B.L.M. MEETING FOR GEOTHERMAL OPERATORS

The Bureau of Land Management has announced that it will hold a one day B.L.M. - Geothermal Operator roundtable discussion regarding Federal Regulations as applied to geothermal leasing, on February 20, 1974, at 9:00 a.m. at the B.L.M. office, 2800 Cottage Way, Sacramento, California, 95825. If you plan to attend, write or call George Nielsen (phone (916) 484-4701). D.N.A.

JOINT VENTURE ANNOUNCED

Geothermal Resources International, Inc., of Marina del Rey, California, announced in mid-January, the completion of an agreement in principal with Chevron Oil Co., a wholly owned subsidiary of Standard Oil Co. of California. Under this agreement the two companies will move toward the acquisition, exploration and development of certain lands in California for the purpose of producing geothermal energy. GRI holds preference rights under the Geothermal Steam Act of 1970 for these lands. Chevron will be the operator of this joint venture and will conduct the necessary geologic research prior to the exploratory drilling.

G.E.C.

GEOTHERMAL FIELD MAPS

The Division of Oil and Gas map G5-1 of the Casa Diablo Geothermal Field has been completely revised. Changes include surveyed well locations and corrected names and numbers for the wells. The names and numbers now correspond to those used during the period of drilling from 1959 to 1969. The three geothermal field maps G1-1 (Salton Sea), G5-1 (Casa Diablo), and G6-1 (The Geysers) are $1.00 each. All geothermal maps are drawn to a scale of 1:20,000.

M.J.R.

GEOTHERMAL DEVELOPMENT IN NICARAGUA

The joint U.N.-Nicaragua geothermal project has gone through a series of ups and downs. As the project was initially set up, geotechnical and feasibility studies were to be followed by exploratory drilling. However, subsequent to the December 1972 Managua earthquakes, the project was curtailed to geotechnical studies only; the balance of the budget having been shifted to other Nicaraguan projects of higher priority. In October 1973, when the world energy crisis became obvious, the Nicaraguan government again re-ordered its system of priorities and shifted funds back to geothermal exploration. Feasibility studies and drilling are now scheduled.

Two areas are being considered for development: Volcan Momotombo and San Jacinto. Resitivity surveys run by the U.N., supplementing previous studies by U.S. A.I.D., show that both areas are characterized by low resistivity anomalies of less than 5 ohm-m.

One interpretation of the resistivity data of the Momotombo area suggests that molten rock may exist at a depth of only 2 km. Momotombo has erupted once in this century and at present is steaming in the crater and on some slopes. Hence, the question of siting a powerplant there is complicated by the potential of a volcanic eruption.

T. Meidav

GEOTHERMAL DEVELOPMENT IN CHILE

Geothermal exploration at El Tatio, high on a remote desert plateau in northern Chile, began in 1967 with a program of geological studies and was followed by the drilling of several slim holes. Slim-hole drilling was done as a practical necessity because of the altitude (4000m+) and remoteness of the area. For the same reasons, this joint U.N.-Chilean project has progressed very slowly. However, in spite of the numerous setbacks, standard diameter drilling is now underway at El Tatio.

T. Meidav
**FEDERAL GEOTHERMAL LEASE SALE**

The first Federal geothermal lease sale was held at the Bureau of Land Management office in Sacramento, California, on February 27, 1974. More than 50 acres in three Known Geothermal Resource Areas (K.G.R.A.): Geysers, Mono-Long Valley, and East Mesa were put up for bid. The Bureau of Land Management off

Unit 2 1175 acres Union Oil Co, 129.161.00 807.26 g

Unit 5 1169 acres Union Oil Co, 180.288.00 288.00

Department 7 162 acres Union Oil Co, 25.28 23

Union Oil Co. of Calif. 297.36

Union Oil Co. of Calif. 297.36

Union Oil Co. of Calif. 297.36

Unions 4, 5, and 7 received no bids

East Mesa K.G.R.A.

Unions 1 and 2 received no bids

Unit 3 (1772.70 acres) Union Oil Co $ 515,767.07 209.95

West Mesa K.G.R.A.

