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GEOTHERMAL PROGRESS MONITOR
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U.S. Department of Energy
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and Renewable Energy
Division of Geothermal Energy
Washington, D.C. 20461

Prepared in Cooperation With the
Interagency Geothermal Coordinating Council
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DISCLAIMER

PREFACE

The Geothermal Progress Monitor Report is published periodically and disseminated within the federal government and to major DOE contractors who need current information on geothermal energy development. The report provides information on status changes and the overall rate of progress in the development of U.S. geothermal resources. These changes are reported to and observed by the Geothermal Progress Monitor (GPM) System.

The primary purpose of the GPM System is to monitor and report activities in the geothermal industry in order to assist the Division of Geothermal Energy and other member agencies of the Interagency Geothermal Coordinating Council (IGCC) in determining R&D priorities.

The principal objectives of the GPM System are to:

1) provide a single point of reference on a national basis for the status of the various geothermal activities, especially R&D directed at solution of recognized technical problems;

2) identify significant trends in these activities; and

3) report events that may have significant impact on the course of these activities.

The reports focus on two types of information:

- Status - the baseline of how much energy is being produced from geothermal sources and the level of activity being pursued to increase production.

- Trends - changes that occur with respect to the baseline information and the possible significance of such trends.

Each of these types of information is addressed, as appropriate, in the separate subject sections listed in the Table of Contents, with the Executive Summary providing a quick highlighting of the new information in each report.

The overall objective of this report is usefulness. The only way to determine its usefulness is by response from its recipients and users. Therefore comments on any aspect of the contents or presentation are encouraged. All comments and contributions will be given serious consideration, even though staff or schedule limitations may preclude their immediate incorporation into the current report. For any contributions, please include a name and address or phone number for follow-up or further information.

These GPM Reports are part of an interactive process, whereby contributions from DOE Headquarters and the field will shape the contents of the reports. Continuing input is needed regarding types of information or analyses that would be of use to recipients.

All IGCC participants are requested to submit items of interest, particularly:

1) changes in policy or regulations, both final and pending;

2) important events in the field, with a comment on the possible significance of the event; and

3) brief data summaries or statistics that may clarify status or indicate trends.

All comments or contributions are welcome. Please address them to:

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EXECUTIVE SUMMARY

This issue of the Geothermal Progress Monitor Report presents updated information on activities and progress in the areas of electric power plants, direct heat applications, deep well drilling, leasing of federal lands, legislative and regulatory actions, research and development, and others. Special attention is given in this report to 1980 highlights, particularly in the areas of electric and direct heat uses, drilling, and the Federal lands leasing program. This report also includes a summary of the DOE FY 1982 geothermal budget request to Congress. Highlights of this issue include the following:

ELECTRIC USES

- Section 1.0 reviews 1980 milestones in bringing geothermal electric power plants on line. Generating capacity at The Geysers was brought to 902 MWe in September 1980. The addition of two 10 MWe plants at Brawley and East Mesa geothermal fields in California brought total U.S. generating capacity to 922 MWe. Section 1.0 also summarizes the status of 32 proposed geothermal electric power plants.

DIRECT HEAT USES

- By the end of 1980, 211 direct use developments in 14 states were providing 12,647 billion Btu annually. Fifteen new projects were put into operation in 1980, supplying 279 billion Btu per year. A unique geothermal sub-industry achieved rapid growth in 1980; four plants using geothermal process heat to produce ethanol are now in service, producing five million gallons of ethanol annually. Four more such plants are under development and 49 are under consideration.

DRILLING

- Sixty-eight deep wells in eight states were spudded and completed in 1980 and early 1981. Forty-two of these are considered producible. A state-by-state summary of deep well completions during the period 1973-1980 shows that the greatest concentration of deep drilling activity remains in California at The Geysers and in the Imperial Valley.

LEASES

- Section 5.0 presents the status of competitive and noncompetitive leases at the end of FY 1980 and a summary of competitive lease sales in 1980. Total acreage under lease as of the end of FY 1980 showed an increase of only about 260,000 acres over the FY 1979 total. The amount of KGRA land leased at the end of 1980 was essentially unchanged compared to the end of 1979. Though the level of federal activity in processing applications appears to have increased in 1980, the backlog of applications grew as a result of an increased rate of new applications for noncompetitive leases.

1.0 ELECTRIC USES

Currently, nearly all commercial electric power-on-line from geothermal sources is from The Geysers field in Northern California, which has been developed exclusively by private industry. With the addition of the 110 MWe Pacific Gas & Electric (PG&E) Unit #14 in September 1980, the current Geysers generating capacity is 902 MWe. PG&E Units #17 and #18, both 110 MWe plants now under construction, are tentatively scheduled to come on-line in late 1982 and May 1983 respectively. The only operational geothermal electric plants in the United States outside The Geysers are the Union Oil/Southern California Edison 10 MWe plant at Brawley and the Magma Power 10 MWe binary plant at East Mesa; both sites are in California's Imperial Valley. The Brawley plant has been operational since June 1980. The East Mesa plant which came on-line in June 1980 was forced to shut down temporarily in November 1980. Both the Brawley and East Mesa plants are currently on line. However, neither of these two plants has achieved full operational status.

1.1 1980 Highlights

- Pacific Gas and Electric Company Unit #13 On-Line

  PG&E Unit #13 at The Geysers went on-line in May 1980. At 135 MWe (gross) and 129 MWe (net), this is the largest geothermal electric operating plant in the world. This is the first unit at The Geysers to be located in Lake County.
  Source: Valley Times, CA, 6/80

- Pacific Gas and Electric Company Unit #14 On-Line

  PG&E Unit #14 at The Geysers went on-line in September 1980. The 114 MWe (gross) and 110 MWe (net) geothermal electric plant is the second largest of the fifteen PG&E Units operating at The Geysers.
  Source: The Geysers, 12/80
  Lawrence Berkeley Laboratory, 10/80

- Brawley - Southern California Edison Company Demonstration Plant On-Line

  SCE's 10 MWe demonstration plant went on-line in June 1980. The plant is located 2 miles north of Brawley in California's Imperial Valley. This geothermal electric power plant is the first commercial operating plant outside The Geysers and the first commercial plant installed at a U.S. liquid-dominated resource. The single-stage flash system developed by Union Oil Company of California is the first flashed steam plant to operate in the U.S.
  Source: Petroleum Information Corporation, 10/80
  Rancho News, San Diego, CA, 11/80

- East Mesa - Magma 10 MWe Binary

  The Magma Power Company 10 MWe binary plant first came on-line in June 1980. This is the first pilot-scale binary-cycle plant to operate in the U.S. It has many unique design features, including an evaporative pond instead of cooling towers for the heat rejection system.

  The plant was forced to shut down on November 15, 1980 due to the loss of several turbine blades. It is back on-line as of February 1981, but has not reached full operational status.
  Source: DOE, 12/10/80
  Magma Power Company, 3/81

- Pacific Gas and Electric Company Unit #18 Receives Application for Certification (AFC) Approval in 12 Months

  Recently the California Energy Commission instituted a new streamlined procedure for evaluation of AFC for geothermal electric plants. PG&E Unit #18 at The Geysers is the first plant to gain AFC approval under this new siting process. The 110 MWe Unit received the AFC approval in 12 months as opposed to the normal 18-24 months. This is a one-step siting process which allows the applicant to forego the Notice of Intent if it can be proven that the site is capable of supplying geothermal fluid in commercial quantities.
  Source: California Energy Commission News, 7/80

- Southern California Utilities to Buy Mexican Geothermal Power

  On November 12, 1980, San Diego Gas and Electric (SDG&E), Southern California Edison (SCE) and the Comision Federal de Electricidad of Mexico signed an agreement that provides for the

purchase of 220 MWe of Mexican geothermal power for ten years. This will be the first international transfer of geothermal power in North America.

The Mexican electricity, 150 MWe to be purchased by SDG&E and 70 MWe purchased by SCE, will not reach California customers until Spring 1984, when four power plants at Cerro Prieto are expected to be in operation. Under the contract, power will be relayed from Cerro Prieto to a sub-station in Tijuana, then over a proposed 13-mile, 230 KV power transmission line to SDG&E's Mingues sub-station for distribution. The two companies may buy additional power from Mexico, possibly as much as 300 MWe each, if the Mexican geothermal resources prove adequate.
Source: Los Angeles Times, 1/16/81

- Roosevelt Hot Springs - Utah Power and Light Company Signs Agreement With Phillips Petroleum Company

On September 18, 1980, Phillips Petroleum Company and the Utah Power and Light Company signed a contract for the construction of a 20 MWe (Net) pilot plant at Roosevelt Hot Springs, Utah. This will be the first privately funded geothermal electric power plant of any significant size outside of California. The Utah Public Service Commission approved the contract in December 1980. The power plant will cost $23 million and is scheduled to go on-line early in 1983.
Sources: Deseret News, Salt Lake City, UT, 9/18/80
Albuquerque Journal, Albuquerque, NM, 9/22/80
DOE-ID, 12/80

- NORNEV Developments

During 1980, the NORNEV consortium of five utilities (Sierra Pacific Power Company, Sacramento Municipal Utility District, Eugene Water and Electric Board, Pacific Power and Light, and Portland General Electric) made considerable progress in their project to establish a 10 MWe pilot scale electric plant at a Nevada geothermal prospect. A 10 MWe binary semi-portable plant has been ordered from HBA Energy Systems. The utility group is considering five potential sites which are: Steamboat Springs, Beowawe, Desert Peak, Salt Wells and Dixie Valley.
Source: GRC Bulletin, 9/80
Eugene, Oregon Register-Guard, 1/27/81

1.2 Geothermal Electric Plants On-Line

Table 1-1 lists Geothermal Electric Plants On-Line in the U.S. at the present time, as well as the sources of information used for Table 1-1, and Table 1-2, Geothermal Electric Plants Proposed.

1.3 Proposed Geothermal Electric Plants

Table 1-2 lists the Geothermal Electric Plants proposed in the U.S. as of March 31, 1981.

Note that the Oxy Geothermal 80 MWe (gross) power plant at The Geysers as well as the 25 MWe power plant in the Puna district of Hawaii have been added to the proposed geothermal electric plant list since GPM Report #4 was published in September 1980. Also note that planning for Sacramento Municipal Utility District (SMUD) Units #2 and #3 in The Geysers is now reported to be relatively inactive. The Sierra Pacific Power Company (SPPC) 50 MWe Unit at the Desert Peak site has been reported changed to two 10 MWe Units planned under the auspices of the NORNEV consortium. The sites under consideration for these Units are: Steamboat Springs, Beowawe, Desert Peak, Salt Wells, and Dixie Valley.

Proposed Plant Status Summaries

Brawley - California Department of Water Resources #1

The resource assessment phase for this 45 MWe proposed plant will be completed in the Spring of 1981. The power-on-line date is scheduled for 1984.

Brawley - Southern California Edison Company

In addition to SCE's pilot plant on-line, this area is viewed by SCE as a potential site for additional expansion.

COSO - COSO #1 and #2

The Environmental Impact Statement was issued in March 1981 for Coso #1, a 20 MWe plant. The drilling of three wells will commence in the second quarter of 1981 as part of the exploration phase.

TABLE 1-1
GEOTHERMAL ELECTRIC PLANTS: ON LINE

STATE	AREA	DEVELOPER	UTILITY	PLANT	PLANT TYPE	NET OUTPUT MWE	YEAR ON LINE	PLANT COST $ 000	SOURCES OF INFORMATION
CA	BRAWLEY	UNION OIL	SCE	SCE PILOT	FLASH	10	1980	10,040	1
CA	EAST MESA	MAGMA POWER	SDG&E		BINARY	10	1980	16,093	2, 3,16
CA	GEYSERS	UNION-MAGMA-THERMAL	PG&E	UNIT # 1	STEAM	11	1960	2,005	4
CA	GEYSERS	UNION-MAGMA-THERMAL	PG&E	UNIT # 2	STEAM	13	1963	2,005	4
CA	GEYSERS	UNION-MAGMA-THERMAL	PG&E	UNIT # 3	STEAM	27	1967	3,805	4
CA	GEYSERS	UNION-MAGMA-THERMAL	PG&E	UNIT # 4	STEAM	27	1968	3,805	4
CA	GEYSERS	UNION-MAGMA-THERMAL	PG&E	UNIT # 5	STEAM	53	1971	6,378	4
CA	GEYSERS	UNION-MAGMA-THERMAL	PG&E	UNIT # 6	STEAM	53	1971	6,378	4
CA	GEYSERS	UNION-MAGMA-THERMAL	PG&E	UNIT # 7	STEAM	53	1972	5,760	4
CA	GEYSERS	UNION-MAGMA-THERMAL	PG&E	UNIT # 8	STEAM	53	1972	5,760	4
CA	GEYSERS	UNION-MAGMA-THERMAL	PG&E	UNIT # 9	STEAM	53	1973	6,760	4
CA	GEYSERS	UNION-MAGMA-THERMAL	PG&E	UNIT #10	STEAM	53	1973	6,760	4
CA	GEYSERS	UNION-MAGMA-THERMAL	PG&E	UNIT #11	STEAM	106	1975	19,666	4
CA	GEYSERS	UNION-MAGMA-THERMAL	PG&E	UNIT #12	STEAM	106	1979	27,580	4
CA	GEYSERS	AMINOIL USA	PG&E	UNIT #13	STEAM	129	1980	52,800	4, 5
CA	GEYSERS	UNION-MAGMA-THERMAL	PG&E	UNIT #14	STEAM	110	1980	27,966	4
CA	GEYSERS	THERMOGENICS	PG&E	UNIT #15	STEAM	55	1979	25,530	4
STATUS TOTAL						922		229,091	

SOURCES OF INFORMATION FOR TABLE 1-1 AND TABLE 1-2

1 3/81 SOUTHERN CALIFORNIA EDISON
2 3/81 MAGMA POWER INC.
3 3/81 SAN DIEGO GAS & ELECTRIC
4 3/81 PACIFIC GAS & ELECTRIC
5 3/81 AMINOIL USA
6 3/81 CALIFORNIA DEPARTMENT OF WATER RESOURCES
7 SCE HAS CONTRACT WITH UNION OIL FOR 460 MWE STEAM SUPPLY
8 3/81 CALIFORNIA ENERGY COMPANY
9 3/81 US NAVY
10 3/81 REPUBLIC GEOTHERMAL INC.
11 3/81 MCR GEOTHERMAL INC.
12 3/81 GEOTHERMAL KINETICS INC.
13 3/81 NORTHERN CALIFORNIA POWER AUTHORITY
14 3/81 SACRAMENTO MUNICIPAL UTILITY DISTRICT
15 3/81 GEOPRODUCTS INC.
16 3/81 DEPARTMENT OF ENERGY / SAN FRANCISCO
17 3/81 MAPCO INC.
18 3/81 HAWAII DEPARTMENT OF PLANNING & ECONOMIC DEVELOP
19 3/81 IDAHO NATIONAL ENGINEERING LABORATORY
20 3/81 DEPARTMENT OF ENERGY / BACA
21 3/81 SIERRA PACIFIC POWER COMPANY
22 UP&L HAS OPEN ENDED CONTRACT WITH PHILLIPS
23 3/81 UTAH POWER & LIGHT

TABLE 1-2
GEOTHERMAL ELECTRIC PLANTS: PROPOSED

STATE	AREA	DEVELOPER	UTILITY	PLANT	PLANT TYPE	NET OUTPUT MWE	YEAR ON LINE	PLANT COST $ 000	SOURCES OF INFORMATION
CA	BRAWLEY	UNION OIL	SCE						1
CA	BRAWLEY	CU-I VENTURE	CDWR		FLASH	45	1984		6
CA	BRAWLEY	UNION OIL	SCE	SCE					1, 7
CA	COSO	CALIFORNIA ENERGY	US NAVY	COSO # 1	FLASH	20	1983		8, 9
CA	COSO	CALIFORNIA ENERGY	US NAVY	COSO # 2	FLASH	55	1985		8, 9
CA	EAST MESA	REPUBLIC GEOTHERMAL	SDG&E		FLASH	50	1982	80,000	3
CA	GEYSERS		CDWR	BINKLEY	STEAM	55	1986		6
CA	GEYSERS	MCR GEOTHERMAL	CDWR	BOTTLE ROCK	STEAM	55	1984		6
CA	GEYSERS	NCPA	NCPA	NCPA # 1	STEAM	66	1985		13
CA	GEYSERS	SHELL OIL	NCPA	NCPA # 2	STEAM	110	1982	28,000	13
CA	GEYSERS	OCCIDENTAL GEO.INC.		CXI # 1		80	1988		
CA	GEYSERS	AMINOIL USA	SMUD	SMUD # 1	STEAM	75	1984		5,14
CA	GEYSERS		SMUD	SMUD # 2	STEAM	55			14
CA	GEYSERS		SMUD	SMUD # 3	STEAM	55			14
CA	GEYSERS	GEOTHERMAL KINETICS	CDWR	SO. GEYSERS	STEAM	55	1986		6
CA	GEYSERS	AMINOIL USA	PG&E	UNIT #16	STEAM	110	1983	42,700	4, 5
CA	GEYSERS	UNION-MAGMA-THERMAL	PG&E	UNIT #17	STEAM	110	1982	41,592	4
CA	GEYSERS	UNION-MAGMA-THERMAL	PG&E	UNIT #18	STEAM	110	1982	48,882	4
CA	GEYSERS	AMINOIL USA	PG&E	UNIT #19	STEAM	55	1986		4
CA	GEYSERS	UNION-MAGMA-THERMAL	PG&E	UNIT #20	STEAM	110	1984		4
CA	GEYSERS	UNION-MAGMA-THERMAL	PG&E	UNIT #21	STEAM	110	1986		4
CA	GEYSERS		PG&E	UNIT #22	STEAM	110	1990		4
CA	GEYSERS		PG&E	UNIT #23	STEAM	110	1990		4
CA	GEYSERS		PG&E	UNIT #24	STEAM	110	1990		4
CA	HEBER	CHEVRON	SDG&E		BINARY	45	1985	128,400	3
CA	HEBER	CHEVRON	SCE	SCE # 1	FLASH	50	1983		1
CA	HEBER	CHEVRON	SCE	SCE # 2	FLASH	100	1986	110,000	1
CA	MONO-LONG VALLEY	MAGMA POWER	SCE		HYBRID	20	1985		1, 2
CA	NILAND	UNION OIL	SCE	SCE					1, 7
CA	NILAND	UNION OIL	SCE	SCE PILOT		10	1982		1, 7
CA	NILAND	MAGMA POWER	SDG&E	SDG&E# 1	FLASH	26	1983	30,000	2, 3
CA	NILAND	MAGMA POWER	SDG&E	SDG&E# 2	FLASH	49	1985	50,000	2, 3
CA	WENDEL-AMEDEE	GEOPRODUCTS	CDWR		HYBRID	50	1985	60,000	6,15
CA	WESTMORLAND	REPUBLIC GEOTHERMAL			FLASH	48	1984		10
HI	PUNA	THERMAL-DILLINGHAM	HELCO			25	1988		18
HI	PUNA	STATE OF HAWAII	HELCO	HGP-A	FLASH	3	1981	7,000	18
ID	RAFT RIVER	INEL/EG&G			BINARY	5		24,000	19
NM	VALLES CALDERA	UNION OIL	PNM	PACA # 1	FLASH	45	1983		20
NV	NORTHERN NEVADA	PHILLIPS PETROLEUM	NORNEV	NORNEV#1	BINARY	10	1982		14,16,21
NV	NORTHERN NEVADA	PHILLIPS PETROLEUM	NORNEV	NORNEV#2	BINARY	10			14,16,21
NV	NORTHERN NEVADA	PHILLIPS PETROLEUM	NORNEV	NORNEV#3	FLASH	10			14,16,21
UT	ROOSEVELT H.S.	PHILLIPS PETROLEUM	UP&L	UP&L # 1	FLASH	20	1983	20,000	22,23
UT	ROOSEVELT H.S.	PHILLIPS PETROLEUM	UP&L	UP&L # 2	FLASH				22,23
UT	ROOSEVELT H.S.	PHILLIPS PETROLEUM	UP&L	UP&L # 3					22,23
STATUS TOTAL						2,237		670,574	

If Coso #1, scheduled to go on-line in 1982 is sufficiently successful, Coso #2, a 55 MWe plant, will be built. Power-on-line is scheduled for 1989.

East Mesa - San Diego Gas and Electric Company

There is no reported activity on this proposed geothermal electric plant at this time.

Oxy Geothermal Plant #1

Application for Certification was filed with the State of California Energy Resources Conservation and Development Commission. A Plan of Development for Federal Lease CA-5637, Lake County, was submitted to the U.S. Geological Survey. The proposed plan is to construct one multi-well pad, to drill 13 additional development wells (2 wells already drilled) and to construct a steam pipeline system from the wells to Occidental's proposed power plant site. An Environmental Assessment Report will be prepared by the U.S. Geological Survey Office. Power-on-line is scheduled for 1988.

Bottle Rock - California Department of Water Resources

This plant is fully licensed. However, county ordinance prohibits earthwork during the winter due to erosion problems associated with rainy weather. Site preparation will commence in the Spring of 1981, and power-on-line is scheduled for 1984.

Geysers - Binkley - California Department of Water Resources

The California Department of Water Resources is currently negotiating for an operator for this proposed plant.

South Geysers - California Department of Water Resources

The Application for Certification was submitted and approval is expected by December of 1981. The power-on-line date is tentatively set for September 1986 but may be advanced if the construction schedule is adjusted.

Geysers - Northern California Power Agency #1

NCPA is currently drilling at this Geysers site and they are in the final licensing stage of development. They have received Notice of Intent approval. Plant construction is scheduled for 1983 and power-on-line is scheduled for September of 1985.

Geysers - Northern California Power Agency #2

Plant foundation work is in progress and is currently about 25 percent complete. Overall construction of the plant is 10 percent complete. All of the equipment procurement contracts have been awarded by NCPA and they are taking delivery on some items. Power-on-line for this plant is scheduled for October 1982.

Geysers - Pacific Gas and Electric Company Unit #16

PG&E expects a decision by June 1981 from the California Energy Commission regarding their resubmitted Application for Certification which included additional analyses of air quality for hydrogen sulfide.

Geysers - Pacific Gas and Electric Company Unit #17

Construction of this plant began in June of 1980. Power-on-line is scheduled for late 1982.

Geysers - Pacific Gas and Electric Company Unit #18

Construction of this plant began in May of 1980. Power-on-line is scheduled for May of 1983.

Geysers - Pacific Gas and Electric Company Unit #19

Although no specific site has been proven for this proposed electric plant, exploration is continuing. Power-on-line is scheduled for 1986 or later depending upon the outcome.

Geysers - Pacific Gas and Electric Company Unit #20

PG&E is in the site selection phase for this electric plant. Power-on-line is scheduled for December of 1984.

Geysers - Pacific Gas and Electric Company Units #21, #22, #23, and #24

These potential electric plant sites are predicated upon the drilling and exploration process now in progress. The estimated power-on-line date for PG&E Unit #21 is 1986. The other plants are scheduled to come on-line in 1990.

Geysers - Sacramento Municipal Utility District #1

The Application for Certification for this plant was received on March 25, 1981. Construction is scheduled to commence in the Spring of 1981. Power-on-line is scheduled for December of 1983.

Geysers - Sacramento Municipal Utility District #2 and #3

According to SMUD, it is highly uncertain that these two plants will come on-line in the near term.

Heber - Southern California Edison Company #1 and #2

The Certificate of Public Convenience for SCE #1 is expected in the Spring of 1981. SCE is currently procuring equipment for this plant and construction is expected to begin in December of 1981. Power-on-line is scheduled for 1983. SCE #2 is scheduled to go on-line in 1986. SCE resource plans include a goal of 460 MWe of electricity production on-line by 1990 from the Heber, Niland, and Brawley areas.

Heber - San Diego Gas and Electric Company Binary Demonstration Plant

The engineering design is currently in progress for this plant. The power on-line date is scheduled for mid-1985.

