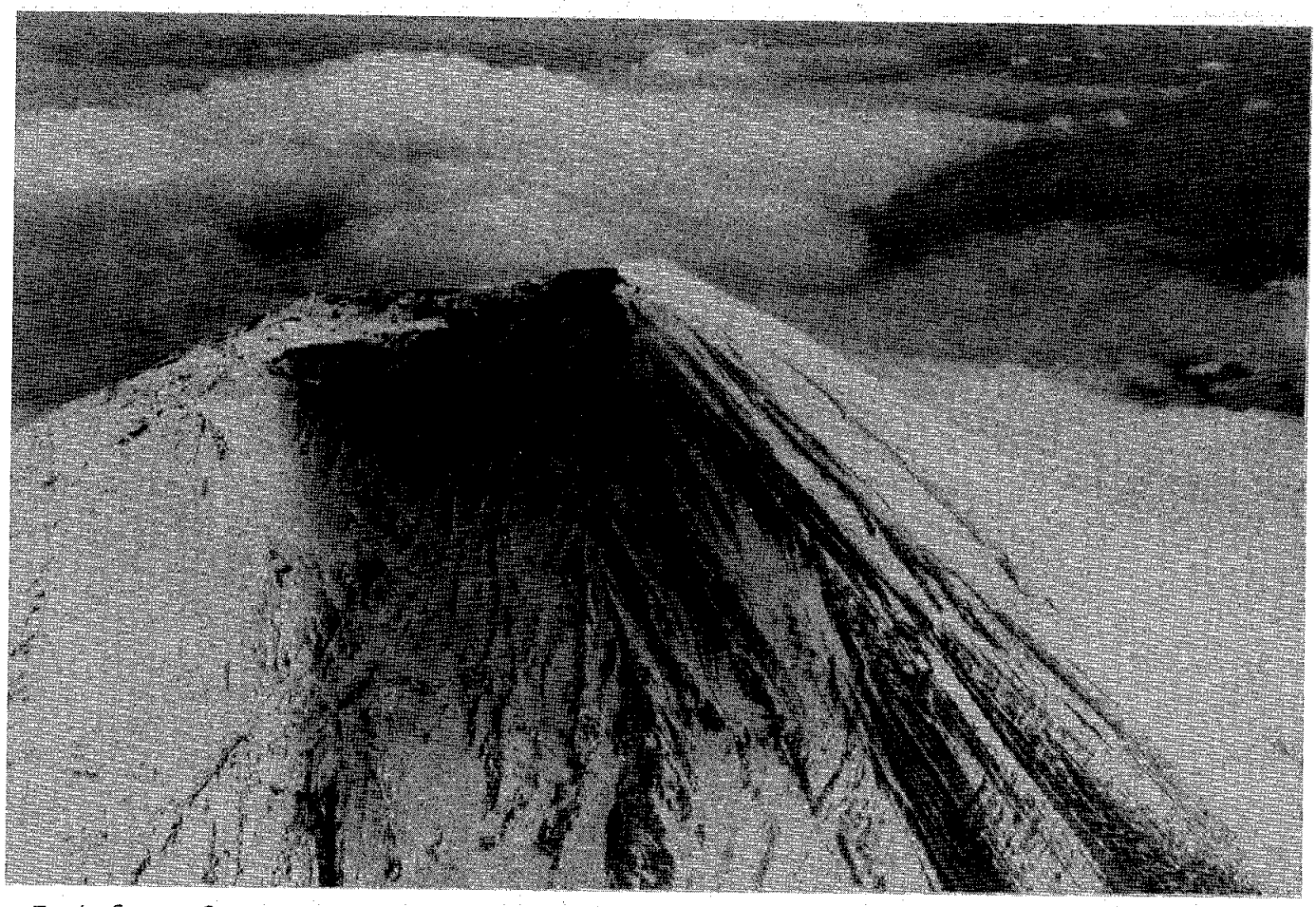
Publication No. TR02

GEOTHERMAL HOT LINE

A Publication of the California Division of Oil &Gas

July 1980 Vol. 10 No. 2



East face of Mt. St. Helens on April 23, 1980, about three weeks before the May 18 eruption. Photo by James Pynchon.

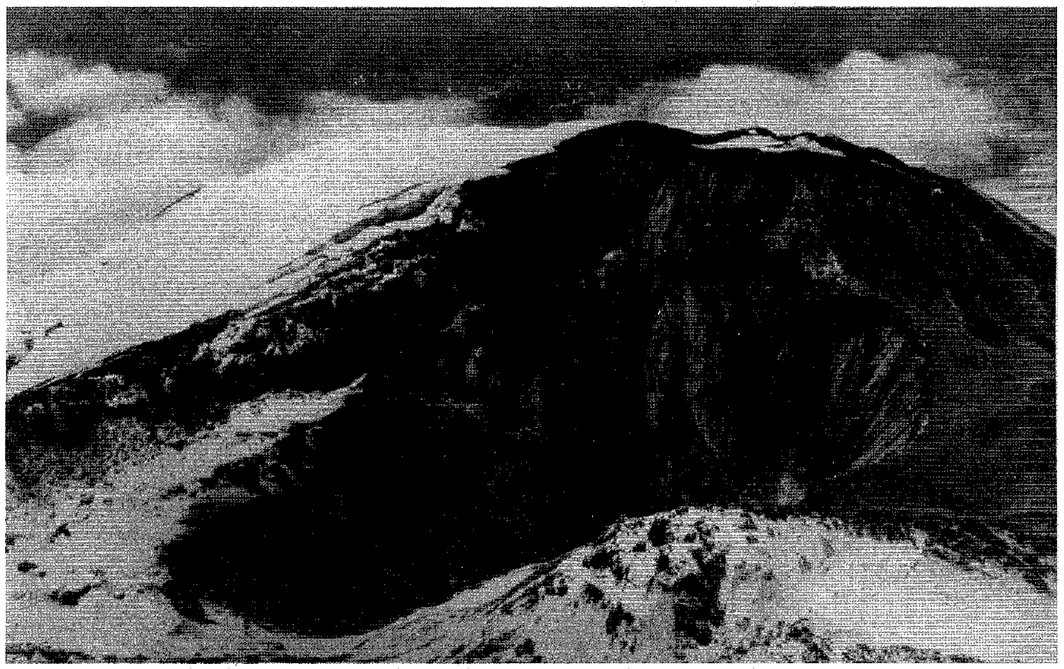
CASCADE RANGE GEOTHERMAL POTENTIAL ASSESSED

Mt. St. Helens and other Cascade Range volcanic areas have a "... high potential for energy that can be exploited," according to Wendell A. Duffield, a volcano expert and the coordinator of the U.S. Geological Survey geothermal research program at Menlo Park. USGS scientists are looking for both high and low temperature resources in the Cascade Range, which, according to a statement in Fire and Ice by Stephen L. Harris, includes "... literally thousands of volcanoes."

The highest summits in the range, often dominating the surrounding landscapes for 50 to 100 miles in all directions, are in Figure 1.

Duffield said that volcanoes reflect the passage of molten rock through the earth's crust, providing direct evidence that unusually high temperatures may be expected at exploitable, shallow depths. At Mt. St. Helens, he added, the apparent rise of molten

(Continued on page 30.)



Two views of the Mt. St. Helens crater on April 23, 1980. Small puffs of steam are rising from vents in the crater floor in the lower photo. Snow surrounds the edges of the crater. To orient these views of the crater with the view on the front cover, match the irregular features found along the rim. Photos by James Pynchon.

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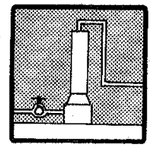
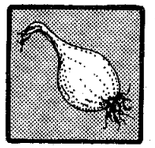
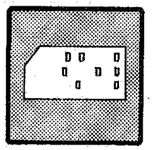
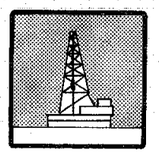








Pacific Northwest

(Continued from page 27.)
rock to a shallow crustal depth caused a series of steam explosions that blasted a large crater in the volcano's summit area. Duffield feels that the unleashing of this explosive energy supports prospects for successful development of geothermal energy in the Cascade Range. However, assessment work at Mt. St. Helens has been halted indefinitely while the eruptions continue. Marshall Reed, a USGS geologist in Menlo Park, said that no surface hydrothermal activity was noted at Mt. St. Helens before the eruption. After the May 18 eruption, active steam vents were present on the northern face of the volcano.

Reed said that the Cascade Range studies are part of an ongoing assessment of United States geothermal resources. The format and guidelines for this assessment will be published by the USGS in early 1981 and the study itself in late 1981.

The assessment includes work underway in the Mt. Hood area, described in another article in this Hot Line issue. Also included in the assessment is a study at the Newberry Caldera in Oregon. Here, in 1979, a 2,000 foot well was drilled that will be deepened and tested this summer, to determine the nature of the geothermal resources in the area.

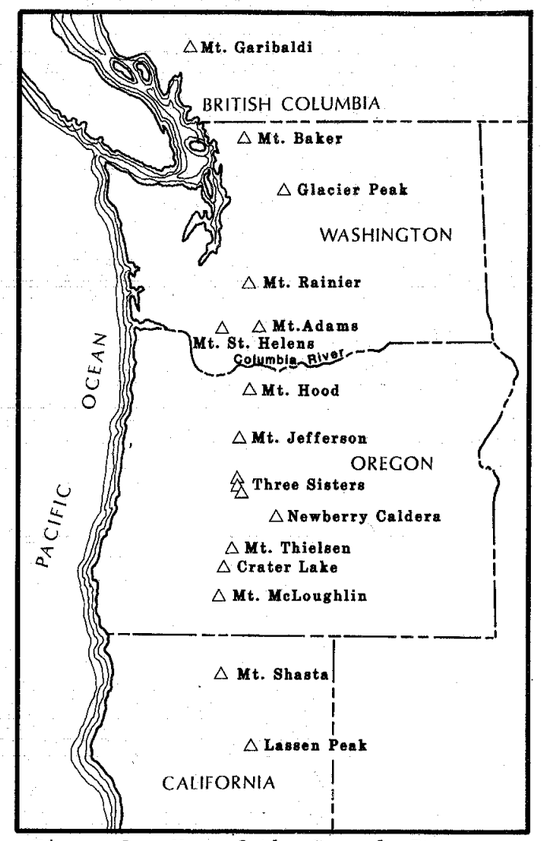


Figure 1. Map of the Cascade Range. After an illustration in Fire and Ice by Stephen L. Harris.

Two DOE Projects on Mt. Hood This Summer

Old Maid Flat

The Department of Energy (DOE) has appropriated $2.4 million dollars in fiscal year 1980 to continue drilling activities on two geothermal projects at Mt. Hood in northern Oregon. One project site is at Old Maid Flat on the lower, western flank of Mt. Hood, and the second is near Timberline Lodge at the bottom of the Pucci chairlift.

This summer at Old Maid Flat, a 5,000 foot deep geothermal well, 7A "Old Maid Flat" SW SW NE 15-2S-8E, may be drilled under a contract with the DOE, by Northwest Geothermal Corporation, a subsidiary of Northwest Natural Gas, Portland. Before drilling, a well drilled earlier at Old Maid Flat will be flow tested, and the water quality will be analyzed.