Units 5 and 6 received no bids

Unit 10 (265 acres) Signal Oil & Gas $ 68,042.84 316.13

Unit 12 (236 acres) Union Oil Co $ 12,243.56 5.11

Unit 5 (169 acres) Union Oil Co $ 80,842.84 397.36

Unit 9 (160 acres) Occidental Pet. Corp. Union Oil Co $ 165,360.00 807.36

Unit 10 (222 acres) Occidental Pet. Corp. Union Oil Co $ 226,662.00 1,021.00

Unit 11 (45 acres) Union Oil Co $ 22,858.10 108.16

Unit 12 (737 acres) Signal Oil & Gas $ 56,646.00 76.89

Union Oil Co. $ 19,631.36 22.28

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**EXPLOSION IN GREECE**

The Greek government has been conducting exploration for geothermal resources during the past two years. Most of the potential prospects are on islands in the Aegean Sea, but some mainland areas are also under consideration. Areas in various stages of exploration are Mikos island, Nisyros Island, Lesbos Island, the Methana Peninsula, the Sorousi region, Thermopyle, and northern Evia.

The greatest interest has centered on the island of Mikos, 150 km south of Athens, where four 1000 m deep wells will be drilled this summer. The drilling sites were chosen on the basis of temperature gradient measurement in over 65 hot flow (50 to 100°C) geothermal fields, geologic mapping, electrical resistivity surveys, and chemical sampling of hot springs and fumaroles. Geothermal fluids are expected to exist in a layer of Mesozoic andesite and andesitic. Above the metamorphic basement are a Late Tertiary limestone and extensive Quaternary siliceous volcanic rocks.

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**GERMAN PRIETO COST ANALYSIS**

The Mexican Department of Geothermal Resources reported that "Geothermal Plant Cecco Prieto, 75 MW," dated June 1973. This report describes the equipment and methods used in constructing the power plant and gives a cost breakdown for the power plant and support works. (For cost of the total field development, see "Hot Line" v. 3, n. 7, Dec. 1973.)

**SUMMARY OF COSTS**

**Peyes** **Dollars**

- Previous studies
- Drilling, control and conditioning of wells
- Surface installations
- Steam lines and accessories
- Collectors and secondary separators
- Turbogenerator units, condensers and ejectors
- Cooling towers
- Fire prevention
- Water storage tank
- Projectors
- Public works and construction materials
- Electromechanical equipment
- Land acquisition and ground preparation
- Defogging system
- Accessory equipment
- Substation
- Transmission lines
- Substation direct costs
- Indirect costs

**TOTAL**

- 3,000,000
- 46,600,000
- 2,500,000
- 10,500,000
- 840,000
- 1,400,000
- 16,000
- 3,000,000
- 240,000
- 18,500,000
- 6,000,000
- 8,600,000
- 450,000
- 1,500,000
- 1,200,000
- 9,400,000
- 2,243,560
- 2,250,000
- 1,400,000
- 42,600,000
- 124,000,000
- 1,424,000

**EXPLORATION IN EL SALVADOR**

As a result of the completion of a successful exploration and development program, jointly sponsored by the government of El Salvador and the United Nations, a 30 MW geothermal powerplant is now under construction at the Abacapan Field. Exploration activities began there in 1965, and the powerplant is expected to be producing electricity late this year or early in 1975. Drilling is now underway for Phase II in development of this area of Quaternary andesite volcanoes. It is expected that a second 30 MW powerplant will be built and producing electricity as early as 1976. By 1978, a bottoming-cycle powerplant should be producing power by utilizing the water hot water from the first two plants, putting it through a lower pressure stage for secondary flashing, to generate another 20 MW of electricity. Thus, the total generating capacity at Abacapan is expected to be 80 MW by the end of 1978.
**SUMMARY OF ACTIVITY AT THE GEYSERS - 1973**

Development activity at The Geysers Geothermal field in 1973 showed a marked increase over 1972, with 2 new wells being drilled and one existing well being deepened. A total of 335,865.1 m (20 new wells) were drilled producing 47,281.1 m of new hole had been drilled.

- **The deepest well drilled during the year was Union Oil Company's 'LS State 4597' (Sec. 20, T. 11N., R. 9W., M.D.B.R.M.) to a total depth of 2401.2 m, making it the deepest geothermal well in the world.**

- **During testing it produced dry steam at the rate of 45,260 kg/h.**

Pacific Energy Company completed the most prolific well of the year when their well, "Rarabora" A-7, in Sec. 1, T. 11N., R. 9W., flowed dry steam at the rate of 138,000 kg/h, during a test. The total depth of this well was 1881.7 m.

