TRUE GEOTHERMAL ENERGY COMPANY
PROJECT PHILOSOPHY, ISSUES AND STATUS REPORT
(February 1990)

HISTORY

True Geothermal Energy Company entered into a joint agreement with Mid-Pacific Geothermal Company in 1980 to develop 100 Megawatts (MW) of electricity from steam fields drilled on lands owned by the Estate of James Campbell in the Puna District, Island of Hawaii.

After nine years, True Geothermal and its partners have invested over \$10 million in environmental and other technical studies to:

- 1) Accommodate a major land exchange recommended by area residents and initiated by the State of Hawaii to protect a pristine forest area and create a "buffer" for Volcanoes National Park. Lands now being developed are Class II and III forest area invaded by non-native plants. (The nearest resident in this sparsely populated area is 1.9 miles from the well sites.)
- 2) Secure various permits needed to begin drilling. The permitting process required numerous hearings, contested cases and other legal challenges in State and Federal Courts, which have upheld permits.

Upon receiving the final State Department of Health permit to proceed, True/Mid-Pacific began drilling on November 18, 1989. This first well is expected to be 8,000-10,000 feet deep and cost about \$3 million. Between 3-5 wells will be needed for the first 25 MW power plant to fulfill Big Island needs at a cost of over \$30 million to the private development team of True/Mid-Pacific/Campbell.

The people of Hawaii will benefit from this project in several ways:

(more)

BENEFITS TO HAWAII RESIDENTS

- 1) 10 percent of the gross revenues earned from "mining" the geothermal resource will be paid to the State of Hawaii. One fifth of this 10 percent is anticipated to go to the Office of Hawaiian Affairs in recognition of ceded land rights.
- 2) Reduction of Hawaii's dependence on foreign oil, which has both economic and environmental benefits: Clearing 350 acres of forest area for 100 megawatts of geothermal energy will produce a net reduction of carbon dioxide emissions equivalent to a 90,000-acre forest. Geothermal energy also reduces the likelihood of a polluting oil spill.
- 3) Economic benefits include the advantage of electricity rates controlled by the Hawaii State Public Utilities Commission rather than foreigners. Over the long term, geothermal energy should help stabilize Hawaii's energy costs while foreign oil escalates due to shrinking world supplies and natural and man-made disruptions to the supply of crude oil.
- 4) Other spin-off benefits of geothermal development for the Big Island include the opportunity to protect and expand agriculture by using energy to assure the delivery of an adequate water supply.
- 5) Geothermal by-products that may have Big Island application include fish farming, wood drying and a variety of arts and crafts endeavors.
- 6) Other advantages are an increase in work opportunities for neighboring businesses such as trucking and materials supply.

COMPANY PROFILE AND PRINCIPALS

True Geothermal Energy Company is a subsidiary of a Wyoming-based family-owned firm built around oil exploration and drilling equipment, banking (2 national banks), ranching (2nd largest landowner in Wyoming), trucking (largest fleet in the Rocky Mountains), ownership of oil and gas pipelines throughout the Rocky Mountain area, and brokering of oil resources.

(more)

To date, True Geothermal has been focusing primarily on working closely with immediate neighbors in Puna and securing necessary permits. True's style is in keeping with the family's Wyoming upbringing; they live by their word and make business commitments based on a handshake.

H.A. "Dave" True, Jr., is the founder and patriarch of the True family of companies. He is an internationally respected independent businessman who was honored as "Oilman of the Century" during Wyoming's recent centennial celebration.

H.A. "Hank" True, is Managing Partner of True Geothermal Energy Company and project manager. He is Dave's son and an experienced driller.

Allan Kawada is True Geothermal's Hawaii representative who directs day-to-day operations. Born and raised on the Big Island, Kawada is an attorney and a former State Deputy Attorney General. He has been involved in this project since the early 1980s.

GEOTHERMAL DRILLING EXPERTISE

Complementing True and Mid-Pacific's drilling expertise are the services of Thermasource, Inc., one of the most respected consulting engineers of steam fields in the world with extensive experience in Imperial Valley and Geysers, California, Japan and Indonesia. Thermasource has helped develop the True/Mid-Pacific drilling plan and is monitoring drilling progress.

UNIQUE ASPECTS OF THE TRUE GEOTHERMAL/MID-PACIFIC PROJECT:

IMPROVING AND PROTECTING THE FOREST: No geothermal development will occur (or would be permitted by the State) in that portion of the Wao Kele O Puna forest that expert biologists identified as unique islands of land untouched by more recent lava flows. This mosaic of kipuka is protected because of the unique ecosystems that have evolved. This area was purposely excluded from the geothermal subzone.

However, the remainder of this forest area is considered Class II and III (less than pristine) because of earlier logging and infestation by non-native exotics, such as strawberry guava, which are spread primarily by wild pigs.

(more)

TRUE GEOTHERMAL PHILOSOPHY, ISSUES, STATUS REPORT

February 14, 1990

Page 4

Carefully controlled geothermal development is being permitted on about 350 acres. This is substantially less than 1 percent of the 1.2 million acres of forest land in conservation or other protective management programs in the State of Hawaii. (More than 500,000 acres of protected forest land are on the Big Island.)

Botanical experts are participating in every step of the geothermal drilling project by hand-flagging access paths to well sites, rerouting roadways if necessary to protect unique plants and shrubs, and then constantly monitoring the area to prevent the introduction of new non-native species.

GRUBBING ERROR: Drilling by True Geothermal/Mid-Pacific got off to a rocky start which was not intentional. The company sincerely regrets the error, which was due to a discrepancy in grading permit documents. Nevertheless, True Geothermal/Mid-Pacific has taken complete responsibility, paid a \$15,000 fine to the State and has put safeguards in place so it can't happen again.

BEST AVAILABLE CONTROL TECHNOLOGY (BACT): BACT is an engineering standard established to mitigate problems associated with a given technology -- in the case of geothermal -- disposing of the hydrogen sulfide gases and other materials, water, silica, etc. that come out of the ground.

