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GEO THERMAL STUDIES COORDINATING COMMITTEE

The Geothermal Studies Coordinating Committee, sponsored by the California Department of Water Resources and composed of members representing industry and various governmental agencies concerned with geothermal development, held their 2nd meeting of the year on October 17, 1973, in El Centro, California.

The current status of several government research projects, drilling done by industry and governmental agencies, and the Imperial Valley subsidence detection program were discussed.

Two members of the Mexican Comision Federal de Electricidad were present who read statements concerning geothermal development at Cerro Prieto.

The California Department of Water Resources is preparing an overview report on geothermal development and prospects in the Imperial Valley. This report is scheduled for publication early in 1974.

During the afternoon the group was taken on a tour of the U. S. Bureau of Reclamation's East Mesa project where 2 wells and 2 desalination units are currently being tested.

D.P.L.

OREGON ENERGY STUDY

The Public Utility Commissioner of Oregon has published a 253 page Energy Study which estimates the energy demands of Oregon, examines the Oregon resource base, and reviews the expected impacts on land use and population distribution. The study contains a 28 page review of geothermal energy by Roy B. Hurlbut, a PUC engineer. Copies of the report are available from:

Public Utility Commissioner
215 Public Service Bldg.
Salem, Oregon 97310
Tel.: (503) 378-6907

D. Finn

CERRO PRIETO FIELD DEVELOPMENT

The Mexican Comision Federal de Electricidad has brought the first liquid phase geothermal system into production in the western hemisphere. Development of the geothermal field at Cerro Prieto, Baja California, is progressing steadily. In April, 1973, the first 37.5 megawatt turbine was put on line, and in October the second unit began electrical generation. Ten wells are now providing steam to the generators, and another five wells will be connected in the near future to bring the 75 MW plant to full capacity.

The total cost for exploration and development of the geothermal wells and construction of the generating plant is \$32 million. Cost per installed kilowatt is \$427, and the cost of electricity produced is \$.008/kw hr. The Cerro Prieto power plant is estimated to free 800,000 barrels/year of oil for other uses.

Drilling is continuing for the installation of a second 75 MW plant. Step out wells to the south have more than doubled the area of the original field. After one year of testing the existing plant, a decision will be made on the construction of the second plant. If the second 75 MW system is installed, it is scheduled for operation in July, 1976.

M.J.R.

EXPLORATION IN ETHIOPIA

Ethiopia and the United Nations have agreed to continue a joint program for evaluation of geothermal resources. Previous exploration revealed three areas for further investigation, Dallol in the northern rift, Tendaho Graben in the Afar region, and the Aluto Caldera in the southern rift. Phase two of the exploration program, due to begin in April, 1974, will consist of intensive studies in the areas of interest.

M.J.R.

* COMING MEETINGS *

**EXPLORATION
SHORT COURSE**

The Geothermal Resources Council will present the first of a series of special short courses, "Geothermal Exploration" on January 14-16, 1974. The entire course will be held at the Senator Hotel, Sacramento, California. Enrollment is limited to 200 regular and 25 student participants. Attendance fees are \$100 for regular and \$25 for students.

Program for the course:

CHAIRMAN: Jim Combs, U.C. Riverside
Monday, January 14

1. Decision Making in Geothermal Exploration, Including Geologic Techniques.
James Koenig, Consultant
2. General Geochemical Exploration, Including Sampling Techniques and Temperature Indicators.
Marshall Reed, Calif. Div. Oil and Gas
3. Mixing Model for Geothermal Fluids and Shallow Groundwater.
Robert Fournier, U.S. Geological Survey
4. Heat Flow Measurements and Shallow Hole Temperature Data Gathering.
Jim Combs, U.C. Riverside

Dinner Talk:

The Energy Crisis and Fuel Rationing
John Matthews, Calif. Oil and Gas Supervisor