Northwest Natural Gas Company is looking for a hydrothermal convection system capable of flowing 25,000 gallons of water a minute from a group of about 20 wells, with each well producing fluid at a minimum temperature of 74°C and, hopefully, at a temperature of at least 82°C. The water should be of a quality high enough not to present any surface disposal problems.

If these requirements can be met at Old Maid Flat, well 7A "Old Maid Flat" will be drilled to the northeast of the test hole.

The company plans to pipe geothermal water produced from the Old Maid Flat field downhill to Portland, 42 miles away, in a 48-inch, insulated, underground pipeline. The company believes the geothermal water can be transported with less than a 10 degree temperature drop because of the water turbulence and the pipe insulation. In Portland, the geothermal water would replace domestic water presently used in wood and food processing plants.

Timberline Lodge

In the summer of 1979, the U.S. Geological Survey, funded by the Department of Energy, drilled temperature gradient holes at Mt. Hood. Among these wells was a 2,000 foot hole drilled at the start of the Pucci chair lift, which begins below Timberline Lodge and ends at the lodge. A temperature survey run on the hole showed a good thermal gradient, and the drilling problems that led to the abandonment of two wells drilled earlier at the lodge itself were not encountered at this site.

This summer, the hole will be deepened to 4,000 feet. The lodge needs 75°C water flowing at a rate of 100 gallons per minute. It is believed there is a good chance of finding such a resource at the Pucci site.

Geothermal Study

The location and depth of geothermal and groundwater aquifers in lower Lake County, California, are being studied in a joint project undertaken by the California Division of Oil and Gas, the Division of Mines and Geology, Mark Walters of Gennis and Associates, and the Lake County Farm Bureau.

As a first step, questionnaires asking for well data and permission to sample well water will be sent to county residents by the Farm Bureau. Requests for data on seasonal fluctuations of well temperatures will be included in the questionnaire.

Eventually, when all the information has been collected, the temperature and depth of area aquifers will be mapped by the Division of Mines and Geology.

Power Plants at The Geysers

On May 15, Pacific Gas and Electric Company power plant Unit 13 began generating full power at The Geysers Geothermal field in Northern California. The 135 MWe plant receives steam from seven wells drilled by Aminoil USA.

A 110 MWe power plant, Unit 14, is expected to be on line by August 1980. Presently, 14 power plants are operating at The Geysers, providing a total capacity of 798 MWe. Eighteen additional plants, including Unit 14, are at various planning, permitting, and construction stages, according to the California Energy Commission. Anticipated total net power capacity for The Geysers by 1983 is 1248 MWe.

Imperial Valley

Imperial Valley Water Applications Approved

On May 15, Chevron U.S.A. Inc. and San Diego Gas and Electric Company received approval from the California Water Resources Control Board for rights to use 50,000 acre feet and 20,000 acre feet per year, respectively, of water from the New River in Imperial County.

Chevron U.S.A. Inc. plans to develop the Heber geothermal field near Heber by building seven geothermal power plants over a 10-year period. Water from the New River will be used by Chevron for

underground injection to maintain the supply of subsurface water and to minimize subsidence. Some of the water will be used in the power plant cooling towers.

San Diego Gas and Electric Company proposes to construct, own, and operate one or more power plants in the field. Water from the New River will be used in the plant cooling towers.

After two years of consideration, the board stated in its decision that the use of water for the production of electrical energy is beneficial. The pollutants and high amount of total dissolved solids in the New River water preclude using the water for irrigation, domestic, municipal, and most industrial purposes.

Although the projects will have environmental impacts on the New River, the impacts will be mitigated. The diversion of the project water will reduce the rate of inundation by the Salton Sea of littoral lands and delta wildlife habitat. It will also improve the overall quality of water in the New River below Clark Road.

The projects will also have an environmental impact on the Salton Sea. The board wrote that while the projects will hasten the demise of life in the Salton Sea, it does not follow that the applicants should be charged with a portion of the cost of preserving the entire Salton Sea. With or without the projects, the future of life in the Salton Sea is limited, and the projects merely aggravate a pre-existing condition.

In summary, the board wrote that it "...finds the appropriation of water by the applicants to be in the public interest."

Heber Plant Negotiations Underway

The U.S. Department of Energy (DOE) and San Diego Gas and Electric Company (SDG&E) are negotiating a contract for the construction of a 50 MWe geothermal binary demonstration power plant near Heber, California, in the Imperial Valley. SDG&E has asked the DOE to pay one-half of the estimated $122 million cost of the two-year demonstration project.

The project objective is to demonstrate the commercial viability of generating electrical power from moderate-temperature geothermal resources using binary conversion technology. Binary systems use hot geothermal fluids to vaporize a secondary fluid to drive a turbine.

The proposed SDG&E system has a single binary loop and a single turbine. The secondary fluid is a mixture of 90 percent isobutane and 10 percent isopentane. The geothermal fluids have a temperature of 127°C (360°F).

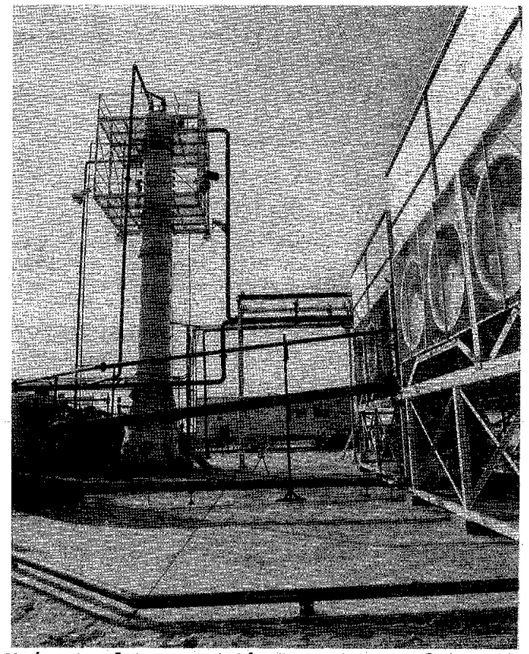
SDG&E will be the project manager and Fluor-Pioneer project engineer and constructor. Chevron Resources wells probably will supply the geothermal fluid to the plant, and the Imperial Irrigation District will purchase the power and supply cooling water.

The proposed site at Heber is just west of the East Mesa Geothermal field, in a 7,320-acre geothermal overlay zone covering geothermal resources estimated as capable of supporting up to 500 MWe for 30 years. Project completion is scheduled in 1984.

East Mesa Power Plant Tested

Tests have begun at a pilot geothermal 0.5 MWe power plant, located in the East Mesa geothermal field in the Imperial Valley, California. The plant, using a direct contact heat exchanger, produces a net output of 0.5 MWe from 200 gallons per minute of hot geothermal brine. In addition, the plant generates all of the power required for its own operation, and is completely self-sufficient after start-up.

The Department of Energy plant was designed and built by Barber-Nichols Engineering of Arvada, Colorado, who will be operating the unit for the

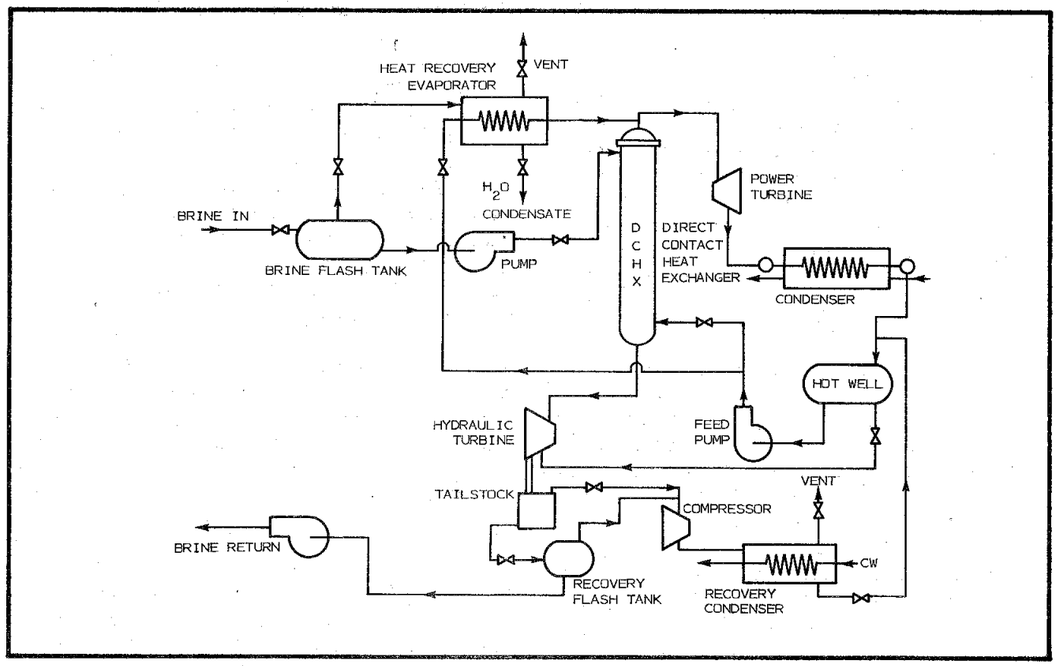


Main steel tower at the Department of Energy pilot geothermal power plant in East Mesa geothermal field, Imperial Valley, California.

next nine months to a year, under the direction of the University of California's Lawrence Berkeley Laboratory.

The main purpose of the tests is to determine if the direct contact heat exchange process, a relatively new concept, is less expensive and more efficient than the use of conventional heat exchangers in extracting energy from hot brines. The tests will also demonstrate the pilot plant's overall performance and produce data that will be useful in designing and building a larger demonstration plant, the next step in this Department of Energy program.

The plant's basic component is a steel tower 3 feet in diameter and 38 feet high. Hot brine from the earth is pumped in at the top of the tower and settles to the bottom, cooling to about 66°C from an initial temperature of about 171°C. The brine drains into a holding pond before being injected into another well. (The injection is to forestall any surface subsidence



Geothermal pilot plant using a direct contact heat exchanger system.

that might occur from the withdrawal of large quantities of fluid from the reservoir.)

Isobutane, the working fluid, is injected in the form of droplets at the bottom of the tower. The droplets rise, picking up heat from the brine, and vaporize near the top of the tower. The isobutane vapor is piped off, under pressure, to turn a turbine and generate electricity. Then, the isobutane is condensed and pumped back into the tower where it repeats the cycle.

In conventional geothermal heat exchangers,the brine flows through metal tubes without coming into direct contact with the working fluid. Problems arise, however, from the buildup of scale deposits from the brine. These deposits reduce the heat transfer efficiency, require periodic cleaning, and increase operating costs. The direct contact system eliminates the heat-transfer surface areas on which scale can form. This allows higher performance and reduces maintenance requirements.

