For distribution at the flash and flow test
of HGP-A, July 22, 1976

FACT SHEET FOR
THE HAWAII GEOTHERMAL PROJECT (HGP)
UNIVERSITY OF HAWAII

SUPPORT FOR PROJECT PROVIDED BY:

Energy Research and Development Administration

National Science Foundation

State of Hawaii

County of Hawaii

Hawaiian Electric Company

Water Resources International, Inc.

The "A" in HGP-A stands for Abbott. Prior to his death in July 1975, Agatin T. Abbott served as Co-Principal Investigator and Chairman of the Site Selection Committee, which was assigned the responsibility for choosing the location of the first well to be drilled by the Hawaii Geothermal Project. The site selection was based upon interpretation of all available geological and geophysical information. The scientific success of HGP-A to date will serve to commemorate Ag's major contributions to the Project.

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FACT SHEET FOR FLOW TEST, JULY 22, 1976

• Current Status of HGP-A

Drilling for HGP-A began on December 10, 1975, and was completed to a depth of 6450 feet on April 27, 1976. The high temperatures encountered at depth were sufficiently encouraging to justify the additional cost of preparing the hole for a comprehensive well testing program. During the intervening three months: 1) A slotted casing was installed in the bottom 4300 feet of the well; 2) The drilling mud was flushed from the hole; 3) A series of pumping tests were conducted, with temperature and pressure measurements recorded; and 4) The well was flashed for a short period on July 2; i.e., the water in the well was converted (flushed) to steam, resulting in a discharge of water and vapor to a height of 80 to 100 feet.

Summarizing the results to date, this is a very hot well, with temperatures easily within the range of commercial power generation. Maximum down hole temperatures of 325°C (617°F) have been recorded and (as noted from Figure 1) this high temperature range extends throughout the bottom 2500 feet of the well.

However, for a geothermal reservoir to exist, there must also be--in addition to heat--sufficient permeability or openness in the hot rock to allow space for steam or hot water to circulate. Preliminary pumping-pressure tests on HGP-A to predict permeability have not been encouraging, and the primary purpose of today's flow test is to provide additional information on reservoir characteristics.

• Dr. Paul C. Yuen, Associate Dean of Engineering, is in charge of the flash and flow operation. He will be assisted by: 1) Dr. Deane Kihara, Professor of Mechanical Engineering; 2) Warwick Tracey, geothermal consultant to the project; 3) Arthur Seki, engineering graduate student; and 4) Jeff Fujii, pre-engineering student from Hilo College.

• Flow Test

Efforts will be made today to flash the well to steam and to discharge it from the vertical pipe at sonic velocity--the speed of sound--for approximately an hour. Pressure will be measured near the tip of the discharge pipe and will be recorded throughout the duration of flow.

If the well sustains a steady rate of discharge and the steam pressure stabilizes, this would indicate that there is some recharge of geothermal fluid to the well at depth. Although this would still provide no guarantee that HGP-A is a potential producing well, it would be sufficiently encouraging to justify building a silencer and proceeding with a long-term flow test (possibly four weeks in duration) to better define reservoir characteristics.

Should the pressure fall off rapidly during discharge--or the steam flow stop entirely--this would indicate that the available fluid supply at depth is limited. This could result either from a tight rock structure, which does not allow sufficient permeability for a geothermal reservoir to form; or could be caused by alteration of the wall of the well, such as the drilling mud filling and blocking the pores so that only limited recharge can occur.

TEMPERATURE-DEPTH PLOT FOR HGP-A

Even if the flow rate should be low, there are a number of methods of stimulation and recharging that could result ultimately in energy recovery from the well. Consequently, the flow test today will not provide conclusive results on whether HGP-A does or does not have the capability to produce electricity. The test should give a better understanding of the probable nature of subsurface conditions, and will suggest the next steps that should be made in the overall well testing program.

An additional objective of discharging the well wide open is to clean it, and possibly induce a higher rate of flow. Drilling mud and rock chips may be discharged with the high temperature fluid. The noise level of the discharging steam will be very high. Therefore, every precaution must be taken to assure that observers remain a safe distance from the well site throughout the test.