Today, the **BEST AVAILABLE CONTROL TECHNOLOGY** for geothermal energy may be reinjection, providing the resource in the area is of a certain chemical mixture. True Geothermal/Mid-Pacific is unable to promise to reinject all resource material until the first several holes have been drilled and solid steam data has been assessed by engineers to be sure this procedure will work.

Two important points:

- 1) Reinjection is still a brand new process. It is a major advancement over the technology of the recently closed HGP-A plant in Puna. However, other alternatives are being studied and it is possible that an even better method of dealing with geothermal resource material will be developed before True/Mid-Pacific's power generation plant is designed in the next 2-3 years. True Geothermal is working closely with engineers in the U.S. and

(more)

Japan on the reinjection process, and are closely monitoring other advances in the **BEST AVAILABLE CONTROL TECHNOLOGY**.

- 2) True Geothermal/Mid-Pacific's permits from the State Land Board demand use of the **BEST AVAILABLE CONTROL TECHNOLOGY**. If reinjection is feasible and the best technology available at the time the power plant is designed, True/Mid-Pacific is required by permit to use it.

EMPLOYMENT BENEFITS: The Puna District of the Big Island has one of the highest unemployment rates in the State. Since its first meetings with residents of neighboring communities in the early 1980s, True/Mid-Pacific/Campbell representatives committed to hiring as many people as possible from the immediate community.

This promise is being fulfilled: True's 20 highly skilled drillers with 15-25 years experience are training eight Big Islanders in the business. These Big Island hires are Hawaiians from Puna, Kalapana and Hilo and they are undergoing an intense on-the-job educational program. Their compensation for this begins at \$15 an hour, plus benefits and a bonus when the hole is completed.

True/Mid-Pacific/Campbell is also contracting for the services of many Big Island businesses.

It is important to note that Geothermal development in general won't generate a great number of direct jobs, though the jobs generated will be long-term and highly skilled opportunities. However, bringing 100 megawatts of power on line will support many indirect jobs, including numerous opportunities in diversified agriculture on the Big Island. Also, while the entire island will benefit, East Hawaii, which is faced with a fragile sugar-based economy, will especially benefit from new opportunities that geothermal energy provides to attract and retain diversified activities.

OTHER POSSIBLE BIG ISLAND BENEFITS

There are other benefits that could be enjoyed by Big Island residents in conjunction with Hawaii achieving energy self-sufficiency through geothermal energy. These might include:

(more)

- 1) A lower electric rate base possibly tied to Honolulu's rate base, which could effectively reduce energy costs for every single family and business on the Big Island.
- 2) A "rebate" to mitigate and/or compensate "impacted" residents and/or communities, if any, out of the mineral rights collected by the State of Hawaii. Such a "rebate" is proposed in Senate bills currently being considered by the State Legislature.

Both of these are, as yet, in the discussion stage. They appear to be contingent upon a cooperative effort by Big Islanders to actively lobby to secure such benefits. Certainly such proposals merit serious attention.

ENERGY CONSERVATION AND ALTERNATIVES

Conservation must be a part of the daily lives of every American and it must be seriously addressed as a part of the energy policy of the nation and every State.

Hawaii has done exceptionally well in reducing per capita energy consumption. This cannot stop.

Conservation alone will not fulfill Hawaii's energy needs. Therefore, Hawaii should pursue development of the cleanest renewable resources possible. This includes exploring a variety of alternatives, such as wind and solar energy. To date, however, most alternatives have not proven to be dependable, i.e., the wind doesn't always blow or the sun doesn't always shine. Other exciting technologies, such as ocean thermal energy conversion, are promising but, as yet, are not economic.

Consequently, only geothermal can fulfill Hawaii's critical energy need for a clean, dependable renewable base load source.

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#

THE TRUE / MID-PACIFIC / CAMPBELL DEVELOPMENT TEAM

(Since 1980)

CAMPBELL ESTATE TRUE GEOTHERMAL ENERGY COMPANY MID-PACIFIC GEOTHERMAL COMPANY

- | | | |
|-----------------------------|-----------------------------|-----------------------------|
| - Land | - Permit Assistance | - Permit |
| - Permit Assistance | - Drilling | acquisition |
| - Power plant participation | - Operation | - Operation |
| | - Power Plant participation | - Power plant participation |

Technical Support Services

Legal Counsel

* Matsubara, Lee & Kotake

Technical Assistance

* Thermasource, Inc.

Permit Acquisition & Control

* Okuhara & Assoc. (engineers)

* Island Survey, Inc.

SECTION III

HAWAII'S ENERGY ALTERNATIVES

Introduction	III-1
Comparison Grid	III-2
Oil	III-3
Coal	III-4
Hydroelectric	III-5
Biomass	III-6
Wind	III-7
Photovoltaic	III-8
Solar Thermal	III-9
Nuclear	III-10
OTEC	III-11
Geothermal	III-12

Hawaii's Energy Alternatives

Hawaii is over 90% dependent upon imported energy sources. As the price and demand for oil and other fossil fuels increases, the cost of electricity for Hawaii's residents will continue to grow. International tensions or natural or man-made disasters could again restrict or even curtail the flow of oil to the islands as happened in the 1973 Arab oil embargo. Since that time, the quest for means to make Hawaii energy self-sufficient has been ongoing. Without question, the establishment of alternative energy sources is one of Hawaii's most important priorities.

The following is a brief rundown of the energy options available to us here in Hawaii.

Hawaii's Energy Alternatives

Type of Energy	Environmental Effects?	Reliability?	Availability in Hawaii?	Renewable?	Proven Technology?	Large Scale Power Generation?	Cost?
Oil	-	+	-	-	+	+	?
Coal	-	+	-	-	+	+	+
Hydropower	+	+	-	+	+	-	+
Biomass	-	+	+	+	+	-	+
Wind	+	-	+	+	-	-	-
Photovoltaic	+	-	+	+	-	-	-
Solar Thermal	+	-	+	+	+	-	-
Nuclear	-	+	-	-	+	+	-
OTEC	-	-	+	+	-	-	-
Geothermal	+	+	+	+	+	+	?