In the pilot plant, the noncondensable gases and some steam from the brine are extracted before they enter the direct contact heat exchanger. The gases and steam then flow through a heat recovery evaporator, where a small amount of isobutane is vaporized. Finally, this isobutane, 3 percent of the total flow, joins the main system vapor for injection into the power turbine.

Working fluid losses in the plant occur because some isobutane is dissolved in the cooled brine leaving the tower. A recovery subsystem recaptures this isobutane by reducing the brine pressure, allowing isobutane vapor to form. The pressure reduction takes place in a hydraulic turbine that also recovers additional energy from the brine leaving the tower. Then, the hydraulic energy is used to reduce the electrical requirements of the primary brine pump. Next, the isobutane vapor formed in the recovery unit is compressed, condensed, and returned to the working fluid system.

Two Niland Power Plants

A letter of intent has been signed for the construction and operation of two geothermal power plants at the Niland geothermal resource area in the northern portion of the Imperial Valley. San Diego Gas and Electric Company (SDG&E) and Magma Power Company have agreed to construct a 28 MWe plant at the site of the SDG&E Niland Geothermal Loop Experimental Facility (GLEF). Existing GLEF wells and new wells, as yet undrilled, will supply geothermal fluid to the power plant, scheduled for operation in July 1982. The second plant, scheduled for operation in October 1984, will be located seven miles southwest of Niland and produce 49 MWe. Geothermal fluids used by both plants are highly saline with temperatures between 260°C to 316°C (500°F to 600°F).

Geothermal Rock Properties Source Book

The U.S. Department of Energy, Division of Geothermal Energy, is sponsoring a program to provide rock property measurements for geothermal development. Core samples extracted from the East Mesa KGRA in the Imperial Valley have been tested for mechanical response, thermal conductivity, thermal diffusivity, thermal expansion, permeability, ultrasonic velocity, and electrical resistivity.

All measurements are taken from samples at an appropriate state of overburden stress, temperature, pore fluid pressure, and pore fluid chemistry. For a source book with test results, write Dan O. Enniss, Terra Tek, Inc., 420 Wakara Way, Salt Lake City, Utah 84108. Phone: (801) 582-2220.

Core samples from a fracture-dominated reservoir are currently being tested and results will be available as soon as testing is completed.

Development

Power Plant Planned for Utah's Roosevelt KGRA

A 20 MWe geothermal power plant will be planned and built by Utah Power and Light Company (UP&L) at the Roosevelt Hot Springs KGRA in south-central Utah, according to a letter of intent signed by UP&L and Phillips Petroleum. A formal contract for the initial, single-flash unit of the power plant will be subject to approval by the directors of both companies within 90 days. The plant is scheduled to be completed in 1983, if necessary approvals can be obtained.

Four wells drilled in the hot-water reservoir will be used to supply steam for the plant, and 4 wells will be operated as injection wells. Phillips has drilled 6 of these wells, and Thermal Power Company 2.

Subsurface reservoir temperatures at the KGRA are between 230°C to 260°C (446°F to 500°F) with a total dissolved solids content of 7,800 ppm and a silica content of 313 ppm, according to a site specific analysis by the Department of Energy. The estimated power potential is 970 MWe for 30 years.

Geothermal Energy on the Delmarva Peninsula

To help support exploratory drilling to confirm a commercially usable geothermal resource in the Delmarva Peninsula of Maryland, Virginia, and Delaware, the Department of Energy (DOE) solicited proposals designed to promote the use of moderate temperature (below 149°C) water resources there for direct use applications such as space heating, and industrial or agricultural process heat. Final filing date for the proposals was June 9, 1980. At this time, the DOE is selecting the proposal outlining the most promising and efficient use of the resource. Only one applicant will be chosen for funding.

The DOE will assume a large part of the risk involved in confirming the resource. Up to $1 million will be provided for the drilling and testing portion of the project. DOE geologists expect this amount will cover costs to drill and test one production well and one injection well, if injection is necessary.

Previous studies have shown that geothermal reservoirs in the Delmarva Peninsula are capable of supporting commercial development. Drilling and testing completed last year at the Crisfield experimental well confirmed the existence of the reservoirs and provided valuable data on the depth, temperature, and physical characteristics of the resource. According to Dr. Gerald Brophy, DOE project manager overseeing the Delmarva explorations, the first Crisfield well was primarily for scientific testing purposes. Data from the well led him to conclude that "...the Crisfield tests definitely show that geothermal reservoirs exist in the Atlantic Coastal Plain, and we feel confident that these resources can be used commercially."

The Crisfield well reached water with a temperature of 57°C at 4,148 feet, and tests indicated higher temperatures at greater depths. Studies completed by researchers at Johns Hopkins Applied Physics Laboratory and Center for Metropolitan Planning and Research show that a broad variety of industrial, agricultural, and residential users might exploit such resources economically, saving substantial amounts of natural gas and fuel oil.

One of the most promising candidates for using the Delmarva resources is the large poultry industry on the Peninsula. Poultry growers and processors annually consume more than 2.5 trillion BTUs of energy, equivalent to nearly 437,000 barrels of oil. The moderate temperature resources found in the Delmarva Peninsula

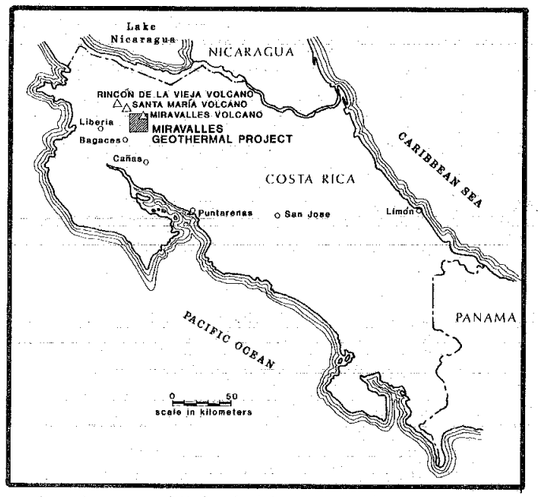
could supply most of the energy needs of this industry. Moderate temperature geothermal waters could also be used for drying crops and lumber and to meet the space heating requirements of high density residential and commercial areas. Other possible uses include vegetable and seafood processing and mariculture operations, all of which are large energy users on the Peninsula.

Costa Rican Geothermal Development at Miravalles

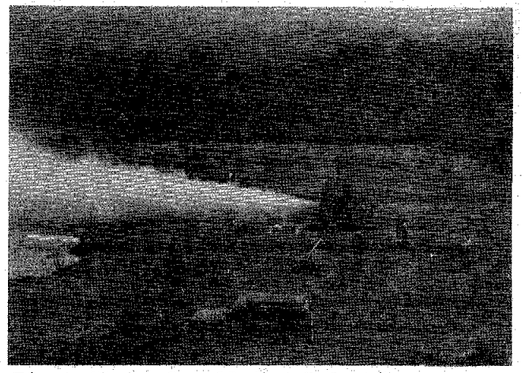
Part 1

The following information has been translated from a booklet titled Proyecto Geotermico de Miravalles, published by the Instituto Costarricense de Electricidad.

"The object of the viability study for the Miravalles geothermal project was to demonstrate the technical and economical feasibilities of building a 40 MWe electric power plant that utilizes geothermal fluids extracted from a zone near the Miravalles volcano in the volcanic mountain range of Guanacaste. In accordance with the actual program of development of the National Interconnected System, this plant ought to be functioning by the beginning of 1985.



Location of the Miravalles Geothermal Project, Guanacaste, Costa Rica.



First flow of well "PGM" 1, Miravalles Geothermal Project, Guanacaste, Costa Rica. Photo courtesy of the Instituto Costarricense de Electricidad.

Notice has been taken of Costa Rican geothermal resources since 1959, when some information was received from the Director of the Geologic Service of El Salvador, based on the available literature, making clear the existence of geothermal fluids that could be used for the production of electrical energy in the volcanic mountain range of Guanacaste. In 1963 and 1964, at the invitation of the Instituto Costarricense de Electricidad (ICE), United Nations geothermal experts visited the country. These experts agreed on the importance of studying in depth the geothermal resources of the zone, Pailas-Hornillas, on the slopes of the volcanoes Rincón de la Vieja and Miravalles. Between 1964 and 1974, these efforts were temporarily abandoned because of lack of financial resources and lack of experience in the American Continent with developing geothermal resources.

The 1973-1974 energy crisis and rise in prices of distilled petroleum products reactivated the interest of the ICE in geothermal resources. In 1975, another collection of data was undertaken in a zone larger than 500 km^2 near the volcanoes Miravalles, Rincón de la Vieja and Santa Maria. The Interamerican Highway forms the northern and southern boundaries of the area, and the rivers Tenorio and Salitral the eastern and western boundaries.

In November of 1975, thanks to a technical assistance loan from the Interamerican Development Bank, resource assessment services for the area were contracted from the firm of Rogers Engineering, associated with Geothermex, both from California, for the study of Phase 1, the overall planning of the geothermal project. This phase ended when the report was submitted in December of 1976.

The zone of La Fortuna-La Union-Hornillas on the slopes of the volcano, Miravalles, was named in the report as the most promising area in which to search for geothermal resources commercially exploitable for the generation of electrical energy. The report mentioned the need to drill four exploratory wells, 1,000 meters in depth, to determine the existence of a geothermal reservoir and to evaluate its physical, chemical, and thermodynamic characteristics."

In the next issue of the Hot Line, up-to-date geologic, drilling, and production information for the Miravalles project will be published, with several well and drill site photos.

Cooperative Agreements

Cooperative Study with Japan and New Zealand

In 1979, representatives from the U.S. Department of Energy (DOE) and the governments of Japan and New Zealand met to discuss United States cooperation with these two countries in developing geothermal resources.

At a meeting of the executive coordinating committee for U.S. - Japanese cooperation, projects related to binary conversion systems and the LASL hot dry rock programs were discussed.

A memorandum between the United States and New Zealand is under negotiation. Areas of cooperative study will include drilling and completion, logging instrumentation, chemistry and materials, stimulation, reservoir engineering, two-phase flow studies, and brine disposal.

U.S. - Mexican Geothermal Agreement May Expand

Mexican and United States governmental representatives are discussing a proposed expansion of an international cooperative agreement between the U.S. Department of Energy and the Mexican Comisión Federal de Electricidad. The purpose of the original agreement, signed in 1977, was to develop an intensive research program for Cerro Prieto Geothermal field.