Tuesday, January 15

5. Federal Geothermal Land Leasing Procedures.
George Nielsen, U.S. Bur. Land Management
6. Introduction to Geophysical Exploration.
Tsvi Meidav, Geothermal Consultant
7. Dipole-Dipole Resistivity Applications.
Bruce Bell, McPhar Geophysics Inc.
8. Micro Earthquakes and Seismic Ground Noise as a Conjunctive Exploration Tool.
John Bailey, Senturion Sciences, Inc.
9. Economics of Exploration.
Bob Greider, Chevron Oil Company

Wednesday, January 16

10. Hydrologic Modeling of Geothermal Reservoirs and How They Affect Shallow Groundwater Systems.
Paul Witherspoon, U.C., Lawrence Berkeley Lab.
11. Case History of the Exploration of the Broadlands Field, New Zealand.
L.J.P. Muffler, U.S. Geological Survey
12. Case History of the Exploration of the Marysville Area, Montana.
David Blackwell, Southern Methodist Univ.
13. Land Acquisition—Its Costs and Problems.
Joe Parmenter, Del Paso Exploration Co.

For information and registration contact:

Beverly Hall
Geothermal Resources Council
P. O. Box 1033
Davis, California 95616
(916) 758-2360

M.J.R.

**LOW-TEMPERATURE GEOTHERMAL
RESOURCE USE**

Judith L. Hannah, working with the Geothermal Unit of the California Division of Oil and Gas, is investigating current and potential uses of low-temperature geothermal resources in northern California. Her report will include:

1. Discussion of such uses as space heating, greenhouse and other agricultural operations, product processing, desalination, and mineral recovery.
2. Descriptions of thermal phenomena in northern California.
3. Estimates of the potential for development of low-temperature geothermal resources.

The report will be published by the Division of Oil and Gas early in 1974. J.L.H.

**DRY ROCK
GEOTHERMAL STUDY**

The Los Alamos Scientific Laboratory is experimenting with a method of heat extraction from dry rock. Tests are being conducted on the Jemez Plateau of New Mexico, about 30 km west of Los Alamos, in Santa Fe National Forest. Late Pleistocene rhyolite and Paleozoic sediments overlie the Precambrian basement in this area on the edge of the collapsed Valles Caldera.

An experimental well, drilled to a depth of 785 m, penetrates 145 m of Precambrian granite gneiss and 17m of amphibolite. The bottom hole temperature is 100.4°C. Basement rock is initially impermeable, and pressures up to 190 bars have been needed to hydraulically fracture the rock. Once fracturing has taken place, only about 140 bars pressure is needed to reopen and maintain the fractures. Calculations of the regional stress field predict that the fractures will be vertical and lie in a northeast-southwest direction.

The Laboratory is encouraged by previous experiments and now plans to drill a 1370 m exploratory hole 1.6 km from the present test. Eventual plans are for a pair of adjacent wells drilled to 2400 m and 1800 m connected by a fracture zone of 500 m radius. Water will be pumped down the deeper hole under pressure, will flow through the fracture zone and absorb heat from the rock, and should flow up through the second hole bringing heat to the surface. M.J.R.

**NATIONAL CONFERENCE
ON GEOTHERMAL ENERGY**

The proceedings of the National Conference on Geothermal Energy held in Palm Springs, California, on May 10 and 11, 1973, are now available. The proceedings include the major addresses, the panel summary reports, a paper on the interrelationship of federal, state, and local regulatory agencies, a list of attendees, and a section on legal documents. The publication includes two volumes with a total of 400 pages and a regulatory flow sheet.

Write:

Arthur E. Sutton
Office of the Chancellor
University of California
Riverside, California 92502

The cost is \$12.50. Make checks payable to the Regents of the University of California. D.N.A.

**HISTORICAL
GEOTHERMAL BOOK**

The Geothermal Resources Council has published an unusual and interesting book:

Geothermal Exploration in the First Quarter Century, edited by D. N. Anderson and B. A. Hall, G.R.C. Special Report 3, 191 p.