Mono-Long Valley - SCE

See Section 5.0 of this publication.

Niland - SCE Pilot

SCE has awarded the engineering and design contract for this plant to Fluor Power Service Company. The steam permit has been approved and field development began in February of 1981. Power-on-line is scheduled for July of 1982. The Niland area is a potential site for additional SCE development.

Niland - San Diego Gas and Electric Company #1

Magma Power Company, the developer, is planning to break ground for this plant in the Spring of 1981. Power-on-line is scheduled for 1983.

Niland - San Diego Gas and Electric Company #2

This plant is currently in the application stage of development. The Environmental Impact Report will be submitted by the end of 1981. Power-on-line is scheduled for 1985.

Wendel-Amedee-Geoproducts Hybrid Plant

The feasibility study for this plant is to be completed shortly. If a viable resource is proven, construction of the plant is scheduled to begin in 1983. Power-on-line is scheduled for late 1985.

Westmoreland - Republic Geothermal Inc., MAPCO Inc.

To date, two wells have been drilled for this proposed plant. Data collected during the 30-day production flow testing is being evaluated. RGI is planning to drill one more well and they are currently negotiating with DOE for milestone revisions on the loan guaranty. Power-on-line is scheduled for 1984.

Puna-HGP-A

This plant is scheduled to come on-line in the Spring of 1981. The plant is essentially complete. However, it is awaiting equipment from the mainland for startup.

Puna - 25 MWe

Thermal Power Company has reached an agreement with Dillingham Corporation to form a joint venture to pursue the development of a 25 MWe power plant in the Puna District of Hawaii. County permits have been issued for two exploratory wells. Drilling will commence shortly. Power-on-line is scheduled for 1988.

Raft River - Department of Energy Pilot Plant

Construction is complete on this plant. However, due to lack of pumping equipment to move fluids, the plant will not be ready for complete start-up operations by September 30, 1981. FY 1982 funding is not in the present administration's budget.

Valles Caldera - Baca #1

The construction permit was received from the Environmental Improvement Division of the State of New Mexico for this plant. Well drilling is now in progress. The Certificate of Public Convenience and Necessity is due in the Spring of 1981. The power-on-line date is scheduled for 1983.

NORNEV #1, #2, and #3

NORNEV #1, a semi-portable 10 MWe binary plant, has been ordered. Power-on-line is scheduled for 1982. NORNEV #2 and #3 are 10 MWe binary and flash units under consideration by the NORNEV consortium.

Roosevelt Hot Springs - Utah Power and Light Company #1, #2, and #3

Field site and transmission line applications for UP&L #1 were filed with BLM and USGS on January 30, 1981. USGS is awaiting the Environmental Assessment Report which is expected by September. The engineering design contractor is Gibbs and Hill of San Francisco. Power-on-line is scheduled for 1983. UP&L #2 and #3 are subsequent plants planned under the Phillips Petroleum Company and Utah Power and Light Company steam contract. Power-on-line for these units is scheduled for 1987.

2.0 DIRECT HEAT USES

The fastest growing application of geothermal energy is as the direct source of heat for a variety of purposes. Individual direct heat developments utilize small amounts of energy in comparison to electric plants. However, these projects collectively displace a significant amount of energy from conventional sources.

2.1 1980 Highlights

The year 1980 saw a number of important developments in the area of direct heat utilization. The Haakon School District, St. Mary's Hospital, and the Diamond Ring Ranch, all federal cost-shared demonstrations in South Dakota, started up their geothermal systems. Uses range from heating a hospital and five school buildings to drying grain and warming stock water. The YMCA in Klamath Falls, Oregon was geothermally heated during the year, as were a crippled children's hospital and greenhouses in New Mexico, and a bank in Montana. Significant progress was made toward the completion of a space heating system for the Navarro College and Hospital at Corsicana, Texas.

Two geothermal ethanol plants, one in Yerington, Nevada, and one at Hot Lake, Oregon became operational. The Yerington facility was developed solely with private funds. These fuel alcohol production facilities have a combined annual capacity of about 2.4 million gallons of ethanol. Many technical assistance requests to assess the potential of various sites for sustained ethanol production using geothermal energy were received in 1980.

Wells were drilled at Pagosa Springs, Colorado; Susanville, California; and Boise, Idaho for geothermal space heating projects under development at these locations. Drilling was initiated in the Imperial Valley for the Holly Sugar plant application. Drilling permits were granted for the El Centro, California community center space heating project.

By the end of 1980, 211 direct use developments in 14 states were providing 12,647 billion Btus annually. Projects put into effect during 1980, supplying 277 billion Btus per year, are presented in Table 2-1. By the end of 1981, it is anticipated that another 29 projects will be supplying an additional 5,582 billion Btus annually.

2.2 Geothermal Ethanol Plants

The utilization of geothermal energy for nonelectric applications continues to increase. Firms engaged in such activities as greenhousing, crop drying, food processing, and waste water treatment have found geothermal energy an attractive heat source. Facilities producing ethanol and employing geothermal energy for process heat, however, are especially economical and technically viable, as evidenced by the rapid growth of this geothermal sub-industry in 1980 and early 1981.

At present, four geothermal ethanol plants are in service and producing five million gallons of ethanol annually. This use consumes about 300 billion Btus of geothermal energy per year, equivalent to 51,720 barrels of oil annually. By 1984, if only all ethanol facilities currently under consideration (under development, proposed, or under study) realize operational status, 53 new plants will be in service producing another 281 million gallons of ethanol, thereby bringing the total capacity to 286 million gallons per year. Therefore, by 1984, total geothermal energy use for ethanol distillation could approximate 16,319 billion Btus per year, the equivalent of 2,813,000 barrels of oil. Where annual energy use is unknown, estimates have been made assuming that 60,000 Btus of geothermal heat are used per gallon of ethanol produced.

Colorado State University is researching a moderate temperature (300°F) process for distilling ethanol from wheat straw and wood wastes. The study focuses on the application of geothermal resources to produce alcohol for use as fuel. The University used geothermal hot water in a process that produces a gallon of ethanol from a bale of wheat straw. The wheat straw was shredded and cooked under pressure using 280°F water from a deep well. The fibers dissolved to glucose which was fermented at room temperature with yeast and distilled at 200°F using geothermal energy as the heat source. After the alcohol solution vaporized, it was condensed to form 180 proof alcohol suitable for mixing with gasoline to produce gasohol.

At Raft River, Idaho, a successful experiment has demonstrated the practicability of using moderate-temperature geothermal fluid to distill sugar beet syrup into alcohol. The 240°F geothermal water supplied the process energy for distillation and was used in fermentation as well. According to the Idaho Office of Energy, there is insufficient feedstock in the region to sustain a large scale permanent geothermal ethanol facility. There is probably an adequate supply of sugar beets (about 163,000 tons per year) to support a small scale operation. Future experiments may include distilling alcohol from materials such as forest slash, pine chips, and surplus farm crops. The utilization of crop waste

TABLE 2-1
DIRECT HEAT PROJECTS
REACHING OPERATIONAL STATUS DURING 1980

STATE	OPERATOR&LOCATION	TYPE OF USE	FIRST YEAR	FEDERAL FUNDS $000	STATE FUNDS $000	LOCAL FUNDS $000	BTU/YEAR BILLIONS	BTU ESTIM	COMMENTS
CO	HUE DAIRY CREARE EAGCSA HS ARCHULETA	CHSH	1980				1.0	E	
MT	FIRST NATIONAL BANK WHITE SULPHUR SPGS MEAGHER	CHSH	1980		*		.5		COMMERCIAL BUILDING,TECH. ASSI S. PROV. BY EG&G
ND	TFOUT WELLS JAMESTOWN STUTSMAN	CHSH	1980				1.0	E	HEAT PUMP APPLIC.,DEMO. PROJEC T
NM	FAYWOOD GREENHOUSES FAYWOOD HS GRANT	AGGH	1980		*		1.0		
NM	CARRIE TINGLEY HOSPITAL TRUTH OR CONSEQUEN. SIERRA	CHSHHW	1980	*		*	1.6		
NM	SOLAR AMERICA PONCE DELEON ES TAOS	AGGHSH	1980	*	*		1.0		7500 SQ. FT. GREENHOUSE
NV	TAD'S ENTERPRISES WABUSKA HS LYON	INPH	1980				24.0	E	ETHANOL PLANT,400K GAL/YR, FEEDSTOCK-CORN
OR	KLAMATH COUNTY YMCA KLAMATH FALLS KLAMATH	HCSH	1980	*		*	5.0		PON-79
OR	LISKEY FARMS KLAMATH FALLS KLAMATH	AGGH	1980			*	5.0	E	10 GREENHOUSES
OR	GRANDE RONDE COMMODITIES HOT LAKE UNION	INPH	1980				120.0	E	ETHANOL PLANT,2 MIL. GAL/YR, FEEDSTOCK-GRAIN DUST
SD	GENE ARMSTRONG DIAMOND RING RANCH HAAKON	AGSHSW	1980	*			78.7		PON-78,HEATING FARM BLDGS., DRY GRAIN,WARM STOCK WATER
SD	HAAKON SCHOOL DISTRICT PHILIP HAAKON	MUDHSH	1980	*		*	9.5		PON-78, 5 SCHOOL BLDGS.,OPER., 8 COMM. BLDGS IN PROGRESS

TABLE 2-1
DIRECT HEAT PROJECTS
REACHING OPERATIONAL STATUS DURING 1980

STATE	OPERATOR&LOCATION	TYPE OF USE	FIRST YEAR	FEDERAL FUNDS $000	STATE FUNDS $000	LOCAL FUNDS $000	BTU/YEAR BILLIONS	BTU ESTIM	COMMENTS
SD	ST. MARY'S HOSPITAL PIERRE HUGHES	CMSHBW	1980	*			11.4		PON-78, HOSPITAL SPACE HEATING
UT	CHRISTENSON BROTHERS NEWCASTLE IRON	AGGH	1980				.5	E	HYDROPONIC GREENHOUSE
UT	UTAH ROSES,INC. CRYSTAL HS SALT LAKE	AGGH	1980				16.3	E	
STATUS TOTAL							276.5		

* DESIGNATES RECIEPT OF GOVERNMENT FUNDING.
E INDICATES ANNUAL ENERGY USE WAS ESTIMATED BY MITRE; ASSUMING THAT 60,000 BTUS OF GEOTHERMAL HEAT ARE USED PER GALLON OF ETHANOL PRODUCED. WHERE CAPACITY IS UNKNOWN, IT IS PRESUMED TO BE 1 MILLION GALLONS/YEAR.

to produce fuel would help to reduce competition between ethanol production and food production. It is estimated that each year 78 million tons or 20 percent of crop residues remain unused, enough to produce 3 billion gallons of fuel.

Current potential and operational geothermal ethanol plants span 12 states. Most projects are in early or intermediate developmental stages. Typical feedstock include corn, wheat, sugar beets, potatoes, barley, grain sorghum, milo, and pineapples. Current in-service ethanol plants are operated by Tad's Enterprises at Wabuska Hot Springs, Nevada; Owyhee Energy Producers in Adrian, Oregon; Willis Brown in Vale, Oregon; and Grande Ronde Commodities at Hot Lake, Oregon (see Table 2-2). The facility at Wabuska Hot Springs, Nevada is highlighted here.

In Yerington, Nevada, a firm named Tad's Enterprises is using 220°F flashed steam from Wabuska Hot Springs to distill ethanol from corn at a rate of 400,000 gallons per year. The 199 proof ethanol will be combined with gasoline to produce gasohol for sale by Western Mountain Oil Company service stations. Stainless steel tanks and distillation towers are located a few hundred feet away from the hot springs, in close proximity to greenhouses formerly used for geothermal hydroponics. Tad's Enterprises hopes to refurbish the greenhouses and utilize the carbon dioxide expelled during the fermentation process.

Currently, the corn is ground, mixed with yeast enzymes and hot springs water, and placed in geothermally heated cookers. It is then pumped first into fermentation tanks for three to five days and then into distillation tanks which are geothermally-heated. Corn was selected as feedstock because the leftover corn mash has a very high protein value. The corn mash is dried and used locally as cattle feed. Tad's Enterprises hopes to attract other businesses and develop an 80-acre geothermal industrial park.

Three geothermal ethanol plants have entered the developmental stage. Magic Resource Investors is developing a facility at Magic Hot Springs Landing, Idaho; Energy Engineering Inc. is constructing an ethanol facility at Hot Springs, Montana; and R&R Energies is developing a plant in Cove Fort, Utah. These facilities will produce 17 million gallons of ethanol and use 1,020 billion Btus of geothermal energy annually. Further information on each of these plants is presented in Table 2-3.

To date, on the order of 36 geothermal ethanol plants are proposed in 11 states. If all were to become operational, total capacity would reach 142 million gallons of ethanol consuming 11,648 billion Btus annually. Table 2-4 provides information about these proposed plants, including capacity and feedstock, where known.

Studies to evaluate the potential of specific sites for geothermal ethanol production are being pursued by some companies. Details of a feasibility evaluation being conducted for an ethanol plant in Vale, Oregon are discussed here.

Technology International is pursuing a geothermal ethanol plant in Vale, Oregon using sugar beet tailings, undersized potatoes, and cull onions as feedstock. The facility, which will be a joint venture between Technology International and a subsidiary of Clover Creek Cattle Company, will produce about 4.5 million gallons of ethanol per year. The high protein byproduct of fermentation will be sold commercially.

Feasibility studies currently underway, which could eventually produce 126 million gallons of ethanol and utilize 3352 billion Btus per year, are detailed in Table 2-5.
Source: MITRE, 3/27/80

2.3 Operational and Potential Direct Heat Utilization

Approximately 213 direct heat applications are in service, spanning 14 states and providing about 13 trillion Btus annually, the equivalent of close to 2,258,000 barrels of oil. Presently 42 direct heat projects are under development and will supply an additional 4 trillion Btus per year. One hundred and ninety-seven further applications have been proposed in 18 states which could eventually provide as much as 17.5 trillion Btus per year. An increasing number of public and private entities are considering the use of geothermal energy as a direct source of heat, as evidenced by these proposed projects and some 50 ongoing feasibility evaluations which have been reported.

State-by-state tabulations of current in-service, under development, and proposed direct use applications and feasibility studies underway appear in Table 2-6. Table 2-7 totals state geothermal direct heat projects by stage of development. Tabulations of balneology applications (hot water spas and pools) are maintained separately, as the energy benefit from these projects is ambiguous, and the government has no program concerned with these applications. Table 2-8 presents a summary of U.S. geothermal direct heat use.

TABLE 2-2
GEOTHERMAL ETHANOL PLANTS
IN SERVICE

STATE	OPERATOR&LOCATION	FIRST YEAR	FEDERAL FUNDS $000	STATE FUNDS $000	LOCAL FUNDS $000	BTU/YR BILLIONS	ESTIM	COMMENTS
NV	TAD'S ENTERPRISES WABUSKA HS LYON	1980				24.0	E	ETHANOL PLANT,400K GAL/YR, FEEDSTOCK-CORN
CO	OWYHEE ENERGY PRODUCERS ADRIAN MALHEUR	1981				36.0	E	ETHANOL PLANT, 600K GAL/YEAR FEEDSTOCK-GRAIN,CORN
OR	WILLIS BROWN VALE MALHEUR	1981				120.0	E	ETHANOL PLANT,2 MIL. GAL/YR, FEEDSTOCK-CORN
OR	GRANDE RONDE COMMODITIES HOT LAKE UNION	1980				120.0	E	ETHANOL PLANT,2 MIL. GAL/YR, FEEDSTOCK-GRAIN DUST
STATUS TOTAL						300.0		

E INDICATES ANNUAL ENERGY USE WAS ESTIMATED BY MITRE; ASSUMING THAT 60,000 BTUS OF GEOTHERMAL HEAT ARE USED PER GALLON OF ETHANOL PRODUCED. WHERE CAPACITY IS UNKNOWN, IT IS PRESUMED TO BE 1 MILLION GALLONS/YEAR.

TABLE 2-3
GEOTHERMAL ETHANOL PLANTS
UNDER DEVELOPMENT

STATE	OPERATOR&LOCATION	FIRST YEAR	FEDERAL FUNDS $000	STATE FUNDS $000	LOCAL FUNDS $000	BTU/YR BILLIONS	ESTIM	COMMENTS
ID	MAGIC RESOURCE INVESTORS MAGIC HS LANDING PLAINE		•			120.0	E	ETHANOL PLANT,2-5 MIL. GAL/YR & INDUSTRIAL PARK,TOTAL PROJ. COSTS-$1200K
MT	ENERGY ENGINEERING INC. HOT SPRINGS FLATHEAD	1982		*		480.0	E	ETHANOL PLANT & FOOD PROCESS. PLANT,IN ADVAN. DESIGN STAGE, 8 MIL. GAL/YR.
UT	R & R ENERGIES COVE FORT MILLARD	1981				420.0	E	ETHANOL PLANT, 7 MIL. GAL/YR, FEED.-BARLEY,SEEK. GLGF FUND. OURI PROV. TECH. ASSIS.
STATUS TOTAL						1,020.0		

* DESIGNATES RECIEPT OF GOVERNMENT FUNDING.
E INDICATES ANNUAL ENERGY USE WAS ESTIMATED BY MITRE; ASSUMING THAT 60,000 BTUS OF GEOTHERMAL HEAT ARE USED PER GALLON OF ETHANOL PRODUCED. WHERE CAPACITY IS UNKNOWN, IT IS PRESUMED TO BE 1 MILLION GALLONS/YEAR.

TABLE 2-4
GEOTHERMAL ETHANOL PLANTS
PROPOSED

STATE	OPERATOR&LOCATION	FIRST YEAR	FEDERAL FUNDS $000	STATE FUNDS $000	LOCAL FUNDS $000	BTU/YR BILLIONS	ESTIM	COMMENTS
CA	UNKNOWN EAST BRAWLEY IMPERIAL					2,400.0	E	ETHANOL PLANT, 40 MIL. GAL/YR, FEEDSTOCK-CORN
CA	UNKNOWN NILAND IMPERIAL					600.0	E	ETHANOL PLANT, 10 MIL. GAL/YR, FEEDSTOCK-CORN
CA	UNKNOWN NORTH BRAWLEY IMPERIAL					1,200.0	E	ETHANOL PLANT, 20 MIL. GAL/YR, FEEDSTOCK-CORN
CO	LARRY HOUSER PUEBLO PUEBLC					60.0	E	ETHANOL PLANT
ID	UNKNOWN COUNCIL ADAMS					12.0	E	ETHANOL PLANT, 200K GAL/YR, FEEDSTOCK-SUGAR BEETS
ID	UNKNOWN RAFT RIVER CASSIA	1982	*			300.0	E	ETHANOL PLANT,5 MIL. GAL/YR, FEEDSTOCK-BARLEY
ID	UNKNOWN RAFT RIVER CASSIA	1982	*			300.0	E	ETHANOL PLANT, 5 MIL. GAL/YR (EXPAN. TO 8 GAL.),FEEDSTOCK-SUGAR BEETS
ID	UNKNOWN DUBOIS CLARK					30.0	E	ETHANOL PLANT,500K GAL/YR, FEEDSTOCK-GRAIN,CULL POTATOES
ID	UNKNOWN EMMETT GEM					60.0	E	ETHANOL PLANTS,FEEDSTOCK-WOOD FIBER
ID	UNKNOWN KOOTENAI RS GEM			*		60.0	E	ETHANOL PLANT
ID	UNKNOWN BLISS GOODING					600.0	E	ETHANOL PLANT, 10 MIL. GAL/YR, FEEDSTOCK-FOOD PROCESS. WASTE
ID	UNKNOWN PEPSI PARK LEWIS					60.0	E	ETHANOL PLANT,FEEDSTOCK-GRAIN

TABLE 2-4
GEOTHERMAL ETHANOL PLANTS
PROPOSED

STATE	OPERATOR&LOCATION	FIRST YEAR	FEDERAL FUNDS $000	STATE FUNDS $000	LOCAL FUNDS $000	BTU/YR BILLIONS	ESTIM	COMMENTS
ID	R. GIERUM BRUNEAU OWYHEE					60.0	E	ETHANOL PLANT,1 MIL. GAL/YR, FEEDSTOCK-GRAIN
ID	UNKNOWN BRUNEAU OWYHEE					120.0	E	ETHANOL PLANT, 2 MIL. GAL/YR, FEEDSTOCK-CORN
ID	VALLEY TROUT FARMS BOBI TWIN FALLS					60.0	E	ETHANOL PLANT & GREENHOUSE
ID	J.R. HENRY PRODUCE KIMBERLY TWIN FALLS					300.0		ETHANOL PLANT
ID	UNKNOWN SWEET UNKNOWN					180.0	E	ETHANOL PLANT,3 MIL. GAL/YR, FEEDSTOCK-GRAIN,DISTRESSED CROPS
ID	UNKNOWN TERRETON UNKNOWN					2.0	E	ETHANOL PLANT,35K GAL/YR, FEEDSTOCK-BARLEY,CULL POTATOES
ID	ADAMS COMPANY MCCALL VALLEY					60.0	E	ETHANOL PLANT,1 MIL. GAL/YR, FEEDSTOCK-WHEAT,BARLEY,OATS
ID	UNKNOWN WEISER WASHINGTON					1,200.0	E	ETHANOL PLANT,10 MIL. GAL/YR, FEEDSTOCK-WHEAT,BARLEY
MT	UNKNOWN ENNIS MADISON					60.0	E	ETHANOL PLANT
MT	JOHN MILLER SILVER STAR MADISON					600.0	E	ETHANOL PLANT,SOUGHT FUNDS UNDER USER-COUPLED DRILLING
ND	NAFOL. FARMER UNION UNKNOWN UNKNOWN					60.0	E	ETHANOL PLANT
ND	ALCO INC. GRAFTON WALSH					60.0	E	ETHANOL PLANT

TABLE 2-4
GEOTHERMAL ETHANOL PLANTS
PROPOSED

STATE	OPERATOR&LOCATION	FIRST YEAR	FEDERAL FUNDS $000	STATE FUNDS $000	LOCAL FUNDS $000	BTU/YR BILLIONS	ESTIM	COMMENTS
NM	J. HILL & ASSOCIATES SILVER CITY GRANT					60.0	E	ETHANOL PLANT
NV	AGRO CHEM. & IOC. MINERAL HS ELKO					300.0		$40 MIL. ETHANOL PLANT
NV	APPROPRIATE TECH. ENGINEERING CRESENT VALLEY EUREKA					300.0		ETHANOL PLANT
NV	DESERT RESEARCH INSTITUTE WINNEMUCCA HUMBOLDT					300.0		ETHANOL PLANT
NV	ALEXANDER DAWSON CO. WABUSKA HS LYON					60.0	E	ETHANOL PLANT
OR	KLAMATH ENERGY,INC. LISKEY FALLS KLAMATH	1982				60.0	E	ETHANOL PLANT($2.4 MIL.),1 MIL. GAL/YR,FEEDSTOCK-WINTER WHEAT
OR	POWER ALCOHOL FUELS, INC UNDETERMINED MCDCC					60.0	E	ETHANOL PLANT,SEEKING FEDERAL FUNDING
OR	WESTERN RENEWABLE RESOURCES TREASURE VALLEY UNKNOWN					90.0	E	ETHANOL PLANT,1.5 MILLION GAL. TO BE PRODUCED ANNUALLY
SD	TOWN OF LEMMON LEMMON CORSON			•		1,014.0		ALSO GREENHOUSES.GRAIN DRY., & ETHANOL PLANT,SEEK. DOE FUND.
TX	UNKNOWN CORSICANA NAVARRO	1983				600.0	E	ETHANOL PLANT,10 MIL. GAL/YR, FEEDSTOCK-MILO
WY	UNKNOWN BIG HORN BASIN PARK					60.0	E	ETHANOL PLANT, IN CONJUNCTION W/SOLAR
WY	AL-AGRA INC. CODY PARK					300.0		ETHANOL PLANT,DEVELOPER/USER FINANCING,RESOURCE APPEARS INADEQUATE
STATUS TOTAL						11,648.0		