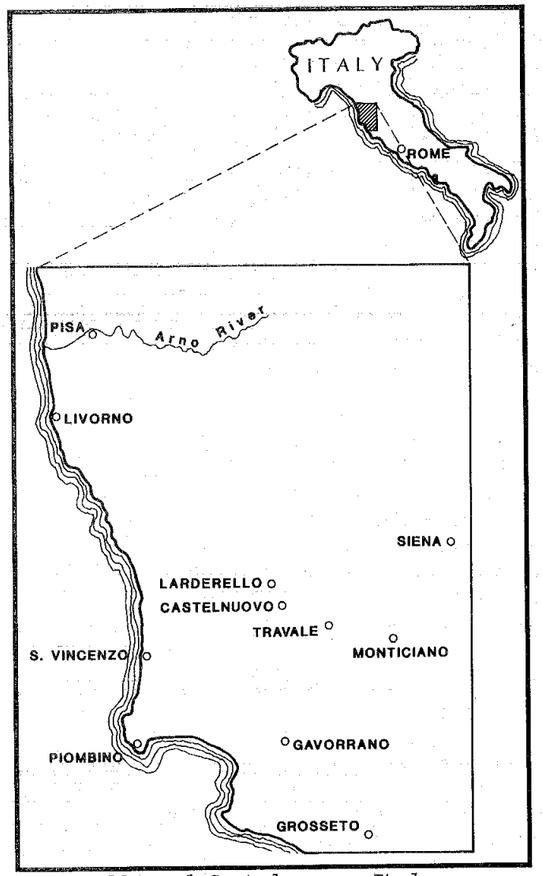
Under the new proposal, the research program would be extended to include a second Mexican geothermal field, Los Azufres in Michoacán. Research in the Los Azufres field would focus on exploration, technology, and reservoir engineering studies.

According to Geothermal Energy, edited by Kruger and Otte, Los Azufres field lies in part of a caldera formed in basaltic and rhyolitic flows and pyroclastics. Superheated steam is emitted from powerful fumaroles in the field at temperatures to 110°C.

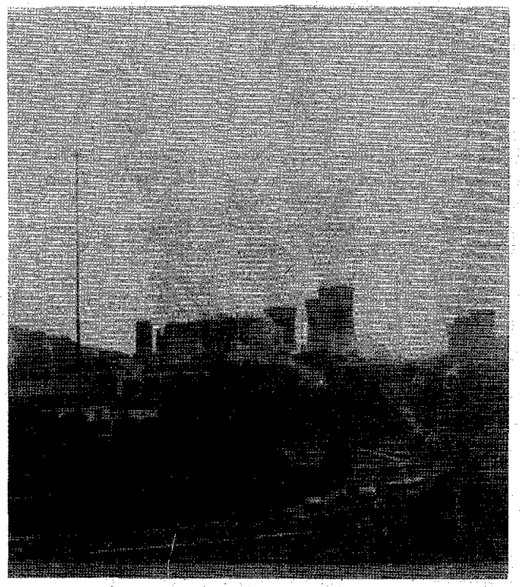
U.S. - Italian Geothermal Agreement

Five projects have been selected for study under the U.S. - Italian Agreement on Cooperative Research and Development in Geothermal Energy. This agreement is between the U.S. Department of Energy (DOE) and the Ente Nationale per l'Energia Electric (ENEL). The project titles are: Stimulation of hot dry rock and hydrothermal reservoirs; Utilization of hot brines; Reservoir definition; Deep drilling; and Environment. Many tasks for each project have been contracted. Most of the studies will take place at Larderello field, a vapor-dominated geothermal field in Larderello, Italy.

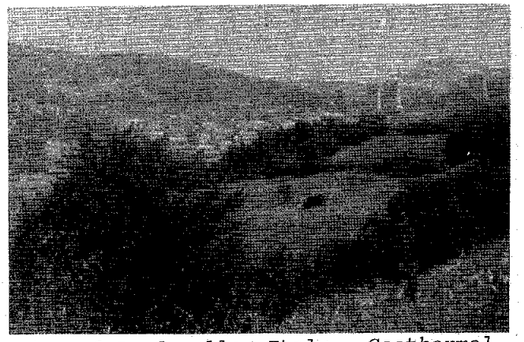
Jack Salisbury is the DOE coordinator, and Dr. Paul Witherspoon at the Lawrence Berkeley Laboratory is the technical coordinator for the agreement.



Larderello and Castelnuovo, Italy.

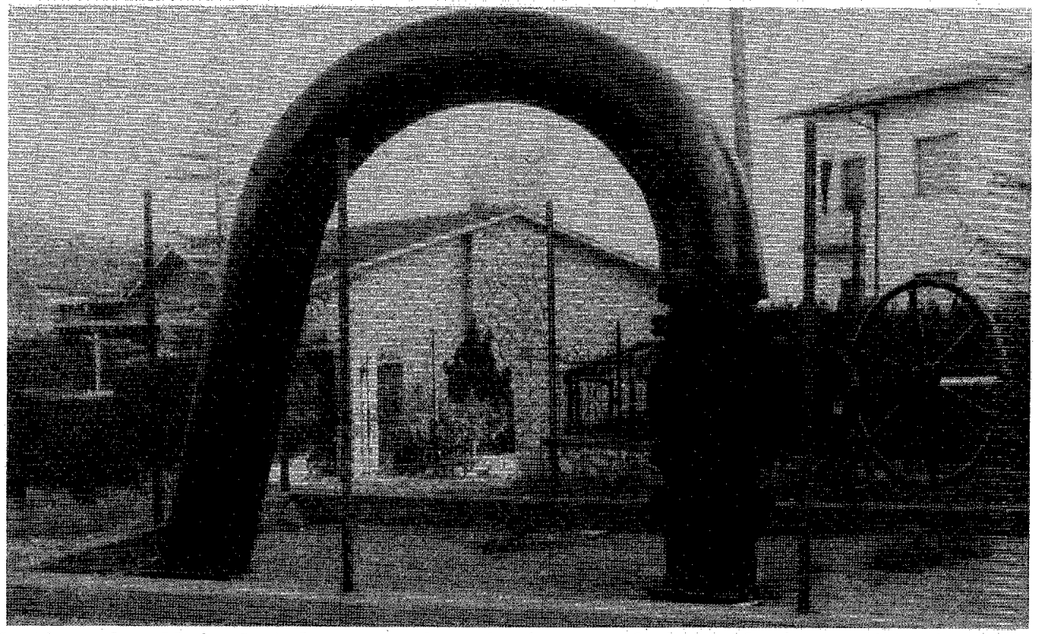


The first experimental generation of electricity from natural steam occurred at Larderello in 1904. In 1913, a 250 kilowatt generating station was placed under operation. According to the results of a recent reserves study undertaken by the Ente Nationale per l'Energia Electric (ENEL), presented at the Unitar conference in Montreal by G. C. Ferrara, Italy's geothermal potential to a depth of 3,000 meters is assessed at 1,000 MWe for 100 years or 2,000 MWe for 50 years.



View of Larderello, Italy. Geothermal power plant, photo right. As of 1979, the total installed electrical generating capacity of Italian geothermal power plants was 450.6 MWe. At Larderello and in other cities, including Castelnuovo (see photos), effluent from the power plants are used for space heating and agricultural projects. Photos by Doug Stockton.

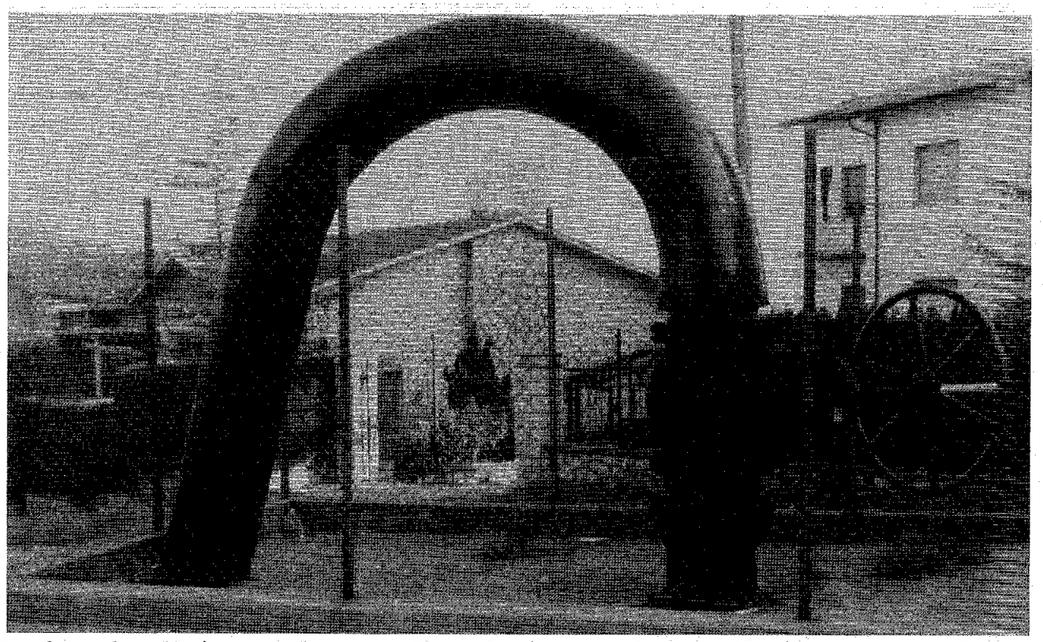
Castelnuovo, Italy. Geothermal power plant, photo right. Some steam lines going to the power plant pass under this city street. Others can be seen along the skyline, where electrical lines are faintly visible, as well.



Geothermal well in Castelnuovo. Through the arc of the well pipe, and behind the house, cooling towers of the geothermal plant are visible. This geothermal reservoir has been under production for 35 years. The producing wells are between 300 meters and 500 meters deep.

Sheep grazing near steam-gathering lines near the geothermal power plant at Castelnuovo. Aluminum sheeting that encases insulation covers the lines.

At Castelnuovo, plans have been made to use effluent from the power plant to space heat the primary and secondary schools, as well as the homes of retired ENEL employees.



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Direct Use

DOE-Direct Heat Program Underway

"Everything hinges on confirming the reservoir," said Bob Gray, Chief of Reservoir Assessment for the Department of Energy (DOE), Division of Geothermal Energy Resource Section. To stimulate low temperature geothermal reservoir exploration and development activity, Gray's section is administering a $10 million geothermal program called the User-Coupled Confirmation Drilling Program. This program provides federal cost sharing (between 20 and 90 percent) incentives for exploration, drilling, and testing activities undertaken to confirm hydrothermal reservoirs that can be developed for direct heat applications.

Because reservoir use is critical to this program, project applicants must identify a resource user before a project proposal will be accepted by the DOE. Proposals must also include geologic evidence that a resource exists at the site; a description of an adequate exploration, drilling, flow testing, and data analysis program; evidence that all required permits can be obtained, including rights to required land and geothermal fluid and/or heat; and evidence that environmental considerations can be handled.

The DOE will cost-share project expenses for exploration and well site selection activities, site preparation, drilling, flow testing, fluid disposal, well completion, an injection well (if necessary), and well abandonment.

Project funding is based on a cost sharing formula negotiated between the proposer and the DOE. Proposers specify to the DOE what would constitute a successful well, an unsuccessful well, or wells with intermediate degrees of success, based on the economic usability of the thermal fluids intersected by drilling activities. The fluids are judged on such characteristics as flow rates, water temperature, water quality, and estimates of reservoir longevity.

If a well is successful under the agreed-upon formula, the proposer will pay 80 percent and the DOE will pay 20 percent of the project cost. If the well is unsuccessful, the proposer will pay 10 percent and the DOE will pay 90 percent of the cost. Payments for intermediate degrees of success are made according to the agreement negotiated between the proposer and the DOE.