● Brief Chronology of the Project:

1. The 1972 Hawaii State Legislature allocated \$200,000 for geothermal research, contingent on Federal matching funds, with \$100,000 of these funds to be administered by the County of Hawaii.
2. May 1973 -- The National Science Foundation provided its initial grant of \$252,000 to the HGP and Phase I got underway.
3. Phase I -- the two-year period from May 1, 1973, through April 30, 1975 -- was the exploratory geophysical survey phase, with support from the Engineering, Environmental and Socioeconomic Programs.
4. May 1975 -- Based on geological and geophysical data, the Site Selection Committee finalized selection of the optimum site for the first research hole at a location along the Puna rift zone of Kilauea Volcano, three miles ESE of Pahoa. Site elevation is approximately 600 feet above sea level.
5. Phase II -- the research drilling program -- began on May 1, 1975, initially with \$1,061,000 from ERDA, \$500,000 from the State, and \$45,000 from the Hawaiian Electric Company.
6. July 31, 1975 -- Death of Dr. Agatin T. Abbott, Co-P.I. and Chairman of the Site Selection Committee, a great personal and professional loss to the Project. Dr. Gordon A. Macdonald, Senior Professor of Geology, agreed to replace Ag as Director of the Drilling Program, responsible for all decisions affecting the scientific testing program.
7. November 22, 1975 -- Dedication of HGP-A.
8. December 10, 1975 -- Drilling commenced on HGP-A.
9. April 27, 1976 -- Drilling completed on HGP-A.
10. May-June, 1976 -- Slotted liner and well head installed; preliminary well tests completed.
11. July 2, 1976 -- Initial flashing of HGP-A.

- Overall Objective of the HGP -- to encourage the development of geothermal energy in Hawaii through:

1. Improvement of geophysical survey techniques for locating underground heat sources.
2. Development of efficient, environmentally clean systems for conversion of underground heat resources to useful energy.
3. Completion of socioeconomic and legal studies to assist in land use regulations and resource utilization.
4. Establishment of environmental baselines with which to monitor subsequent geothermal development.
5. Identification of potential geothermal resources, initially on the Big Island, but ultimately for the entire island chain. If a conventional geothermal resource suitable for the production of electricity is discovered, then the HGP will assist with the development of the geothermal production field and a prototype power plant on Hawaii.

- HGP Principal Investigators:

Project Director: John W. Shupe, Dean of Engineering

Program Directors:

Geophysical -- Augustine S. Furumoto, Professor of Geophysics

Engineering and Well Testing -- Paul C. Yuen, Associate Dean
of Engineering

Environmental-Socioeconomic -- Robert M. Kamins, Professor of
Economics

Drilling: a) Agatin T. Abbott, Professor and Chairman of Geology
and Geophysics (deceased)

b) Gordon A. Macdonald, Senior Professor of Geology

Joining the project effective July 1, 1976, is Dr. Charles Helsley, Director of the Hawaii Institute of Geophysics. Dr. Helsley will have supervision over all subsequent activity in the geosciences.

• BUDGET SUMMARY FOR HGP

Phase I -- Exploratory Surveys & Related Research
(May 1973 through April 1975)

State of Hawaii	FY72	\$100,000	
County of Hawaii	FY72	100,000	
National Science Foundation	FY73-74	469,000	
ERDA	FY75	119,000	
Other public & private funds	FY72-75	<u>39,000</u>	
	Subtotal		\$ 827,000

Phase II -- Experimental Drilling, Well Testing, & Related Research
(May 1975 through June 1976)

ERDA	FY75-76	\$1,472,000	
State of Hawaii	FY74	500,000	
Water Resources International	FY76	60,000	
Hawaiian Electric Company	FY75	<u>45,000</u>	
	Subtotal		2,077,000

Phase III -- Well Testing, Analysis, & Wrap-up
(July 1976 through September 1977)

ERDA	Transition Period	\$147,000	
ERDA (Requested)	FY77	225,000	
State of Hawaii (Requested)	FY77	<u>69,000</u>	
	Subtotal		<u>441,000</u>

Total	\$3,345,000
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Support totaling \$3,051,000 has been received to date by the project and includes all funds listed in the summary, except the two final items--for which proposals have been submitted. A breakdown of the summary by category is as follows:

Federal Support (NSF & ERDA)	\$2,432,000
State & County Support	779,000
Private Funding	<u>134,000</u>
	\$3,345,000

- Geothermal Consultants to the HGP -- Kingston, Reynolds, Thom, & Allardice Limited (KRTA), Auckland, New Zealand.

Mr. W. J. Tracey, of KRTA served as drilling supervisor to the HGP, and has continued to provide advice and assistance with the well testing program.

- Drilling Contractor -- Water Resources International, Inc., Honolulu, Edgar Craddick, President; Willis Craddick, Vice President.

- Land for use by the Project to drill the experimental geothermal well was made available by the Lyman Estate; Arthur Lyman and Richard Lyman.

- Hawaii Geothermal Project Advisory Committee (Membership list attached).

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