TABLE 2-5
GEOTHERMAL ETHANOL PLANTS
FEASIBILITY STUDIES

STATE	OPERATOR&LOCATION	FIRST YEAR	FEDERAL FUNDS $000	STATE FUNDS $000	LOCAL FUNDS $000	BTU/YR BILLIONS	ESTIM	COMMENTS
CA	ULTRASYSTEMS, INC. MADERA IRVINE		•			120.0	E	FEAS. STUDY OF 20 MIL. GAL/YEAR ETH. PLANT
CO	WESTEC SERVICES SAN LUIS VALLEY ALAMOSA		*			60.0	E	ETHANOL PLANT, FRDA,20-50 MIL. GAL/YR.
ID	UNKNOWN KUNA ADA		•			60.0	E	ETHANOL PLANT,EG&G ASSIS.
ID	UNKNOWN PAYNE CANYON					60.0	E	ETHANOL PLANT CONSIDERED,EG&G ASSISTANCE
ID	BECHTEL NATIONAL RAFT RIVER CASSIA		*			60.0	E	ETHANOL PLANT,FEAS. STUDY NEAR COMP.,10 MIL. GAL/YR FAC., FLOW IS FOR 9-10 WELLS
ID	UNKNOWN FELT TETON		*			60.0	E	ETHANOL PLANT,EG&G ASSIS.
ID	WESTERN RESOURCE RECOVERY TWIN FALLS TWIN FALLS					360.0	E	FEASIBILITY STUDY PERFORMED, ETHANOL PLANT, FEEDSTOCK-CULL POTATOES,WHEAT
ID	BECHTEL WEISER WASHINGTON					1,200.0	E	ETHANOL PLANT,20 MIL. GAL/YR, FEEDSTOCK-WHEAT,BARLEY
MT	FORT PECK INDIAN TRIBE POPLAR ROOSEVELT		*			285.6		VERY GOOD POTENTIAL,ETHANOL PLANT,FRDA
NM	AMERICAN DRILLING AND GROUTING UNKNOWN DONA ANA					6.0	E	ETHANOL PLANT,30 MIL. GAL/YR, FEAS. STUDY CONDUCTED BY PRIV. FIRM
NV	GEOTHERMAL FOOD PROCESSORS BRADY HS CHURCHILL	1982	•			300.0	E	FEAS. STUDY OF 5 MIL. GAL/YEAR ETHANOL PLANT,FEEDSTOCK-EARLEY GRAINS
NV	GRACE GEOTHERMAL BRADY HS CHURCHILL	1982	•			600.0	E	ETHANOL PLANT-10 MIL. GAL/YR& COMM. MUSH. GROWING & CANNING OPERATION,FRDA

TABLE 2-5
GEOTHERMAL ETHANOL PLANTS
FEASIBILITY STUDIES

STATE	OPERATOR&LOCATION	FIRST YEAR	FEDERAL FUNDS $000	STATE FUNDS $000	LOCAL FUNDS $000	BTU/YR BILLIONS	ESTIM	COMMENTS
NY	NYSERDA & CORNELL UNIVERSITY UNKNOWN FIVE REGIONS					60.0	E	ETHANOL PLANT, EVAL. FEAS. OF USING CHEESE WHEY AS FEEDSTOCK
OR	TECHNOLOGY INTERNATIONAL VALE MALHEUR	1982	*			120.0	E	ETHANOL PLANT,-4.5 MIL. GAL/YR PRDA PREV. FUND.,TOT. ERGJ. COSTS-$1400K
STATUS TOTAL						3,351.6		

* DESIGNATES RECIEPT OF GOVERNMENT FUNDING.
E INDICATES ANNUAL ENERGY USE WAS ESTIMATED BY MITRE; ASSUMING THAT 60,000 BTUS OF GEOTHERMAL HEAT ARE USED PER GALLON OF ETHANOL PRODUCED. WHERE CAPACITY IS UNKNOWN, IT IS PRESUMED TO BE 1 MILLION GALLONS/YEAR.

TABLE 2-6

GEOTHERMAL DIRECT HEAT USE PROJECTS[1] BY STATE
(BILLION BTU USE/YEAR)[2]

STATE/ PROJECT TYPE \ PROJECT STATUS	OPERATIONAL 10^9 Btu	OPERATIONAL (No.)	UNDER DEVELOPMENT 10^9 Btu	UNDER DEVELOPMENT (No.)	FEASIBILITY STUDIES 10^9 Btu	FEASIBILITY STUDIES (No.)	PROPOSED 10^9 Btu	PROPOSED (No.)
ALASKA								
Residential	2	(2)	-	-	-	-	26	(3)
Commercial	-	-	-	-	-	-	5	(1)
Industrial	8	(1)	-	-	-	-	10	(1)
Agricultural	28	(3)	-	-	-	-	-	-
Recreational	10	(3)	-	-	-	-	1	(1)
Subtotal	48	(9)	-	-	-	-	42	(6)
ARKANSAS								
Recreational	1	(1)	-	-	1	(1)	-	-
Subtotal	1	(1)	-	-	1	(1)	-	-
CALIFORNIA								
Residential	59	(2)	25	(1)	-	-	-	-
Commercial	2	(2)	50	(4)	-	-	26	(4)
Industrial	110	(2)	1300	(1)	531	(6)	4300	(4)
Agricultural	364	(5)	315	(2)	-	-	101	(2)
Aquacultural	171	(1)	-	-	-	-	-	-
Subtotal	706	(12)	1690	(8)	531	(6)	4427	(10)
COLORADO								
Residential	4	(5)	32	(1)	-	-	61	(7)
Commercial	11	(6)	50	(1)	103	(2)	21	(8)
Industrial	20	(2)	5	(1)	169	(4)	260	(3)
Agricultural	2	(2)	-	-	-	-	2	(2)
Aquacultural	6	(2)	-	-	-	-	-	-
Recreational	1	(2)	-	-	-	-	3	(4)
Subtotal	44	(19)	87	(3)	272	(6)	347	(24)
HAWAII								
Industrial	-	-	-	-	-	-	100	(1)
Agricultural	-	-	-	-	-	-	100	(1)
Subtotal	-	-	-	-	-	-	200	(2)

[1]Tabulations of balneology applications (hot water spas and pools) are not included.

[2]Rounded to nearest whole number.

TABLE 2-6 (CONTINUED)

STATE/ PROJECT TYPE \ PROJECT STATUS	OPERATIONAL 10^9 Btu	OPERATIONAL (No.)	UNDER DEVELOPMENT 10^9 Btu	UNDER DEVELOPMENT (No.)	FEASIBILITY STUDIES 10^9 Btu	FEASIBILITY STUDIES (No.)	PROPOSED 10^9 Btu	PROPOSED (No.)
IDAHO								
Residential	44	(7)	-	-	5	(1)	1006	(13)
Commercial	3	(3)	209	(2)	-	-	870	(11)
Industrial	-	-	120	(1)	1900	(7)	3904	(19)
Agricultural	14	(9)	-	-	-	-	45	(5)
Aquacultural	895	(5)	-	-	-	-	301	(4)
Recreational	14	(28)	-	-	-	-	1	(1)
Subtotal	970	(52)	329	(3)	1905	(8)	6127	(53)
INDIANA								
Industrial	-	-	-	-	100	(1)	-	-
Commercial	-	-	-	-	-	-	1	(1)
Subtotal	-	-	-	-	100	(1)	1	(1)
MARYLAND								
Residential	-	-	-	-	4	(1)	-	-
Commercial	-	-	-	-	5	(1)	-	-
Industrial	-	-	-	-	100	(1)	55	(1)
Subtotal	-	-	-	-	109	(3)	55	(1)
MICHIGAN								
Agricultural	-	-	-	-	-	-	1	(1)
Subtotal	-	-	-	-	-	-	1	(1)
MONTANA								
Residential	3	(3)	-	-	-	-	35	(4)
Commercial	5	(6)	27	(2)	5	(1)	6	(2)
Industrial	-	-	480	(1)	286	(1)	660	(2)
Agricultural	2	(1)	4	(1)	-	-	1	(1)
Aquacultural	100	(1)	-	-	-	-	3	(1)
Recreational	4	(6)	-	-	1	(1)	-	-
Subtotal	114	(17)	511	(4)	292	(3)	705	(10)
NEVADA								
Residential	9	(7)	5	(1)	1200	(1)	11	(3)
Commercial	16	(2)	131	(3)	1	(1)	12	(4)
Industrial	289	(4)	100	(1)	900	(2)	1060	(5)
Agricultural	2	(2)	-	-	-	-	31	(2)
Aquacultural	-	-	-	-	-	-	100	(1)
Subtotal	316	(15)	236	(5)	2101	(4)	1214	(15)

TABLE 2-6 (CONTINUED)

STATE/ PROJECT TYPE \ PROJECT STATUS	OPERATIONAL 10^9 Btu	OPERATIONAL (No.)	UNDER DEVELOPMENT 10^9 Btu	UNDER DEVELOPMENT (No.)	FEASIBILITY STUDIES 10^9 Btu	FEASIBILITY STUDIES (No.)	PROPOSED 10^9 Btu	PROPOSED (No.)
NEW JERSEY								
Residential	-	-	-	-	40	(1)	-	-
Subtotal	-	-	-	-	40	(1)	-	-
NEW MEXICO								
Residential	4	(5)	-	-	-	-	23	(4)
Commercial	9	(3)	405	(4)	770	(1)	553	(4)
Industrial	1	(1)	-	-	43	(2)	160	(2)
Agricultural	116	(6)	42	(2)	-	-	600	(1)
Recreational	1	(2)	-	-	-	-	-	-
Subtotal	131	(17)	447	(6)	813	(3)	1336	(11)
NEW YORK								
Commercial	-	-	1	(1)	-	-	-	-
Industrial	-	-	-	-	110	(2)	50	(1)
Subtotal	-	-	1	(1)	110	(2)	50	(1)
NORTH DAKOTA								
Residential	-	-	-	-	-	-	5	(3)
Commercial	1	(1)	5	(1)	1	(1)	27	(8)
Industrial	-	-	-	-	-	-	220	(3)
Agricultural	2	(2)	-	-	-	-	1	(1)
Subtotal	3	(3)	5	(1)	1	(1)	253	(15)
OREGON								
Residential	39	(11)	1	(1)	1	(1)	41	(5)
Commercial	21	(4)	37	(3)	-	-	14	(6)
Industrial	277	(4)	120	(1)	200	(2)	310	(5)
Agricultural	18	(5)	-	-	-	-	-	-
Aquacultural	110	(4)	-	-	-	-	-	-
Recreational	7	(3)	-	-	-	-	-	-
Subtotal	472	(31)	158	(5)	201	(3)	365	(16)

TABLE 2-6 (CONCLUDED)

STATE/PROJECT TYPE \ PROJECT STATUS	OPERATIONAL 10^9 Btu	OPERATIONAL (No.)	UNDER DEVELOPMENT 10^9 Btu	UNDER DEVELOPMENT (No.)	FEASIBILITY STUDIES 10^9 Btu	FEASIBILITY STUDIES (No.)	PROPOSED 10^9 Btu	PROPOSED (No.)
SOUTH DAKOTA								
Residential	*	(1)	*	(1)	-	-	40	(2)
Commercial	32	(5)	-	-	-	-	16	(6)
Industrial	100	(1)	-	-	-	-	-	-
Agricultural	79	(2)	-	-	-	-	1016	(2)
Subtotal	211	(9)	*	(1)	-	-	1072	(10)
TEXAS								
Commercial	-	-	46	(2)	-	-	1	(1)
Industrial	-	-	-	-	-	-	600	(1)
Subtotal	-	-	46	(2)	-	-	601	(2)
UTAH								
Residential	1	(1)	5	(1)	-	-	110	(2)
Commercial	21	(3)	-	-	-	-	2	(2)
Industrial	-	-	420	(1)	-	-	-	-
Agricultural	18	(3)	75	(1)	-	-	-	-
Aquacultural	5	(1)	-	-	-	-	1	(1)
Recreational	11	(8)	-	-	-	-	100	(1)
Subtotal	56	(16)	500	(3)	-	-	213	(6)
VIRGINIA								
Commercial	-	-	-	-	3	(1)	-	-
Subtotal	-	-	-	-	3	(1)	-	-
WASHINGTON								
Residential	-	-	-	-	5	(1)	5	(1)
Commercial	-	-	-	-	7	(3)	6	(2)
Industrial	10	(1)	-	-	-	-	-	-
Agricultural	2	(1)	-	-	-	-	-	-
Recreational	2	(1)	-	-	-	-	-	-
Subtotal	14	(3)	-	-	12	(4)	11	(3)
WYOMING								
Residential	1	(3)	-	-	-	-	4	(1)
Commercial	15	(2)	-	-	-	-	10	(3)
Industrial	10001	(3)#	-	-	-	-	360	(3)
Agricultural	1	(1)	-	-	-	-	102	(3)
Subtotal	10018	(9)	-	-	-	-	476	(10)
TOTAL	13104	(213)	4010	(42)	6491	(47)	17,496	(197)
GRAND TOTAL							41,101	(499)

*Less than .5 x 10^9 Btu/year.

#Includes Wyoming water-flood oil-recovery project.

TABLE 2-7

GEOTHERMAL DIRECT HEAT USE TOTALS[1] BY STATE
(Billion BTU Use/Year)[2]

	OPERATIONAL	UNDER DEVELOP-MENT	FEASIBILITY STUDIES	PROPOSED	TOTAL
Alaska	48	-	-	42	90
Arkansas	1	-	1	-	2
California	706	1690	531	4427	7354
Colorado	44	87	272	347	750
Hawaii	-	-	-	200	200
Idaho	970	329	1905	6127	9331
Indiana	-	-	100	1	101
Maryland	-	-	109	55	164
Michigan	-	-	-	1	1
Montana	114	511	292	705	1622
Nevada	316	236	2101	1214	3867
New Jersey	-	-	40	-	40
New Mexico	131	447	813	1336	2727
New York	-	1	110	50	161
North Dakota	3	5	1	253	262
Oregon	472	158	201	365	1196
South Dakota	211	*	-	1072	1283
Texas	-	46	-	601	647
Utah	56	500	-	213	769
Virginia	-	-	3	-	3
Washington	14	-	12	11	37
Wyoming	10018[3]	-	-	476	10494
TOTAL	13104	4010	6491	17496	41101

[1] Tabulations of balneology applications (hot water spas and pools) are not included.
[2] Rounded to the nearest whole number.
[3] Includes enhanced oil recovery project consuming 10,000 x 10^9 BTU/Yr.
* Less than .5 x 10^9 BTU/Yr.

TABLE 2-8

SUMMARY OF U.S. GEOTHERMAL DIRECT HEAT USE

AREA OF USE	NUMBER OF USERS	BTU/YEAR (10^9)
Current Uses On-Line	212	3,104
Enhanced Oil Recovery	1	10,000
Baths and Pools	90	52
TOTAL	303	13,156

2.4 Recent Major Activities

Recent significant developments in the area of geothermal direct heat use include:

- HUD/DOE Cooperative Solicitation: Fiscal Year 1981 Technical Assistance for Assessing Potential District Heating and Cooling System Projects

  In October 1980, a solicitation for proposals assessing the potential for district heating and cooling systems in Community Development Block Grant (CDBG) eligible communities was jointly announced by the Department of Housing and Urban Development and the Department of Energy. Proposals are to contribute to CDBG achievement of national and local community development objectives by determining the feasibility of such heating and cooling systems, and obtaining community consensus on a decision to pursue and develop a district heating system.

  A community district heating/cooling system was defined in the Federal Register announcement as "an energy system that generates thermal energy from one or more central plants to service a multiple number of buildings and customers with thermal services through a piping distribution network, and where possible, a storage facility. The piping system may extend throughout an entire urban area, or may be limited to a single neighborhood."

  The aim of the solicitation is to lower energy costs, reduce environmental pollution, and expand local economic opportunities in CDBG communities. It is expected that $1.5 million will be available and that from 25 to 30 proposals will receive contract awards. A typical contract will be funded at $50,000. The deadline for submitting proposals was January 5, 1981. A total of 111 proposals were submitted; 35 of these mentioned geothermal or heat pump district heating and cooling systems. Results will be announced by late spring or early summer.

  The HUD/DOE Cooperative District Heating Technical Assistance Solicitation will provide funding for Phase I (the feasibility study) of a three-phased program. Phase II, not yet funded, is the design stage. Phase III, which includes no provision for HUD funding, is the construction stage.

  A Geothermal District Heating Technical Assistance Team has been established to provide coordinated technical assistance to those interested in developing geothermal district heating systems and disseminating information about the benefits and possible problem areas in instituting geothermal district heating systems. Experience gleaned from current in-service and under development geothermal district heating systems will be transmitted to potential users. The team is developing a bibliography of geothermal district heating documents, which is scheduled for publication during the next few months.

  Sources: Federal Register, Vol. 45, No. 203, 10/17/80
  GRC Bulletin, 10/80
  International Cogeneration Society Newsletter #6, 12/3/80
  DOE, 9/30/80

- Susanville, CA and Ephrata, WA Awarded HUD Innovative Energy Conservation Grants

  Under HUD's Innovative Energy Conservation Grant Program, the cities of Ephrata, Washington, and Susanville, California have been selected for funding. Over 350 communities have submitted pre-applications under the program. In all, 17 cities were awarded grants totalling $11 million; Ephrata and Susanville were selected for their proposed geothermal energy systems.

  The $468,000 grant awarded to Ephrata, Washington will use the thermal energy of the existing city water supply with heat pumps for space heating residential and commercial buildings. The fluid will subsequently be cooled for drinking water consumption.

  The Susanville, California heating system is funded at $800,000 and will serve 126 low and moderate income residences. It will be integrated with the DOE-funded application demonstration in Susanville, which is under construction.

  Sources: DOE, 10/21/80
  Lassen Times, Susanville, CA, 10/22/80
  Ephrata Granty County Journal, Ephrata, WA, 10/16/80
  Nation's Cities Weekly, 11/3/80

- Klamath Falls, OR Receives Urban Development Action Grant from HUD

  Through its Urban Development Action Grants (UDAG) Program, the Department of Housing and Urban Development issues grants to aid in the development of geothermal district heating projects.

The overall program assists distressed cities and urban counties by alleviating physical and economic deterioration through economic development and neighborhood revitalization. Of the $675 million made available to such municipalities, $5 million has been set aside for district heating projects. This program can assist private utilities start up district heating systems.

The Division of Geothermal Energy, Department of Energy, and HUD jointly mailed a UDAG informational bulletin, followed by a request for proposal, to officials in cities with geothermal potential which also qualify for urban development action grants.

Klamath Falls, Oregon was the first of these cities to receive HUD block grant approval for district heating. The grant, totalling $462,000, will be used to heat residences in the Michigan Street area and to create a revolving fund to retrofit other homes for geothermal heat.
Sources: GRC Bulletin, 10/80
DOE-Region X, 1/80

- Rohr Industries Investigates Use of Geothermal Heat for Manufacturing Plant

Through a $50,000 grant from the California Energy Commission, Rohr Industries, Inc. plans to drill wells on the property surrounding its manufacturing facility in Chula Vista, California to determine if geothermal resources are sufficient to be used for space heating, water heating, and process drying of freshly painted parts. Six buildings could be converted if geothermal resources prove adequate.
Sources: Geothermal Energy Magazine, 7/80
California Energy Commission News, 7/80

- Farmers Home Administration Offers Gasohol Loan Guaranties

About $100 million has been set aside by the Business and Industry Division of the Farmers Home Administration for loan guaranties to stimulate gasohol production. Corporations, organizations, and individuals in cities with populations of less than 50,000 are eligible.
Source: The Geyser, 2/22/81

- Cheyenne, SD Indian Tribe Awarded DOE Geothermal Grant

The Cheyenne River Sioux Indian Tribe of Ziebach County, South Dakota has received a $57,500 grant from DOE for a geothermal development. The system will pipe hot fluid from a geothermal well to 15 housing units on the reservation.
Sources: Aberdeen American News, Brookings, SD, 10/14/80
DOE, 10/24/80

- Modoc Lumber of Klamath Falls, OR Receives Federal Alternate Energy Grant

The Modoc Lumber Company has received a $406,900 DOE grant award to study the feasibility of wood pellet production as an alternate fuel. The aim of the study is to determine the commercial feasibility of producing densified wood biomass fuel for Southern Oregon and Northern California markets. The evaluation will include confirmation of a geothermal resource for process heat. If constructed, the plant could reach a capacity of 80 tons per day and displace 188 barrels of oil per day.
Sources: Oregonian, Portland, OR, 7/10/80
Herald and News, Klamath Falls, OR, 7/10/80

- Nakashima Nursery Plans Geothermal Greenhouse Development

The Nakashima Nursery Company is planning to construct a 40 acre nursery about one mile north of the Salton Sea. One 2.5 acre greenhouse for roses will be constructed annually for the next ten years. A recently drilled 1000 foot geothermal well will supply 115°F water to the structures, each approximately 500 feet long and 218 feet wide. The first crop of roses will be shipped to market in 1981.
Source: GRC Bulletin, 10/80

- Columbia LNG Continues to Consider Use of Geothermal Energy for LNG Vaporization

The Columbia LNG Corporation and the Consolidated System LNG Company are studying the use of moderate-temperature (115°F) geothermal fluid to vaporize liquefied natural gas at a receiving terminal at Cove Point, Maryland. The Southern Energy Company's LNG receiving facility at Elba Island, Georgia is watching the progress at Cove Point. Studies of the amount of water required to replace all of the 1.9 Bcf gas currently used annually have been made by APL.
Source: APL, 3/17/81

- California Energy Commission to Fund Studies of Potential Direct Use Markets

The California Energy Commission (CEC) has issued Request for Proposal #500-80-506 to assess potential markets for direct use geothermal energy projects, particularly those with the highest probability of successful commercial development. Proposals with high potential to stimulate market development will be recommended for detailed feasibility evaluations. Although there is a $50,000 budget for awards resulting from this RFP, funding is dependent on the anticipated extension of a Cooperative Agreement with CEC scheduled to expire on June 30, 1981. Copies of this solicitation can be obtained by contacting:

Contracts Office
MS-56
California Energy Commission
1325 Howe Avenue
Suite 110
Sacramento, California 95825
(916) 920-6068

Source: The Geyser, 3/16/81

- Two Housing Developments Using Geothermal Energy Planned for Truckee Meadows, NV

The Double Diamond Development Company plans to build an 8000 unit residential development near Reno, Nevada. Geothermal and passive solar heating systems will be used by these homeowners and by three schools, a police and fire station, a fair and rodeo grounds, a golf course, a casino, a commercial section, and a light industrial area. The construction of 1500 homes is expected to be completed in 1981.

Warren Properties, Inc. has plans to construct 160 single family dwellings near Reno which will be heated by geothermal energy. Construction of 60 units commenced in late 1980.
Source: GRC Bulletin, 10/80

- Westec Services Assesses Feasibility of Geothermal Alfalfa Drying

Westec Services, Inc., Handlers, Inc., and the California Energy Commission are cooperatively designing and assessing the economics of a geothermal alfalfa drying facility in El Centro, California. If the work proves successful, the project will be the first application of geothermal energy for alfalfa drying in the U.S. It is anticipated that the plant will have an annual capacity of 10,000 tons of alfalfa.
Source: Geothermal Energy Magazine, 9/80

- Resource Confirmation Well to Be Drilled in Montezuma, New York

A deep well is to be drilled on the property of the Clinton Corn Products plant in Montezuma. Drilling will be through the sedimentary sequence to basement. Temperature and productivity of the basal sandstone will be measured to assess the potential hydrothermal resource. The crystalline basement is also to be tested for potential as a hot dry rock resource.