HOW GEOTHERMAL COMPARES -- This chart graphically illustrates the comparative pluses and minuses of various alternative energy sources. When compared to Hawaii's other alternatives in seven key areas, geothermal energy gets good marks.

OIL

Oil is our most proven and widely available resource for generating electricity. The use of oil in power generation is reliable. However:

- Oil now provides 90% of Hawaii's energy needs, yet we have only 30 days worth of oil reserves.
- Any disruption in the shipping of oil could have a tremendously adverse effect on Hawaii.
- On a global basis, oil is environmentally detrimental. Oil-burning engines release carbon dioxide which contributes to global warming.
- As world oil resources are depleted, prices for this commodity will rise dramatically, creating a serious economic disadvantage for Hawaii.

COAL

Coal is cheaper than oil and abundant. Like oil, it is a widely proven and reliable technology for power generation. However:

- A disruption in coal shipping has a negative effect on our energy production.
- A coal-fired plant costs a great deal more to construct than an oil-powered plant.
- Its use is environmentally undesirable. Coal emits twice as much carbon dioxide than does oil.
- It is not a renewable resource.

HYDROPOWER

Hydroelectric power is a good source of power where there are major rivers. It's relatively inexpensive and cannot be depleted. Hydropower has been a reliable and proven technology all over the world. However:

- There are no waterways in Hawaii large enough to generate large quantities of energy.
- It is site-specific; it can only work where there is a consistent source of running water. In a dry season, no electricity can be generated.

BIOMASS

Biomass, the burning of wood chips, bagasse and other plant material, has been proven feasible at Hawaii's sugar plantations, and sugarcane is abundant in Hawaii. It is reliable, inexpensive and proven. However:

- Our sugar industry is on the decline due to foreign competition and therefore is not a viable source of energy.
- It requires a lot of forest or agricultural land to produce fuel.
- Produces as much carbon dioxide as coal or oil, making it environmentally undesirable.

WIND

Wind power is a renewable resource. Hawaii's tradewinds are fairly steady and reliable. With wind power, there are no air pollutants discharged into the atmosphere. However:

- Wind power requires a tremendous amount of acreage to make a significant contribution to Hawaii's energy needs; Hawaii simply doesn't have the space for such development.
- The power generation is intermittent. Electricity is generated during a wind "window," i.e., between 15 and 30 mph. The windmills only operate when and where there is wind.
- The windmills are visually unattractive, and the visual impact is some cause for concern.
- The noise may disturb close neighbors.
- Since the developments are in rural areas, transmission systems must be put into place to transmit the electricity.
- The technology has not been proven to be reliable in some cases.

[Note: The State is looking into ways of storing electricity when there is no wind, i.e., batteries and pumped storage.]

PHOTOVOLTAIC (Direct Solar)

Photovoltaic energy technology is new and promising. It is also environmentally sound. However:

- The technology is not reliable at the present time.
- It requires a large number of solar panels, and therefore, large acreage. Hawaii does not have the acreage that would make this technology a viable energy alternative.
- It's initial cost is great. More expensive than geothermal.
- Photovoltaic is intermittent and only good when the sun is out.
- Like wind power, the developments are in rural areas, requiring transmission systems.
- The panels are visually unattractive.
- Requires development of cost-effective storage systems if it is to become a 24-hours-a-day source of energy. Otherwise, back-up systems are required.

SOLAR THERMAL

(Solar panels focus sun's rays onto water (or another suitable fluid), heats it to produce steam, which in turn drives the turbines, generating electricity.)

Solar Thermal energy technology is proven. Many of us in Hawaii already use it to heat our water (domestic solar hot water heaters). However:

- Its commercial use would require a great deal of acreage in order to fulfill Hawaii's energy needs.
- It is only good when the sun is out.
- Solar thermal is expensive and unreliable on a large scale.
- Requires development of cost-effective storage systems if it is to become a 24-hours-a-day source of energy. Otherwise, back-up systems are required.

NUCLEAR

Nuclear energy has proven to be a sound energy alternative to the use of fossil fuels. It is capable of producing energy on a grand scale. However:

- Hawaii's power grid is too small to warrant nuclear power.
- It is environmentally controversial.
- The technology is expensive.
- It is not a renewable resource.
- Hawaii would have to depend upon outside sources for nuclear fuel.

OTEC (Ocean Thermal Energy Conversion)

OTEC is a feasible energy technology for Hawaii, as the ocean is one of our greatest and most widely available resources. Unfortunately:

- It has not proven to be a reliable or proven technology.
- At present, it is extremely expensive.
- It is not now known whether or not large-scale development is a practical investment.
- Since it is a relatively new technology, it's long term environmental effects have not been documented.

GEOHERMAL

Geothermal seems to be the best alternative to Hawaii's over-dependence on fossil fuels. Unfortunately, it's initial cost can be high and the technology is site-specific; the energy must be transmitted long distances from the source of the wells. It is unknown exactly how much an interisland transmission system might cost here in Hawaii. Still, it may be the answer to Hawaii's energy needs:

- Its technology has been proven in other parts of the world (The Geysers, California; The Phillipines; Italy; Iceland).
- Managed properly, geothermal can be a renewable resource.
- Its power plants do not release carbon dioxide, a contributing factor to the "greenhouse effect," as our present fossil fuel-burning plants do.

SECTION IV

BACKGROUND

Current Energy Consumption	IV-1
Well Locations	IV-2
History	IV-2
Technical Data	IV-2
Investment Considerations	IV-3
Court Cases	IV-3
- Religious Claims	IV-3
- Land Exchange	IV-4
Geothermal Resource Subzone	IV-4
Maps	IV-5-8

GEOTHERMAL BACKGROUND PAPER
Updated: 1/15/90

CURRENT ENERGY USAGE IN HAWAII:

In 1987, Hawaiian Electric Co. spent \$217 million on oil, all of it imported, mostly from Indonesia, for its generators on Oahu. Another \$36 million was spent on Maui and Hawaii.