Project applications will be accepted through the first part of September. Private individuals, companies, and state and local governmental agencies may apply, as may users or developers of direct heat hydrothermal energy. Successful proposers will be notified in September 1980; at that time, contract negotiations will begin. Present plans call for additional project solicitations in approximate six-month cycles.

For information on the User-Coupled Confirmation Drilling Program, contact the Department of Energy Idaho Operations Office, 550 2nd Street, Idaho Falls, Idaho 83401.

Third Aquafarms Well

A third shallow, direct use, geothermal well is being drilled by Aquafarms International, Mecca, California. The projected well depth is 200 feet. This commercial prawn farm in the Coachella Valley raises the prawns in the 32°C (90°F) geothermal water.

El Centro Direct-Use Well Planned

Fluids from a geothermal well will be used to provide air conditioning and heating for a 13,000 square foot community center in El Centro, California. The Imperial Valley project will involve drilling an 8,500 foot geothermal well capable of flowing

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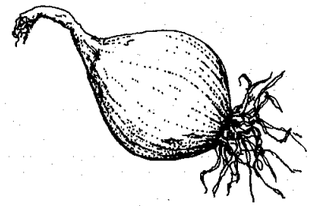
El Centro Direct-Use Well Planned

Fluids from a geothermal well will be used to provide air conditioning and heating for a 13,000 square foot community center in El Centro, California. The Imperial Valley project will involve drilling an 8,500 foot geothermal well capable of flowing 100 gpm of 121°C (250°F) fluid. The well will be the first California well to be used in a geothermal cooling project. The Department of Energy-sponsored demonstration project will be undertaken by Westec Services, Inc., San Diego. Cost of the initial well and the project is estimated at $1.6 million.

The proposed production well will be drilled on land owned by the Imperial Irrigation District, about 4 miles north of the Heber KGRA and about one-half mile north of the community center. A 4,000 foot injection well will be drilled in the same quarter section. At the well site, a plant operating on a lithium bromide/water cycle will be constructed to produce chilled water from the geothermal fluid.



Onion Dehydration Plant at Fernley, Nevada

The new Geothermal Food Processors dehydration plant at Fernley, Nevada, processed about 27 million pounds of raw onions from June through mid-November last year using only superheated water from a nearby geothermal well to heat the air that dries the onion slices.

Operation of the vegetable dehydration plant, located about 50 miles east of Reno, began in the spring of 1979. The hot water comes from a well drilled in the Brady Hot Springs Geothermal field that lies beneath the plant at a depth of several hundred feet.

In late 1977, the Department of Energy awarded a $2.8 million geothermal, long-term loan guaranty for the plant. The federal guaranty, the second of its type, was for a loan by the Nevada National Bank. The dehydrator was manufactured by SCM Corporation's Proctor and Schwartz.

The geothermal fluids at the Fernley project replace natural gas, the conventional fuel for major food processors. Plant owners expect to save more than 117 million cubic feet of natural gas during the first year of operation. Similar plants normally consume about 10 million cubic feet of natural gas a month in the growing season, at an average cost of $25,000 per month. Dehydration requires more heat than almost any other aspect of food processing, according to the firm.

Geothermal Food Processors, a subsidiary of the Anderson Group of Bloomfield, Conn., is now considering expansion at Fernley. The plant was designed to process carrots, celery, bell peppers, chili peppers, and potatoes as well as onions.

Hot Dry Rock

Fenton Hill Tests Encouraging

From October 23 through November 15, 1979, a 3-week period of tests at the Fenton Hill Hot Dry Rock Geothermal Energy Development Project was carried out with encouraging results. The tests were a major flow experiment for the extended system contained between the existing connection at approximately 9,670 feet in depth of the well EE-1 and well GT-2B wellbores. An old fracture from well EE-1 was modified and extended to produce a fracture with an effective heat transfer area of at least 50,000 square meters. Microseismic data indicated the possibility of the fracture approaching 600,000 square meters. The temperature of the water circulating through the extended EE-1/GT-2 system was 132°C (270°F) at the surface, and did not decrease during the 23-day test.

Flow volumes and pressures, along with back pressure, were varied throughout. The experiment was completed with a series of microseismic tests. Further studies are needed to determine more closely the actual area effective in heat exchange.

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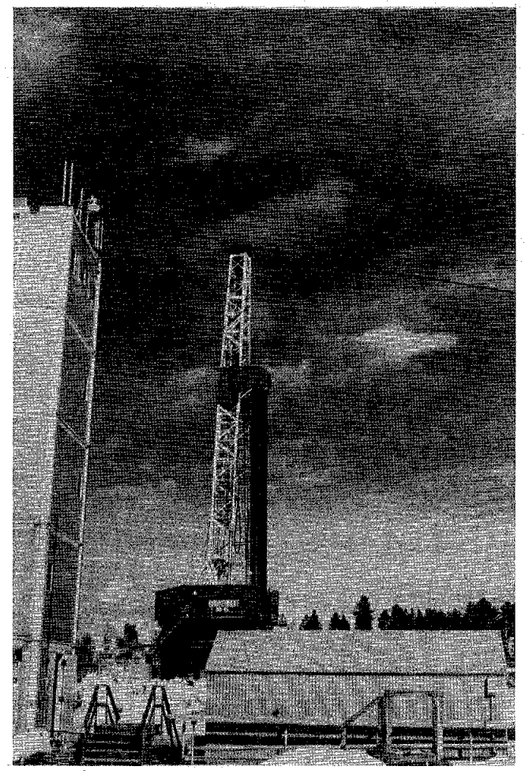
Fenton Hill drill site, location of the first U.S. field test of hot dry rock geothermal resources.
At Fenton Hill, water is injected into well GT-2, beneath the tower photo left, and extracted from well EE-1, beneath a similar tower to the right of the photographed area. After extraction, the hot water passes through one or more heat exchangers, where its energy is transferred to a secondary fluid. The cooled, extracted water is then injected into well GT-2.

The drilling rig, center photo, is for well EE-2, the injection well of Fenton Hill's Phase II system. The hole depth of the well has been increased to about 14,000 feet, and five core runs have been made. Site preparation for well EE-3, the Phase II production well, has begun.



Geopressured Resources

Geopressured Prospects May Be Dimming

According to an article in the March 28 issue of Science, the prospects for geopressured-geothermal energy development may be dimming. The Department of Energy has found that natural gas may be less concentrated in geopressured zones than had been hoped, and energy experts are writing that the geopressured-geothermal energy is too dilute and in too many small reservoirs to be economically recoverable, even if the price of natural gas were to double. The DOE program to determine the size and recoverability of the geopressured resource will continue, although at a slower pace, to eliminate remaining uncertainties in the program.

The purpose of the program was to drill into the pressurized water zones found in the coastal areas of Texas and Louisiana. The pressurized hot water would be brought to the surface, the dissolved natural gas extracted, and the heat energy utilized.

Two other recent articles on this topic are "Natural Gas from Geopressured Zones" by Rosenberg and Sharer, published in the April 28, 1980 issue of the Oil and Gas Journal; and "Technology and Economics of Methane Production from Geopressured Aquifers" by Todd M. Duscher, et al, published in the December 1979 issue of The Journal of Petroleum Technology.

DOE Geopressured-Geothermal Wells

In January 1980, the Department of Energy began work on a long term test facility for a geopressured-geothermal well in Brazoria County, Texas. The test, to determine production flow rates, is scheduled for mid-March and will take about nine months. The well, General Crude - DOE Pleasant Bayou No. 2, was completed to a depth of 16,500 feet. In an earlier test, the well flowed at rates up to 25,000 barrels of water per day.

In February 1980, the DOE began the evaluation of a geopressured-geothermal "well of opportunity" near Houma, La. The well was drilled to 17,276 feet and completed as a dry hole by Tenneco Oil Exploration and Production in January 1979. Geopressured-geothermal sands were penetrated at about 17,000 feet. As an existing well, it became part of the DOE Well of Opportunity Program to evaluate geopressured-geothermal zones as sources of energy. Tenneco is participating in the project.

Technology & Reservoirs

Innovative Steam-Gathering System

A geothermal steam-gathering system at The Geysers Geothermal field has won two major awards for the designer, Daniel, Mann, Johnson and Mendenhall of Los Angeles. The $3.4 million system won a 1980 Engineering Project Achievement Award during National Engineers Week and an honorable recognition citation in the Consulting Engineers Association of California's engineering excellence competition.

The automatic, computer-controlled system provides accurate record-keeping on steam well data, computer-optimized steam rate extraction, and a pipeline support system designed to absorb thermal expansion over rough terrain. It is owned by Thermogenics Inc., a lessee at The Geysers.

New Energy Conversion System Researched

Research for a geothermal energy conversion system based on a gravity-head thermodynamic cycle has been funded by the Department of Energy (DOE). The system is expected to generate one-third more electricity than a conventional geothermal power plant, at an equivalent cost. Lower-temperature reservoirs could be exploited with this system, which uses a downhole pump and turbine set beneath a string of concentric pipes and a heat exchanger. Heat transfer occurs in the well.

The DOE awarded about $16.5 million in contracts to Sperry Research Center in Sudbury, Massachusetts to develop the system.

Reservoir Simulation Problem Proposals

The Department of Energy desires to receive and consider for support proposals to run a standard set of geothermal reservoir simulation problems. Comparisons among the solutions will be used to evaluate the validities and capabilities of numerical reservoir simulator codes. Final results are due by November 1, 1980, so a summary of results can be presented at the Sixth Workshop on Geothermal Reservoir Engineering at Stanford University in December 1980.

Between six and twelve awards will be made. Copies of the Request for Proposals (RFP), which include detailed specifications of the simulation problems, will be available June 1, 1980. Proposals are due on July 7, 1980. To receive an RFP, contact the U.S. Dept. of Energy, Attn: Gerald Katz, Secretary, Geothermal Energy Division, Code Comparison RFP, 1333 Broadway, Oakland, California 94612, Phone: (415) 273-7943.

Leasing

Mono-Long Valley KGRA Lease Sale

The U.S. Bureau of Land Management has announced the sale of leases on 18 parcels, totaling about 26,563 acres, in the Mono-Long Valley KGRA. The deadline for bids is on July 16, 1980 at 10:00 a.m.

All bids must be submitted to the office of the State Director, Bureau of Land Management, U.S. Department of the Interior, 2800 Cottage Way, Sacramento, California 95825. If submitted by mail, to Room E-2841; if delivered in person, to Room E-2811. Bids may not be withdrawn unless written withdrawal is received prior to 10:00 a.m., July 16, 1980. Bids will be opened and read at 1:00 p.m. on July 16 in Room W-1140 of the Federal Building, 2800 Cottage Way, Sacramento, California.

Lake County Lease Sale

The State Lands Commission will open bids July 18 in Long Beach for lease of geothermal resources from approximately 120 acres of reserved mineral lands in Lake County.

Terms of the sale will be a royalty of 12.5 percent of gross revenue, annual rental of $1 per acre, with the biddable factor being a percentage of net profits. Bids will be opened at 11:00 a.m. in the commission's Long Beach office.