Responses to the RFP for drilling and testing are being evaluated currently and drilling is expected to start shortly. The program is funded by both the New York Energy Research and Development Authority and the Department of Energy, Division of Geothermal Energy. Intended initial applications of the resource are preheating boiler feed water and steeping corn.
Source: APL, 4/81

- New York State Conducting Geothermal Resource Definition Program

The program to define the geothermal resources in the capitol area of New York is in progress and expected to continue for several years. The work is being performed presently by Dunn Geoscience Corporation under joint funding from the State Energy Research and Development Authority and DOE/DGE.
Source: APL, 3/81

3.0 DRILLING ACTIVITIES

This report of drilling activity has been compiled from a data file maintained at MITRE. The file is updated at least once a week from data sources including the Daily Munger Oilogram, the Weekly Reports of the Petroleum Information Corporation's National Geothermal Service, the DOE Weekly Report, USGS monthly reports, and other publications such as the Bulletin of the Geothermal Resource Council and Geothermal Energy Magazine.

Section 3.1 includes a status report on Deep Geothermal Well Completions for 1980 and an analysis of the trends in deep drilling from 1973-1980. For the purposes of this report a deep well is defined as being greater than 2500 feet in depth.

The preliminary status report identifies the number of deep wells spudded in 1980 and reported completed as of March 6, 1981. Due to reporting delays some deep geothermal wells may not be included in the completion data for 1980. The well data are reported by state, well type and footage drilled.

The preliminary trend analysis identifies deep well completions in The Geysers, the Imperial Valley and in aggregated other areas.

This chapter of GPM report number 5 concludes with Section 3.2, which highlights recent major drilling activities.

3.1 Deep Well Completions - Status and Trends

During 1980, deep geothermal wells which have been completed were spudded in eight states. A total of 68 such wells are reported in the MITRE drilling file with a total of 517,812 feet drilled. Forty-two of these wells are considered to be producible, 8 wells were abandoned, and drilling activity on 4 other wells was suspended. The remaining 14 wells are being used for injection, observation, or testing. Therefore 56 of the 68 deep wells completed may be considered useful. The deep geothermal well completions for wells spudded in 1980 are reported by state in Table 3-1.

The number of deep wells completed and the total footage drilled during the analysis period is reported for each state in Table 3-2. California has the largest number of deep well completions, 305. The majority of these are located in The Geysers. The Imperial Valley is the second most active area, both in the state and in the country. California accounts for 71.3 percent of all deep well completions from 1973-1980. Nevada is the next most active state with 40 deep wells completed (9.3 percent). Most of these wells have been drilled in Churchill County. Sixteen wells have been completed in both Idaho and New Mexico. Well completions in Utah numbered 15 during the period. These three states represent 11 percent of the well completions. The remaining 8.5 percent of the completed wells are divided among the other states listed in the table. A summary of the total number of deep geothermal wells completed for the period 1973-1980 is given in Figure 3-1.

The majority of the deep well completions have occurred in California and particularly at The Geysers and the Imperial Valley. The annual and cumulative number of deep wells completed at The Geysers, in the Imperial Valley and in all other locations is shown in Table 3-3. The number of well completions in each of the three areas is plotted in Figure 3-2. Although the number of deep wells drilled outside of The Geysers and the Imperial Valley has increased in 1978-1980 compared to previous years, the percentage of all deep geothermal wells drilled outside of these two areas has varied hardly at all in the 1973 to 1980 period. This can be seen by examining the percentage distribution of the cumulative number of wells completed, Table 3-4.
Source: MITRE, 3/24/81

3.2 Recent Major Activities

This section highlights the major drilling activities reported since the publication of GPM report number 4. The intent is to provide an objective and representative sample of national drilling activity. Due to space limitations it is not practical to include every available drilling report. The items reported here are intended to provide specific information to local interests and at the same time be of general interest to the geothermal community. For ease of assembly the activity reports have been grouped by state.

Nevada

Through the end of 1980 and into the beginning of 1981 several developers were active in various areas of Nevada. At the end of January, Sun Energy Development Corporation (SUNEDCO) was drilling its well on its Dixie Valley Prospect in Churchill County. This well is near a cluster of four

TABLE 3-1A

DEEP GEOTHERMAL WELL COMPLETIONS FOR WELLS SPUDDED IN 1980

WELL TYPE	CALIFORNIA		HAWAII		IDAHO		LOUISIANA		NEW MEXICO	
	# OF WELLS	FOOTAGE	# OF WELLS	FOOTAGE	# OF WELLS	FOOTAGE	# OF WELLS	FOOTAGE	# OF WELLS	FOOTAGE
PRODUCIBLE	38	280544	1	7000					3	15380
INJECTION	4	32236								
OBSERVATION									1	8000
GEOPRESSURED										
HOT DRY ROCK										
TEST	2	14647								
THERMAL GRADIENT										
SUSPENDED	2	19835								
ABANDONED	2	14904			1	7981	2	32942		
TOTAL	48	362166	1	7000	1	7981	2	32942	4	23380

TABLE 3-1B

DEEP GEOTHERMAL WELL COMPLETIONS FOR WELLS SPUDDED IN 1980

WELL TYPE	NEVADA		OREGON		TEXAS		TOTAL	
	# OF WELLS	FOOTAGE	# OF WELLS	FOOTAGE	# OF WELLS	FOOTAGE	# OF WELLS	FOOTAGE
PRODUCIBLE							42	302924
INJECTION							4	32236
OBSERVATION	2	14517	2	9002			5	31519
GEOPRESSURED								
HOT DRY ROCK								
TEST	2	12880					4	27527
THERMAL GRADIENT	1	3010					1	3010
SUSPENDED	2	18427					4	38262
ABANDONED	1	8565	1	4002	1	13940	8	82334
TOTAL	8	57399	3	13004	1	13940	68	517812

TABLE 3-2A

NUMBER OF DEEP WELLS COMPLETED AND
TOTAL FOOTAGE DRILLED 1973-1980

YEAR / STATE	1973		1974		1975		1976		1977	
	NO.	FOOTAGE	NO.	FOOTAGE	NO.	FOOTAGE	NO.	FOOTAGE	NO.	FOOTAGE
ARIZONA	2	19661	1	8027	-	-	-	-	-	-
CALIFORNIA										
Geysers	22	156934	21	152552	24	163052	23	182005	28	227727
Imp. Valley	6	34616	7	39402	11	70777	16	108887	8	53349
Other	4	23437	2	11951	-	-	2	17148	1	4848
HAWAII	1	4123	-	-	1	6450	-	-	-	-
IDAHO	-	-	1	11125	2	11530	1	5850	2	17342
LOUISIANA	-	-	-	-	-	-	-	-	-	-
MARYLAND	-	-	-	-	-	-	-	-	-	-
MONTANA	-	-	1	6790	-	-	-	-	-	-
NEW MEXICO	2	12930	3	24464	3	22548	-	-	1	8909
NEVADA	-	-	5	31876	5	21593	5	19342	1	4975
OREGON	1	5440	1	2828	1	7510	1	5842	-	-
SOUTH DAKOTA	-	-	-	-	-	-	-	-	-	-
TEXAS	-	-	-	-	-	-	-	-	-	-
UTAH	-	-	1	11005	1	6886	4	30902	4	26987
TOTAL	38	257141	43	300020	48	310346	52	369976	45	344137

TABLE 3-2B

NUMBER OF DEEP WELLS COMPLETED AND
TOTAL FOOTAGE DRILLED 1973-1980

YEAR / STATE	1978		1979		1980		TOTAL	
	NO.	FOOTAGE	NO.	FOOTAGE	NO.	FOOTAGE	NO.	FOOTAGE
ARIZONA	-	-	5	21235	-	-	8	48923
CALIFORNIA								
Geysers	24	190183	30	208961	40	292638	212	1574052
Imp. Valley	12	92227	10	64844	7	60424	77	524526
Other	3	17035	3	13543	1	9104	16	97066
HAWAII	1	5595	1	6500	1	7000	5	29668
IDAHO	7	38385	2	14356	1	7981	16	106569
LOUISIANA	1	16234	1	15231	2	32942	4	64407
MARYLAND	-	-	1	5562	-	-	1	5562
MONTANA	-	-	-	-	-	-	1	6790
NEW MEXICO	1	6254	2	13010	4	23380	16	111495
NEVADA	4	21503	12	72523	8	57399	40	229211
OREGON	1	4003	2	12874	3	13004	10	51501
SOUTH DAKOTA	1	4266	1	4112	-	-	2	8378
TEXAS	1	2628	3	24320	1	13940	5	40888
UTAH	3	20742	2	17654	-	-	15	114176
TOTAL	59	419055	75	494725	68	517812	428	3013212

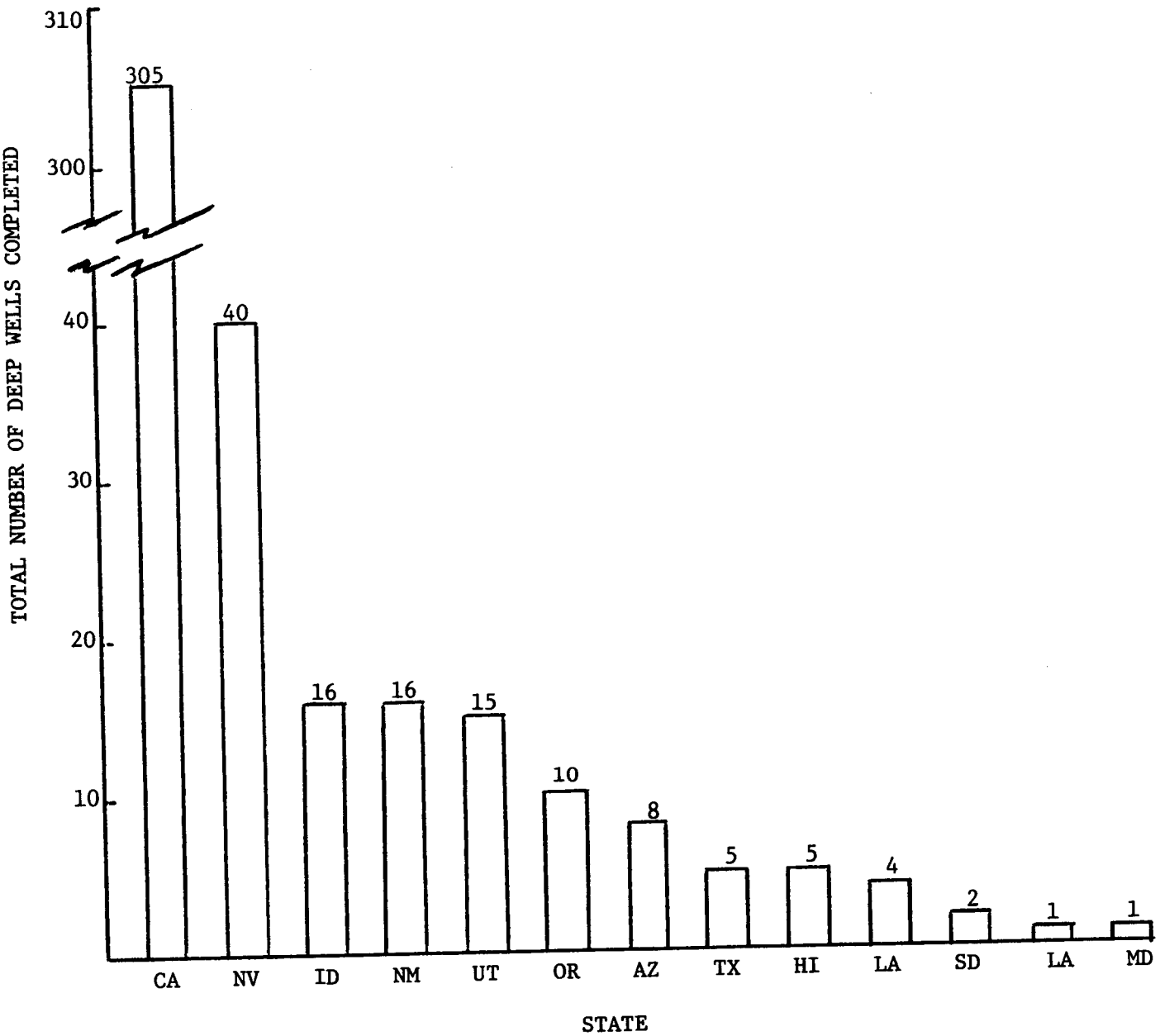


FIGURE 3-1

THIRTEEN STATE SUMMARY OF TOTAL NUMBER OF DEEP GEOTHERMAL WELL COMPLETIONS
1973-1980

TABLE 3-3

NUMBER OF DEEP WELLS COMPLETED

	ANNUAL				CUMULATIVE			
	Geysers	Imperial Valley	Other	Total	Geysers	Imperial Valley	Other	Total
1973	22	6	10	38	22	6	10	38
1974	21	7	15	43	43	13	25	81
1975	24	11	13	48	67	24	38	129
1976	23	16	13	52	90	40	51	181
1977	28	8	9	45	118	48	60	226
1978	24	12	23	59	142	60	83	285
1979	30	10	35	75	172	70	118	360
1980	40	7	21	68	212	77	139	428

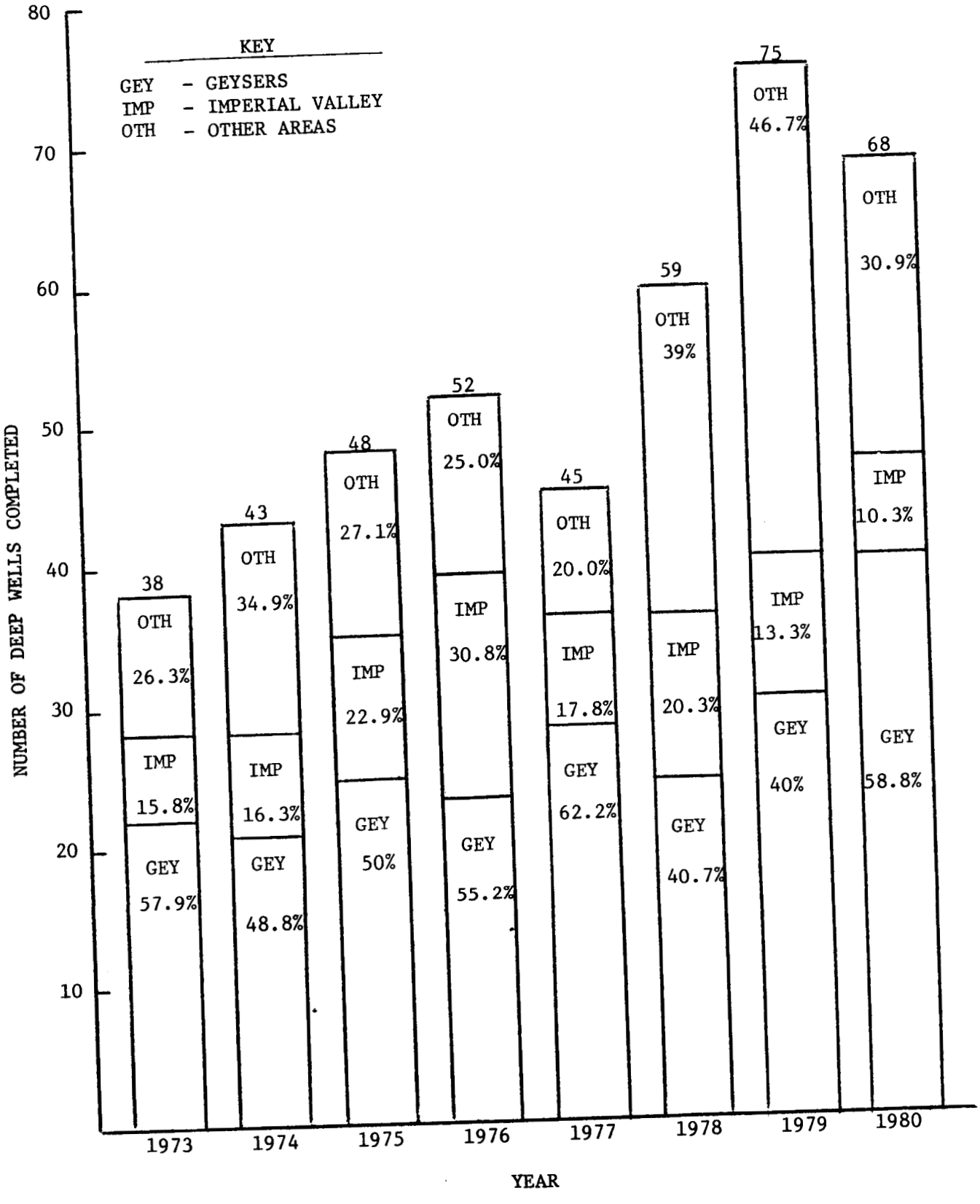


FIGURE 3-2

NUMBER OF DEEP WELLS
COMPLETED ANNUALLY

TABLE 3-4

PERCENTAGE DISTRIBUTION OF THE CUMULATIVE
NUMBER OF DEEP WELL COMPLETIONS

YEAR \ LOCATION	THE GEYSERS	IMPERIAL VALLEY	ALL OTHER LOCATIONS	TOTAL*
1973	57.9	15.8	26.3	100
1974	53.1	16.0	30.9	100
1975	51.9	18.6	29.5	100
1976	49.7	22.1	28.2	100
1977	52.2	21.2	26.5	100
1978	49.8	21.1	29.1	100
1979	47.8	19.4	32.8	100
1980	49.5	18.0	32.5	100

*May not add due to independent rounding.

wells which were completed as potential producers. SUNEDCO's sixth well on the Dixie Valley prospect, the deepest in the State of Nevada (12,000 ft), was also completed as a potential geothermal producer.

Still within Churchill County, Anadarko Production is drilling at the Salt Wells KGRA and has staked the location for a second well. At the Stillwater-Soda Lake KGRA Chevron is drilling a geothermal wildcat in an area where two thermal gradient wells have reported bottom hole temperatures of 147°C (297°F) and 186°C (367°F). Union Oil is also planning to drill in the Stillwater-Soda Lake KGRA.

In Pershing County, Getty plans to drill to 8000 feet in the southern portion of the Colado KGRA. Getty has completed eighteen shallow and intermediate depth wells in this area.

AMAX is drilling in the Tuscarora Mining District of Elko County. The well depth is reported to be greater than 300 feet with a maximum temperature of 91°C (196°F). Production testing is under way.
Sources: PIC NGS, Vol. 2, No. 50, 12/12/80
Vol. 3, No. 4, 1/23/81
Vol. 3, No. 9, 2/27/81
Vol. 3, No. 10, 3/6/81

Oregon

During 1980, as part of the Mount Hood Geothermal Project, the Old Maid Flat (OMF) #1 well was flow tested and OMF #7A was drilled and tested by DOE. The USGS deepened the Pucci and McGee thermal gradient holes and drilled three new ones at Elliot Branch, Clear Branch, and Mount Hood Meadows. At McGee Creek a thermal gradient of 88°C/Km continued to a total depth of 610 meters (2000 feet). The two deep wells in Old Maid Flat had adequate temperatures but inadequate water. None of the three new wells were deep enough to reach below the very active hydrology on the slopes of the mountain, but the Clear Branch hole cut highly permeable fracturing along the Red Hill Fault and the Mount Hood Meadows gradient had curved up to 75°C/Km at the bottom of the well.

Several new leads have been developed during the drilling activity on Mount Hood. Abnormal temperatures in the mud flows of Old Maid Flat may indicate buried hot springs. Very high heat flow rates were encountered at McGee Creek and are probable at Mount Hood Meadows. There are also indications of good permeability along the Red Hill Fault and the possibility of finding permeable zones below the Columbia River Basalt. This may open up targets closer to Portland.
Source: DOE

New Mexico

By the beginning of October, 1980, Union Geothermal had completed its sixth potential production well at the Baca Location in the Valles Caldera. Drilling on the seventh well began in mid-October and this well was completed during the first week of January. This hole bottomed out at 6006 feet and is capable of commercial production.

It was also reported at the end of January that New Mexico State University had scheduled new drilling for its direct use project at Las Cruces. The new well will be drilled to 1000 feet and offsets the University's original 1979 production well.
Sources: PIC NGS, Vol. 3, No. 2, 1/9/81
Vol. 3, No. 3, 1/30/81

Utah

During the last quarter of 1980 Mountain State Resources Corporation (MSR) entered into a joint venture agreement with Union Oil Company of California. Union Oil will drill and test a temperature observation hole to a depth of 2000 feet on an MSR/Chevron lease in the Monroe-Joseph KGRA. In 1982 Union must complete a 6000 foot geothermal exploratory well, unless a commercial reservoir is encountered at a shallower depth. MSR and Chevron will assign all their rights to the Joseph Hot Springs parcel to Union, but will retain a 2.5 percent overriding royalty. Should Union Oil complete the drilling operations specified in the agreement and find geothermal fluid, Union is to assign a 1.25 percent overriding royalty to both MSR and Chevron on certain Union leases in Sevier County.
Sources: PIC NGS, Vol. 2, No. 47, 11/21/80
The Geyser, 12/15/80

Hawaii

By the end of 1980, Geothermal Exploration and Development Co. (GEDCO) had completed its well in the Apihikao-Puna Rift Zone on the Island of Hawaii. The well reached a depth of approximately 7000 feet and is about 2-1/2 miles southwest of the HGP-A Development Group well on the eastern rift zone of Kilauea Volcano.

Early this year Barnwell Geothermal, which owns 80 percent of GEDCO, received a permit to drill the first of six wells near the HGP-A discovery. This will be a joint venture with GEDCO. The remaining five permits are pending. The objective of the initial phase of this development program is to bring 10 to 15 megawatts on line by 1983 or 1984. GEDCO-Barnwell also has several other well applications pending for drilling in the Kapoho Area. Additional activity in the Puna area includes a joint venture between the Kapoho Land Partnership, Dillingham Corporation, and Thermal Power Company. Two 8000 foot wells are planned in the Kapoho Area. The Hawaii County Planning Department has already approved the required special use permits.

Sources: PIC NGS, Vol. 2, No. 41, 10/10/80
Vol. 2, No. 52, 12/24/80
Vol. 3, No. 3, 1/16/81

California

Early in the third quarter of 1980 Aquafarms International of Mecca, California completed a geothermal direct use well to supply its commercial scale prawn farm in Southern California's Coachella Valley.

In October the City of Susanville (Lassen County) began drilling for a three phased direct use project. The first phase calls for two production wells and one injection well to supply the heating requirement of 14 public building complexes. The second phase is independent development of a commercial park, 9 miles east of Susanville. In the final phase of the project a heating system will be developed for 126 residences and a commercial park within the city.

In November 1980, it was reported that the aerospace firm Rohr Industries, Inc. in Chula Vista will drill a 1500 foot hole to tap heat sources ranging from 150-250 degrees Fahrenheit. Expected uses include space and water heating and paint drying. If successful the geothermal system could replace half of Rohr's natural gas consumption which represents 39 percent of the firm's energy bill.

Plans for several holes in the Imperial Valley were announced by Imperial Magma (a subsidiary of Magma Power). Two production wells will be drilled in the Salton Sea KGRA, one near the production wells outside of Niland and one near the San Diego Gas and Electric 10 MW flash binary power plant. In addition, six other holes are planned in the KGRA.

Magma Power filed a plan of operation for development for drilling two wells on its East Mesa lease.

Also in the Imperial Valley, McCulloch Resources Company (MCR) announced plans to drill a 12,000 foot geothermal well near Brawley.

If TRW successfully completes its geothermal production well, 44P Holly Sugar, the company plans 5 more production wells and 1 or 2 more injection wells elsewhere in Imperial County.

The California Department of Water Resources (DWR) and GeoProducts of Oakland, California, obtained federal assistance from DOE. DWR and GeoProducts plan to build a 55 MW power plant near Honey Lake (Lassen County) combining low temperature geothermal energy with burning wood waste to produce electrical energy.

In January, California Energy of Santa Rosa announced plans to begin drilling at the China Lake Naval Weapons Center during the second quarter of this year. If the reservoir is confirmed the initial stage of the development plan calls for the production of 35 MW from a powerplant to be on line by late 1984. Ultimately the field would be expanded to produce 75 MW.