The current amount of oil used for power generation on Oahu, Maui and Hawaii is as follows:

- Oahu: 10,529,265 barrels
- Maui: 1,180,364 barrels
- Hawaii: 856,381 barrels

TOTAL: 12,566,364 barrels per year (Source: Hawaiian Electric Company "HECO") *

HECO estimates that nearly 9 million barrels of oil per year, or almost 3/4 of the amount currently used, will be saved if a 500 MW geothermal system becomes operational on the Big Island for consumption on Hawaii, Maui and Oahu.

Breakdown by island:

- Oahu: 7 million barrels saved per year
- Maui: 800,000 barrels saved per year
- Hawaii: 900,000 barrels saved per year

TOTAL SAVED: 8,700,000 barrels/year

Current Oahu peak power use is about 1,060 megawatts, with an increase to 1,300 megawatts (MW) expected by the mid-1990's. Based upon today's electrical demand and current oil prices, satisfactory completion of the geothermal project on the Big Island, and the construction of an undersea cable to Oahu, could decrease oil imports to Oahu by approximately 7.3 million barrels a year at a saving of \$160 million per year excluding inflation. (By 1995 the price of oil will have increased by 25%, putting the savings near \$190 million.)

* Note: HECO primarily burns residual crude oil, rather than raw crude oil.

WELL LOCATIONS:

True/Mid-Pacific Geothermal Venture -- Wao Kele O Puna, Puna District, in the Big Island's Kilauea East Rift Zone southwest of Pahoa on land owned by the Estate of James Campbell.

Puna Geothermal Venture -- Kapoho, Puna District, East of Pahoa, on land owned by Kapoho Land and Development Co., (The Lyman Family)

HISTORY:

Past developers:

- Barnwell Industries (4 wells drilled; none were producers)
- Puna Geothermal Venture initially was made up of Thermal Power Co. (50%), Dillingham Geothermal (25%) and Amfac Energy (25%). In 1986, Dillingham sold its 25% share to Thermal Power. In 1988, Amfac sold its 25%, and later the same year, Thermal sold its share, both to Ormat.

Current developers:

- True/Mid-Pacific Geothermal Venture (True Geothermal Co. owned by True family of Casper, Wyoming.
 - Hank True, President/Major Stockholder, True Geothermal
 - Allan Kawada, Attorney
 - Jack Ellbogen, President, Mid-Pacific Geothermal
 - Rod Moss, Vice President, Mid-Pacific Geothermal
- Puna Geothermal Venture (Ormat)
 - Hezy Ram, President, Ormat Energy Systems
 - Maurice Richard, Regional Development Manager, Ormat

TECHNICAL DATA (PRODUCTION AND TRANSMISSION):

Potential of the Puna geothermal field has been estimated at between 500 and 2,000 megawatts by geophysicists who have studied the heat source in the area.

Modern geothermal wells are capable of drilling to 22,000 feet, but wells on Campbell Estate land are expected to be no deeper than 7,000.

When fully developed, the number of wells in Puna could number 200 on 300 acres of land. There could be about 5 wells on a single well pad, 3 or 4 well pads per power plant. There would also be about 10 power plant "islands," each connected to the wells by a pipeline system.

The overland portion of the transmission cable will have towers, possibly as high as 90 feet. The plan now is for the towers to follow the saddle road across the Big Island to where the undersea cable to Oahu and Maui would begin. Overland transmission is also planned across parts of Maui and windward Oahu. The cable would come ashore near Kaupo on Maui and near Makapuu on Oahu.

Converter stations will be required to convert alternating current (ac) electricity to direct current (dc) for transmission over the inter-island transmission system. Converter stations will also be required where power is taken off the cable. Each station will occupy about 10 acres of land.

Lab tests on a 6,000-foot prototype cable in October 1988 and an at-sea test of a surrogate prototype cable in late 1989 established that the technology is mechanically and electrically sound.

INVESTMENT CONSIDERATIONS:

Development costs for the cable have been estimated to be over \$2 billion, including \$450 million for the cable which will cross 150 miles of ocean and reach a depth of 6,300 feet. This is twice the distance and four times the depth of any electrical cable laid anywhere in the world. Sought is a private consortium willing to commit to building a 500-megawatt power plant on the Big Island and the deep water cable system. Developer's investment would be repaid from the sale of the electricity through long-term contracts with HECO and its subsidiaries.

COURT CASES:

Religious Rights Cases:

In brief, the claim by Palikapu Dedman and Emmett Aluli of the Pele Defense Fund that their religious rights were being violated by the Board of Land and Natural Resources' (BLNR) actions vis a vis geothermal was rejected by the Hawaii Supreme Court (July 1987) and was denied certiorari by the U.S. Supreme Court (April 1988). The argument by the plaintiffs alleged that the BLNR, in granting Campbell Estate a conservation district use application for geothermal development, promoted the desecration of Pele, creating a violation of their religious rights. The Court found that the actions of the BLNR would not show a substantial burden on the plaintiffs' religious beliefs, mainly because the plaintiffs had never conducted nor participated in religious ceremonies on the Puna lands.

LAND EXCHANGE:

Pele Defense Fund's suit to overturn the State's land exchange with Campbell Estate was dismissed but now is on appeal in the Ninth Circuit Court. The Federal District Court's dismissal was based on two grounds:

First, invoking the Eleventh Amendment to the Constitution, the Court interpreted the case as being a case for the State and not the federal government. A case can be dismissed on these grounds.

Secondly, the plaintiffs in the case failed to join Campbell Estate as a party in the case. The court refused to pass any decision which might have adversely affected Campbell Estate when the Estate was not present to defend itself.

GEOHERMAL RESOURCE SUBZONES:

The prospect of geothermal development has caused public concern about its impact on the environment, lifestyle and future of Puna and the Big Island. Proper management of land and resources while allowing reasonable development has been a major issue in Hawaii for years. In 1983, the legislature enacted the Geothermal Resource Subzone Assessment and Designation Law (Act 296, SLH 1983) which stated that the exploration and development of Hawaii's geothermal resources is of statewide benefit, and that this interest must be balanced with the preservation of Hawaii's unique social and natural environment.

