

NOTICE CONCERNING COPYRIGHT RESTRICTIONS

This document may contain copyrighted materials. These materials have been made available for use in research, teaching, and private study, but may not be used for any commercial purpose. Users may not otherwise copy, reproduce, retransmit, distribute, publish, commercially exploit or otherwise transfer any material.

The copyright law of the United States (Title 17, United States Code) governs the making of photocopies or other reproductions of copyrighted material.

Under certain conditions specified in the law, libraries and archives are authorized to furnish a photocopy or other reproduction. One of these specific conditions is that the photocopy or reproduction is not to be "used for any purpose other than private study, scholarship, or research." If a user makes a request for, or later uses, a photocopy or reproduction for purposes in excess of "fair use," that user may be liable for copyright infringement.

This institution reserves the right to refuse to accept a copying order if, in its judgment, fulfillment of the order would involve violation of copyright law.

THE HAWAII 500 MEGAWATT PROJECT

Gerald O. Lesperance
Alternate Energy Specialist

Department of Business and Economic Development
335 Merchant Street, Room 110
Honolulu, Hawaii 96813

ABSTRACT

The State of Hawaii has conducted an aggressive program for over 20 years to facilitate the commercial development of its abundant high temperature geothermal resource to reduce its extreme overdependence on imported petroleum for its electricity. Commercial geothermal activity in Hawaii has been slow because of institutional issues, changes in developer ownership and economics. The State government has continued to strive for a positive scenario for development. There is a reasonable prospect that over 125 megawatts will be delivered to the utilities by 1995 with a total exceeding 500 megawatts early in the next century.

BACKGROUND

The dislocations that occurred in the global oil market in the 1970's were particularly critical for Hawaii which even today is 90 percent dependent on petroleum for its electricity. Oahu, with 80 percent of the State's population and electrical demand, relies almost totally on oil-fired electricity. Further, Oahu has no indigenous resources that could make a significant contribution of firm electricity.

Four shallow geothermal exploratory wells were drilled in the Lower Kilauea East Rift Zone on the Island of Hawaii in the 1960's. This exploration indicated that deeper wells would be required to recover the resource. The University's Hawaii Geothermal Project led to the drilling of the successful HGP-A well in 1976. This well was drilled to a depth of 1,951 meters with a bottomhole temperature, under shut-in conditions, of 360 degrees celsius.

With support from the U.S. Department of Energy, the State built a three megawatt wellhead generator plant at HGP-A in 1981. That plant continues today to be the sole demonstration of the viability of geothermal energy in Hawaii.

In the early 1980's, Puna Geothermal Venture, now fully owned by Ormat Energy Systems, Inc., drilled three wells within 1000 meters north of HGP-A. All three were producers but two were capped because of casing problems. This developer intends to resume drilling in 1989 toward fulfilling a 25 megawatt power purchase agreement with the local utility.

In 1985, a local company dropped out of active exploration in Hawaii after drilling three deep wells and a sidetrack west and south of HGP-A. Although high temperatures were recorded, none of these wells were producers.

A third developer, True/Mid-Pacific Geothermal Venture has obtained necessary permits for exploration up to 100 megawatts and development to 25 megawatts in the Kilauea Middle East Rift Zone. This developer rig in 1989.

STATUS

The potential for large-scale geothermal activity has caused some public concern about its environmental effects and impact on land use. Proper management of its limited land and the need to preserve its uniqueness yet allow for reasonable development has been a major issue for Hawaii for many 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 preserving Hawaii's unique social and natural environment. The law mandated the establishment of geothermal resource subzones,

Lesperance

only within which geothermal exploration and development could take place. The Board of Land and Natural Resources assessed the State on a county-by-county basis to examine factors including but not limited to:

- o Potential for geothermal energy production.
- o Use of geothermal energy in the area.
- o Geologic hazards.
- o Social and environmental impacts.
- o Compatability with present and permitted land uses.
- o Economic benefits.