Sources: PIC NGS, Vol. 2, No. 30, 7/25/80
PIC NGS, Vol. 2, No. 46, 11/14/80
L.A. Times, 11/12/80
Record Bee, Lakeport, CA, 12/31/80
PIC NGS, Vol. 2, No. 52, 12/31/80
Vol. 3, No. 5, 1/30/81

Idaho

Drilling was started in August for the Idaho Mall direct use project in Boise. The well was completed late in December. It is estimated that the well will provide 90 percent of the heating requirements of seven Capital Mall buildings (750,000 square feet).

Sources: Idaho Statesman, Boise, ID, 11/11/80
PIC NGS Vol. 3, No. 8, 2/20/81

4.0 EXPLORATION

This section presents periodic reports of exploration activities pertinent to geothermal energy interests. Included in this issue of the Geothermal Progress Monitor is a status report on the DOE/NOAA/State geothermal mapping program. Several regional and local exploration efforts are also highlighted along with a few brief items on research awards to improve exploration techniques.

- The State Geothermal Mapping Program

The state geothermal mapping program is a joint effort of the Department of Energy's Division of Geothermal Energy (DOE/DGE), the National Oceanic and Atmospheric Administration's National Geophysical and Solar Terrestrial Data Center (NOAA/NGSDC) and state resource assessment teams.

Several states that participated in the program produced "public usage" maps. These maps provide detailed information to the public including users, developers, planners, legislators, and members of the legal and financial communities. The data sets for the thermal springs and wells shown on each map include:

- Temperatures
- Flow rates
- Total dissolved solids content
- Depth of wells
- Descriptive paragraphs denoting areas of present use or projected use
- Areas of high probability for future discoveries
- Gradient ranges
- Heat flow values
- Known Geothermal Resource Areas (KGRA's)

Each map also includes cultural and political data sets. Although there may be some variations as to the level of detail reported by each state, the codes and symbols are standardized from map to map.

Public usage maps are currently available for California, Colorado, Idaho, New Mexico, and Utah. Maps for Washington, Texas and North Dakota are scheduled for publication by July 1981. In addition to the maps, NOAA has compiled and published a document entitled Thermal Springs List for the United States, NOAA Key to Geophysical Records Documentation Number 12. The list is arranged alphabetically by state and provides the spring name, the location, the most recently reported surface temperature and the appropriate USGS topographic map coverage.
Source: The Geyser, Vol. 7, No. 4, 10/24/80

- Powell Butte Tested for Geothermal Potential

In late September, the Oregon Department of Geology and Mineral Industries drilled six 500 foot test holes near Powell Butte between Prineville and Bend. DOGAMI geologists were waiting until November for temperatures to stabilize before announcing the results or evaluating the exploration. However, by early October Francana Resources, Inc. of Denver was actively seeking leases from local ranchers in order to continue the exploration.
Source: Sunday Oregonian, Portland, OR, 10/15/80

- Potential Geothermal Energy for Albuquerque, New Mexico

Preliminary reports of the results of a two-year University of New Mexico study indicated that direct use geothermal energy sources are obtainable at economic depths within the Albuquerque metropolitan area.
Source: GRC Bulletin, 9/80

- Exploratory Work Scheduled in Southeastern Arizona

In December it was announced that Phillips Petroleum obtained approval to drill three temperature gradient wells to 300 feet in Greenlee County. Union Oil Co. also plans to drill a 1000-foot heat flow well in Cochise County.
Source: DOE-ID, 12/80

- Idaho Geothermal Study

The University of Idaho is conducting a systematic study of the geothermal resources in the Blackfoot River Basin of Southeastern Idaho. The project includes locating thermal and non-thermal springs, and analyzing their mode of occurrence and water chemistry to determine the types of rock the water flows through. Well log data from deep drilling activities is also being collected.
Source: GRC Bulletin, 12/80

- Geothermal Assessment in Nebraska

Analyses of shallow hole thermal gradient measurements and bottom hole measurements in deep oil and gas exploration holes indicate that potential low-temperature geothermal resources are accessible to about two-thirds of the State.
Sources: University of Nebraska
APL/JHU, 3/81

- Preliminary Results of Hot Dry Rock Exploration Program Reported

In Ohio, a distinct positive temperature anomaly was reported in the shallow aquifer along the Cincinnati-Findlay Arch.

In the mid-continent region, the panhandle of Nebraska, the Mississippi Embayment, and south-eastern Michigan have been identified as possible regions suitable for developing and testing an HDR exploration strategy.

An evaluation of a prospect area in a corridor between Smith Island, Maryland and Assateaque Island, Virginia has indicated a potential for extracting heat by the HDR concept.

Heat flow and thermal gradient anomalies in Central and Western New York are thought to result from radiogenic granite formations. The anomalies are as high as any others observed in the Eastern United States.
Source: APL/JHU, 3/81

- Tennessee Valley Geothermal Resource Appraisal

Extreme western Kentucky and Tennessee (the Mississippi Embayment) are the most likely areas to show direct heat geothermal potential. Shallow wells are considered to be nearly ideal for heat pump applications.
Source: APL/JHU, 3/81

- BLM Issues Permits for Temperature Gradient Drilling in Nevada

It was reported in December, 1980 that the Bureau of Land Management had issued more than 45 permits for geothermal gradient drilling in four Nevada counties. In Lander County, 29 permits were issued for exploratory holes in the Big Smoky Valley area. Permits were also issued for 3 to 5 holes in the Grass Valley area and for a single 500-foot well in the Argenta Rim Area.

In Eureka County, nine 500-foot wells are planned near the Beowawe Geysers geothermal area. Three wells are also planned in the Silver Cloud Mine area of Elko County, and in Pershing County four wells are planned in the Packard Wash area.
Source: DOE-ID, 1/20/81

- DOE Awards Research Grants for Geothermal Exploration Methods Improvement

The Department of Energy has awarded four contracts for research projects aimed at improving methods for geothermal exploration. The responsible organizations and brief project descriptions are provided in the following list:

- California Division of Mines and Geology	Micro-Earthquake Survey and Analysis in the Mono-Long Valley KGRA
- Department of Geology Stanford University	Origins of Geothermal Reservoirs

- Institute of Geophysics and Planetary Physics Univ. of Cal., Riverside	A Quantitative Model of Water-Rock Interactions in the Cerro Prieto Geothermal System
- Department of Geophysics Stanford University	A Laboratory Evaluation of a Sodium-Potassium-Calcium Geothermometer

Source: PIC NGS, Vol. 2, No. 45, 11/7/80

5.0 LEASES

The acquisition of leases by commercial developers is an indicator of both their long-term expectations for developing general areas and their near-term requirements for developing specific sites. Because land acquisition must occur before exploration and development, the leasing process is a crucial phase in exploiting geothermal resources for energy production.

This section reports activities of federal and state governments in making lands available for exploration for and use of geothermal resources. Sources of information on lands leased by the federal Bureau of Land Management (BLM) and the U.S. Forest Service (USFS) include the USGS Conservation Division, which maintains records of federal lease status, the Petroleum Information Corporation National Geothermal Service newsletter, and other general geothermal news services. The National Geothermal Service is the main source of information on state land leasing.

Section 5.1 summarizes highlights of the federal lands leasing program in 1980. Section 5.2, Recent Major Activities, includes information on recent state leasing activities.

5.1 1980 Highlights

Six major competitive lease sales were reported in 1980: three in Oregon, two in Nevada, and one at the Heber geothermal field in California. A major lease sale scheduled by BLM in July for lands in the Mono-Long Valley, California KGRA was cancelled as a result of an unresolved conflict over the lease terms. The highest bid in 1980 was submitted by Chevron USA for 10.26 acres in the Heber KGRA at $4,403.13 an acre, for a total of $45,776.11 for the parcel. The largest leased parcel was in Oregon's Alvord KGRA, for which Getty Oil bid $20.99 an acre for 14,461 acres. The greatest amount of land competitively leased in 1980 was also in the Alvord KGRA, a total of almost 32,000 acres. A summary of the results of competitive lease sales in 1980 is presented in Table 5-1.

Table 5-2 presents a comparison of the status of geothermal leasing on federal and Indian lands at the end of FY 1979 and FY 1980. The greatest increases in the amount of land leased in 1980 were in Nevada and Oregon, states which were also areas of greatest competitive leasing activity in 1980.

Figures 5-1 and 5-2 present leasing activity (in cumulative acres) over the six-year period from 1974 to 1980. By the end of fiscal year 1980, about 550,000 acres of land were under competitive lease, about 39 percent of all offered lands. The amount of KGRA land "currently leased" at the end of FY 1980 was essentially unchanged compared to the end of FY 1979.

Approximately two million acres were held under non-competitive leases at the end of fiscal year 1980. This is about a 19 percent increase compared to non-competitive lease lands under lease at the end of FY 1979 and represents about 11 percent of all lease applications filed over the six-year period. Lands terminated or relinquished account for about 32 percent of lands ever leased non-competitively. The rate of federal actions on non-competitive applications increased significantly in FY 1980, compared to the three previous years. Nevertheless, the backlog of applications awaiting action rose slightly in FY 1980 because of an increased rate of new applications.

Source: MITRE, 4/7/81.

5.2 Recent Major Activities

Federal Lands Leasing

- o USFS Modifying Leasing Decisions for Gifford-Pinchot National Forest

  The U.S. Forest Service (USFS) has rescinded a May 15, 1980 decision regarding leasing of lands in Gifford-Pinchot National Forest. The earlier decision, which established terms and conditions for leases being offered in the national forest, was considered by industry as too restrictive and led to a request from the Washington State Energy Office for a moratorium on offering new leases within the forest. The USFS denied the request, but agreed to meet with the USGS and other groups to re-evaluate the decision. A recent Draft Record of Decision by the Region VI Forester discusses the outcome of the review and states intentions to modify conditions surrounding remaining leases to be offered in the forest and to offer leases in 98 percent of the area in question.

  A similar controversy which arose last summer over leasing in the Inyo National Forest, which represents 280,000 acres of the Mono-Long Valley KGRA, has not yet been resolved. An administrative appeal filed with the USFS by Phillips Petroleum in June 1980 contended that specific provisions in the terms of the scheduled lease sale of acreage in the Mono-Long Valley KGRA

TABLE 5-1

FEDERAL COMPETITIVE LEASE SALE RESULTS,* 1980

DATE	KGRA/STATE		HIGH BIDDER	ACREAGE OFFERED	ACREAGE ISSUED	$ ACRE	ACCEPTED BIDS ($)
1/8	Klamath Falls	OR	Intercontinental Energy Corp.	4,854.34	118.35	7.75	917.53
	Crump Geyser	OR	Hunt Oil	22,756.16	6714.53	1.45	9711.93
	Alvord	OR	Anadarko	66,679.29	4743.34	68.93	326,972.93
	Breitenbush H.S.	OR	Union Oil of CA	1029.00	1040.00	9.94	10,341.45
4/22	Steamboat Springs	NV	Geothermal Resources International	29,961.09	248.75	64.82	16,123.97
	Dixie Valley	NV	Geothermal Resources International		9572.00	3.87	33,043.59
	Darrough H.S.	NV	National Geothermal Corp.		1720.00	9.30	16,000.00
	Darrough H.S.	NV	National Geothermal Corp.		1983.14	5.04	10,000.00
	Darrough H.S.	NV	Geothermal Resources International		2380.04	3.11	7401.92
4/29	Alvord	OR	Anadarko	73,658.36	2560.00	155.28	397,515.80
	Alvord	OR	Anadarko		2520.00	90.23	227,379.60
	Alvord	OR	Anadarko		2400.00	62.36	149,664.00
	Alvord	OR	Getty Oil		14,461.07	20.99	303,503.13
	Crump Geyser	OR	Chevron USA	19,642.59	80.96	13.06	1057.34
	Crump Geyser	OR	Chevron USA		2568.46	2.25	5779.04
9/23	Gerlach	NV	Occidental Geothermal	27,025.00	2535.00	8.88	22,500.00
	San Emidio Desert	NV	Chevron USA		1980.00	5.27	10,434.60
10/23	Alvord	OR	Al Aquitaine	4,926.46	2360.00	105.77	249,617.20
	Alvord	OR	Hunt Oil		2566.46	8.32	21,352.95
12/10	Heber	CA	Chevron USA	10.26	10.26	4,403.13	45,176.11

*Acreage offered but not bid on is not shown in this table.

SOURCE: Compiled from Petroleum Information's National Geothermal Service newsletter

TABLE 5-2

CHANGES IN THE STATUS OF GEOTHERMAL LEASING
ON PUBLIC LAND DURING FY 1980

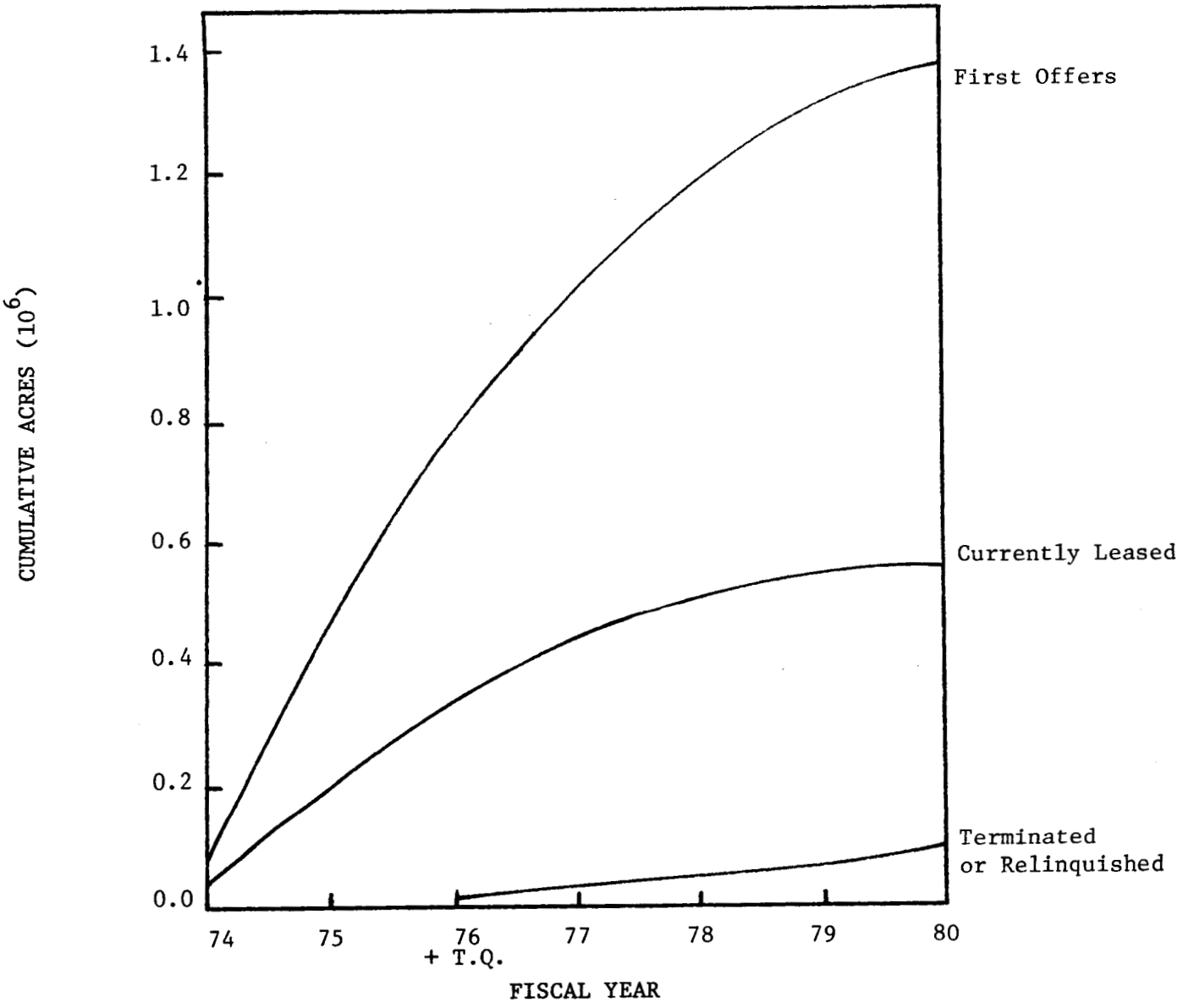
STATE	NUMBER OF LEASES[1]			ACREAGE LEASED[1]		
	1979	1980	CHANGE	1979	1980	CHANGE
Alaska	-0-	-0-	-0-	-0-	-0-	-0-
Arizona	13	13	-0-	21,541	21,541	-0-
California[2]	57	56	-1	68,943	67,830	-1,113
Colorado	25	22	-3	34,927	30,476	-4,451
Idaho	136	86	-50	246,722	153,427	-93,295
Montana	6	-0-	-6	10,687	-0-	-10,687
Nevada[3]	499	647	+148	954,577	1,201,257	+246,680
New Mexico	121	120	-1	220,155	210,014	-10,141
Oregon	150	233	+83	228,929	375,740	+146,811
Utah	278	269	-9	472,507	453,677	-18,830
Virginia	11	11	-0-	19,774	19,774	-0-
Washington	-0-	2	+2	-0-	5,120	+5,120
Wyoming	4	4	-0-	7,448	7,448	-0-
TOTAL	1,300	1,463	+163	2,286,210	2,546,304	+260,094

[1]As of September 30 in the respective years

[2]Includes one lease of 120 acres on Indian land.

[3]Includes one prospecting permit on 79,590 acres on Indian land.

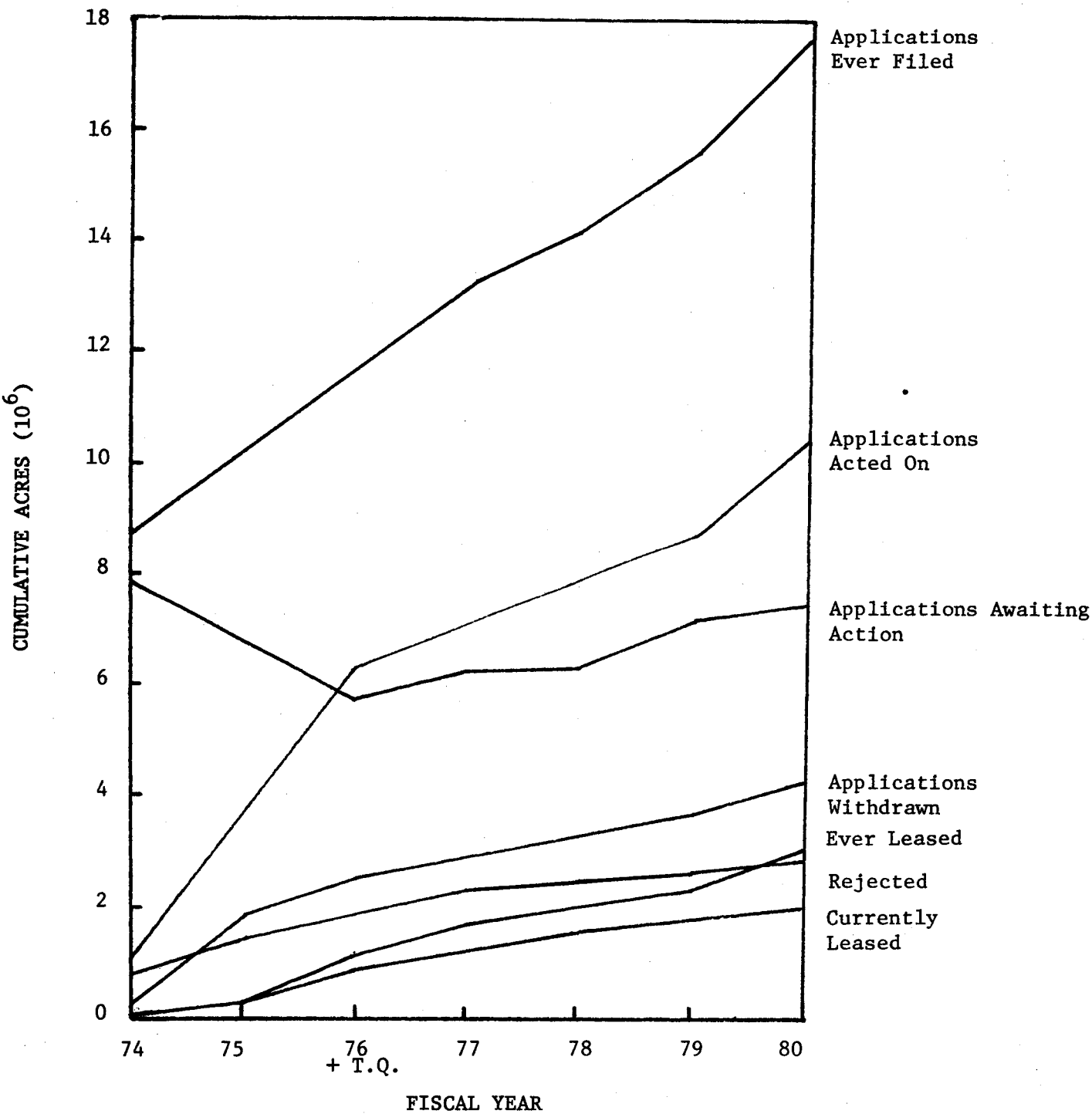
SOURCE: USGS, Conservation Division, Office of Deputy Conservation Manager for Geothermal, Menlo Park, CA.



Source: USGS, Conservation Division, Office of Deputy Conservation Manager for Geothermal, Menlo Park, CA

FIGURE 5-1

COMPETITIVE GEOTHERMAL LEASES (KGRA Lands)



Source: USGS, Conservation Division, Office of Deputy Conservation Manager for Geothermal, Menlo Park, CA

FIGURE 5-2

NONCOMPETITIVE GEOTHERMAL LEASES

were unacceptable to industry. The company, arguing that the small percentage of land being offered in the KGRA was inconsistent with the land management agencies' mission to expedite leasing in KGRA's, was joined by three other major companies. As a result, the sale was postponed until further notice by BLM. Regional Foresters are now re-evaluating the stipulations and a new revised decision by the Chief Forester is expected in April. A lease sale will not be scheduled until the decision is issued.
Source: GRC Bulletin, 12/80; USFS, 3/26/81

- USFS Region VI to Process Leases

The U.S. Forest Service (USFS) Region VI office in Portland, Oregon announced in October that it would process a backlog of 500 geothermal lease applications by the third quarter of 1981. Thirty-six more will be processed in the first quarter of 1982 and 21 in the first quarter of 1983. The applications are for leases in seven different national forest areas of Oregon and Washington.
Source: GRC Bulletin, 12/80

- USFS to Lease in Deschutes National Forest

A recently-completed supplement to the Environmental Assessment Report for non-competitive geothermal leasing in the Forest Rock Ranger District in Oregon's Deschutes National Forest details acreage to be set aside for different types of leasing and acreage where leases will be denied. The report prohibits leasing in old growth management areas, permits two-stage leasing in visual and game species management areas, and allows standard leasing in the remainder of the district. Under the two-stage leasing plan, the first stage will allow exploration up through the drilling of an exploratory well, while the second stage, which is contingent on discovering a usable resource and then completing a site-specific environmental assessment, would allow production or full-scale development of geothermal resources. Over 115 applications for leases within the study area had been awaiting the outcome of the leasing assessment.
Sources: Pioneer, Madras, OR, 1/8/81
Bulletin, Bend, OR, 12/31/80
Herald and News, Klamath Falls, OR, 8/21/80

- Lassen Park Off Limits to Geothermal Exploration

At the request of the National Park Service, a recent "Declaration By Taking" order issued by the U.S. Congress has restricted California's Lassen Park from geothermal exploration. The action effectively took 566 acres of "inholdings" from 30 private individuals and corporations. One of the major reasons for taking the land, according to the park's chief naturalist, is the potential adverse effects of geothermal development on geysers and hot springs, effects which are not yet fully understood. Though exploration is no longer allowed in the park as a result of the declaration, the U.S. Forest Service has apparently not ruled out the possibility of allowing drilling near the park; a recently completed environmental study of the area just outside the Lassen border includes detailed procedures to be followed during geothermal exploration.
Source: Chico News and Review, Chico, CA, 8/1/80

- Eighty-four Leases Approved in Idaho

The BLM district office in Idaho Falls has recommended approval of 84 of 87 geothermal lease applications for 350,000 acres of land in southeastern Idaho. BLM recommended that the leases be issued with stipulations to protect sensitive resources in critical areas.
Source: Deseret News, Salt Lake City, UT, 7/9/80

- Coso KGRA Lease Sale

The Bureau of Land Management and the U.S. Department of the Navy expect to reach an agreement in April on modifying a China Lake Naval Weapons Center land order to allow for geothermal leasing on the military base. The proposed 66,000 acre lease sale is for an area in the Coso KGRA. The original order giving the Navy jurisdiction over the lands containing the Coso KGRA does not allow for geothermal leasing. When the land order modification becomes effective, the resource will be made available for lease sale, which is tentatively scheduled for July or August 1981.
Sources: PIC NGS, Vol. 3, No. 6, 2/6/81
BLM, 3/26/81

- Borax Lake Leases

The Bureau of Land Management (BLM) has issued four leases for geothermal exploration in Oregon's Borax Lake area to Anadarko Production Company and Getty Oil. (See Section 11.0, ENVIRONMENTAL ACTIVITIES).