The following described parcel is scheduled for lease at the sale:

W 9973

The S1/2 of the NW1/4 of Section 29, and the SE1/4 of the NE1/4 of Section 30, T12N, R8W, MDM, Lake County, containing 120 acres, more or less.

An outline of the conditions for bidding and the form of geothermal resources lease, including the bid form, may be obtained at the office of the State Lands Commission, Suite 300, 100 Oceangate, Long Beach, California 90802.

Sonoma County Lease Sales

The California State Lands Commission has announced high bidders for two recent, Sonoma County lease sales. On April 24, leases for approximately 839 acres were awarded to the Sacramento Municipal Utility District (SMUD) and the Geothermal Power Corporation of Novato. Terms of the sale were for a fixed royalty of 12.5 percent of gross revenue and an annual rental of $1 per acre.

SMUD was named by the commission as the highest qualified bidder for a parcel of approximately 599 acres of reserved mineral lands in the northwestern portion of The Geysers Geothermal field. SMUD bid 71 percent of net profits. Geothermal Power Corporation was picked as the highest qualified bidder for a 40-and a 200-acre parcel in the same area. Geothermal Power bid 72.5 and 76.1 percent of the net profits on these parcels.

On May 16, leases for approximately 360 acres were awarded to the Geothermal Power Corporation of Novato, MSR Public Power Agency, and SMUD. Terms of the sale were a fixed royalty of 10 percent of gross revenue and an annual rental of $1 per acre.

Geothermal Power Corporation,with a bid of 70.6 percent of the net profits, was the high bidder for approximately 200 acres. MSR Public Power Agency, a consortium of Modesto Irrigation District and the Cities of Santa Clara and Redding, was the high bidder for approximately 40 acres, with a bid of 26.1 percent of the net profits. SMUD, with a bid of 55 percent of the net profits, was the high bidder for approximately 120 acres.

State law provides that in cases where the state has sold the surface, but reserved the mineral rights, the owner of the surface must be notified of the sale of geothermal resources and given an opportunity to match the high bid. The commission has notified the surface owners of these parcels,and the owners have 10 days to exercise their rights to match the high bids. If the surface owners fail to act within that period, the leases will be awarded to the other bidders.

Audiovisual

Geothermal Slide Show

"Geothermal Journey," a 30-minute geothermal slide show, is available from the International Society for Geothermal Engineering, Inc., P.O. Drawer 4743, Whittier, California 90607.

The show consists of two boxed cassette tapes, a script, and 80 slides. The presentation may be used with any remote control Kodak Carousel slide projector connected with a slide/sync. cassette tape recorder. The show sells for $250 and rents for $125.

"Geothermal Journey" is described as a nontechnical introduction to practical geothermal developments.

Geothermal Film

A 20-minute film on geothermal energy, produced by Union Oil Company, is available for community viewing. Titled "Harnessing the Heat of the Earth," the film shows how geothermal energy is discovered and developed.

For further information, write to Harry Bain, Union Oil Company, P.O. Box 684, Santa Rosa, California 95406.

Film Available

A 16mm film illustrating space heating, industrial, and agricultural uses of low-temperature geothermal energy is available from the Department of Energy. Although rather vaguely titled A Gift from the Earth, the film covers a lot of ground in reviewing current, U.S. low-temperature geothermal projects. Geothermal activities along the Raft River and in Boise, Idaho; in Klamath Falls, Oregon; and in the Honey Lake and Mammoth Lake areas in California are featured, although East Coast and Gulf Coast developments are mentioned.

The 30-minute film (#537) may be borrowed, free of charge, from the DOE Film Library, Technical Information Center, P.O. Box 62, Oak Ridge, Tennessee 37830.

Computerized Information Retrieval

Use a Computer to Find Geothermal Data

Computerized library searches are inexpensive, fast, and very efficient ways to assemble lists of data on geothermal topics. Most large libraries, including university and college libraries, have terminals and printout machines linked to computerized data systems, such as the Lockheed Dialog Service.

To make a computer search of the literature, contact a reference librarian at a library subscribing to the service. The librarian will ask you to describe the general area of the topic you want information on, such as "geothermal", and to list the subtopics to be included or excluded. For example, you may be interested only in hot dry rock, and then only in fracturing. The more specific you are, the smaller will be the number of articles identified.

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When the search is completed, you may elect to have the citations printed out immediately. This is expensive, however. Unless there are few citations, it is usually better to order a copy through the mail, and a mailed copy takes two or three days to receive. The print-out will contain all the bibliographical information you will need to find every article, and, for a little more money, can include abstracts of the articles, as well.

Energy Data Retrieval Systematized by EIC

A special service providing energy information is now available at many libraries. Prepared and distributed by Energy Information Center, Inc. (EIC), the service provides a single-source access point to energy data published by all energy-related disciplines, professions, and industries. Some screening is done by the company so that only the most "significant, timely, and authoritative information enters the data base." The data released by the company is comprised of a bibliographical entry and , usually, (unless permission cannot be obtained) an abstract.

Three kinds of access to the data are available: online computerized access (the quickest, most flexible method of retrieval), microfiche, and a journal published 10 times a year.

The company also publishes other data on geothermal energy. (These publications or microfiche collections are often available in libraries.) An Environmental Regulational Handbook is a reference collection of major U.S. Environmental laws and regulations in 10 environmental areas, including: air, noise, and water pollution; toxic substances; land use; solid wastes; and NEPA.

The Statefiche collection includes microfiche copies of environmental laws and regulations in the United States.

The Energy Directory Update lists all persons doing research in energy today in the United States.

For more information, write Environmental Information Center, Inc., 292 Madison Avenue, New York, N.Y. 10017. Telephone: (212) 949-9494.

Geothermal Energy Update

Available on a subscription basis as NTISUB/E/147 from the National Technical Information Service (NTIS), Springfield, Virginia 22161. $27.50 a calendar year for domestic subscribers and $40.00 a calendar year for subscribers outside the North American continent. Single issues are $3.25 (domestic) and $6.50 (outside the North American continent).

This publication includes abstracts and indexes of scientific and technical reports; journal articles; conference papers and proceedings; patents; theses; and monographs from all sources on geothermal energy in the energy data base of the DOE's Technical Information Center.

The subjects include resource exploration and evaluation, reservoir engineering and productivity, utilization technology, economics, environmental and institutional aspects, and basic geoscience data and theory.

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Computerized Data Base from Gulf Publishing Company

Energy bibliography and index. Five volumes, $295.00 each. Quarterly updating service for $125.00 a year. Published by and available from Gulf Publishing Company, Book Division, Dept. 227M, P.O. Box 2608, Houston, Texas 77001. Phone (713) 529-4301.

These volumes contain bibliographical information and abstracts from energy and energy-related literature published from the turn of the century to the current year. The series is available as an on-line data base from Systems Development Corporation, Santa Monica, California.

Publications

USGS Information, Products, and Services

Sources of information, products, and services of the U.S. Geological Survey. Free. Published by the U.S. Geological Survey and available from any of the 10 USGS Public Inquires Offices. (The USGS describes these offices as "focal points for information for the programs of the USGS.") The address of one public inquiry office is Room 122, Bldg. 3, 345 Middlefield Road, Menlo Park, California 94025. 23 page pamphlet.

Here is a starting point for discovering the enormous range of information, products, and services made available by the USGS. These include: Maps and charts; publications, including professional papers, bulletins, water-supply papers, circulars, periodicals, and catalogs; cartographic data; water resources data; geologic inquiries; land evaluation, classification, and mineral operations supervision; computer data; photographs and transparencies; motion picture films; technical exhibits; library services; and news media services.

Additional pamphlets are available with further information on several of the subjects. All are free and available from any USGS Public Inquires Office.

Subject	Pamphlet Title
USGS Library	"U.S. Geological Survey Library"
Water data	"NAWDEX: A Key to Finding Water Data"
Remote photographic imagery and electronic data about the earth's resources	"Aerial Photographic Reproductions" "Introduction to the U.S. Geological Survey's EROS Data Center, Sioux Falls, South Dakota"
Photographs	"The U.S. Geological Survey's Photographic Library"
Maps	"National Cartographic Information Center (NCIC)" "Topographic Maps" "Geologic Maps: Portraits of the Earth" "A Selected Bibliography on Maps and Mapping"

Subject	Pamphlet Title
Maps	"Types of Maps Published by Government Agencies" "Land Use and Land Cover and Associated Maps"
Motion pictures and films	"Motion Picture Film Services of the U.S. Geological Survey"

Newsletters and Small Journals

The following newsletters and small journals on geothermal energy are available. If you know of others that can be added to this list, let us know.

Newsletter

Issued by the New Zealand Geochemical Group. Cost: $NZ6.00 for two years (includes a two-year membership in the group). For information, contact S. D. Weaver, Secretary-Treasurer, N.Z.G.G., Department of Geology, University of Canterbury, Christchurch, New Zealand.

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National Geothermal Service

Issued weekly by Petroleum Information Corporation. Cost: $420 per year. For information, contact Petroleum Information Corporation, P.O. Box 2612, Denver, Colorado 80201.

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Earth Sciences Div. Newsletter
News from Geothermal Subsidence Research Management Programs
News from Geothermal Reservoir Engineering Management Programs
News of Geothermal Energy Conversion Technology
ATES Newsletter (Aquifer Thermal Energy Storage)

All issued intermittently by the Lawrence Berkeley Laboratory. Free. To place your name on any mailing list, write Ms. Orah Goldman, U.C. Lawrence Berkeley Laboratory, Earth Sciences Division Reference Room, Building 90, Room 1070, Berkeley, California 94720.

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California Energy Commission

Issued by the California Energy Commission. Free. For information, write the Office of Communications, California Energy Commission, 1111 Howe Avenue, Sacramento, California 95825.

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Bulletin

Issued monthly by the Geothermal Resources Council (GRC). Annual subscription is included with membership dues for the GRC: student - $3.00, individual - $25.00, benefactor - $100.00, institution or company - $250.00, supporting - $500.00, sustaining - $1,000.00, patron - $1,500+, library - $18.00. Available from the Geothermal Resources Council, P.O. Box 98, Davis, California 95616.

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Energy Insider

Issued biweekly by the Department of Energy Editorial Division. Free. For information, write DOE, Mail Stop GA-343, Washington, D.C. 20585.

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Update, Hot Dry Rock Geothermal Energy Development Program

Issued quarterly by the Los Alamos Scientific Laboratory. Free. For information, write Glenda Cremer, Editor, P.O. Box 1663, MS575, Univ. of California, Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87545.

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Geothermal Log Interpretation

Issued quarterly by the Los Alamos Scientific Laboratory. Free. For information, write Glenda Cremer, Editor, P.O. Box 1663, MS977, University of California, Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87545.

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Geo-Heat Utilization Center Quarterly Bulletin

Issued by the Oregon Institute of Technology. Free. For information, write Paul J. Lienau, Editor, Geo-Heat Utilization Center, Oregon Institute of Technology, Klamath Falls, Oregon 97601.