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.

The State continued through the 1980's to try to stimulate development. Statutes, such as the authority to waive the royalties on the geothermal resource for up to eight years, were enacted. In 1987, Governor John Waihee established a blue-ribbon Advisory Board on the Geothermal/Cable Project to determine what should be done concerning geothermal development and what the State's role should be. In their preliminary report to the Governor, the Board noted that the development of 500 MW geothermal energy on the Island of Hawaii for transmission was feasible and highly desirable. The report offered that the geothermal and cable project should be undertaken as one integrated project and it should be a private sector undertaking. The Board forwarded two bills to the Governor, one for a Public Authority to facilitate geothermal and cable development; and the other to establish a consolidated geothermal/cable development permit application and review process. There was concern that the Public Authority bill had a potential for "public power." The bill did not survive.

The bill to consolidate the permitting process did pass after considerable legislative debate and redraft. The bill assigns the Department of Land and Natural Resources (DLNR) as lead agency to establish and administer the process. It requires all

State and County agencies and invites Federal agencies who have jurisdiction to participate. Federal agencies have been an active part of the process.

The 1988 State Legislature also appropriated \$3 million for geothermal exploration. The 1989 Legislature added another \$2.6 million and we intend to ask for another \$3 million. We are aggressively working to obtain \$15 million from the federal government over three years for resource verification and characterization. These government funds would constitute about half of the estimated cost to prove out the accessibility of 500 megawatts of geothermal resource in the Kilauea East Rift Zone.

Geothermal is the State's only major source of renewable energy whose conversion to baseload electricity is technologically mature and economically feasible. The resource is predominantly on the Big Island and scientists estimate sufficient thermal energy in excess of the State's electrical needs. Over 80 percent of the State's total present peak demand of over 1,300 megawatts is on Oahu. Oahu is separated from the Island of Hawaii by a distance of 240 kilometers of mostly ocean, and ocean depths up to 2,100 meters. No high voltage transmission has been installed under these conditions.

In 1981, the State initiated the Hawaii Deep Water Cable (HDWC) program to demonstrate the feasibility of a 500 megawatt interisland electric transmission system. Generally the State's \$5 million has been used for Hawaii-specific elements of the program including: integration of the cable with the existing grid on Oahu; economic, financial, legal and institutional analyses; environmental assessment; overland and at-sea route analysis including bathymetric surveys; and public information. The federal share of \$23 million has been used to design and manufacture a test length of cable and to develop cable vessel and cable handling parameters. One task remains. At-sea deployment and retrieval of a 5-mile long surrogate cable will be conducted at and near the deepest part of the ocean route in late 1989.

The State recently awarded a major planning contract that will include the preparation of a 500 megawatt geothermal/cable Master Development Plan, overland transmission line corridor analysis,

a public participation program and preparation of a programmatic Environmental Impact Statement.

In late 1988, the Governor and the President of Hawaiian Electric Company, Inc. (HECO) decided in principle to jointly issue a Request for Proposals to select a consortium to finance, develop, own and operate the steam fields, power plants and inter-island transmission system for the 500 megawatt project with an estimated capital cost exceeding \$1.5 billion. The RFP was issued in May 1989. A June 1989 open proposers' conference was well attended. More meetings will be held individually with interested consortia in early September. Technical proposals are due by November 1, and business proposals by December 1, 1989. The intent is to have evaluated the proposals and developed a short list of several consortia early in 1990. Negotiations with these several consortia will occur through most of 1990 leading to a purchase power agreement with one developer by the end of that year.

The RFP is a performance requirement document. Although HECO intends to purchase 180 megawatts of combined cycle petroleum power and 146 megawatts of coal power early in the 1990's, the RFP suggests that 125 megawatts of geothermal power can be purchased in 1995 leading to a total of 500 megawatts ten years later.