- Leasing of State Lands

Utah -- Only one tract of twelve offered by the Utah Department of Natural Resources drew an application at a sealed bid sale in September 1980. A total of $1710.02 or $3.02 an acre was paid by a private individual for lands in the Meadow-Hatton KGRA in Millard County.

California -- Geothermal Power Corporation was the apparent high bidder in a lease sale of 120 acres of reserved state mineral lands in Lake County last July. The company bid 30.6 percent of net profits for the parcel. The only other bid was submitted by the Northern California Municipal Power Corporation.
Sources: Independent Coast Observer, Gualala, CA, 8/25/80
PIC NGS, Vol. 2, No. 40, 10/3/80

- Revisions to California Exploration Regulations

The California State Lands Commission has proposed minor revisions to its regulations dealing with exploration, leasing and development of geothermal resources on state lands. The Commission's proposal would allow deferral of drilling requirements at any time during the lease and would extend time limits during which the owner of surface lands for which the state has reserved the minerals can exercise his option to match a high bid in a competitive lease sale. According to the Commission, the amendments are designed to assist both the Commission and industry to develop the resource on state lands more rapidly.
Sources: Times-Star, Middletown, CA, 10/2/80
Observer, Sacramento, CA, 10/17/80

6.0 OUTREACH AND TECHNICAL ASSISTANCE

Outreach and technical assistance is provided to individual citizens, cities, businesses, and others interested in pursuing the use of geothermal energy for space heating, agricultural, industrial processing and other applications.

A program funded by the Division of Geothermal Energy offers up to 100 hours of technical and economic assistance to interested potential users of geothermal energy. The assistance provided is not intended to include a complete engineering study of potential users' problems, but rather an identification of possible problem areas. The Applied Physics Laboratory, the Idaho National Engineering Laboratory, and the Oregon Institute of Technology provide basic engineering evaluations; Gruy Federal, Inc. and the University of Utah Research Institute perform geothermal resource analyses. (For example, Gruy Federal can provide up to 100 hours of geologic/hydrologic assistance to potential users of geothermal resources in the eastern portion of the United States. The assistance can be provided in conjunction with the surface facility engineering and economic analysis assistance provided by Johns Hopkins Applied Physics Laboratory.) Further, these technical assistance centers utilize the capabilities of the Brookhaven National Laboratory, which has developed a computer model to analyze the technical and economic feasibility of geothermal district heating systems; and the Earl Warren Legal Institute, which assesses legal and institutional ramifications of geothermal development. Federal funding for these centers will be phased out in FY 1982.

The National Conference of State Legislatures (NCSL) provides technical assistance to state legislatures. The NCSL Geothermal Project is designed to encourage and facilitate state policy reviews leading to legislation which will provide a favorable climate for geothermal development. It prepares research documents and, in conjunction with state legislatures, identifies issues of concern, analyzes policy options and proposes legislation. The Project includes water-source heat pumps within its scope. Federal funding for this program will be phased out in FY 1982.

A geothermal components analysis program is offered by the Division of Geothermal Energy. The objective of this program is to increase understanding of geothermal materials performance in field applications. The analysis of electric and nonelectric components is provided at no cost, and the materials need not be considered "failed" to qualify under the program. Through the materials analysis program, DGE is able to identify and study materials problems, review designs, and recommend solutions.

6.1 Recipients of Technical Assistance During 1980

The centers funded under the Division of Geothermal Energy's 100-hour technical assistance program received many requests during the year. A sample of the projects receiving assistance in 1980 is presented in Table 6-1. An increase in the number of requests to assess the feasibility of geothermal ethanol production at various sites was noted.

6.2 Recent Major Activities

Described below are selected projects recently requesting or receiving technical assistance and other outreach efforts.

- Geothermal Space Heating Considered at Kings Bay Naval Base, GA

  Using available data, the prospects for using geothermal energy for space heating at the Naval Facilities Engineering Command (NAVFAC) were estimated and discussed with representatives from this military installation.
  Source: JHU/APL, 3/17/81

- Oregon Institute of Technology Recruits Private Engineering Firms

  The OIT Geo-Heat Center's Technical Assistance (TA) program, which provides preliminary engineering and economic feasibility studies, began recruitment of qualified private engineering and consulting firms interested in obtaining first-hand geothermal project experience. Some of the Geo-Heat Center's requests for assistance under the TA program will be subcontracted to selected firms. The Center's TA program covers the states of Oregon, Washington, Nevada, California, Arizona, Alaska, and Hawaii.

  A total of between 40 and 50 feasibility study subcontracts will be awarded by OIT and the other technical assistance centers during calendar year 1981. Past subcontracts have included assessments of geothermal space heating systems for schools, hospitals, and municipal buildings. One

TABLE 6-1
PROJECTS RECEIVING AID UNDER DOE TECHNICAL ASSISTANCE PROGRAM

STATE	OPERATOR&LOCATION	TYPE OF USE	FIRST YEAR	FEDERAL FUNDS $000	STATE FUNDS $000	LOCAL FUNDS $000	BTU/YEAR BILLIONS	BTU ESTIM	COMMENTS
AK	MELOZI HS LODGE MELOZI HS FAIRBANKS	RCSH					.5	E	
AR	NATIONAL PARK SERVICE HOT SPRINGS GARLAND	RCSH					.5	E	FEAS. STUDY REQUESTED BY PARK SERVICE,PERFORMED BY APL
CA	NAKASHIMA NURSERY SALTON SEA IMPERIAL	AGGH	1981				140.0	E	DEV. 40 ACRES FOR GREENHOUSE O PER. AS RESULT OF TECH. ASSIS. PROGRAM
CO	STATE OF COLORADO CANON CITY FREMONT	MUSHRM					100.0	E	FOR PENITENTIARY & PRISON INDU S.,FEAS. EVAL. BY MMEI
CO	TIMBERLINE ACADEMY DURANGO LA PLATA	CMSH		*			1.0	E	RECEIVED TECH. ASSIS. FROM EG& G,MMEI
GA	NAVAL FACILITIES ENG. COMM KINGS BAY UNKNOWN	CMSH					1.0	E	APL PROV. TECH. ASSIS.
ID	UNKNOWN KUNA ADA	INPH		*			60.0	E	ETHANOL PLANT,EG&G ASSIS.
ID	UNKNOWN PARMA CANYON	INPH					60.0	E	ETHANOL PLANT CONSIDERED,EG&G ASSISTANCE
ID	CITY AND SCHOOL DISTRICT CHALLIS CUSTER	RESH			*	*	5.0	E	SITE SPECIFIC PLAN TO BE PREPA RED
ID	UNKNOWN FELT TETON	INPH		*			60.0	E	ETHANOL PLANT,EG&G ASSIS.
MD	COLUMBIA NATURAL GAS CCVE POINT CALVERT	INPH					55.2	E	GASIFY LNG,APL PERFORM. FEAS. STUDY,VPI TO DRILL RES. CONF. WELL
MD	SOMERSET COUNTY SCHOOL CRISFIELD SOMERSET	RESH					4.0	E	FOR HIGH SCHOOL,FEASIBILITY ST UDY PERFORMED BY APL
MD	WICOMICO COUNTY SCHOOL PITTSVILLE WICOMICO	CMSH					4.5	E	MIDDLE SCHOOL,APL PERFORMING F EASIBILITY STUDY

TABLE 6-1
PROJECTS RECEIVING AID UNDER DOE TECHNICAL ASSISTANCE PROGRAM

STATE	OPERATOR&LOCATION	TYPE OF USE	FIRST YEAR	FEDERAL FUNDS $000	STATE FUNDS $000	LOCAL FUNDS $000	BTU/YEAR BILLIONS	BTU ESTIM	COMMENTS
MT	FIRST NATIONAL BANK WHITE SULPHUR SPGS MEAGHER	CESH	1980		*		.5		COMMERCIAL BUILDING,TECH. ASSIS. PROV. BY EG&G
MT	MT. VIEW HOSPITAL WHITE SULPHUR SPGS MEAGHER	CHSHHW	1				1.0	E	ALSO COURTHOUSE,2 SCHOOLS
NJ	U.S. AIR FORCE MCGUIRE AFB UNKNOWN	RESHSC					40.0	E	APL PROV. TECH. ASSIS.,200 RESIDENTIAL UNITS
NV	DILL MEDICAL CENTER CALIENTE LINCOLN	CESH					1.0	E	FEAS. STUDY PERFORMED BY OIT
NV	DAMONTE RANCH RENO WASHOE	REDH			*		1,200.0	E	CONSID. FEAS.,OIT PROV. TECH.ASSIS.,6000 UNIT SUBDIVISION
OR	MODOC LUMBER COMPANY KLAMATH FALLS KLAMATH	INPH			*		100.0	E	FEAS. STUDY OF DENS. OF WOOD BIOMASS RESIDUE, GEO. FOR PROC. HEAT.
OR	PELICAN SCHOOL KLAMATH FALLS KLAMATH	CHSH					1.0	E	
OR	PACIFIC WOOD FUEL LAKEVIEW LAKE	INPH					100.0	E	WOOD CHIP DRYING FOR PRESTO LOGS,FEAS. STUDY COMPLETE
OR	UNKNOWN LAKEVIEW LAKE	MUDH					5.0	E	20-30 HOMES,CHURCH,BUSINESSES, USFS BLDGS.,TECH. ASSIS. FROM OIT
SD	EDGEMONT SCHOOL DISTRICT EDGEMONT FALL RIVER	CESHHW			*		4.0		RECEIVED TECH. ASSIS. FROM EG&G,PRELIM. DESIGN UNDERWAY
SD	CAPITOL MALL PIERRE HUGHES	CESH					3.0		PROPOSED HEATING OF MALL,NREL PROV. TECH ASSIS.
UT	U.S. AIR FORCE HILL AFB DAVIS	RESH	1981		*		10.0		PILOT PROJECT,DISAPPOINT. EXPL. RESULTS,TECH. ASSIS. BY EG&G
UT	B & B ENERGIES COVE FORT MILLARD	INPHGH	1981				420.0	E	ETHANOL PLANT, 7 MIL. GAL/YR, FEED.-BARLEY,SEEK. GLGF FUND. UURI PROV. TECH. ASSIS.

TABLE 6-1
PROJECTS RECEIVING AID UNDER DOE TECHNICAL ASSISTANCE PROGRAM

STATE	OPERATOR&LOCATION	TYPE OF USE	FIRST YEAR	FEDERAL FUNDS $000	STATE FUNDS $000	LOCAL FUNDS $000	BTU/YEAR BILLIONS	BTU ESTIM	COMMENTS
UT	UNKNOWN CRYSTAL HS SALT LAKE	RCSEPL					.5	E	GREENHOUSE BEING EVAL., EG&G P ROV. TECH.ASSIS.
VA	NAVAL AIR REFIT FACILITY SEWELLS PT.COMPLEX NORFOLK	CHSH					3.3	E	FEAS. STUDY BY APL COMPLETE-BE COMM. GEOTHERMAL USE W/OUT HEA T PUMP
WA	CITY OF OTHELLO OTHELLO ADAMS	CHDH					5.0	E	OIT TO DO FEAS. STUDY
WA	CITY OF NORTH BONNEVILLE NORTH BONNEVILLE SKAMANIA	CHDHPH		*	*		5.0	E	POSS. EXPANSION TO LIGHT INDUS , APPLIC.
WA	UNKNOWN DAVIS HIGH SCHOOL YAKIMA	CHSH					1.0	E	FEASIBILITY STUDY BY CIT
WA	JOHN GRAHAM ASSOC. ST. ELIZ. HOSP. YAKIMA	CHSH					1.0	E	FEASIBILITY STUDY BY CIT
PROJECT TOTAL							2,393.0		

* DESIGNATES RECIEPT OF GOVERNMENT FUNDING
E INDICATES ANNUAL ENERGY USE WAS ESTIMATED BY MITRE; ASSUMING THAT 60,000 BTUS OF GEOTHERMAL HEAT ARE USED PER GALLON OF ETHANOL PRODUCED. WHERE CAPACITY IS UNKNOWN, IT IS PRESUMED TO BE 1 MILLION GALLONS/YEAR.

KEY FOR TYPE OF USE

USE CATEGORY:
AG = AGRICULTURAL
CM = COMMERCIAL
RC = RECREATIONAL
AQ = AQUACULTURAL
IN = INDUSTRIAL
RE = RESIDENTIAL

APPLICATION:
AG = AGRICULTURE
BA = BATH
BW = BOTTLED WATER
CW = COMMUNITY WATER SUPPLY
EO = ENHANCED OIL RECOVERY
GH = GREENHOUSE
IR = IRRIGATION
PH = PROCESS HEAT
SH = SPACE HEATING
SM = SNOW/ICE MELT
SW = STOCK WATERING
AQ = AQUACULTURE
BO = BOILER WATER
CG = CAMPGROUND
DH = DISTRICT HEAT
GD = GARDEN
HW = HOT WATER
LN = LAUNDRY
PL = POOL
SC = SPACE COOLING
SP = SPA

subcontracted request made to OIT involved the use of geothermal heat for a wood waste dryer in Oregon.
Source: OIT, 12/80

- Geothermal Community Workshop Held in Oregon

A Geothermal Community Workshop was held in December 1980 at Oregon Institute of Technology. The morning session consisted of classroom-type instruction using Geothermal Resources Council Special Report No. 8, "Direct Utilization of Geothermal Energy: A Layman's Guide" as a text. The afternoon session involved a field trip to six geothermal application sites. Dr. Kenneth Light, OIT president and Derek Freeston, Geothermal Institute, University of Auckland, New Zealand were the luncheon and dinner speakers. Community representatives from Burns, Union County, Lakeview, Vale, Corvallis, McKenzie Bridge, the Bureau of Land Management, Bellevue, Richland, and Snohomish attended.
Source: OIT, 12/80

7.0 FEASIBILITY STUDIES AND APPLICATION DEMONSTRATIONS

The U.S. Department of Energy, Division of Geothermal Energy, has issued solicitations and awarded funding for direct use feasibility studies (Program Research and Development Announcements). Support has been provided for site-specific agribusiness, industrial process heating, and district and institutional heating evaluations of direct use potential.

As a result of two direct use demonstration solicitations (Program Opportunity Notices), 21 demonstration projects are being funded on a cost-shared basis by the U.S. Department of Energy, Division of Geothermal Energy. These applications seek to demonstrate the economics and technical feasibility of the direct use of geothermal energy. When operational, these projects will produce close to 2,954 billion Btus per year, the equivalent of 509,000 barrels of oil. At present, 4 demonstration applications are in service, providing 105 billion Btus per year (see Table 7-1). The other 17 projects are under development, as described in Table 7-2. Federal financial support for these kinds of projects will be phased out in FY 1982.

7.1 1980 Highlights

The following DOE-funded direct heat demonstrations achieved operational status in 1980:

- Klamath County YMCA, Klamath Falls, Oregon -

  A geothermal system successfully supplies energy to heat a 30,000 square foot recreational center and an olympic-size swimming pool. Geothermal fluid at a temperature of 147°F is extracted from a 1410 foot well, flowing at 350 gallons per minute. The hot water is then circulated through a heat exchanger, and disposed of down another well. Total system costs approximated $250,000.

- Diamond Ring Ranch, Hayes, South Dakota -

  This direct use demonstration satisfies the space heating demands of two mobile homes, two permanent residences, a shop building, a bunkhouse, a hospital barn, and dries all grain harvested on the ranch. The 153°F water is also used to irrigate lawns, gardens, and trees without affecting the soil. A garage is heated with a series of pipes embedded in the concrete floor. All other heating is accomplished via water-to-air heat exchangers. The grain dryer is used to dry small grains such as wheat, oats, and barley in the summer and corn in the fall. Approximately 100 gallons of geothermal fluid per minute flow to the grain dryer. The resource fulfills the total heating energy demand of the ranch.

- St. Mary's Hospital, Pierre, South Dakota -

  A 2100 foot well drilled into the Madison aquifer supplies 106°F geothermal water at a rate of 375 gallons per minute for hospital space heating. This application satisfies 100 percent of the space heating needs of a new 70,000 square foot wing, and partial heating needs of the original hospital complex. Geothermal energy space heats the high volume of outside air required to flow into the hospital for ventilation. The well also provides energy to preheat domestic hot water from 55°F to 100°F, before going to a conventional oil-fired unit. The St. Mary's geothermal system is expected to save 115,000 gallons of fuel oil annually. The discharged geothermal fluid is pumped into the Missouri River. Project costs totalled $712,000 (75 percent funded by DOE); the system is expected to save $109,000 annually in fuel costs.

- Haakon School District, Philip, South Dakota -

  The high school, the elementary school, and four other school buildings in Philip are supplied with space heat and domestic hot water from a 4200 foot geothermal well. From these facilities, the water is pumped to downtown businesses to meet about half of their heating needs. The project, which cost close to $1.1 million, could save the school district as much as 36,000 gallons and the businesses 26,000 gallons of fuel oil annually.

Federally-funded direct use demonstrations which were terminated during 1980 are described below:

- Ore-Ida Potato Processing Plant, Ontario, Oregon -

  This food processing direct use application was abandoned in early 1980, when extensive drilling failed to locate a sufficient quantity of hot water to satisfy plant needs. The well, drilled to 10,000 feet, produced 400°F bottom hole temperatures, but the flow rate fell far short of that expected.

TABLE 7-1
DOE-SPONSORED APPLICATION DEMONSTRATIONS
IN SERVICE

STATE	OPERATOR&LOCATION	FIRST YEAR	TYPE OF USE	FEDERAL FUNDS $000	STATE FUNDS $000	LOCAL FUNDS $000	BTU/YEAR BILLIONS	ESTIM	COMMENTS
OR	KLAMATH COUNTY YMCA KLAMATH FALLS KLAMATH	1980	RCSH	*		*	5.0		PON-79
SD	GENE ARMSTRONG DIAMOND RING RANCH HAAKON	1980	AGSHSWPH	*			78.7		PON-78,HEATING FARM BLDGS., DRY GRAIN,WARM STOCK WATER
SD	HAAKON SCHOOL DISTRICT PHILIP HAAKON	1980	MUDHSH	*		*	9.5		PON-78, 5 SCHOOL BLDGS.,OPER., 8 COMM. BLDGS IN PROGRESS
SD	ST. MARY'S HOSPITAL PIERRE HUGHES	1980	CMSHHW	*			11.4		PON-78, HOSPITAL SPACE HEATING
STATUS TOTAL							104.6		

* DESIGNATES RECIEPT OF GOVERNMENT FUNDING.
E INDICATES ANNUAL ENERGY USE WAS ESTIMATED BY MITRE; ASSUMING THAT
60,000 BTUS OF GEOTHERMAL HEAT ARE USED PER GALLON OF ETHANOL PRODUCED.
WHERE CAPACITY IS UNKNOWN, IT IS PRESUMED TO BE 1 MILLION GALLONS/YEAR.

TABLE 7-2
DOE-SPONSORED APPLICATION DEMONSTRATIONS
UNDER DEVELOPMENT

STATE	OPERATOR&LOCATION	FIRST YEAR	TYPE OF USE	FEDERAL FUNDS $000	STATE FUNDS $000	LOCAL FUNDS $000	BTU/YEAR BILLIONS	ESTIM	COMMENTS
CA	HOLLY SUGAR CORPORATION BRAWLEY IMPERIAL	1981	INPR	*			1,300.0		PULP DRY.,PRIV. FUND. ONLY IF PILOT FACILITY A SUCCESS,PON-79
CA	CITY OF EL CENTRO EL CENTRO IMPERIAL	1981	CMSCHW	*		*	7.0		COOLING OF COMM. CENTER, PON 79,PRDA PREV. FUNDED ($125K), DRILL. TO BEGIN 3/81
CA	CITY OF SUSANVILLE SUSANVILLE LASSEN	1981	CMDH	*		*	41.0		PON-79,WILL BEGIN CONSTRUCTION SPRING '81,PRDA PREV. FUNDED ($124K),EDA FUNDS
CA	GEOTHERMAL POWER CORPORATION KELLEY HS MODOC	1982	MUSHAG	*			175.0		PON-79
CA	AQUAFARMS INTERNATIONAL MECCA RIVERSIDE	1981	AQ	*			171.0		PON-79,RAISING PRAWNS,PROJ. COSTS $1090K
CO	TOWN OF PAGOSA SPRINGS PAGOSA HS ARCHULETA	1981	RESDH	*			32.0		PON-79,PROD. WELLS DRILLED, FINAL DESIGN IN PROGRESS
ID	WARM SPRINGS HOLLOW BOISE ADA	1983	CMDH	*	*	*	207.0		PON-79,UPGRADE WM.SPGS.DIST. HEAT, PRELIM. DESIGN COMPLETE, EDA FUNDS
ID	MADISON COUNTY ENERGY COMMISSION REXBURG MADISON	1981	MUDHPH	*			680.0		FOOD PROC., PON-79,DRILLING TERMIN. DUE TO LOW TEMP,RES. ASSESS. IN PROGRESS
MT	WARM SPRINGS STATE HOSPITAL DEER LODGE DEER LODGE	1981	CMSHHW	*	*		26.0		HOSPITAL,PON-79,PROBLEMS W/ WELL,PROJ. IS STALLED
NV	ELKO HEAT COMPANY ELKO ELKO	1982	MUDHPH	*			25.7		3 COMMERCIAL BLDGS., CASINO & LAUNDRY, PON-79,WELLS DRILL., RES. ASSESS. IN PROG.
NV	HYDROTHERMAL ENERGY CORPORATION RENO WASHOE	1981	RESHHW	*		*	5.0	E	SUNDANCE APT. COMPLEX, PON-79
OR	CITY OF KLAMATH FALLS KLAMATH FALLS KLAMATH	1981	CMDH	*	*	*	35.4		DISTRICT HEATING OF 14 CITY, COUNTY,STATE, AND FED. BLDGS. PON-79

TABLE 7-2
DOE-SPONSORED APPLICATION DEMONSTRATIONS
UNDER DEVELOPMENT

STATE	OPERATOR&LOCATION	FIRST YEAR	TYPE OF USE	FEDERAL FUNDS $000	STATE FUNDS $000	LOCAL FUNDS $000	BTU/YEAR BILLIONS	ESTIM	COMMENTS
TX	T.H.S. MEMORIAL HOSPITAL MARLIN FALLS	1981	CMSH	*			11.0		SPACE HEATING-HOSPITAL, PON-79
TX	NAVARRO COLLEGE AND HOSPITAL CORSICANA NAVARRO	1981	CMSH	*			35.0		SPACE HEATING, COLLEGE BLDG. AND HOSPITAL, PON-79
UT	UTAH STATE PRISON CRYSTAL HS SALT LAKE	1982	CMSHHW	*	*		18.5		PON-79,EG&G PROV. TECH. ASSIS. ,APPROX. 7000 SQ. METERS AREA
UT	UTAH ROSES, INC. SANDY SALT LAKE	1981	AGGH	*			75.0		PON-79,WELL DRILL., FLOW TEST. & DESIGN COMPLETE
UT	MONROE CITY MONROE CITY SEVIER	1981	RECH	*			5.0	E	ORIG. PLANS NOT ECON. FEAS., ENERGY SERVICES, INC. PERFORM EVAL. OF ALT. USES FOR PON
STATUS TOTAL							2,849.6		

* DESIGNATES RECIEPT OF GOVERNMENT FUNDING.
E INDICATES ANNUAL ENERGY USE WAS ESTIMATED BY MITRE; ASSUMING THAT 60,000 BTUS OF GEOTHERMAL HEAT ARE USED PER GALLON OF ETHANOL PRODUCED. WHERE CAPACITY IS UNKNOWN, IT IS PRESUMED TO BE 1 MILLION GALLONS/YEAR.