**WELL OPERATIONS**

**MARICOPA COUNTY, ARIZONA**

Geothermal Kuwait Systems Corp.

- In early January GKS ran drilling tests in both of their wells near Higley (see Hot Line v. 3, n. 3). In "Power Ranches" 1, with packers set at 2287 m in 1982, the flow rates were 206 l/min and 582 l/min, respectively. In "Power Ranches" 2 tests indicated that the upper producing zones were closed off and that the casing had been poorly cemented; consequently the top of the producing zone was squeeze-cemented, thereby recompressing the casing and plugging off the unwanted zone.

**PHILIPPINES - NEW ZEALAND COOPERATIVE PROJECT**

Geothermal personnel and equipment of the New Zealand government have been made available to the consultation of Bayesian Engineering & Allied Ltd. of Auckland. The company is carrying out a Philippine - New Zealand technical cooperation project for geothermal development.

In the Tungonan Valley on the north end of Leyte Island, a shallow well exploration drilling program is underway, and if preliminary results are favorable, production drilling will follow. The involvement of K.R.T.A. with construction from exploration to exploitation is currently in design.

- Previously, the Union Oil Co. operation in the Tawi-Tawi field of Southern Luzon Island was the only foreign participation in geothermal development of the Philippines.

**BOX ELDER COUNTY, UTAH**

Geothermal Kuwait Systems Corp.

In mid-February Geothermal Kinetics, in joint venture with Utah Power and Light Co., hopes to begin drilling a deep geothermal test well a few miles south of one of Utah's major hot springs, Crystal Hot Springs, which flows at a rate of about 475 l/min. at 85°C from fissures in the Wasatch Front fault zone.

GKS expects to drill through a thick section of Paleozoic carbonate rocks and intersect one or more of the faults in the Wasatch Front fault zone at depth. G.E.C.
MENDOCINO COUNTY, CALIFORNIA

Sun Oil Co.

In early January Sun Oil Co. filed with the Division of Oil and Gas a notice to drill a wildcat geothermal well, "Annette Fedeli" 1. This new well will be 567 m north and 1059 m west of the southeast corner of Sec. 23, T. 12N., R. 10W., M.D.B.&M., which is approximately 2075 m west of Cordero Mining Co.'s "Torchio-Ferro" 1, drilled (2422 m total depth) and abandoned in 1972.

Sun plans to begin drilling operations in early spring.

G.E.C.

MODOC COUNTY, CALIFORNIA

Kelley Hot Springs, Ltd.

A notice has been filed to drill a geothermal prospect well "Kelley Hot Springs" 1, 4.5 km east-northeast of Canby. This exploratory test is 805 m east and 15 m north from the southwest corner of Sec. 21, T. 42N., R. 10E., M.D.B.&M. Drilling will begin when the weather becomes favorable, possibly in April or May. In 1971, Geothermal Resources International drilled "Kelly Hot Springs Ranch" 1 at a location 1300 m southwest of the present exploration site, and was abandoned at a depth of 977 m.

G.E.C.

PLUMAS COUNTY, CALIFORNIA

Phillips Petroleum Co.

Phillips well "Filippini-A" 1 located 488m east and 137 m north from the southwest corner of Sec. 32, T. 22N., R. 15E., M.D.B.&M. was abandoned at a total depth of 680 m. Approximately 400 m of lake sediments and 250 m of volcanic rocks were drilled before granitic rock was encountered.

M.J.R.

SONOMA COUNTY, CALIFORNIA

The Geysers Geothermal Field
Geothermal Kinetics Systems Corp.

Geothermal Kinetics filed a notice to drill well "Rorabaugh" 2 with the Division of Oil and Gas in January 1974. It will be the second well drilled by GKS in California. The well will be 24 m north and 128 m west of the west-quarter corner of Sec. 14, T. 11N., R. 9W., M.D.B.&M., and is intended to augment production on their Rorabaugh lease. Weather permitting, "Rorabaugh" 1 (560 m south of proposed "Rorabaugh" 2), completed in late 1973, will undergo extensive production testing to determine the reservoir potential.

G.E.C.

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