In a news release announcing the RFP, Governor Waihee said, "Hawaii's energy outlook requires positive action now. We are fortunate to have our own natural resource for electricity on a commercial scale around the clock. Development of geothermal energy is the key to achieving State's goals of energy self-sufficiency."

In a letter incorporated in the RFP, Governor Waihee said, "the State will facilitate the efforts of the private sector in determining the financial and technical feasibility of this project and in constructing viable proposals." The State has a public documents room as well as a permit information and coordination center, both specifically for this project. If deemed appropriate, the Governor also declared that, "I will personally involve myself in addressing issues that may be impeding the advancement of this project."

Recognizing that in the present times of depressed petroleum prices, this project may be marginally economic, the Governor went on to say, "... the State must be receptive to ideas for public financial assistance if such assistance is necessary. ... My Administration is willing to explore such (financial support) mechanisms with perspective developers whose proposals are judged technically viable, but only if we are satisfied if the project cannot be accomplished without the State's support."

CONCLUSION

This development will be one of the world's most innovative electrical generation and transmission projects. There are obvious soft spots: the resource must be verified; access to the resource must be assured; permitting issues on this first-of-a-kind endeavor are unknown; and economic viability is a concern. Nonetheless, the State government has removed many of the barriers to commercial geothermal development in Hawaii. We will continue to aggressively work with the utility developers, general public, and other levels of government to see this project accomplished in an economically beneficial, environmentally sound and socially acceptable manner.

REFERENCES

- Barnwell Industries, Inc. 1985 Annual Report
- Baughman, E.C., B. Chen, R. Farrington, K.F.P. Lam, D. Thomas, L. Lopez, and R. Uemura, Report on Hawaii Geothermal Power Plant Project, prepared by the Research Corporation of the University of Hawaii, Honolulu, 1983.
- Callies, D.L., Regulating Paradise, University of Hawaii Press, Honolulu, 1984.
- Decision Analysts Hawaii, Inc., Undersea Cable to Transmit Geothermal-Generated Electrical Energy from the Island of Hawaii to Oahu: Economic Feasibility, 1988.
- Goodman, L.J., and R.N. Love, Energy Projects: Planning and Management, Pergamon Press, New York, 1980.
- Lesperance, G.O., The Financing of a Demonstration Geothermal Project, Geothermal Resources Council Transactions, Vol. 9, Part I, pp. 183-187, 1985.

Lesperance

-----, The Status of Geothermal Development in Hawaii, Geothermal Resources Council Transactions, Vol. 10, pp. 273-277, 1986.

-----, Geothermal Development in Hawaii, Geothermal Resources Council Transactions, Vol. 11, pp. 129-130, 1987.

-----, Geothermal Development in Hawaii, Geothermal Resources Council Transactions, Vol. 12, 1988.

----- and R. Eaton, III, Hawaii's Geothermal and Deep Water Cable Programs, Geothermal Resources Council Transactions, Vol. 9, Part II, pp. 151-154, 1985.

Quinn, W.F., Governor's Advisory Board on the Underwater Cable Transmission Project, Preliminary Report, 1988.

State of Hawaii, Department of Planning and Economic Development, Geothermal Development in Hawaii, Vol. I and II, 1982.

----- and Lawrence Berkely Laboratory, Hawaii Integrated Energy Assessment, Vol. I-VI, 1981.

State of Hawaii, Department of Land and Natural Resources, A Report on Geothermal Resources Subzones for Designation by the Board of Land and Natural Resources, 1984.

-----, Statewide Geothermal Resource Assessment, Circular C-103, 1984.

Sumida, G.A. and A.L. Hills, Legal, Institutional and Financial Aspects of an Inter-Island Electrical Transmission Cable, Geothermal Resources Council Transactions, Vol. 9, Part II, pp. 193-199, 1985.

Yoshihara, T., The Designation of Geothermal Subzones in Hawaii, Geothermal Resources Council, Transactions, Vol. 9, Part I, pp. 237-241, 1985.