A collection of historical documents covers early geothermal exploration and development in Italy, California and Baja California. This publication contains an extensive report written for the Southern Sierras Power Company in 1925, and papers presented to an Engineering Society meeting in 1925. Included are accurate descriptions of over 20 geothermal areas, exploration and drilling techniques, and early power plants. More than 100 excellent photographs, graphs, and charts show the technology in use during this early period.

Copies of this book are \$10 paperbound and \$12 hardbound.

Contact:

Geothermal Resources Council
P. O. Box 1033
Davis, California 95616

B. Hall

**TAX TREATMENT OF
GEOTHERMAL RESOURCES**

Samuel Eisenstat, a New York attorney, recently published a discussion of geothermal tax problems: Eisenstat, S.M., September, 1973, Tax Treatment of Exploring and Developing Geothermal Resources: Oil & Gas Tax Quarterly, v. 22, n. 1, p. 76-81.

In the paper, Eisenstat points out the tax discrepancies between oil and gas exploration and geothermal exploration. He concludes, "Exploration and development of geothermal resources should be subject to the same tax treatment as exploration and development of oil and gas." This more equitable situation can be accomplished by "immediate and unambiguous legislation". M.J.R.

**NEW GEOTHERMAL
EXPLORATION TOOL**

J. W. Cooksley Co. has proposed to use seismic reflection in the exploration for geothermal resources. This method uses a concept called the "bright spot" which is now being applied successfully to natural gas exploration. A geothermal "bright spot" would be caused by a zone of hydrothermal alteration around a geothermal reservoir.

The "bright spot" is a high amplitude seismic response originating at a rock interface where the deeper rock has much lower seismic velocity than the rock above. The energy coupling at this contact is poor and a large amount of seismic energy is reflected back to the surface. Cooksley Co. has applied seismic reflection to the exploration for porphyry copper deposits in Arizona. The halo of hydrothermal alteration surrounding the ore body is detected by its low seismic velocity with respect to overlying rock.

For information contact:

J. W. Cooksley Co. J. W. Cooksley Co.
P. O. Box 1602 or 2610 E. Grant Road
Redding, CA 96001 Tucson, AZ 85716

M.J.R.

**REVIEW OF
NSF PROJECTS**

The National Science Foundation funded nine geothermal studies during 1973, some of which will continue for several years. Approximately \$2 million was granted for the following geothermal research projects.

1. *Evaluation of a geothermal area of abnormally high heat flow at Marysville, Montana:* Thermal flux measurements, gravity and infra-red surveys, and seismic studies will better characterize the anomaly.

D. H. Stewart, Battelle Memorial Institute, Richland Washington.

2. *The use of electrical methods for the delineation of geothermal reservoirs:* Resistivity, self-potential, induced polarization, and electromagnetics will provide a description of the electrical properties of thermal areas in Nevada.

H. F. Morrison, University of California, Berkeley.

3. *Geological-geochemical-geophysical investigations of a recognized geothermal area in the Imperial Valley of southern California:* Physical and chemical measurements made on core material from the "Dunes" 1 well in the East Mesa will characterize the metamorphism and chemical environment in the sediments.

W. A. Elders, University of California, Riverside.

4. *Hydrothermal systems at Kilauea Volcano, Hawaii:* Physical tests in the deep drill hole provide evidence of groundwater dynamics.

G. V. Keller, Colorado School of Mines, Golden.

5. *Geothermal energy laboratory experiments:* Geophysical surveys and economic study will assess the geothermal potential and impact on the island of Hawaii.

J. W. Shupe, University of Hawaii, Honolulu.

6. *Investigation of the thermal regime of the Rio Grande rift system of New Mexico:* Heat flow-measurements will assess the geothermal potential of the area.

M. A. Reiter, New Mexico Institute of Mining and Technology, Socorro.

7. *Stimulation of geothermal aquifers:* Physical and mathematical models of a geothermal steam reservoir will provide data on explosion stimulation of aquifers.