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Geothermal Report

Issued by Maria del Carmen Smith. Cost: U.S.-$140.00 year, overseas-$160.00 (airmail postage included). For information, write Maria del Carmen Smith, P.O. Box 35-K, Tracey's Landing, Maryland 20869.

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ISGE - Transactions and the Geothermal Journal

Issued semiannually by the International Society for Geothermal Engineering. $14.00 a year, postpaid. For information, write to the ISGE, P.O. Drawer 4743, Whittier, California 90607. Special sets for Japan and New Zealand are being prepared.

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Geothermal Hot Line

Issued semiannually by the California Division of Oil and Gas. Free. To subscribe, write the California Division of Oil and Gas, 1416 Ninth Street, Room 1310, Sacramento, California 95814.

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Natural steam for power. By Donald E. White. One copy, free. Published by the USGS and available from the U.S. Geological Survey Public Inquiries Office, Room 122, Bldg. 3, 345 Middlefield Road, Menlo Park, California 94025. 5-fold pamphlet.

Geothermal energy. Limited quantities free. Published by and available from ENERGY, P.O. Box 62, Oak Ridge, Tennessee 37830. If you wish to reprint this or other Department of Energy publications, request the negatives from: U.S. Department of Energy, Editorial Services, GA-343, Office of Public Affairs, Washington, D.C. 20585.

These pamphlets clearly describe the basics of geothermal energy and geothermal development. Some organizations receiving requests for such information may not have the time to prepare a brochure on these topics themselves, and may find the publications useful to have on hand.

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Geothermal progress monitor. Published by the Department of Energy. To place your name on the distribution list, contact Dr. Fred Able, Division of Geothermal Energy, DOE, 12th and Penn. Avenue, N.W., Federal Bldg., Room 7151, Washington, D.C. 20461.

This useful publication, now on its third issue, provides an update on DOE geothermal activities. Progress on many aspects of geothermal development is described, and newsworthy events are highlighted. Some chapter titles are: Electrical, Direct Heat, Drilling, Legal, and State and Local Governments.

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Energy information referral directory, DOE/EIA-0205/1. January 1980. $5.00. Available from the Government Printing Office, Washington, D.C. 20402. Ask for Stock No. 061-003-00084-3.

Identifies energy information sources in the Department of Energy and other federal agencies, with individual names and addresses arranged topically. Lists the office of primary interest for a particular activity and includes a subject index.

☆

Energy Executive Directory. Original volume, $36.00. Original volume and two updates, $60.00 a year. Published by and available from Fraser/Associates, 1800 K Street, N.W., Suite 1006, Washington, D.C. 20006. (202)452-1188.

This book lists current federal, state, and local officials in energy-related fields. Telephone numbers and office mission assignments are included.

☆

Geothermal energy:obstacles and uncertainties impede its widespread use. Report to the Congress of the United States. January 1980. First copy free. Available from U.S. General Accounting Office, Distribution Section, Room 1518, 441 G Street, N.W. Washington, D.C. 20548.

This report makes several recommendations for improvements in federal geothermal development programs. Obstacles and uncertainties impeding the widespread use of geothermal resources in the United States are discussed.

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Lassen Known Geothermal Resource Area, California, 1980. By K. R. Christopherson, D. B. Hoover, V. Lewis, B. Radtke, and R. M. Senterfit. $3.50, paper or microfiche. Available from the California Division of Mines and Geology, P.O. Box 2980, Sacramento, California 95812.

Audio-magneto-telluric data sheets, station location map, and contour maps at 7.5 and 27 hertz; telluric and self-potential profiles, and location maps.

☆

Geology and slope stability in selected parts of The Geysers Geothermal Resources Area, a guide to geologic features indicative of stable and unstable terrain in areas underlain by Franciscan and related rocks. Special Report 142. By Trinda L. Bedrossian. $6.00. 63 pages, 1 map. Published by and available from the California Division of Mines and Geology, P.O. Box 2980, Sacramento, California 95612.

The results of the study are published to assist planners, staffs of permitting agencies, developers, and all persons involved in road, geothermal well, and power plant sitings at The Geysers Geothermal field. With the help of this guide, they may recognize geologic features indicative of stable and unstable conditions within Franciscan terrain and, through an understanding of geologic conditions, may better evaluate the effectiveness of engineering practices used in the area.

☆

Workshop on environmental control technology for The Geysers-Calistoga KGRA, UCRL-52887. 1980. Paul L. Phelps, project manager, Lawrence Livermore Laboratory. $7.00 per copy; microfiche $3.50. Available from the National Technical Information Service, U.S. Dept. of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161.

Workshop participants discussed environmental control technology applicable to The Geysers-Calistoga KGRA. Eighty experts on well drilling, geothermal operations, noise abatement, hydrogen sulfide abatement, power plant operation, materials, systems design, systems control, and legal regulations gathered to discuss ways to prevent, control, and mitigate undesirable environmental impacts caused by geothermal development at The Geysers.

☆

Geothermal energy and regional development, the case of Imperial County, California. Edited by Stahrl W. Edmunds and Adam Z. Rose. 1979. $20.95. Published by and available from Praeger Publishers, 383 Madison Avenue, New York, New York 10017.

Written after two years of research into the utilization of geothermal resources in Imperial County, this book is aimed at other researchers in the field of regional science who are interested in resources and development. The purpose of the book is to interrelate and refine technological assessments with social impacts, so that the costs and benefits of policy options can be identified for every point of view.

Chapters contain data on geothermal development; resource assessment; technological design and cost engineering; sociological and economic, environmental, and political impact; and policy development and implementation.

☆

Assessment of H_2S control technologies for geothermal power plants. Prepared by Acurex Corporation. $3.98. Available from and published by the California Energy Commission, Publications Unit, 1111 Howe Avenue, Sacramento, California 95825. (916) 920-6216.

This report analyzes techniques for controlling H_2S emissions from geothermal power plants and well operations.

☆

Geothermal well logging operations and log analysis in geothermal well Desert Peak No. B-23-1. Los Alamos Scientific Laboratory report LA-8254-MS. By D. K. Sethi and W. H. Fertl. Free. Available from Mr. Mark Mathews, Los Alamos Scientific Laboratory, MS 977, Los Alamos, New Mexico 87545.

☆

Geothermal reservoir assessment case study, Northern Basin and Range Province, final report, October 1, 1978 - September 30, 1979, DOE/ET/27099-1. By Phillips Petroleum Company, Geothermal Operations. Paper copy $9.00. Microfiche $3.50. Available from the National Technical Information Service, U.S. Department of Commerce, Springfield, Virginia 22161.

The report describes drilling and completion activity for well "Campbell E" No. 2 and "Desert Peak" B-23-1, drilled, respectively, in central Pershing County, Nevada, and northwestern Churchill County, Nevada. Daily drilling reports, drill bit records, descriptions of casing and cementing programs, drilling fluid programs, wellhead equipment, and logging programs are described.

☆

An appraisal of Colorado's geothermal resources. By J. K. Barrett and R. H. Pearl. 1978. 224p. $7.00.

Geothermal energy development in Colorado: processes, promises, and problems. By B. A. Coe. 1978. $3.00.

Colorado's hydrothermal resource base—an assessment. By R. H. Pearl. 1979. 144p. $6.00.

These three, recent publications are published by and available from the Colorado Geological Survey, Department of Natural Resources, Publications Department, 1313 Sherman Street, Room 715, Denver, Colorado 80203. The mailing charge is $.50 on orders up to $3.00, $1.00 on orders between $3.01 and $5.00, $1.50 on orders between $5.01 and $10.00, and $2.00 on orders between $10.01 and $20.00.

☆

Reconnaissance geophysics in the Clifton and Gillard geothermal areas, SE Arizona. By D. Klein, C. Long, K. Christopherson, and F. Boler. $2.50 for paper copy, $3.50 for microfiche. Available from the Arizona Bureau of Geology and Mineral Technology, 845 North Park Avenue, Tucson, Arizona 85719.

☆

Preliminary targeting of geothermal resources in Delaware. Progress Report, July 15, 1978 - July 14, 1979, COO-4715-1. By Kenneth D. Woodruff. Paper copy $4.50. Microfiche $3.00. Available from the National Technical Information Service. U.S. Department of Commerce, Springfield, Virginia 22161.

A one-year study was carried out in Delaware to assist the U.S. Department of Energy (DOE) in making its evaluation of the geothermal potential of the East Coast. Results of temperature logging the five DOE 1,000 foot test wells in Delaware indicate that the potential is good for a relatively low-temperature geothermal resource. Details of the study are included in the report.

☆

Direct heat application program summary. September 1979. Published by and available from the U.S. Department of Energy, Geothermal Energy, Idaho Operations Office, 550 Second Street, Idaho Falls, Idaho 83401.

Twenty-two direct heat geothermal projects undertaken as part of a DOE cost-sharing program are summarized in this publication. It is useful to have information about all these projects in one volume.

☆

Self-start manual for direct use applications of geothermal resources, P500-78-034, $2.10; Summary of findings, P500-78-033, $2.50; and Appendices, P500-78-035, $7.00. By Chris C. Christiansen, program manager, City of Desert Hot Springs, California. 1978. Published by and available from the California Energy Commission, Publications Unit, 1111 Howe Avenue, Sacramento, California 95825. (916) 920-6216.

These publications discuss direct use applications of geothermal resources at Desert Hot Springs.

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Bibliography of the geological and geophysical aspects of hot dry rock geothermal resources LA-8222-HDR. 1979. $4.50. Microfiche $3.00. Available from National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161.

Published papers on the geology and geophysics of geothermal areas and on the thermal history of the earth's crust. Most papers concern heat flow measurement techniques and measurement results.

Conferences & Courses

Geothermal Heat Pump Conferences

August 20 (July 8)	Airport Marina Hotel Dallas, TX
August 22 (July 10)	Hyatt Regency-Crown Center Kansas City, MO
September 9 (July 29)	Sheraton-Airport Minneapolis, MN
September 10	Ramada Inn Sioux Falls, SD
September 12 (August 1)	Red Lion Inn-Downtowner Boise, ID
September 17 (August 6)	Red Lion Inn-Portland Ctr. Portland, OR
November 17 (October 6)	Sheraton Intl. Airport Hotel Orlando, FL
December 8 (October 27)	Stockton Inn Stockton, CA
December 9 (October 28)	Salt Lake City Hilton Salt Lake City, UT
December 10 (October 29)	Sheraton-Sky Harbor Airport Phoenix, AZ

Tuition for each one-day conference is $110 per person, and advanced registration is encouraged. The fee will be $150 per person when paid six weeks or less before the conference. The dates in parentheses in the schedule indicate the last days early registration fees will be accepted.

Each conference will include such topics as an examination of heat pump components, groundwater geothermal heat pump sizing, water well fundamentals and sizing, groundwater geothermal heat pump effluent disposal methods, economics of the groundwater geothermal heat pump, groundwater geothermal heat pump system maintenance, and legal and environmental implications of groundwater.

For further information, write Heat Pump Conference, c/o NWWA, 500 W. Wilson Bridge Road, Worthington, OH 43085.