In 1984 and 1985, Geothermal Resource Subzones were designated totalling 22,000 acres in the Kilauea Lower and Middle East Rift and 4,000 acres in the Haleakala Southwest Rift on Maui.

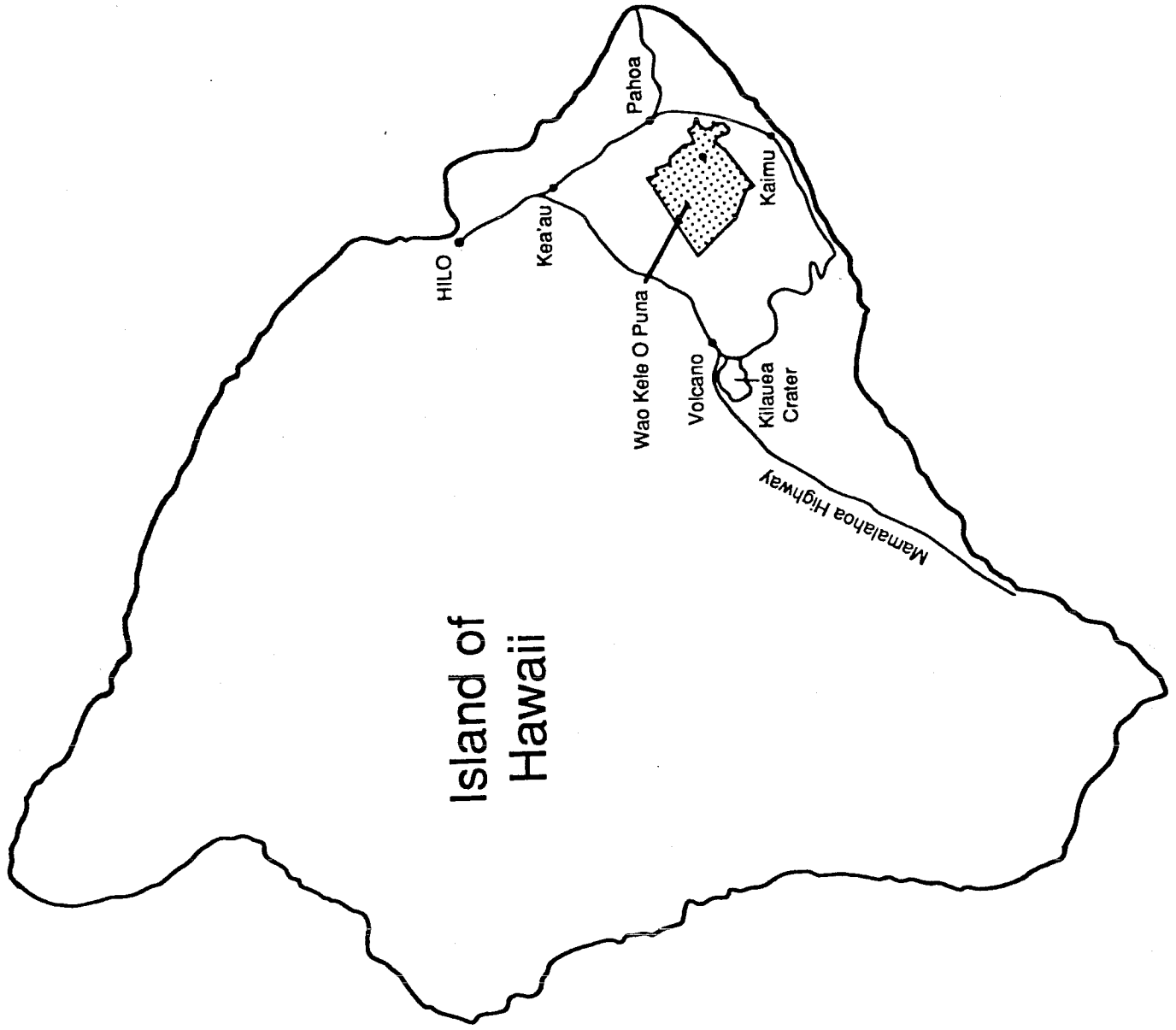
ADDITIONAL INFORMATION:

William Quinn, Committee Report, January 1988

Environmental Impact Statement

Governor Waihee's letter to the PUC, July 1988

Governor Waihee's letter to Dan Williamson at HECO in RFP, May 1989



Island of
Hawaii

Mamalahoa Highway

HILO

Kea'au

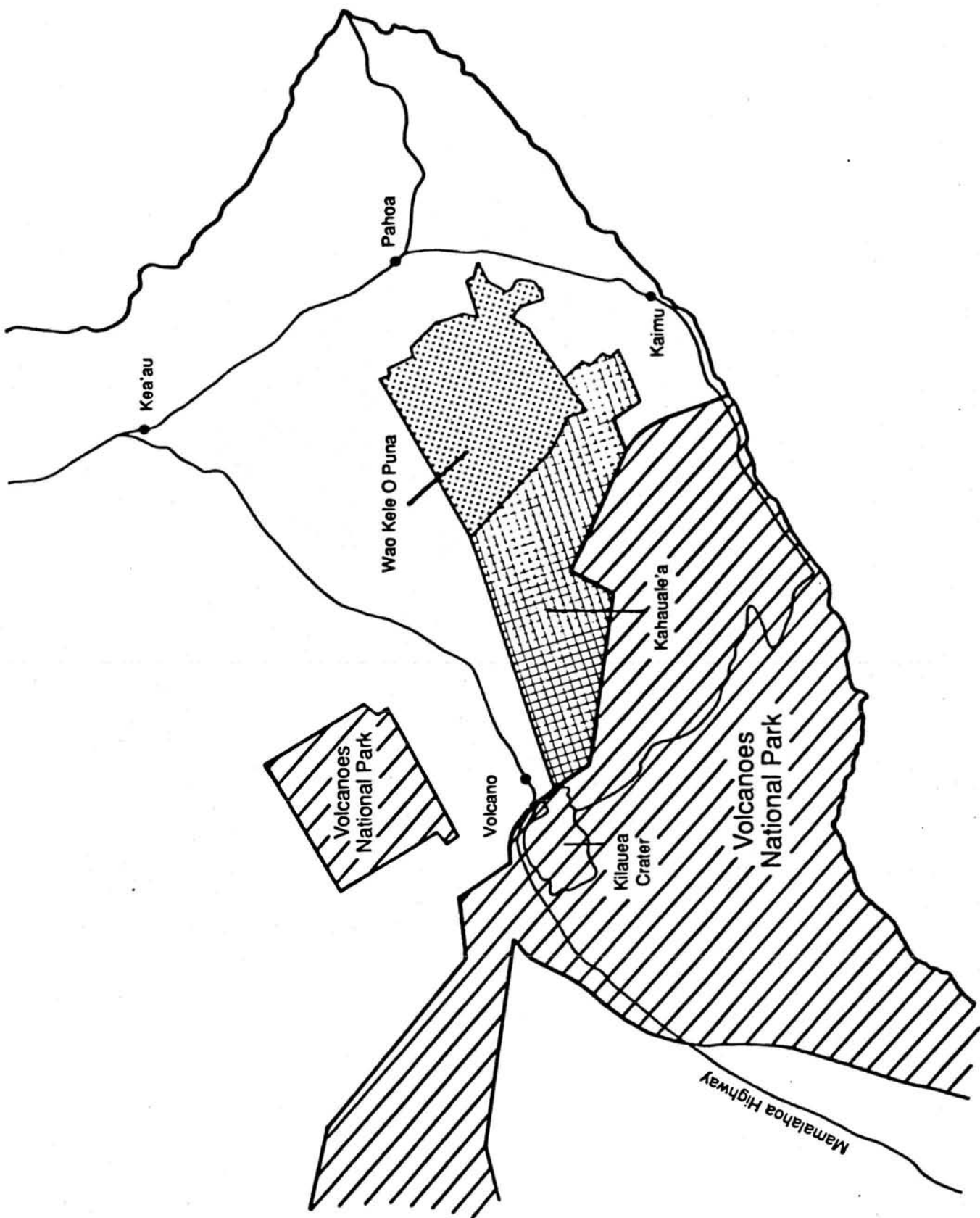
Pahoa

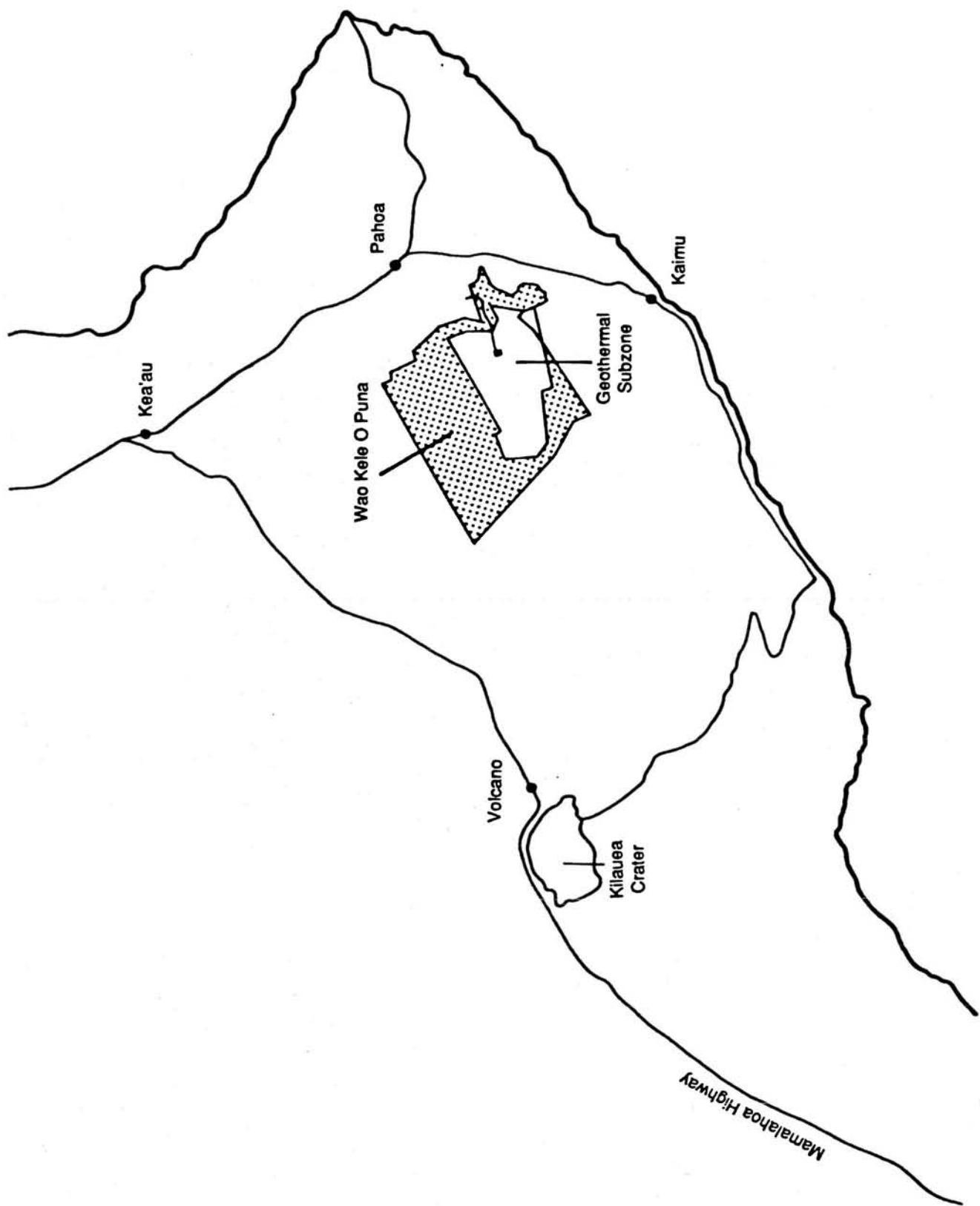
Wao Kele O Puna

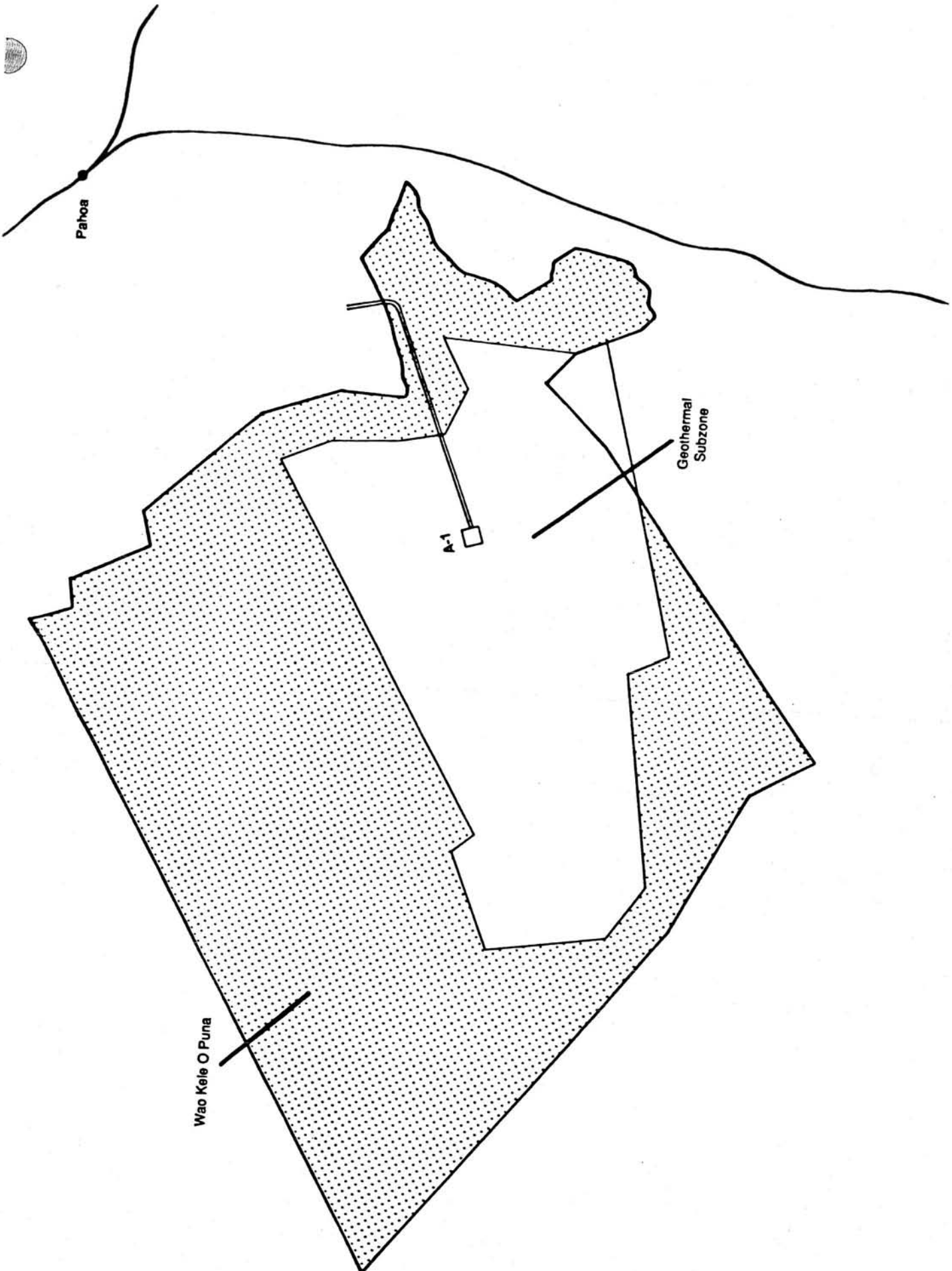
Volcano

Kilauea
Crater

Kaimu







SECTION V

PHONE LIST

State of Hawaii	V-1
County of Hawaii	V-3
Private Industry	V-4
Chambers of Commerce	V-6
PR Firms	V-7
Key Media	V-8
Coalitions	V-9

ORGANIZATION/ADDRESS	KEY PERSONNEL	PHONE	FAX
State of Hawaii			
-Governor's Office State Capitol Honolulu, HI 96813	Governor John Waihee Lisa Kanimoto, Appointment Secretary Chuck Freedman, Comm. Director Sus Ono, Governor's Geothermal Coordinator	548-5420 548-5420 548-3170 548-7443	543-2787
Goodsill, Anderson, Quinn and Stifel 16th Floor, Bancorp Tower Honolulu, HI 96813	Gov. William Quinn, Chair, Governor's Advisory Board on the Geothermal Cable Project	547-5600	531-2628
-Department of Business and Economic Develop. Kamamalu Building 250 South King Street Honolulu, HI 96813	Roger Ulveling, Director Les Matsubara, 2nd. Deputy Norman Reyes, Info. Director	548-6914 548-4619 548-3156	548-8156
DBED Energy Division Old Federal Building., Room 110 335 Merchant Street Honolulu, HI 96813	Maurice Kaya, Division Head Lois Sagatis, Information Specialist	548-4150 548-2334	531-5243 531-5243
Bancorp Tower, Suite 1060 Honolulu, HI 96813	Gerald Lesperance, Alternate Energy Consultant	548-7208	548-7210
-Department of Land and Natural Resources Kalanimoku Building 1151 Punchbowl Street Honolulu, HI 96813	William W. Paty, Chairman	548-6550	548-6461
P.O. Box 936 Hilo, HI 96721-0936	John Arisumi, 2nd Land District	961-7317	961-7249