P. Kruger and H. J. Ramey, Stanford University, Stanford, California.

8. *Technical assessment of geothermal energy:* A forecast of the future from a political, economic and environmental point of view will be used by the N.S.F. for planning their geothermal program.

J. Gordon, The Futures Group, Glastonbury, Connecticut.

9. *The legal and economic aspects of geothermal development:* An analysis of rights of ownership to geothermal resources and their economic implications will delineate legal problems in the development of the resources.

S. Sato, University of California, Berkeley. M.J.R.

**COLORADO
EXPLORATION AGREEMENT**

Public Service Co. of Colorado and Petro-Lewis Corp. have signed a contract for exploration and development of geothermal resources in north-central Colorado, near Buena Vista. Petro-Lewis will provide the geothermal wells and surface steam lines, and Public Services will build the electrical generating and transmission facilities. Their first venture will be a small, 1.5 megawatt, pilot plant.

Denver Post

*** WELL OPERATIONS ***

LAKE COUNTY, OREGON

Gulf Oil Co.

Gulf geothermal exploration well "Favell-Utley" 1-ST, 1 1/2 km west of Lakeview, was drilled to a depth of 1658 m and abandoned on November 15, 1973.

This was the last of five exploration wells drilled by Gulf in 1973. Four of the wells were drilled in California (see Hot Line v. 3, nos. 4, 5, & 6). A sixth well proposed for the Klamath Falls area has been postponed until the 1974 drilling season. *M.J.R.*

SONOMA COUNTY, CALIFORNIA

**The Geysers Geothermal Field
Geothermal Kinetics Systems Corporation**

Geothermal Kinetics well "Rorabaugh" 1, on the southwest side of Big Sulphur Creek, was completed November 9, at a depth of 2195 m. Steam was encountered in several zones below 1347 m. Estimated production for the well is 45,000 kg/hr. *M.J.R.*

Pacific Energy Corporation

In December, Pacific Energy filed a notice to drill the first well on their Bruno lease. The well "Bruno" 1 will be 247.5 m north and 112.1 m west of the southeast corner of Sec. 14, T.11N., R.9W., M.D.B.&M. The elevation at the kelly bushing will be 696.3 m. This lease block adjoins P.E.C.'s Rorabaugh lease where several producing wells have been drilled. *M.J.R.*

IMPERIAL COUNTY, CALIFORNIA

Q.B. Resources, International

Q.B. Resources has completed their observation well located 604 m north and 201 m east from southwest corner

STATE OF CALIFORNIA
DIVISION OF OIL AND GAS
1416 NINTH STREET, ROOM 1316-35
SACRAMENTO, CALIFORNIA 95814

of Sec. 1, T. 9S., R. 12E., S.B.B.&M. The well was drilled at a point along the frontal fault system of the Chocolate Mountains in an area of hot springs and wells. *M.J.R.*

U. S. Bureau of Reclamation

The Bureau's well, "Mesa" 6-2, has undergone preliminary testing. Drilled to a depth of 1831 m, the well has a maximum bottom hole temperature of 187°C. The maximum shut-in pressure at the wellhead is 8 bars. Unrestricted flow through a 20.3 cm pipe produced 8560 kg/hr steam and 44,940 kg/hr water at 109°C and 1.9 bars.

The well is located in SE/NE/SW 1/4, Sec. 6, T. 16S., R. 17E., S.B.B.&M. near the well "Mesa" 6-1 and the experimental desalting plant. *M.J.R.*

Geothermal Hot Line

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Ray B. Hunter, Director
Department of Conservation

John F. Matthews, Jr.
Oil and Gas Supervisor

David N. Anderson, Editor
Glen E. Campbell, Asst. Editor
Marshall J. Reed, Asst. Editor
Don Lande, Asst. Editor

1416 Ninth Street, Room 1316-35
Sacramento, CA 95814
(916) 445-9686