Geothermal: Energy for the Eighties, GRC 1980 Annual Meeting, Hotel Utah, Salt Lake City, Utah, September 9-11, 1980.

The meeting will include 12 technical sessions with over 100 papers, 60 poster session papers, and special sessions on hot-dry-rock geothermal energy, geopressured geothermal energy, and two-phase flow in geothermal wells.

For information, contact Beverly A. Hall, Geothermal Resources Council, P.O. Box 98, Davis, California 95616.

Third Annual Hot Dry Rock Information Conference, Santa Fe, New Mexico, October 28-29, 1980. Further details will be available soon.

Geothermal Aquifers of the Inner Gulf Coastal Plain: A Future Hydrothermal Energy Source, Austin, Texas, December 4-5, 1980.

For information, contact Joyce Akiyoshi, Geothermal Resources Council, P.O. Box 98, Davis, California 95616.

National Conference on Renewable Energy Technologies, Sheraton-Waikiki Hotel, Honolulu, Hawaii, December 8-11, 1980.

Regional energy planning using solar thermal, ocean thermal, photovoltaics, wind, biomass, and geothermal resources.

For information, contact Donni S. Hopkins, Hawaii Natural Energy Institute, University of Hawaii at Manoa, 2540 Dole Street, Holmes Hall 246, Honolulu, Hawaii 96822.

First International Conference on Geothermal Drilling and Completion Technology, Albuquerque, New Mexico, January 21 - 23, 1981.

Sponsored by the U. S. Department of Energy, Sandia National Laboratories, and the Comision Federal de Electricidad de Mexico. For information, contact Mr. Sam Varnado, Conference Coordinator, Drilling Technology Division 4741, Sandia Laboratories, Albuquerque, New Mexico 87185. Phone (505) 844-6094.

Third Symposium on the Cerro Prieto Geothermal Field, Baja California, Mexico, St. Francis Hotel, San Francisco, California, March 24-26, 1981.

The first 3½ years of a cooperative program at the Cerro Prieto field between the United States and Mexico will be summarized at the conference. A field trip for up to 120 people will be made to The Geysers on March 27.

For information, contact Werner Schwarz, University of California, Lawrence Berkeley Laboratory, Earth Sciences Division, Berkeley, California 94720.

GRC Courses

The following courses have been scheduled for 1980 by the Geothermal Resources Council. For further information, write the Geothermal Resources Council, P.O. Box 98, Davis, California 95616.

Geologic Fundamentals and Techniques for Geothermal Exploration and Development, Technical Training Course, Klamath Falls, OR. July 21-23, 1980.

Evaluation of a Single-Phase Geothermal Reservoir, Technical Training Course, Imperial Valley, CA. October 20-22, 1980.

Evaluation of a Two-Phase Geothermal Reservoir, Technical Training Course, Imperial Valley, CA. October 22-24, 1980.

Geochemical Fundamentals and Techniques for Geothermal Exploration and Reservoir Evaluation, Technical Training Course, Reno, NV. November 5-7, 1980.

California Wells

So far in 1980, the California Division of Oil and Gas has approved drilling permits for the following geothermal wells. All wells are in The Geysers Geothermal field.

Date Notice Received	Operator, Well No.	API No.	Sec.	T.	R.	Location, Elevation
1-14-80	Union Oil Co. of Calif. "DX State 4596" 47	097-90440	7	11N	8W	Fr. SE cor. 548m. N, 91m. W. 964m. KB.
4-8-80	Aminoil USA, Inc. "M and W" 1	033-90291	22	11N	8W	Fr. SE cor. 307m. N, 155m. W. 778m. KB.
4-17-80	Thermogenics, Inc. "Rorabaugh" A-14	097-90445	14	11N	9W	Fr. SE cor. 336m.N, 610m. W. 659m. KB.
5-12-80	Union Oil Co. of Calif. "DX State 4596" 48	097-90447	7	11N	8W	Fr. SE cor. 555m. N, 102m. W. 964m. KB.
5-12-80	Union Oil Co. of Calif. "DX State 4596" 49	097-90448	7	11N	8W	Fr. SE cor. 559m. N, 114m. W. 964m. KB.
5-28-80	Union Oil Co. of Calif. "NE Geysers Unit" 7	033-90277	4	11N	8W	Fr. SW cor. 173.7m. N, 579.3m. E, 861.62m. KB.
5-28-80	Union Oil Co. of Calif. "NE Geysers Unit" 8	033-90278	5	11N	8W	Fr. SE cor. 731.5m. N, 362.7m. W. 812.82m. KB.
5-28-80	Union Oil Co. of Calif. "NE Geysers Unit" 10	033-90280	4	11N	8W	Fr. SW cor. 167.6m. N, 570m. E. 861.62m. KB.
5-28-80	Union Oil Co. of Calif. "NE Geysers Unit" 11	033-90281	5	11N	8W	Fr. SE cor. 731.5m. N, 347.5m. W. 812.82m. KB.

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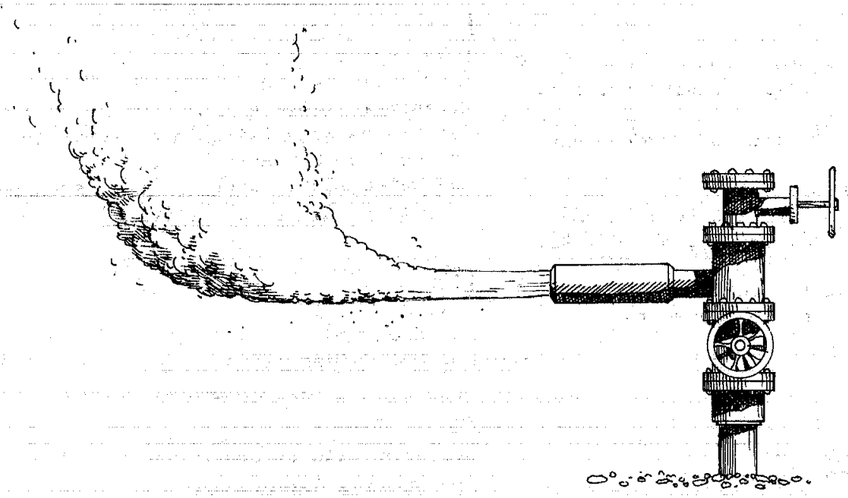
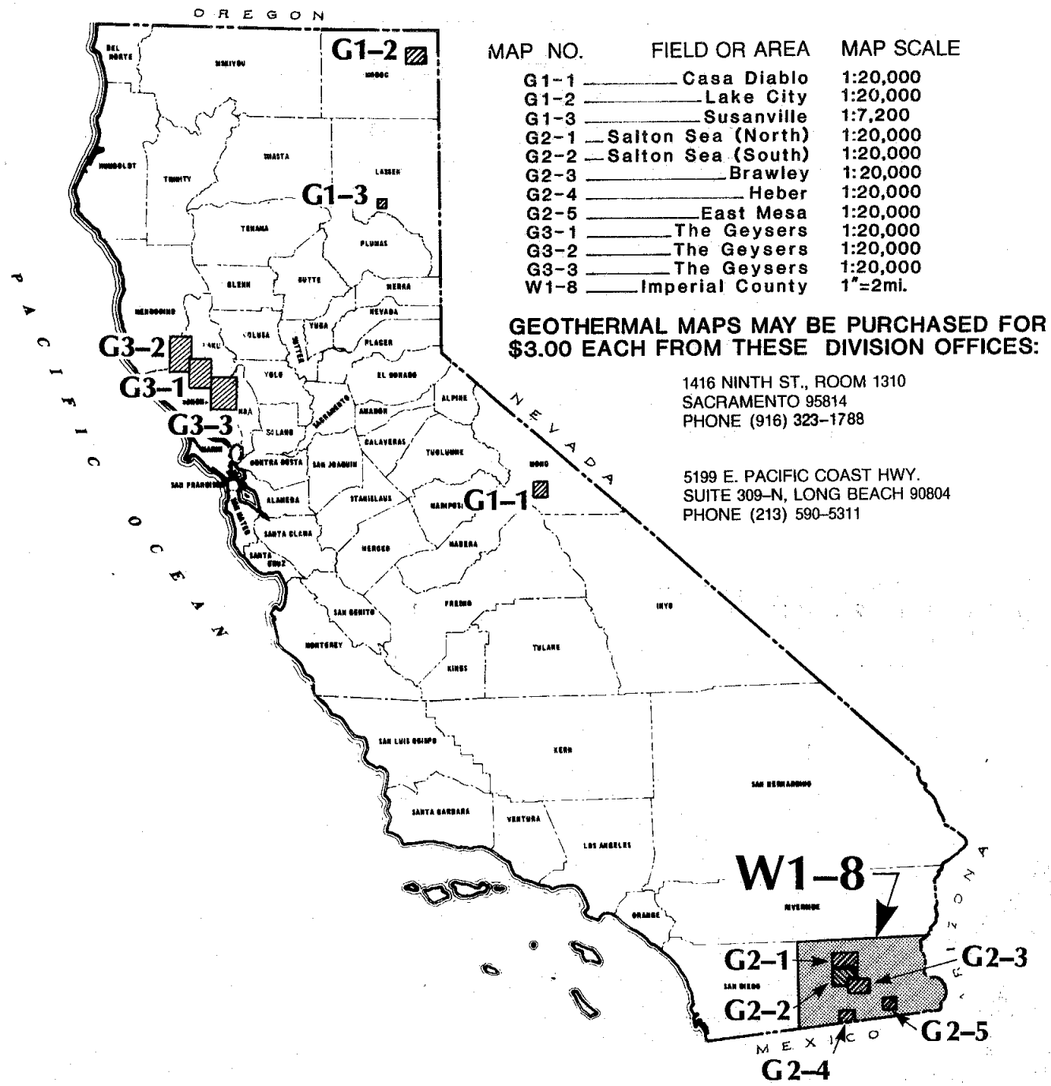
January, p. 1-26; July, p. 27-57.



GEOTHERMAL MAPS

California Division of Oil and Gas



MAP NO.	FIELD OR AREA	MAP SCALE
G1-1	Casa Diablo	1:20,000
G1-2	Lake City	1:20,000
G1-3	Susanville	1:7,200
G2-1	Salton Sea (North)	1:20,000
G2-2	Salton Sea (South)	1:20,000
G2-3	Brawley	1:20,000
G2-4	Heber	1:20,000
G2-5	East Mesa	1:20,000
G3-1	The Geysers	1:20,000
G3-2	The Geysers	1:20,000
G3-3	The Geysers	1:20,000
W1-8	Imperial County	1"=2mi.

GEOTHERMAL MAPS MAY BE PURCHASED FOR $3.00 EACH FROM THESE DIVISION OFFICES:

1416 NINTH ST., ROOM 1310
SACRAMENTO 95814
PHONE (916) 323-1788

5199 E. PACIFIC COAST HWY.
SUITE 309-N, LONG BEACH 90804
PHONE (213) 590-5311

(7-80-DWRR-8C)

CALIFORNIA DIVISION OF OIL AND GAS
1416 NINTH STREET, ROOM 1316–35
SACRAMENTO, CA. 95814