KEY FOR TYPE OF USE

USE CATEGORY:	AQ = AQUACULTURAL
AG = AGRICULTURAL	IN = INDUSTRIAL
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RC = RECREATIONAL	
APPLICATION:	AQ = AQUACULTURE
AG = AGRICULTURE	BO = BOILER WATER
BA = BATH	CG = CAMPGROUND
BW = BOTTLED WATER	DH = DISTRICT HEAT
CW = COMMUNITY WATER SUPPLY	GD = GARDEN
EO = ENHANCED OIL RECOVERY	HW = HOT WATER
GH = GREENHOUSE	LN = LAUNDRY
IR = IRRIGATION	PL = POOL
PH = PROCESS HEAT	SC = SPACE COOLING
SH = SPACE HEATING	SP = SPA
SM = SNOW/ICE MELT	
SW = STOCK WATERING	

- Douglas School District, Douglas, South Dakota -

  After drilling, the well did not produce sufficient geothermal fluid to space heat the Douglas High School. The project was terminated in March of 1980.

7.2 Recent Major Activities

The following describe recent major events involving DOE-sponsored feasibility studies and direct use demonstrations:

- City of Klamath Falls, Klamath County, Oregon (DOE Field Demo)

  A local group of citizens have expressed concern about the impact of the district heating project on the existing wells. The City of Klamath is monitoring 100 wells to gather baseline data for comparison when the pump test results are available. A citizen's advisory board has been created to review the project progress and city decisions regarding project expansion. Pipe has been ordered and excavation has begun for the heat exchange building.
  Source: DOE, 2/9/81

- Town of Pagosa Springs, Archuleta County, Colorado (DOE Field Demo)

  The Hub Dairy Creame (see section 2.4) has been retrofitted and hooked up to use geothermal fluid from a well drilled for this demonstration. Data obtained will be applied to user retrofit designs when the system is operational in 1981.
  Source: DOE, 12/9/80

- City of Susanville, Lassen County, California (DOE Field Demo)

  Flow tests of the geothermal well drilled for this district heat application indicated 175°F fluid flowing at 700 gallons per minute. This exceeds the design requirements of the system. Construction is set for the spring of 1981 and the system would be operational by early 1982.
  Source: DOE, 12/9/80

- Aquafarms International, Mecca, California (DOE Field Demo)

  A direct use well has been completed by Aquafarms International to supply energy to a commercial-scale prawn farm in Coachella Valley. The 300 foot well flows at 50 gallons per minute at a temperature of 89°F.
  Source: GRC Bulletin, 9/80

- Hanes L'eggs Plant, Las Cruces, New Mexico (DOE Feasibility Study)

  After completing two phases of the study and drilling a well to 1800 feet, Energetics Corporation of Dallas concluded that the use of geothermal energy for process heat at this plant was not economically feasible. A redesign of the manufacturing process reduced the heat requirement to one-third of the output of the well. This application would be economical if the well was shared with other users.
  Source: EG&G, 9/80

- District Heating System, Glenwood Springs, Colorado (DOE Feasibility Study)

  A technical feasibility study for the utilization of low temperature (140°F-180°F) geothermal energy for a mini-district heating system (seven public buildings) has been completed. The engineering and economic feasibility of developing numerous warm water springs near the city were studied. A primary brine loop and secondary distribution loop were proposed to deliver the energy. Retrofit of the proposed seven buildings will be minimized if energy conservation measures are undertaken. The economic projections for system installation are favorable.
  Source: EG&G, 10/80

- Trans Energy Systems, Inc., Awarded DOE Feasibility Study Contract

  DOE has entered into a contract with Trans Energy Systems, Inc. of Bellevue, Washington to determine the feasibility of using geothermal energy to heat a proposed barley malting facility near Pocatello, Idaho. Results will be provided to Great Western Malting Company for consideration.
  Source: EG&G, 12/80

- Friendship Dairies, Friendship, NY Awarded Federal Contract for Feasibility Study

  Friendship Dairies was awarded a contract for an engineering study of the potential use of hydrothermal/geothermal energy in manufacturing cottage cheese. This effort is scheduled to be completed in 1981.
  Source: JHU/APL, 4/81

8.0 LOAN GUARANTY PROGRAM

The Department of Energy's FY 1982 budget request for geothermal energy programs, currently before Congress, calls for phase-out of the Geothermal Loan Guaranty Program in 1982. The Department is requesting $200,000 for administration of existing guarantied projects. No new projects will be guarantied. A proposed rescission of 1981 authorized guaranty funds would eliminate the reserve for loan defaults; in the event of a default, a supplemental appropriation would be required. Guaranty fees paid by borrowers for outstanding debts will provide DOE with income of about $2,500,000 for the reserve fund.

The Loan Guaranty office at the San Francisco office is continuing to process loan guaranty applications. As of March 25, 1981, ten to twelve new applications had been received by the loan guaranty office. Of this group, five are for electric plants and the remainder are for ethanol plants, agribusiness applications, and others.

Source: DOE

9.0 R&D ACTIVITIES

This section summarizes the DOE budget submittal to Congress for geothermal technology development activities in FY 1982 and R&D highlights of 1980.

9.1 DOE FY 1982 Geothermal Technology Development Budget Submitted

DOE's proposed FY 1982 geothermal energy budget contains $20,439,000 for geothermal technology development, out of a total geothermal budget of $48,575,000. The proposed budget reflects a shift in overall program strategy toward emphasis on long-term R&D and phasing out of federal support of near-term technologies. In 1982 the program will focus on R&D for higher-risk technologies and on transferring to industry technology developed over the past few years.

Table 9-1 presents R&D components of the proposed FY 1982 budget for technology development.

9.2 Geothermal R&D Accomplishments in FY 1980

- The Hot Dry Rock subactivity, managed by Los Alamos Scientific Laboratory, demonstrated the technical feasibility of extracting thermal and electrical energy from hot dry rock through operation of a 5 MWt thermal loop and installation of a 60 kWe electric generator. The first well for a much larger (20 to 50 MWt) thermal loop was completed at the Fenton Hill, New Mexico site and work on the second well for this loop is progressing.

- An exploration strategy for high-temperature hydrothermal resources in the Rocky Mountain Basin and Range Province was developed. The strategy is based on exploration data generated by the Industry-Coupled Drilling Program and can be adapted to the search for lower-temperature resources.

- The initial reservoir stimulation experiments at Raft River, East Mesa, and Baca have been highly successful. The results have allowed the reservoir stimulation program to be extended to the stimulation of hotter wells and the evaluation of additional fracturing techniques. A casing packer using newly developed elastomeric seals performed well at 450°F during the Baca experiment.

- New numerical codes were developed to simulate reservoir production. These codes increase the industry's ability to predict reservoir production capacity and longevity.

- The upgrading of well-logging tool components from a rating of 180°C to 275°C was essentially completed.

- A new high-temperature drilling mud was developed. This mud is now used commercially for geothermal drilling in the Imperial Valley.

- The 1 MWe helical screw expander, a transportable wellhead generator system, was successfully field tested in Mexico under an International Energy Agency agreement.

- A 500 kWe skid-mounted binary system using direct contact heat exchangers was installed and preliminary tests were run. Such heat exchangers are non-fouling and 75 percent lower in cost than conventional shell-and-tube heat exchangers.

- The preliminary design of components for the 5 MWe gravity head binary cycle geothermal electric concept was completed. The large diameter well for this pilot plant was successfully drilled and cased.

- Water treatment techniques to minimize corrosion associated with the use of geothermal fluids for cooling tower makeup were successfully developed for the Raft River geothermal site.

- High-temperature cements for well completion applications were developed and an agreement was concluded with the Mexican Comision Federal de Electricidad for field testing at Cerro Prieto.

TABLE 9-1

FUNDING LEVELS FOR DOE GEOTHERMAL TECHNOLOGY DEVELOPMENT ACTIVITY
FY 1980 THROUGH FY 1982

ACTIVITY/TASK	BUDGET AUTHORITY (Dollars in Thousands)		
	ACTUAL FY 1980	ESTIMATE FY 1981	ESTIMATE FY 1982
Component Development			
Drilling and Completion Technology	6,530	9,400	2,539
Energy Conversion Technology	8,311	10,703	2,500
Reservoir Stimulation	1,656	3,200	1,900
Geochemical Engineering and Materials	3,931	4,700	700
Geoscience Technology	4,630	7,297	2,300
Environmental Control Technology	0	0	500
Subtotal	25,058	35,300	10,439
Hot Dry Rock	14,000	13,500	10,000
Capital Equipment	2,120	1,110	0
TOTAL	41,178	49,910	20,439

Source: Geothermal Energy Program Summary Document, 1981.

10.0 LEGAL, INSTITUTIONAL, AND REGULATORY ACTIVITIES

The purpose of this section is to provide a summary of the major events at federal, state, and local levels which relate to non-technical issues in the development of U.S. geothermal resources. Legal, institutional and regulatory activities, as reported in this section, include the following:

- Congressional legislation (status of bills, results of hearings, passage of federal laws affecting geothermal development).
- State legislation (status of bills, passage of state laws affecting geothermal development, activities of the National Conference of State Legislatures).
- Federal and state regulations.
- Status and results of litigation on geothermal energy-related issues.
- Activities of federal, state, and local government agencies and interagency coordination relevant to legal, institutional and regulatory aspects of geothermal development.

Sources for the information reported in this section typically include member agencies of the IGCC, state and regional offices, the National Conference of State Legislatures, the Congressional Record and the Federal Register, reports on legislative and regulatory activities at state and local levels, and reports from Congressional hearings.

10.1 FY 1982 DOE Geothermal Budget

The Department of Energy's fiscal year 1982 budget submission to Congress calls for funding of the geothermal energy program at about $48.4 million. The proposed budget reflects a major change in program strategy and a shift in responsibility for near-term geothermal development to the private sector. The strategy emphasizes long-term R&D to remove technological barriers to development and concentrates on geopressured resources and hot dry rock, resource types for which the technology and economics have not yet been proven.

Table 10-1 presents federal funding for geothermal activities from FY 1980 through FY 1982. A proposed rescission of funds from the FY 1981 appropriation would reduce the overall funding for geothermal programs by $40.6 million. The revised 1981 budget would place more of the responsibility for industrialization of hydrothermal resources in the hands of the private sector.

10.2 Recent Major Activities

- DOE Reorganized

  In a recent DOE reorganization, the Division of Geothermal Energy was transferred from the Assistant Secretary for Resource Applications to the Assistant Secretary for Conservation and Renewable Energy. Resource Applications functions are being eliminated, phased out or transferred to other branches of management. The Division of Geothermal Energy now reports to the Deputy Assistant Secretary for Solar Energy. The new organization reflects a shift in the Department from commercialization programs for near-term technologies to emphasis on R&D for high-risk, high-payoff technology development.

- IGCC Approves Federal Geothermal Plan

  The Interagency Geothermal Coordinating Council (IGCC) approved the first Federal Geothermal Program Plan for submittal to the Office of Management and Budget last fall. The plan, which integrates the five-year plans of the eight federal agencies participating in the geothermal energy program, includes the IGCC's recommendations for increasing program effectiveness. Because of changes in the current Administration's policies regarding the government's role in energy development, the plan will undergo substantial revision in 1981.

Congress

- McClure Is Chairman of Senate Energy

  Senator James A. McClure (R-ID) is the new chairman of the Senate Energy and Natural Resources committee in the 97th Congress. Last year Senator McClure sponsored legislation designed to effect reforms in federal lands leasing policies and procedures in order to hasten development of geothermal resources on federal lands and open up more land for development.

TABLE 10-1

FUNDING LEVELS FOR DOE
GEOTHERMAL ENERGY ACTIVITIES
FY 1980 THROUGH FY 1982

ACTIVITY	BUDGET AUTHORITY (DOLLARS IN THOUSANDS)				
	ACTUAL FY 1980	ESTIMATE FY 1981	FY 1981 RECISSION	REVISED ESTIMATES FY 1981	ESTIMATE FY 1982
Hydrothermal Industrialization					
Resource Definition	12,634	21,224	(8,100)	13,124	0
Non-electric Demonstration	9,778	11,500	0	11,500	0
Planning and Analysis	6,011	6,081	0	6,081	0
Private-Sector Development	3,409	2,378	(274)	2,104	0
Geothermal Facilities	35,363	24,152	(4,000)	20,152	6,000
Environmental Control	2,184	2,600	0	2,600	0[a]
Capital Equipment	1,033	0	0	0	0
Subtotal	70,412	67,935	(12,374)	55,561	6,000
Geothermal Resource Development Fund					
Program Direction	181	193*	0	193	200
Guaranty Reserve Fund	0	41,982*	(22,066)	19,916	0
Loan Evaluation Fund	0	1,091	0	1,091	0
Energy Security Act	0	0	0	0	0
Subtotal	181	43,266	(22,066)	21,200	200
Geopressured Resources					
Resource Definition	33,032	32,126	(3,865)	28,261	18,900
Supporting Research and Development	1,360	3,474	0	3,474	1,436
Capital Equipment	300	200	0	200	0
Subtotal	34,692	35,800	(3,865)	31,935	20,336
Geothermal Technology Development					
Component Development	25,058	35,300	(2,261)	33,039	10,439
Hot Dry Rock	14,000	13,500	0	13,500	10,000
Capital Equipment	2,120	1,110	0	1,110	0
Subtotal	41,178	49,910	(2,261)	47,649	20,439
Program Direction	1,802	2,376	0	2,376	1,600
Total Geothermal Energy	148,265	199,287	(40,566)	158,721	48,575

*Represents reappropriation of unobligated balances in FY 1981.
[a]Transferred to Geothermal Technology Development.

Source: Geothermal Energy Program Summary Document, 1981.

- Geothermal Bills Die in 96th Congress

The 96th Congress drew to a close as supporters of geothermal energy "omnibus" bills failed to reach a compromise on proposals to remove impediments to geothermal exploration and development posed by the federal leasing and permitting process. Energy observers anticipate that Senator James McClure (R-ID) may reintroduce leasing reform legislation in the 97th Congress. Senator Henry Jackson (D-WA) has already introduced a modified version of one of the 1980 bills (S.669).
Source: The Geyser, 12/15/80

- FERC Issues Geothermal Small Power Producer Regulations

The Federal Energy Regulatory Commission (FERC) has issued final regulations applicable to geothermal small power production facilities under the Public Utility Regulatory Policies Act (PURPA). PURPA provides for exemption of qualifying small power producing facilities from certain federal and state regulations and requires utilities to buy excess power generated by small power producers. The Energy Security Act (ESA), enacted in June 1980, extends regulatory exemptions to utility-owned as well as non-utility owned facilities and increases the size limit for qualifying geothermal facilities from 30 to 80 MWe. The final regulations issued by FERC on March 23, 1981 increase the eligible plant size to 80 MWe, in accordance with the ESA, but do not extend non-utility benefits to utility-owned qualifying geothermal facilities. A decision on this extension has been deferred because of objections raised by the public utility commissions of California, New Mexico, and Hawaii. A decision will be made after public hearings are held to address the issue. The status of these exemptions has been clouded by a decision by a federal district court in Mississippi ruling PURPA's rate provisions unconstitutional. FERC has appealed to the Supreme Court. The regulatory exemption might also make these plants eligible for the 15 percent business investment tax credit for energy property, which is not applicable to public utility property as defined by IRS regulations.
Source: Federal Register, 3/30/81

- IRS Issues Final Energy Tax Credit Regulations

On January 23, 1981 the Internal Revenue Service (IRS) published final regulations implementing tax credit provisions of the Energy Tax Act of 1978. Under the regulations, tax credits are extended to owners and renters investing in certain energy conservation measures or alternative energy sources for residential properties and to businesses investing in certain types of energy property. In order for geothermal resource-related expenditures to qualify for the credits, geothermal fluids must have wellhead temperatures exceeding 50°C (122°F).

The credit for residential geothermal systems is 40 percent of the system cost, to a maximum credit of $4,000. The eligible costs include labor as well as equipment. Heating/cooling systems that supplement or back up geothermal systems are excluded. All heat pump equipment is excluded. Parts of systems that are not exclusively geothermal also are ineligible for the credit.

The business investment credit is 15 percent of the cost of equipment used to "produce, distribute or use energy derived from a geothermal deposit..." Exploration and development equipment does not qualify. The existence of backup equipment to protect against a failure in the geothermal system will not disqualify the system; otherwise, equipment that uses both geothermal energy and energy derived from other sources is not eligible. For geothermal electric power plants, equipment through the turbine/generator stage is eligible for the credit.
Source: Federal Register, 1/23/81

State Legislation

- California Law Provides for Disbursal of BLM Geothermal Funds

Over the next five years, California can expect revenues of over $4 million from federal geothermal lands under legislation which provides for 50 percent of federal revenue from BLM geothermal lease sales to be returned to the state. The bill (AB 1905, sponsored by Assemblyman Doug Bosco) was passed on May 30, 1980 to allocate these funds to specific uses. The money will be used to plan for economic and social change occurring as a result of geothermal development.

Prior to passage of the bill, all funds were paid to the state in two lump sums per year which included revenue from geothermal as well as oil and gas, potash, and other mining operations. The new law requires BLM and the U.S. Geological Survey to separate geothermal funds from funds from other sources. Geothermal mineral lease revenues are henceforth to be placed in a Geothermal Resources Development fund and divided between the California Energy Commission (CEC) for

use in making grants to local jurisdictions having geothermal resources (30%), a renewable resources investment fund administered by the state (30%), and the counties from which the revenue was generated (40%). The CEC grants are for resource assessment, local and regional planning and policy development, mitigation of environmental impacts, environmental monitoring and baseline data collection, and planning for geothermal facilities.
Sources: GRC Bulletin, 9/80
Advocate News, Fort Bragg, CA, 10/8/80
Record Bee, Lakeport, CA, 10/8/80
GRIPS Commission Memorandum, 7/30/80

- Nevada Studying Geothermal Legislative Proposals

A special Nevada legislative subcommittee is studying proposals related to geothermal resource definition, jurisdiction, and ways to encourage geothermal development. Three alternatives are being considered: (1) to treat geothermal resources as separate from water resources, the difference being in the temperature of the water, (2) to treat geothermal energy as the heat itself and not the water that carries it, and (3) not to give any special treatment to geothermal uses. The subcommittee is also considering geothermal tax credits and earmarking of federal revenues for geothermal funding.
Source: GRC Bulletin, 9/80

- Maryland Bill to Encourage Geothermal Development

A bill creating the Maryland Energy Supply and Conservation Authority has been introduced into the state legislature. The Authority would provide direction and financial assistance to Maryland residents wishing to adopt energy conservation measures or use alternative energy sources. Financial assistance would be provided for energy projects, feasibility studies, and technical and management advice. Among the energy projects to be assisted are geothermal energy facilities and facilities using groundwater heat pumps.
Source: JHU/APL, 3/17/81

- Geothermal Policy Options for States Examined

The National Conference of State Legislatures (NCSL) has recently prepared geothermal policy reports discussing legislative options for Maryland and Nevada and has developed recommendations for the Virginia state legislature for providing an adequate legal framework for developing geothermal resources. The policy papers address such issues as resource allocation and access, resource definition and ownership, tax treatment and regulatory treatment.

Policy guidance reports on legal treatment of groundwater heat pumps have been prepared for legislatures of Wisconsin and South Carolina.
Source: NCSL

- Delaware Geothermal Bill Vetoed

The 1980 Geothermal Resources Act was passed by the Delaware legislature but vetoed by the governor. After review of the bill by the National Conference of State Legislatures, a slightly revised version of the geothermal resource act was submitted to the 1980-1981 legislature.
Source: JHU/APL, 3/17/81

State Regulation

- Geothermal Small Power Producers May Benefit from Idaho Regulation

In keeping with the intent of the national Public Utility Regulatory Policies Act, the Idaho Public Utilities Commission has established minimum rates and contract guidelines for two of the state's electric utilities to do business with cogenerators and small power producers. The order follows an August 1980 order that requires the state's three largest utilities -- Idaho Power, Washington Water and Power, and Utah Power and Light -- to buy excess power from cogenerators and small power producers at prices commensurate with the utilities' avoided costs of producing the energy.
Source: Idaho Statesman, Boise, 12/4/80, 8/17/80

- Power Plant Policy Adopted in Oregon

After ten months of hearings and conferences, the Oregon Energy Facility Siting Council has adopted a regulation that will give the state control of its energy supply. Under the Power

Siting Standard, power plant license applicants will have to show that the proposed plant's output meets the state's own demand predictions and that the necessary power cannot be generated or conserved in any other way. The new policy favors renewable-source power generators to coal-fired or conventional fuel plants. Current forecasts of available power in Oregon include 60 megawatts of geothermal electric power, now nonexistent in Oregon, by 1985.
Source: Oregon Journal, Portland, OR, 1/7/81

- Court Awards $20 Million to California

A recent court action upholding the state's contention that geothermal resources are mineral rather than water resulted in a $20 million boost to California's general fund. The California State Lands Commission had been involved in lengthy litigation with a group of geothermal energy producers at The Geysers who sought to show that the state had no claim to geothermal production royalties on the basis of holding the mineral rights. The object of the controversy was 4,000 acres of land in Lake and Sonoma Counties where Union Oil, Magma Power, and Thermal share leaseholds.
Sources: Bee, Sacramento, CA, 11/18/80
Press Democrat, Santa Rosa, CA, 11/16/80
The Geyser, 12/15/80

Local Activities

- Public Resistance to Klamath Falls District Heating Project

Geothermal well owners in Klamath Falls, Oregon are worried that the city's present plan for district heating of 14 government buildings may have negative effects on the geothermal reservoir supplying their wells. Citizens have banded together to examine alternatives for blocking the city's action on the project. Some have urged the city to use downhole heat exchangers to avoid well drawdown instead of following the current proposal to pump the water from two wells on the outskirts of the town, run it through a heat exchanger, and then inject it in another well. The use of downhole heat exchangers, however, would require several more wells and an additional pipe and add an extra $1 million to project costs. School board members have warned city officials of possible legal action if the proposed project is detrimental to the wells that currently heat most city schools. (See Section 7.0).
Source: Herald and News, Klamath Falls, OR, 11/9/80, 11/18/80, 1/18/81

- Fee Proposed to Offset Tax Loss in Sonoma County

A fee to be levied against the public generators of steam at The Geysers has been proposed by the Sonoma County 4th District Supervisor. If the proposal is approved by the general public, Sonoma County could receive between $28 and $30 million additional revenue. The objective of the fee would be to help the county profit from steam generated at The Geysers by public entities, such as the Department of Water Resources, who are not currently charged for steam and do not pay land taxes. The fees would approximate the revenue the county would receive if public generators paid taxes and would be used to help offset costs to the county of coping with geothermal development. The measure will be voted on in June.
Sources: Tribune, Healdsburg, CA, 1/13/81
Press Democrat, Santa Rosa, CA, 1/21/81

11.0 ENVIRONMENTAL ACTIVITIES

This section reports on environmental protection issues arising in the course of geothermal exploration and development, environmental control R&D activities, and environmental regulations which may apply to various stages of geothermal development and energy production.