ORGANIZATION/ADDRESS	KEY PERSONNEL	PHONE	FAX
State (Continued)			
-Department of Health Kinau Hale 1250 Punchbowl St. Honolulu, HI 96813	Dr. John C. Lewin, Director Dr. Bruce S. Anderson	548-6505 548-4139	548-3263
-Center for Alternative Dispute Resolution P.O. Box 2560 Honolulu, HI 96814	Peter Adler, Director Dede Letts, Assistant Director	548-3080	548-6002
-State House of Representatives State Capitol Honolulu, HI 96813	Rep. Mark Andrews, Chair., Planning, Energy and Environ. Protection	548-8488	548-8474
-State Senate State Capitol Honolulu, HI 96813	Sen. Richard Matsuura, Chair., Energy and Natural Resources	548-6291	548-7609

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County of Hawaii

-County of Hawaii
25 Aupuni Street
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Mayor Bernard Akana
Russell Kokubun, Chairman,
County Council

961-8211 961-6553

961-8263 969-7138

Duane Kanuha, Director,
Planning Department

961-8288 961-9615

Fred Fujimoto, Chairman
Planning Commission

961-8288 961-9615

Lynn C.Z. Maunakea, Director,
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961-8366 969-7138

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Private Industry (Continued)

-The Estate of James Campbell 828 Fort St. Mall, Suite 500 Honolulu, HI 96813	Clint Churchill, Chief Executive Officer Russ Alger, Director, Hawaiian Properties Theresia Cortez, Community Affairs Man. Bill Dement (Big Island), Herb Cornuelle, Trustee Paul Cassiday, Trustee Fred Trotter, Trustee Wade McVay, Trustee C. Mike Kido	544-3208 544-3281 544-3122 544-3278 544-3200 544-3203 544-3201 544-3202 544-3282	544-3111
-ERC Environmental and Energy Services Co. Pioneer Plaza, Suite 1550 900 Ft. Street Mall Honolulu, HI 96813	Frank Kingery, Regional Manager, Pacific Operations John Porteous, Senior Project Manager	545-2462	528-5379

ORGANIZATION/ADDRESS	KEY PERSONNEL	PHONE	FAX
Chambers of Commerce			
-Big Island Business Council P.O. Box 384 Kapaau, HI 96755	Mike Luce, President	885-7270	885-5970
-Chamber of Commerce of Hawaii 735 Bishop Street Honolulu, HI 96813	Bill Paul, Chairman Bob Robinson, President	522-8802 521-8801	522-8836
-Hawaii Island Chamber of Commerce 180 Kinoole St. Suite 118 Hilo, HI 96720	Patricia Poppe, President	935-7178	935-4435
-Japanese Chamber of Commerce and Industry of Hawaii 476A Hinano St. Hilo, HI 96720	Clifton Tsuji, President	961-6123	N.A.
-Kona-Kohala Chamber of Commerce 75-5737 Kuakini Hwy., #206 Kailua-Kona, HI 96740	Peter Young, President	329-1758	

ORGANIZATION/ADDRESS

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PR Firms

-Stryker Weiner Associates
737 Bishop Street, Suite 2860
Honolulu, HI 96813
(for The Estate of James Campbell)

Doc Stryker, Chairman
Sharon Weiner, President
Joel Kennedy, Vice President

523-8802

521-6141

-Patti Cook & Associates
1088 Bishop Street, Suite 1227
Honolulu, HI 96813
(for True Geothermal)

Patti Cook, President

533-0033

521-2129

Other Consulting Firms

-Pacific Asian Inc.
915 Fort Street Mall, 6th Floor
Honolulu, HI 96813
(for True Geothermal)

Valerie Mendes, President

531-8181

524-6122

ORGANIZATION/ADDRESS	KEY PERSONNEL	PHONE	FAX
Key Media			
Hawaii Tribune-Herald 335 Kinoole St. Hilo, HI 96721	Gene Tao-Editor David Harada-Stone	935-6621	969-9100
Honolulu Advertiser			
Big Island Bureau P.O. Box 1956 Hilo, HI 96721	Hugh Clark, Big Island Correspondent	935-3916	523-9396
Honolulu: 605 Kapiolani Blvd. Honolulu, HI 96813	Jim Borg, science writer (and stringer for the S.F. Examiner) Jerry Burris, City Editor	525-8680	525-8037
Honolulu Star-Bulletin			
Big Island Bureau: 688 Kinoole St #208 Hilo, HI 96720	Rod Thompson, Big Island correspondent	935-1012	523-9048
Honolulu: 605 Kapiolani Blvd. Honolulu, HI 96813	Gwenda Iyechad, city editor Bud Smyser, contributing editor Becky Ashizawa, religion writer Russ Lynch	525-8000	523-8509
West Hawaii Today P.O. Box 789 Kailua-Kona, HI 96740	Gordon Y.K. Pang	329-9311	329-9316

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Key Media (Cont'd)			
West Hawaii Today P.O. Box 789 Kailua-Kona, HI 96740	Gordon Y.K. Pang	329-9311	329-9316
The Maui News P.O. Box 550 Wailuku, HI 96793	Nora Cooper, Editor Harry Eager, Staff Writer	244-3981	242-6390

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- Hawaii Island Geothermal Alliance
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 P.O. Box 1299
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885-7270

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Eusebio "Bobo" Lapenia, Jr.
 (Labor Co-Chair, HIGA)
 Division Director
 ILWU Local 142
 100 West Lanikaula St.
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961-2490

Clint Churchill
 Chief Executive Officer
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Coalitions (Cont'd)			
Hawaii Island Geothermal Alliance (Cont'd)	Randolph Ahuna (Business Co-Chair, HIGA) (Co-Chair Geo Sub Committee BIBC) Manager Industrial Steel 55 Kukila Street Hilo, Hawaii	935-3334	
	Rick West Vice President and Regional Manager Bank of Hawaii P.O. Box 305 Hilo, Hawaii 96721	935-9701	935-8825
	James Ednie (Business Co-Chair HIGA) (Co-Chair Geo Sub Committee BIBC) President HT&T Company P.O. Box 4190	935 -3301	935-4345
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