Recent activities are reported below.

- Borax Chub Controversy

  The Bureau of Land Management (BLM) recently granted leases for exploration in the Borax Lake area of Oregon's Alvord Desert to Anadarko and Getty Oil. The leases had been held up by BLM as a result of the controversy over the Borax Lake Chub, a small fish found only in Borax Lake. The fish, which was placed temporarily on the endangered species list by the Fish and Wildlife Service, will be protected by stipulations in the leases, which include a provision for a half-mile buffer zone on public lands where no surface disturbance, occupancy, or new access can take place, monitoring, and a shut-down of operations if a "significant" change in water quality is detected.
  Sources: Times-Herald, Burns, OR, 11/20/80
  Register-Guard, Eugene, OR, 8/4/80
  The Geyser, 1/28/81

- Federal PSD Regulations Holding Up Power Plant

  The Sacramento Municipal Utility District (SMUD) may not be able to meet a 1983 deadline for completing its proposed 72 MW geothermal power plant at The Geysers because of the new federal Prevention of Significant Deterioration (PSD) regulations. The district is required to seek an EPA H_2S emissions control permit which could take from six months to a year to approve. The Northern Sonoma County Air Pollution Control District has approved the plant on the condition that SMUD use the best available control technology. The new regulations require any plant emitting 250 tons per year of H_2S to apply for a PSD permit. EPA lawyers are looking at a "mini-permit" option, requiring considerably less delay, which would require SMUD to guarantee that its plant would not emit more than 70 tons of H_2S per year. SMUD officials say that by using control technology they can reduce H_2S emissions to 42 tons per year.
  Source: The Union, Sacramento, CA, 11/27/80

- PG&E vs. Air Pollution Control District

  Pacific Gas and Electric (PG&E) has taken issue with the air pollution control conditions attached to the Lake County Air Pollution Control District's approval of Geysers Unit 16, a 110 MWe power plant. A key area of contention between PG&E and the air district is a condition requiring a turbine bypass to reduce air pollution when the plant is down for repairs. PG&E plans on venting the steam directly to the atmosphere before it reaches the turbines. Utility spokesmen say that the turbine bypass and other measures are unnecessary to meet clean air standards and that the conditions would require "substantial modification" of the proposed project. The matter has been referred to the energy commissioner.
  Source: Record Bee, Lakeport, CA, 9/19/80

- Tracking the Path of Geothermal Pollutants

  About 100 scientists from Lawrence Livermore and 18 other laboratories and companies participated last fall in a three-week series of nighttime experiments in California's Anderson Creek Valley to trace airborne pollutants, particularly H_2S produced by geothermal operations at The Geysers. In sponsoring the Atmospheric Studies in Complex Terrain (ASCOT) experiment, DOE hoped to find more accurate mathematical models to predict the pollution fallout of future energy developments. Existing models for describing the path of airborne pollutants are based on very simple terrain; the Anderson Creek Valley was chosen as ASCOT's first test area because the particular land formations around the valley produce "nocturnal drainage winds" which carry H_2S odors to residents in the valley. The determination of how and where pollutants will travel in the course of future development at The Geysers should help shed light on the implications for future residential development around The Geysers. Data are now being analyzed at Brookhaven Laboratory.
  Sources: National Energy Insider, 1/19/81
  Examiner, San Francisco, CA, 9/10/80
  Tribune, Oakland, CA, 9/10/80
  Bee, Sacramento, CA, 9/5/80

12.0 STATE, LOCAL, AND PRIVATE SECTOR ACTIVITIES

This section summarizes reports of geothermal meetings, symposia or other significant activities involving the state, the local and/or the private sectors.

A special item featured in this issue of the Geothermal Progress Monitor is a report on the findings of the Oregon Alternate Energy Development Commission as they pertain to Geothermal Energy. This section concludes with state, local, and private sector activity reports.

- Future Renewable - The Final Report of the Oregon Alternate Energy Development Commission September 1980

The geothermal section of Chapter V (Overview of The Options and Summary of Task Force Reports) is reprinted here in its entirety. Following the geothermal section are excerpts of recommendations made by the geothermal Task Force. These sections taken together may provide a model for future studies and initiatives in other jurisdictions.

- Geothermal

Current Status: Oregon's Department of Geology and Mineral Industries (DOGAMI) has three resource assessment programs: high-temperature geothermal assessment throughout the Cascades with the US Geological Survey (USGS) and US DOE; low-temperature assessments in nine direct-use target areas with US DOE; and a site-specific assessment of Mt. Hood with USGS. The Oregon Department of Water Resources (DWR) is planning its first low-temperature assessment program for direct-use and heat pump applications. Private exploration is being conducted by seven companies in as many locations throughout the state.

Geothermal energy is now used directly in Klamath Falls (a 60 MW [thermal] equivalent now, increasing to a 104 MW [thermal] equivalent in 1981), Lakeview, and Cove. Eleven other communities represent near-term (1982-91) targets, principally for district heating. A detailed feasibility study has been completed for Oakridge. Long-term potentials include an additional 20 communities in 17 counties.

A statewide planning program was initiated in 1978 through the Oregon Institute of Technology (OIT) Geoheat Center and will be continued through 1980 by ODOE. The OIT technical assistance program offers no-cost engineering and economic feasibility studies to prospective resource users. An OIT regional market development project is to begin in late 1980. Statewide planning assistance in late 1980 will identify constraints, develop commercialization incentives, and provide technical planning assistance to local governments in near-term target areas.

Potential: The identified thermal potential of Oregon's geothermal resources is estimated at 46 trillion Btu per year, 8 percent of Oregon's 2000 energy demand.

Thirteen cities, with a combined population of about 100,000 persons and a total heating load of 3.5 trillion Btu per year, have near-term potential for supporting urban heating districts. Eighteen other cities, with 500,000 total population, have long-term direct-use or heat pump potential.

Several areas in Oregon have potential for electrical generation from high-temperature resources, including sites near the Alvord Desert, Crump, Bully Creek, Newberry Crater, and the Cascades. Based on a development scenario of 100 MW coming on-line every two years starting in 1984, Oregon has the potential to geothermally generate 800 MW of electricity by 2000.

Constraints: Fifty-two percent of Oregon's lands are federally-owned and controlled. Most of the state's geothermal resources are within those holdings. Access to these federal lands for resource exploration and development is dependent upon federal leasing and environmental programs. Thus far, only a small portion of federal land has been made available for leasing, and lengthy delays characterize most federal leasing programs.

High costs, difficulties in financing, and the inherent risks of geothermal exploration impede resource development. Misplaced incentives focus on post-development phases and do not stimulate new discoveries or initial development.

Misconceptions of geothermal energy, and its environmental and economic impacts, hinder the initiation of small projects and the positive reception of larger projects. Technical resource expertise is in extremely short supply.

Several institutional factors likely will constrain geothermal development over the longer term. These include a lack of clarity in certain legal definitions, overlapping agency jurisdictions, lack of land-use planning coordination, and the applicability of certain public utility performance criteria.

Development Strategy: Five basic strategies have been identified to spur the development of Oregon's geothermal resources.

1. Resource Assessment: Expand and accelerate assessment and exploration through enlarged DOGAMI and DWR programs and increased attention to federal programs. Particular emphasis should be given to coordinating such work with local development projects.

2. Near-Term Commercialization: The strategy is to focus resource assessment work on, and provide financial incentives and site-specific technical assistance for, local projects engaged in these near-term categories:

   a. Low temperatures--ground water heat pump applications
   b. Moderate temperatures--urban district heating and industrial process use
   c. High temperatures--electrical generation and complementary waste heat uses.

3. Long-Term Commercialization: Implement measures similar to near-term actions for resources and sites with longer-range potentials. Emphasis should be on shortening environmental baseline delays, coordinating land-use planning and growth controls, siting long-distance pipelines, and demonstrating advanced technological systems such as wellhead generators.

4. Information and Education: Implement an aggressive program for local or community-based action. Objectives include creating public and potential user awareness and local expertise in resource development techniques.

5. Institutional: Develop a closely coordinated network of institutions working toward consistent and specific goals. Emphasize lead action by local entities and technical and financial support from state and federal agencies.

Specific Recommendations Pertaining to Geothermal Energy

- Request the [Federal] Interagency Geothermal Coordinating Council to investigate and report how their 1978 streamlining recommendations have been applied to Oregon's federally-managed lands. IGCC should also determine what specific additional actions are necessary for a rapid expansion in Oregon energy resource exploration and leasing activities.

- Refine the Energy Facility Siting Council's (EFSC) 1974 Site Suitability Study specifically to evaluate crucial geothermal areas identified by DOGAMI, DWR and ODOE.

- Adopt legislation to establish provisions for the management and operation of a geothermal reservoir to assure that it is developed for maximum benefit.

- Develop a program to directly involve geothermal heating districts in the management of their geothermal reservoirs.

- Notify heating districts of any well drilling notices for wells that are in the vicinity of the heating district.

- Exempt geothermal pipelines which are less than 16 inches in diameter and less than 5 miles long, or which are distribution lines for a heating district, from the Energy Facility Siting Council site certificate requirement.

Additional Activity Reports

- Lakeport, California Symposium

  A symposium entitled "Geothermal in Your Own Backyard" was planned for late November, 1980. The objective of the symposium was to provide Lake County residents with an overview of backyard uses for geothermal energy. Environmental Research and Design of Lakeport and The Lake County Chamber of Commerce served as co-sponsors. Topics covered included simple commercial enterprises to financial aid and assistance for local geothermal development.
  Source: Daily Journal, Ukiah, CA, 10/30/80

- Report of Geothermal Potential in Thermopolis, Wyoming

  At a regular luncheon meeting of the Thermopolis - Hot Springs Chamber of Commerce, in November, 1980, a report was presented which outlined the geothermal potential of the Thermopolis area. A principal finding of the report, which was prepared by the Wyoming

Geothermal Commercialization Office, was that development in the Thermopolis area is strictly question for local people to decide. Additional presentations were made to the Rotary Club, the County Planning Commission and the Thermopolis Planning Commission.
Source: Independent - Record, Thermopolis, WY, 11/20/80

- Oregon Energy Program Announced

In late November, Oregon's Governor, Victor Atiyeh, announced a $144 million energy program. Included in the program is $1.4 million for the Department of Geology and Mineral Industries for geothermal exploration. In addition, a $250,000 fund would be established to help local governments create heating districts using geothermal resources.
Source: Oregonian, Portland, OR, 11/21/80

- Lakeview Oregon to Use Geothermal Energy For Economic Development

The Oregon State Economic Development Commission designated the City of Lakeview as a Demonstration Community Project. Lakeview is being studied with an eye toward economic needs and projects which can put the state's resources to work for economic growth. One aspect of the study includes the use of geothermal energy to draw industry to a planned industrial park.
Source: GRC Bulletin, 12/80

13.0 REPORTS AND PUBLICATIONS

This section presents abstracts and references of significant reports of interest to members of the geothermal community. The information is obtained from the sources listed with each entry.

- A Sourcebook on the Production of Electricity From Geothermal Energy

  This book is a companion volume to Geothermal Energy as a Source of Electricity. The Division of Geothermal Energy sponsored the preparation and publication of these two volumes which present the state of the art on geothermal energy use for electric power production. The books are available free on request (first come, first served) to persons working in the field of geothermal energy.

  Available from: Geothermal Books
  R. DePippo
  Box D
  Brown University
  Providence, Rhode Island 02912
  Source: GRC Bulletin, 10/80

- Geothermal Energy and Regional Developments: The Case of Imperial County

  The results of NSF/ERDA/DOE sponsored research have been compiled in this one volume. Edited by Stahrl Edmunds and Adam Rose (University of California, Riverside), the volume includes chapters dealing with various technical, physical and social aspects of geothermal development in the county. The cost of this 371-page book is $26.95.

  Available from: Praeger Publishers
  383 Madison Avenue
  New York, New York 10017
  Source: GRC Bulletin, 10/80

- Regulation of Geothermal Energy in Colorado

  This pamphlet by B. A. Coe and Nancy Forman is being offered by the Colorado Geological Survey as Information Series #15. The pamphlet is free although there is a 50-cent mailing charge.

  Available from: Colorado Geological Survey
  Room 715
  1313 Sherman Street
  Denver, Colorado 80103
  Source: GRC Bulletin, 10/80

- Progress Report on Activities of the Low-Temperature Assessment Program 1974-80

  This report by the Oregon Department of Geology and Mineral Industries (No. 0-80-14) summarizes information about the State's geothermal resources. It contains summaries of geothermal research activities that were completed by August, 1980. The report includes geothermal gradient and heat flow data, bibliographies, and listings of additional data to be presented in nine separate regional reports. The regional reports will be released in stages as open file material. The progress report may be purchased for $3.

  Available from: Oregon Department of Geology and
  Mineral Industries
  1005 State Office Building
  Portland, Oregon 97201
  Source: The Bulletin, Bend, OR, 12/26/80

- Direct Utilization of Geothermal Energy: A Layman's Guide

As the title indicates, this special report (No. 8) is a non-technical guide to the direct use of geothermal energy. It is a joint publication of the Geothermal Resources Council and the Geo-Heat Utilization Center of the Oregon Institute of Technology. This softbound book costs $8.

Available from: Geothermal Resources Council
P. O. Box 98
Davis, California 95616
Source: GRC Bulletin, 9/80

- Geothermal Gradient Map of the Conterminous United States

This map, published by Los Alamos National Laboratory, was prepared with the support of the Hot Dry Rock Geothermal Program. The map plots color-coded regional conductive gradients.

Available from: Hot Dry Rock Geothermal Program Office
MS 575
Los Alamos National Laboratory
Los Alamos, New Mexico 87545

- State Geothermal Handbooks

Several state-specific geothermal energy handbooks have been published recently. The Geo-Heat Utilization Center of the Oregon Institute of Technology published the handbooks for Washington, Oregon, and Alaska. The South Dakota handbook is available from the State geothermal commercialization team.

For Washington, Oregon, Alaska

Available from: Oregon Institute of Technology
Klamath Falls, Oregon 97601
or
DOE - Region X
Room 1910
Federal Building
915 Second Avenue
Seattle, Washington 98174

For South Dakota

Available from: South Dakota State
Geothermal Commercialization Team
Office of Energy Policy
Capitol Lake Plaza
Pierre, South Dakota 57501
Sources: GRC Bulletin, 9/80
DOE-ID, 1/81

- Geothermal Space Heating at McGuire AFB, New Jersey

This report discusses the use of water referenced heat pumps to heat and cool housing units located on the Air Force Base. Fuel costs benefits and pay-back time are estimated.

Report Title: Geothermal Space Heating, McGuire AFB, New Jersey,
APL/JHU Technical Assistance Report #6

Available From: The Johns Hopkins University
Applied Physics Laboratory
Johns Hopkins Road
Laurel, Maryland 20810
Source: JHU/APL

- Minutes, Fifth Technical Information Interchange Meeting

This meeting, 6-7 November 1980, was sponsored by DOE/DGE for the purpose of exchanging information among people concerned with geothermal programs in the Eastern United States. Seventy-four persons were in attendance and the minutes include textual and illustrative material furnished by 34 speakers.

Report Title: Geothermal Energy and the Eastern United States Fifth Technical Information Interchange Meeting Minutes, QM-80-185

Available from: The Johns Hopkins University
Applied Physics Laboratory
Johns Hopkins Road
Laurel, Maryland 20810
ATT: Mr. William B. Chapman

Source: JHU/APL

- Geothermal Energy Use at LNG Receiving Terminal, Maryland

This report describes a program for using geothermal energy to vaporize liquified natural gas (LNG) at a receiving terminal at Cove Point, Maryland. Funding, environmental aspects and economics are included. An updating of this March 1980 report is presented in the Minutes of the Fifth Technical Interchange Meeting (op cit.).

Report Title: Utilization of Geothermal Energy at the Cove Point LNG Receiving Terminal

Available from: Columbia LNG Corporation
Source: JHU/APL

- Workshop on Environmental Control Technology for The Geysers - Calistoga KGRA, UCRL-52887, 1980

Eighty participants discussed ways to prevent, control and mitigate undesirable environmental impacts caused by geothermal development at The Geysers. The proceedings were prepared by Lawrence Livermore Laboratory.

Available from: NTIS
U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161
$7.00 paper
$3.50 microfiche

Source: Geothermal Hot Line, Vol. 10, No. 2
California Division of Oil and Gas

- Assessment of H_2S Control Technologies for Geothermal Power Plants

This report, prepared by Acurex Corporation, analyzes techniques for controlling H_2S emissions from geothermal power plants and well operations.

Available from: California Energy Commission
Publications Unit
1111 Howe Avenue
Sacramento, California 95825

Source: Geothermal Hot Line, Vol. 10, No. 2
California Division of Oil and Gas

- Reports Published by the University of Utah Research Institute

Periodically, the Earth Science Laboratory at UURI publishes reports and open file material generated under Department of Energy contracts. For a listing of current material contact:

Publications
Earth Science Laboratory
University of Utah Research Institute
420 Chipeta Way. Suite 120
Salt Lake City, Utah 84108
(801) 581-5283
FTS 588-5098

- The Geothermal Resource Areas Database at LBL

The Geothermal Resource Areas Database (GRAD) and associated data system provide broad coverage of information on the development of geothermal resources in the United States. Established by the Lawrence Berkeley Laboratory for the DOE Division of Geothermal Energy, the system is designed to serve the information requirements of the Geothermal Progress Monitoring System. GRAD should also be of interest to other offices of DOE; to other government agencies at the federal, state and local level; to universities; and to private organizations in the geothermal industry.

GRAD covers development from the initial exploratory phase through plant construction and operation. Emphasis is on actual facts or events (a geochemical survey done, a lease sold, a well drilled or a plant constructed) rather than projections or scenarios.

Data collected in the various subject areas is critically evaluated, and entered into an on-line interactive computer system. The Area Status Report (Figure 13-1) is a typical example of the GRAD output. It is a one-page synopsis of the current development status of a geothermal resource area. Such a report is available for over 70 areas at present and will cover several hundred areas by the end of 1981.

GRAD is publically available for retrieval and use in analysis. For more information, including user instructions, please write or call:

Dennis Lawrence
Lawrence Berkeley Laboratory
Building 90J
University of California
Berkeley, California 94720
(415) 486-6871
FTS 451-6871

Source: LBL

- The State Geothermal Mapping Program

Details of this program are included in Section 4 of this issue of the GPM. The data products from this program, including the Thermal Springs List for the United States, NOAA Key to Geophysical Records Documentation Number 12, are available free of charge. Send either a business card or name, affiliation, and address to:

NOAA/NGSDC
Data Mapping Group, Code D64
325 Broadway
Boulder, Colorado 80303
(303) 497-6124

Source: GRC Bulletin, 12/80

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STATUS REPORT FOR ROOSEVELT HOT SPRINGS JULY 18, 1980
Roosevelt Hot Springs KGRA, Beaver county, Utah

Development Status: Plant Planning

Major Markets: Electricity

Resource Characteristics	Estimated Value	Range
Depth to Top of Reservoir (ft)	4,012	1,253 - 6,102
Reservoir Thickness (ft)	6,562	4,921 - 8,202
Reservoir Area (sq miles)	9.1	2.3 - 19.3
Reservoir Volume (cu miles)	11.3	
Temperature (deg F)	509 (265 C)	469 - 543
Total Dissolved Solids (ppm)	7,800	5,000 - 8,000
Electric Power Potential (MWe, 30 yrs)	970	
Thermal Energy (10**15 Btu)	28.5	

Exploratory Surveys: Seismic Methods, Gravity, Geological, Heat Flow, Electrical Resistivity, Thermal Gradient

Permits

Type	Nmbr. Filed	Nmbr. Approved	Latest Approval Date
NOI	3	2	03/22/76
Total	3	2	03/22/76

Leasing

	Federal	State	Private	Other	Total
Nmbr. Leases	26	4	3	0	33
Nmbr. Leaseholders	12	4	2	0	18
Acres under Lease	37,386	2,482	2,533	0	42,401
Acres Withdrawn	5,305	0	0	0	5,305
Total Acres in Area	24,592	2,482	2,864	0	29,938

Drilling

23 Wells Spudded	2 Production	14 Idle, Suspended
18 Wells Completed	??? Injection	??? Abandoned
	2 Observation	5 Type Unknown

	Well Statistics Average	Range	Nmbr. Wells Reporting
Depth (ft)	5,735	1,253 - 7,513	9
Sfc. Temp. (deg F)	???	??? - ???	???
Sfc. Flow (lb/sec)	???	??? - ???	???

Plants (Entries are Nmbr. Plants/Total Power)

Type	Operational	Under Constr.	Planned	Total
Electric Power (MWE)	0/0	0/0	3/120	3/120
Direct Use (10**9 Btu/yr)	0/0.0	0/0.0	0/0.0	0/0.0
Total Plants (MWe Equivalent)	0/0	0/0	3/120	3/120

Major Organizations Involved in Area Development

Phillips Petroleum	Rogers Engineering
O'Brien Resources	Utah Power & Light
AMAX Exploration	Thermal Power
Union Oil	Geothermal Exploration
Plattsburgh Quarries	Chevron USA

O'Brien, Phillips and Thermal have unitized the production of their individual interests.

Note: ??? denotes Value Unknown

FIGURE 13-1

EXAMPLE OF AN AREA STATUS REPORT
FROM THE GEOTHERMAL RESOURCE AREA DATABASE

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GLOSSARY

AFC	Application for Certification
APL	Applied Physics Laboratory (of Johns Hopkins University)
BLM	Bureau of Land Management
BPWG	Budget and Planning Working Group (of the IGCC)
BTU	British Thermal Unit
CDBG	Community Development Block Grant
CDWR	California Division of Water Resources
CEC	California Energy Commission
CSA	Community Services Administration
DGE	Division of Geothermal Energy
DOE	Department of Energy
DOI	Department of the Interior
EDA	Economic Development Administration
EPA	Environmental Protection Agency
EPRI	Electric Power Research Institute
ERAB	Energy Research Advisory Board
FMHA	Farmers Home Administration
GAO	General Accounting Office
GEDCO	Geothermal Exploration and Development Company
GLGP	Geothermal Loan Guaranty Program
GPM	Geothermal Progress Monitor
GRAD	Geothermal Resource Area Database (at LBL)
GRC	Geothermal Resources Council
GRIPS	Geothermal Resources Information and Planning Service (CA)
HELCO	Hawaii Electric Company
HUD	Department of Housing and Urban Development
IGCC	Interagency Geothermal Coordinating Council
IMAGE	Inyo Mono Association of Government Entities
INEL	Idaho National Engineering Laboratory
JHU	Johns Hopkins University
KGRA	Known Geothermal Resource Area
LBL	Lawrence Berkeley Laboratory
LNG	Liquefied Natural Gas
MCR	MCR Geothermal (formerly McCulloch Geothermal Corporation)
MOU	Memorandum of Understanding
MSR	Mountain State Resources Corporation
MWe	Megawatts (electric)
MWt	Megawatts (thermal)
NAVFAC	Naval Facilities Engineering Command
NCPA	Northern California Power Association
NGSDC	National Geophysical and Solar Terrestrial Data Center (of NOAA)
NOI	Notice of Intent
NMEI	New Mexico Energy Institute
NOAA	National Oceanic and Atmospheric Administration
NTIS	National Technical Information Service
OIT	Oregon Institute of Technology

PG&E	Pacific Gas and Electric Company
PIC	Petroleum Information Corporation
PNM	Public Service Company of New Mexico
PON	Program Opportunity Notice
PRDA	Program Research and Development Announcement
RD&D	Research, Development and Demonstration
REA	Rural Electrification Administration
RFP	Request for Proposals
SCE	Southern California Edison
SDG&E	San Diego Gas and Electric
SMUD	Sacramento Municipal Utility District
SPPC	Sierra Pacific Power Company
TA	Technical Assistance
TIC	Technical Information Center
UDAG	Urban Development Action Grant
UP&L	Utah Power and Light
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
UURI	University of Utah Research Institute

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